From:	Kalie Hatt-Kilburn
To:	Sam Fotia
Subject:	RE: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020
Sent:	1/9/2020 5:29:00 PM

Thanks Sam. I got tied up in some other meetings and am just freeing up now. I should have some time tomorrow around 9:30am your time. If you're available, I can fill you in.

Kalie

From: Fotia, Sam (ACOA/APECA) <sam.fotia@canada.ca>
Sent: Thursday, January 09, 2020 4:09 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Subject: RE: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020

Hi

See below. Would like to chat when you are done your call.

- Moltex Energy Canada (NB)
    - Requested SIF contribution of $47.5M for the development of a Stable Salt Reactor, Waste to Stable Salts conversion process and GridReserve storage clean-energy system to develop technologies that will revolutionise power production and reduce stocks of used nuclear fuel. .
- ARC Nuclear Canada (NB)

From: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Sent: Thursday, January 09, 2020 2:53 PM
To: Fotia, Sam (ACOA/APECA) <sam.fotia@canada.ca>
Subject: RE: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020

Thanks Sam. I'm just on the DG Ops call right now. Glad to hear that Hugh touched base.

From: Fotia, Sam (ACOA/APECA) <sam.fotia@canada.ca>
Sent: Thursday, January 09, 2020 3:15 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Subject: RE: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020

s.20(1)(b)
s.21(1)(b)
s.21(1)(c)

I'm available now…and Hugh reach out as well. Let me know.

From: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Sent: Thursday, January 09, 2020 12:35 PM
To: Fotia, Sam (ACOA/APECA) <sam.fotia@canada.ca>
Subject: FW: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020

Hi Sam,

HO is coordinating briefing material for an upcoming meeting between Simon Kennedy and Francis. We've been asked to supply information on SMRs I just want to confirm a couple of facts with you. Would you have some time this afternoon for a quick call?

Not relevant to the request

Thanks,
Kalie

From: AuCoin, Wade (ACOA/APECA) <wade.aucoin@canada.ca>
Sent: Thursday, January 09, 2020 11:54 AM
To: Amo, Courtney (ACOA/APECA) <courtney.amo@canada.ca>; Drodge, Susan (ACOA/APECA) <susan.drodge@canada.ca>; Etter, Marianne (ACOA/APECA) <marianne.etter@canada.ca>; Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Cc: Trainor, Sophie (ACOA/APECA) <sophie.trainor@canada.ca>; Savoie, Louise (ACOA/APECA) <louise.savoie@canada.ca>
Subject: FW: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020

Hi everyone,

Just to confirm, ACOA-HO Policy will coordinate the note for the breakfast meeting between Simon Kennedy and our President on January 17.

Daryell and I just spoke with the President, and he would like the note to focus on the following:

1. Potential SIF Projects
    b. SMRs/Moltex (ACOA-NB to provide information)
2.
3.
4.

Not relevant to the request

Courtney and I would need whatever input you are able to provide by noon on Friday, January 10th.

Thanks.

Wade

From: Belanger, Christina (IC) <christina.belanger@canada.ca>
Sent: Wednesday, January 08, 2020 6:41 PM

s.21(1)(b)

To: ACOA.F ACOA TRIPS/VOYAGES APECA F.APECA <acoa.acoatripsvoyagesapeca.apeca@canada.ca>; ACOComms-CommsAPEC (ACOA/APECA) <acoa.acocomms-commsapec.apeca@canada.ca>; IC.F SPSTripsATL F.IC <IC.SPS-Trips-ATL.IC@canada.ca>; IC.O SRS ADMO / BSMA SSR O.IC <IC.SISADMO-BSMASSI.IC@canada.ca>; IC.O ICS ADMO / SMA ICS O.IC <ic.icsadmo-smaics.ic@canada.ca>
Cc: IC.O OCS Trips / Voyages BSG O.IC <ic.ocstrips/voyagesbsg.ic@canada.ca>; Sypien, Nicole (IC) <nicole.sypien@canada.ca>; Verrier, Valérie (IC) <valerie.verrier@canada.ca>
Subject: RE: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020
Importance: High

Hello,

Please see revised due date for the call-out:

BF / Date de rappel: **Tuesday, January 14 by 10:00 a.m. EST**

Thank you,

Christina Belanger
Team Lead, Executive Planning and Outreach (ExPO), Office of the Corporate Secretary
Innovation, Science and Economic Development Canada / Government of Canada
Christina.Belanger@Canada.ca / Tel : (343) 291-2208 / Cell : (343) 550-7476

From: Belanger, Christina (IC) <christina.belanger@canada.ca>
Sent: January 8, 2020 5:35 PM
To: ACOA.F ACOA TRIPS/VOYAGES APECA F.APECA <acoa.acoatripsvoyagesapeca.apeca@canada.ca>; ACOComms-CommsAPEC (ACOA/APECA) <acoa.acocomms-commsapec.apeca@canada.ca>; IC.F SPSTripsATL F.IC <IC.SPS-Trips-ATL.IC@canada.ca>; IC.O SRS ADMO / BSMA SSR O.IC <IC.SISADMO-BSMASSI.IC@canada.ca>; IC.O ICS ADMO / SMA ICS O.IC <ic.icsadmo-smaics.ic@canada.ca>
Cc: IC.O OCS Trips / Voyages BSG O.IC <ic.ocstrips/voyagesbsg.ic@canada.ca>; Sypien, Nicole (IC) <nicole.sypien@canada.ca>; Verrier, Valérie (IC) <valerie.verrier@canada.ca>
Subject: RE: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020

Looping in ICS - My apologies, please see call-out below.

From: Belanger, Christina (IC) <christina.belanger@canada.ca>
Sent: January 8, 2020 5:34 PM
To: ACOA.F ACOA TRIPS/VOYAGES APECA F.APECA <acoa.acoatripsvoyagesapeca.apeca@canada.ca>; ACOComms-CommsAPEC (ACOA/APECA) <acoa.acocomms-commsapec.apeca@canada.ca>; IC.F SPSTripsATL F.IC <IC.SPS-Trips-ATL.IC@canada.ca>; IC.O SRS ADMO / BSMA SSR O.IC <IC.SISADMO-BSMASSI.IC@canada.ca>
Cc: IC.O OCS Trips / Voyages BSG O.IC <ic.ocstrips/voyagesbsg.ic@canada.ca>; Sypien, Nicole (IC) <nicole.sypien@canada.ca>; Verrier, Valérie (IC) <valerie.verrier@canada.ca>
Subject: Call-out for products: DM Kennedy - Halifax, NS - January 17, 2020

Dear colleagues,

Please prepare the following materials for Deputy Minister Kennedy's program in Halifax, NS on January 17, 2020

Materials should be sent directly to IC.O OCS Trips / Voyages BSG O.IC
ic.ocstrips/voyagesbsg.ic@canada.ca
Veuillez S.V.P. préparer la suivante et l'envoyer directement à IC.O OCS Trips / Voyages BSG O.IC ic.ocstrips/voyagesbsg.ic@canada.ca

BF / Date de rappel: Tuesday, January 14 by 10:00 a.m. EST

Please note:

- Lead Sectors/Regions/Departments must coordinate input with other Sectors/Regions/Departments identified in this call-out.
- Attached is the latest itinerary (draft 1.1)
- Template for briefing products is attached.

Thank you,

Christina Belanger
Team Lead, Executive Planning and Outreach (ExPO), Office of the Corporate Secretary
Innovation, Science and Economic Development Canada / Government of Canada
Christina.Belanger@Canada.ca / Tel : (343) 291-2208 / Cell : (343) 550-7476

From:	Kalie Hatt-Kilburn
To:	Sam Fotia
Cc:	Hicks, Hugh (ACOA/APECA)
Subject:	RE: Moltex and CNL
Sent:	4/24/2020 10:15:00 AM

I'm not sure right off the top of my head. Hugh, do you know the funding amount?

From: Fotia, Sam (ACOA/APECA) <sam.fotia@canada.ca>
Sent: Friday, April 24, 2020 9:35 AM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Cc: Hicks, Hugh (ACOA/APECA) <hugh.hicks@canada.ca>
Subject: Moltex and CNL

Hi Kalie,

I hope all is well. Would you know how much CNL funding is for the research?

Thanks,
Sam

SAINT JOHN Saint John-based Moltex Energy has partnered with Canadian Nuclear Laboratories (CNL) to support development and research of its Stable Salt Reactor.

The partnership means CNL is funding the majority of the studies to develop the technology through the Canadian Nuclear Research Initiative, as well as making available the specialized equipment, materials and people to support the project.
"Canadian Nuclear Laboratories up in northern Canada is one of the best facilities in the world to do this," said Rory O'Sullivan, CEO of Moltex Energy. "They see such strategic interest in the technology for Canada. To have the CNL support behind us is really a massive step for the project."

This is the first major partnership with CNL for Moltex, which is one of two companies in the province chosen by NB Power to develop the technologies for Small Modular Reactors at Point Lepreau. ARC Nuclear is the second company.

Moltex is working to develop two technologies. The first is a Stable Salt Reactor, a 300 megawatt Small Modular Reactor. The second is their Waste to Stable Salt technology. This is the process of converting spent fuel, or Canada Deutrium Uranium (CANDU) fuel, to a new fuel for the Stable Salt Reactor. Moltex is the only company in the industry using the technology and first developed it in the UK.

It takes nuclear waste and converts it to a usable fuel for a nuclear reactor. These technologies, O'Sullivan said, will result in producing more clean energy from the Stable Salt Reactor.

"It's the first of a kind of technology that can solve climate change and deal with the old issue of nuclear waste," he said.
The funding will also bring CNL capabilities to the University of New Brunswick, a partner of Moltex Energy, and help with their research. O'Sullivan said the resulting training students in the technology will help grow the small modular reactor space in the province.
"It gets us closer to building one of these Small Modular Reactors so that we can have those big benefits of jobs and the economy going to New Brunswick," O'Sullivan said.

Regards,
Sam

Sam Fotia
Senior Advisor – Industrial Benefits (Defence) & National Programs Lead
Atlantic Canada Opportunities Agency (ACOA) – Ottawa Office
60 Queen Street, 8th Floor | Ottawa, ON | K1P 5R5
Email: sam.fotia@canada.ca
Tel: (613) 954-8059 | Cell: (613) 286-8853

Atlantic Canada Opportunities Agency | Agence de promotion économique du Canada atlantique | Canada

From:	Kalie Hatt-Kilburn
To:	Cain, Kelly (IGA/MAI)
Subject:	RE: Can you please tell me what ISDC has provided
Sent:	5/27/2020 6:43:00 PM

Glad I could help out. ☺

From: Cain, Kelly (IGA/MAI) <Kelly.Cain@gnb.ca>
Sent: Wednesday, May 27, 2020 6:43 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Subject: Re: Can you please tell me what ISDC has provided

Outstanding. Thank you SO much Kalie. This is exactly what I need. Premier wants to get behind the winners. This is an enormous help.
K

Get Outlook for iOS

From: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Sent: Wednesday, May 27, 2020 6:36:54 PM
To: Cain, Kelly (IGA/MAI) <Kelly.Cain@gnb.ca>
Subject: RE: Can you please tell me what ISDC has provided

No problem at all. Happy to help anytime.

He may wish to note that it will be important that that the review of the full SIF submission move along in a timely manner (can take months) so any help that can be provided to keep this on the priority list would be appreciated.

The US recently announced a $230M dedicated fund for SMR development and has offered Moltex $4.5M already.

My two cents. Feel free to use your judgment on what to pass along ☺

Kalie

From: Cain, Kelly (IGA/MAI) <Kelly.Cain@gnb.ca>
Sent: Wednesday, May 27, 2020 6:23 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Subject: Re: Can you please tell me what ISDC has provided

Outstanding. Thank you SO much Kalie. I am sitting beside him and that call is coming up later tonight. Are there any other things floating around NB that PBH should push?
Thanks
Promise I will leave you alone!!! I so appreciate your help.
K

Get Outlook for iOS

s.20(1)(b)

From: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Sent: Wednesday, May 27, 2020 6:20:39 PM
To: Cain, Kelly (IGA/MAI) <Kelly.Cain@gnb.ca>
Subject: RE: Can you please tell me what ISDC has provided

Sure thing, Kelly. Here you go:

- Moltex requested a contribution under ISED's Strategic Innovation Fund for a contribution of $47.5M [for the development of a Stable Salt Reactor, Waste to Stable Salts conversion process and GridReserve storage clean-energy system to develop technologies that will revolutionise power production and reduce stocks of used nuclear fuel.
- s.21(1)(a)
  s.21(1)(b)
- This project will help the company to move along in the second stage of its vendor design review – a necessary step before approval to actually build a reactor can be granted.

More on the SIF Program:

The Strategic Innovation Fund's objective is to spur innovation for a better Canada. Specifically, it serves to simplify application processes, accelerate processing, and provide assistance that is more responsive and focused on results.

The program has **five Streams**, each with its own precise objective:

- **Stream 1:** Encourage R&D that will accelerate technology transfer and commercialization of innovative products, processes and services;
- **Stream 2:** Facilitate the growth and expansion of firms in Canada;
- **Stream 3:** Attract and retain large scale investments to Canada;

- **Stream 4:** Advance industrial research, development and technology demonstration through collaboration between the private sector, researchers and non-profit organizations; and
- **Stream 5:** Support large-scale, national innovation ecosystems through high impact collaborations across Canada.

Eligibility Under Stream 1—R&D and Commercialization

The project must involve activities related to the research, development and commercialization of innovative products, processes and/or services. Activities in this stream must be within Technology Readiness Levels (TRLs) 1-9 (see Annex A for more information on TRLs) and should support the development of a technology to a higher readiness level which then has the potential to lead to the implementation or commercialization of a resultant product, process or service.

For example, projects could focus on:

- R&D to test the commercial potential of an early TRL concept or finding;
- Adaptation of research findings for commercial applications that have the potential for market disruption;
- Development of current products through the implementation of new technology that will enhance the Recipient's competitive capability; and
- Development of process improvements which reduce the environmental footprint of current production through the use of new technologies.

If you need anything else, just let me know.
Kalie

From: Cain, Kelly (IGA/MAI) <Kelly.Cain@gnb.ca>
Sent: Wednesday, May 27, 2020 6:06 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Subject: Re: Can you please tell me what ISDC has provided

Thanks so much Kalie.
Can you please shoot me a few bullets re what "the program" is? I assume it is research or is it design? Etc. My Premier is speaking to Baines tonight and he has been running all day. I need a few quick snaps for him.
Thank you so much.
K

Get Outlook for iOS

From: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Sent: Wednesday, May 27, 2020 6:03:34 PM
To: Cain, Kelly (IGA/MAI) <Kelly.Cain@gnb.ca>
Subject: RE: Can you please tell me what ISDC has provided

ATTENTION! External email / courriel externe.

Kalie

From: Cain, Kelly (IGA/MAI) <Kelly.Cain@gnb.ca>
Sent: Wednesday, May 27, 2020 5:24 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Subject: Can you please tell me what ISDC has provided

Trying to reach FM but can't get a hold of him.
Tahsn
K

Kelly Cain
Deputy Minister Intergovernmental Affairs / Sous-ministre des Affaires intergouvernementales
Deputy Minister responsible for Women's Equality Branch (Executive Council) / Sous-ministre responsable de la Direction de l'égalité des femmes (Bureau du Conseil exécutif)
Deputy Minister responsible for Human Resources, Finance and Treasury Board / Sous-ministre responsable des ressources humaines, ministère des Finances et du Conseil du Trésor
P. O. Box 6000, Fredericton, NB E3B 5H1
506-444-5485
Kelly.Cain@gnb.ca

s.21(1)(b)

s.21(1)(c)

From:	Manon Maurice
To:	Manon Maurice
Subject:	MINO: VP call with Kent Estabrooks – ACOA NB - 2021/01/26
Sent:	5/23/2025 9:32:05 AM

s.16(2)(c)

Meeting Date: 2021/01/26 2:15 PM
Location: 1-855-288-0982, code
Link to Outlook Item: *click here*
Invitation Message
Participants

- Cantin, Martine (ACOA/APECA) (Meeting Organizer)
- Estabrooks, Kent (ACOA/APECA)
- Hatt-Kilburn, Kalie (ACOA/APECA)
- Sandell, Carolee (ACOA/APECA)
- Sagra, Pavan (IC)
- Hicks, Krista (ACOA/APECA)
- Rutanga, Eddie (ACOA/APECA)

Kalie is out from January 12th to February 16th, therefore for planning purposes here is a breakdown of who will do which call.

January 12 – (name) JH	February 2 - LM
January 19 - LM	February 9 - JH
January 26- JH	February 16 -LM

VP NB						
STATUS (Ongoing, Firm, Completed)	Firm					
AGENDA	No agenda					
Internal MATERIALS/RESOURCES/LINKS	Laurie's list	Tide and Boar Email from Claire				
	Outstanding at MINO					
CONSIDERATIONS (Programs/Policy)	**FOLLOW-UPS (2)**					

Not relevant to the request

s.21(1)(b)

s.21(1)(c)

Not relevant to the request

a
y

e

Moltex

Moltex is a start-up technology company which is developing a range of molten salt reactors (MSRs) known as Stable Salt Reactors (SSRs), one of which, called the Stable Salt Reactor Wasteburner (SSR-W300) is specifically designed for burning used nuclear fuel.

Not relevant to the request

<<Project Over 1M - Moltex QA 217315 (003).docx>>

Update from Debbie re **Moltex - Jan 26, 2021**

SMRs Update

Moltex ($3M) Contribution agreement is with Moltex. They forwarded questions on CA clauses and ACOA is meeting to discuss.

Not relevant to the request

s.21(1)(b)

s.21(1)(c)

s.21(1)(b)

s.21(1)(c)

Not relevant to the request

s.21(1)(b)

s.21(1)(c)

Not relevant to the request

NOTES/ACTION ITEMS	
FINAL MINUTES	

s.21(1)(b)

s.21(1)(c)

Not relevant to the request

From:	Patrick Lacroix
To:	Kalie Hatt-Kilburn; Sharon Stanford-Rutter;
Subject:	RE: HEADS-UP MEDIA CALL: The Globe and Mail
Sent:	5/25/2021 4:25:28 PM

Thank you Kalie for the detailed response,

Sharon, will ISED take the lead in responding? Thank you for keeping us in the loop on the next steps.

Patrick

From: Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>
Sent: Tuesday, May 25, 2021 2:26 PM
To: Sharon Stanford-Rutter <Sharon.Stanford-Rutter@ACOA-APECA.GC.CA>; ACOA.F MediaCallReport-RapportAppelsMedias F.APECA <mediacallreport-rapportappelsmedias@acoa-apeca.gc.ca>
Cc: Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>; Peta Fussell <Peta.Fussell@ACOA-APECA.GC.CA>; Tristan Hovey <Tristan.Hovey@ACOA-APECA.GC.CA>; Ted Parisé <Ted.Parise@ACOA-APECA.GC.CA>; ACOA.F NBCommunications-CommunicationsNB F.APECA <nbcommunications-communicationsnb@acoa-apeca.gc.ca>
Subject: RE: HEADS-UP MEDIA CALL: The Globe and Mail

Thanks Sharon. While the recommendations of NRCan were taken into account when considering our funding to Moltex, NRCan is the lead technical department in this area. Our funding is also consistent with Canada's Action Plan on SMRs, so it might be appropriate to direct them both to that publicly released plan (which speaks to the GoC policy position on SMRs) and to NRCan for more technical questions relating to proliferation.

With respect to the waste question, as you know our support will contribute to the company's research in using existing nuclear waste as fuel for its SMR design – a key advantage highlighted in the sector advice we had from NRCan. In this way, it can actually help to reduce our impact in this area.

With respect to proliferation, this should really be directed to NRCan. As I understand it, Canada is not a nuclear arms power, therefore all of its nuclear usage is for energy purposes and our regulatory framework reflects this position. But I would suggest that it would be more appropriate for NRCan to comment on this, since we would be parroting the positions we've heard from them on this.

Kalie

From: Sharon Stanford-Rutter <Sharon.Stanford-Rutter@ACOA-APECA.GC.CA>
Sent: Tuesday, May 25, 2021 2:18 PM
To: ACOA.F MediaCallReport-RapportAppelsMedias F.APECA <mediacallreport-rapportappelsmedias@acoa-apeca.gc.ca>
Cc: Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>; Peta Fussell <Peta.Fussell@ACOA-APECA.GC.CA>; Tristan Hovey <Tristan.Hovey@ACOA-APECA.GC.CA>; Ted Parisé <Ted.Parise@ACOA-APECA.GC.CA>; Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>; ACOA.F NBCommunications-CommunicationsNB F.APECA

<nbcommunications-communicationsnb@acoa-apeca.gc.ca>
Subject: RE: HEADS-UP MEDIA CALL: The Globe and Mail

A note the reporter has approached ISED as well, with essentially identical questions.

From: Sharon Stanford-Rutter <Sharon.Stanford-Rutter@ACOA-APECA.GC.CA>
Sent: Tuesday, May 25, 2021 2:15 PM
To: ACOA.F MediaCallReport-RapportAppelsMedias F.APECA <mediacallreport-rapportappelsmedias@acoa-apeca.gc.ca>
Cc: Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>; Peta Fussell <Peta.Fussell@ACOA-APECA.GC.CA>; Tristan Hovey <Tristan.Hovey@ACOA-APECA.GC.CA>; Ted Parisé <Ted.Parise@ACOA-APECA.GC.CA>; Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>
Subject: HEADS-UP MEDIA CALL: The Globe and Mail

Approval Yellow

Subject | Sujet : ACOA support to Moltex – due diligence

Language of the request | Langue de la demande : English

Media | Média : The Globe and Mail,

Deadline | Échéance : Tuesday, May 25 @ 5:30 pm EDT (working on extending this deadline)

Questions:
Today, a group of American non-proliferation experts sent a letter to Prime Minister Trudeau complaining about the recent federal financial support to Moltex Energy. The main allegation is that the government's support for reprocessing of CANDU spent fuel for plutonium extraction presents a proliferation risk and "will undermine the global nuclear weapons non-proliferation regime." The letter also says that "like other reprocessing efforts, Moltex, even in the R&D stage, would create a costly legacy of contaminated facilities and radioactive waste streams and require substantial additional government funding for cleanup and stabilization prior to disposal."

I have some questions about ACOA's due diligence process for this investment:

- Prior to providing support to Moltex through the Strategic Innovation Fund, what due diligence did ACOA perform regarding the non-proliferation risks associated with Moltex's reprocessing process? Please describe.
- What were ACOA's findings regarding the non-proliferation risks (if any) and why were they acceptable to ACOA?
- Prior to providing support to Moltex, what due diligence did ACOA perform on the environmental consequences of Moltex's reprocessing process? Please describe.
- What were ACOA's findings regarding the environmental consequences of Moltex's reprocessing process, and why were those risks deemed acceptable?

s.19(1)

- If ACOA is aware of any other due diligence by the federal government on the non-proliferation and/or environmental implications of Moltex's proposed reprocessing process, please identify—this would be helpful. I request related materials (reports etc.) if they exist.

Background | Contexte:

ACOA has provided $3M to Moltex under the REGI to develop SMR technology. This was announced by Minister LeBlanc on March 28, 2021 as part of a larger bundle.

Call to be returned by | Appel sera répondu par: Ann Kenney, via email.

Status (i.e. New Call – Pending input)

From:	Kalie Hatt-Kilburn
To:	Chuck Maillet
Cc:	Ted Parisé; Laura DeLong; Peta Fussell;
Subject:	FW: Notes from the North Shore Micmac District Council (NSMDC) virtual SMR Workshop Series
Attachments:	SMR Workshop Notes (Day 1 & 2).docx
Sent:	6/17/2021 5:47:00 PM

Hi Chuck,
You may have seen in the clippings this week that there was a 2-day workshop hosted by the North Shore Micmac District Council on opportunities for the Indigenous community in SMR development. They have partnered with the First Nations Power Authority out of SK, which is well organized and have experience in this area. The FNPA is the group that NRCan tapped to help coordinate Indigenous engagement relating to Canada's SMR Action Plan.
It's early days, but the tone was very positive. There is interest in accessing funding for a variety of initiatives. I have passed along to Ted your advice re: the First Nations Finance Authority as a pathfinding option for funding relating to NSDMC's interest in an equity position on such projects. There are likely other areas where some pathfinding will be required in future (training, supply chain development etc.), but this will play out over the long term (approx. 10 years before the first unit would be deployed). I just wanted to keep you apprised and extend the offer to brief you at any point, given your role as Indigenous Champion.
Kalie

From: Ted Parisé
Sent: Thursday, June 17, 2021 4:43 PM
To: Laura DeLong ; Kalie Hatt-Kilburn ; Peta Fussell
Subject: RE: Notes from the North Shore Micmac District Council (NSMDC) virtual SMR Workshop Series
I will corroborate that this was very good indeed. Momentum is really growing for the FN in this sector.
Laura, you are simply amazing! Great notes.
I was not so good with notes, but did a little networking... ☺

More to come...

s.19(1)

s.20(1)(b)

s.21(1)(b)

s.21(1)(c)

Ted

From: Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Sent: Thursday, June 17, 2021 4:11 PM
To: Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>; Peta Fussell <Peta.Fussell@ACOA-APECA.GC.CA>; Ted Parisé <Ted.Parise@ACOA-APECA.GC.CA>
Subject: Notes from the North Shore Micmac District Council (NSMDC) virtual SMR Workshop Series

All: Please find attached my notes from both Day 1 and Day 2 of the North Shore Micmac District Council (NSMDC) virtual Workshop Series on SMRs.

Both days were informative, useful, dynamic and interesting sessions! I understand that the NSMDC is organizing two additional workshops (June/July) and I'd offer that if the opportunity presents itself, I would welcome the opportunity to attend and stay informed on this file.

In case you have any questions about anything in my notes, please reach out and we can discuss.

Laura

Planning Process Overview and NSMDC Perspective

NSMDC

- NSMDC SMR Leadership – to date
  - NB Power Advanced Reactor Info workshop
  - Moltex MOU
  - OCNI – growing the new Brunswick nuclear supply chain
  - FNPA – SMR forum
  - NRCan SMR Action Plan
  - Atlantica Centre for Energy – collaboration
  - Indigenous Clean Energy Co-lab (may 2021)
  - Strategic Partnership Agreement with NB Power (May 2021)
- Energy Team - Enable NSMDC member first nation communities and their members to benefit from SMR, benefit from SMR supply chain, as well as ongoing SMR technology development.
- Youth and community engagement – promote education and employment opportunities.
- Vision – supporting commercialization of SMR technologies in NB ...and beyond. (supply chain, equity, promote role of SMR in net zero emission, employment, labour opportunities).
- Work with partners from the beginning. The more prepared we are the better chance there is for success.
- First Nations communities will be the best partners – really strong partnership.
- Action #1: work with industry partners to create equity stakeholder opportunities for NB First Nation Communities
- Action #2: work with industry partners to create education and employment opportunities for NB First Nation Communities.
- Action #3: Lead initiatives to increase awareness with FN Communities on economic, environmental and clean energy benefits
- NSMDC has FNPA to lead development of the NSMDC SMR Strategic Plan.
- Key opportunity that FN can provide – demographics. The indigenous population is on average, nearly a decade younger than the rest of the NB population.

FNPA SMR Perspective, Indigenous Equity, and Considerations

CEO FNPA & Advisor FNPA

- 2011 FNPA developed MOU with SK gov. and SK Power.
- Not for profit organization to facilitation, the development of FN led power projects. Representing 165 FNs.
- Canada's SMR Action Plan – FNPA believes this can't be a team Canada approach without First Nations at the table. It is a game-changer.
  - FNPA had seven themes of input for SMR Roadmap
  - FNPA developed 28 action items for the roadmap
- Cannot stress enough that this is a long-term development agenda. We have time to think about longer-term opportunities – jobs, labour, etc.
- Indigenous equity models Overview of sample ranges
- 10% is minimal for beneficial equity

s.19(1)

- Demographics – more youth, population growth is much higher than the country as a whole,
- New Brunswick demographics – has more predominant youth segment and FN population growth is forecast to grow. (63x regular growth rate).

NB Power Perspective and Plans

NB Power

- A multi-pronged approach is needed to achieve a managed transition to net zero. (Transmission, SMR, renewable/storage, efficiency, distributed energy resources).
- Recognized advantage of advanced SMRs
- MOU – SK, ON, NB and AB; working with FN partners
- Canadian collaboration is an advantage for Cdn.
- Strategic deployment plan this summer (from GNB)
- NB – on grid advanced SMRs developed in NB (Stream 2)
- Vision – demo these technologies by mid 2030s, fleet development; establish supply chain in NB & Cdn.
- Estimated that half of specialized modular components can be manufactured in NB.
- Continue to work with industry & Federal government (did not specifically mention SMRs – need assistance with this to access nuclear development)
- Next steps – perform preliminary design, work on fuel supply/recycyling; R&D, supply chain activities, engagement activities, continue to form strategic partnerships.
- Economic Impact is HUGE; need to explore:
    - Supply chain
    - Research and development
    - Training
    - Employment
    - Equity opportunities
    - Involvement in studies
    - Traditional indigenous studies

Moltex Perspective and Plans

Moltex

- Collaboration and growth – to ensure opportunities for FNs related to SMRs in NB
- Simpler components that current reactors means a wider supply chain base.
- Focus on development of NB/FN supply chain, then the rest of Canada, then the world.
- Preliminary review of NB supply chain revealed 50% readiness, some gaps.
- One on one meetings and deeper assessment of suppliers' capabilities ongoing.
- Moltex is committed to early indigenous engagement (meaningful and long-lasting relationships).
- UNB collaboration – research, nuclear-related courses, work on establish nuclear curriculum and new training opportunities.
- What is next - Building up the team now, supply chain, indigenous engagement, engineering design, large experiments at universities, NB Power pre-project support, new customer acquisition, and fundraising.

ARC Clean Energy Canada Inc. Perspective and Plans

ARC

s.19(1)

- Recognizes importance of partnership
- Understand that words are important, but actions are more important. ARC support UNDRIP, reconciliation.
- ARC can foster local economic growth opportunities
    - Promoting equal economic opportunities for indigenous peoples
    - Providing opportunities for equity partnerships
    - Hiring plan is reflective of the NB region – FN, diversity, bilingualism, focus on local & Cdn. Talent.
- Steps to getting operational: Phase 1 is complete, Phase 2 is in progress – (this is the pre-feasibility study), Phase 3 Feasibility, Phase 4 Deployment.
- ARC's current estimates predict 74% of all components and systems could be supplied in Cdn.
- Opportunities in manufacturing & supply chain, fleet services – a lot left to be done.
- Generally 3 areas for supplier participation
    1. Nuclear island
    2. Turbine island
    3. Balance of Plant
- Various qualifications required:
    - Nuclear grade, code standard, industrial standards
- Requirements for fabrication facility include – ability for transportation by road, rail or sea; supporting infrastructure like a port, airport, offices and housing; other potential areas of impact.
- Timeline progression – 2031 deployment.

Further Discussion and Consideration of SMR Roadmap Action Plan

Comments from participants:

- WRT Equity Participation - FNPA is happy to help to provide some experience in risk tolerance and project ownership / business model structures that work.
- We really need government partners to be engaged as well, so that the process of investment can be accessed in a more timely manner.
- Models to leverage Federal dollars for Indigenous equity with other capital sources
- General Request was made for *any and all assistance in navigating Federal funding*. It was noted that all participants were getting great cooperation with all levels of government, just need help navigating the new funding.
    - John Stronach (Nuclear Division, NR Can) Indigenous Engagement Unit – offered that they, too, are looking at the Federal Budget and 'how it's all going to work and how funding will roll out'. Stay tuned on this.
    - Ted Parise (ACOA) – offered that ACOA is open to listen to any particular ideas, initiatives, and that if ACOA can't fund, there is the opportunity for ACOA to pathfind to other Federal programs.
- Great momentum is building, creating partnerships, building the opportunities. Thank you to all. This is a real opportunity to be a 'have' province.
- First Nations need to be at the forefront, not an afterthought.
- First Nations is the second largest contributor to clean energy initiatives in Cdn.
- We want all FNs participation – North Shore welcomes all. We all need to come together to move this file.

Adjournment

Welcome & Opening Remarks

Panel 1 - Education & Training (FNPA to Chair / Facilitate)

University of New Brunswick, New Brunswick Community College, Collège communautaire du Nouveau-Brunswick. NB Power, Franklin Covey, Organization of Canadian Nuclear Industries

(UNB); (NBCC), (CCNB), (OCNI), (NBPower), (Franklin Covey), (FNPA).

- Revive and expand on the nuclear program at UNB.
- CNER – research institute with expertise, great collaboration with NB Power, Moltex and ARC
- Team at CNER of 25 ppl who are all working on aspects of nuclear
- Revived chemical engineering courses with focus on nuclear and nuclear focus.
- Grads will be able to support NBPower and SMR technologies.
- SMR cluster has been a big 'boom' for courses; increased in interest from students.
- UNB is fully supportive of nuclear energy, looking to expand faculty wrt nuclear.
- NBCC can support SMR needs in NB
- Understand some of the basic elements, but more discussion needs to take place to better understand the full set of skills that will be required.
- NBCC will be able to address needs with elements of existing program.
- Think of it as a skill set menu – introducing flexibility and pathway options
- NBCC will help, once they fully understand the 'skills' that are needed.
- CCNB has R&D capabilities, and has been in touch with NB Power about how they can assist.
- Mission is to spur growth in Atl. Cdn businesses through accelerating the adoption of technology.
- R&D advanced manufacturing – six labs for hands on learning.
- Can help in many ways – example Welding Simulations (hybrid laser arc welding); automation/process development
- OCNI has a skills development project focus on indigenous peoples in trades (and women).
- Outreach and partnerships with other organizations is strong and active
- Working directly with FNs to design the program.
- Lots of opportunity to replicate this type of program in other provinces.
- NB Power will be the customer of the previous speakers – so their view is different.
- Early discussions – operational readiness, what does that mean? How we staff it, how do we operate it (it's different than legacy nuclear).
- Lot of opportunity to do things differently.
- Franklin Covey intention is to inspire and empower youth in the North Shore.
- Personal effectiveness, leadership – enable greatness in organization and people.
- Offer solutions for building personal leadership. Want to build culture of continuous growth.
- FNPA/NSMDC – what does it mean for indigenous peoples in NB
- Usually FNs are the last to be considered, but SMRs opportunity we are joining the conversation early.
- Increase participation in this sector. FN has the fastest growing population in NB. What does it take to train FN people, in employment, in procurement, etc.
- Network of EDOs where talk about opportunities. Information sharing is important.
- Sharing knowledge will help build relationships.
- ONB, ACOA, ESDC, ISED, PETL – will be advocating for all to be involved.
- UNB tries to promote diversity. Is there help, funding? Yes – opportunities in nuclear education program are there. OCNI also has sponsorship. There is support for nuclear education, from nuclear sector.

s.19(1)

- At the community colleges there are lots of support systems in place to support FNs and their transition to college – including FN advisors, etc.
- We need to keep supporting FNs youth – show youth examples of other community members who are successful, educated, and have well-paying jobs.
- Q: Are there coop position, intern, etc. for indigenous peoples at NB Power? A: That is underway.

Panel 2: Supply Chain Development (FNPA to Chair / Facilitate)
NB Power, Sunny Corner, Organization of Canadian Nuclear Industries, FNPA

(Sunny Corner), (OCNI), (NB Power), (FNPA)

- Sunny Corner: First nuclear fabrication company in the province, nuclear program since 2005.
- SMR Considerations – Nuclear: a lot of oversight/documentation/transparency. Challenge: quality control, procurement, and project management.
- Corporate culture to support business (human performance tools)
- Technology – mfg automation and efficiency
- NSDMS participation and alignment – opportunities. Need a certain corporate culture to support nuclear business. (level of detail is needed)
- Being competitive at the end of the day – quality product, cost competitive.
- How do we work together with FNs to come up with a plan that is inclusive?
- OCNI - 80% of members are SMEs.
- Federal government has provided leadership with SMR Roadmap, and Call to Action.
- OCNI is committed to three specific actions under the Roadmap: promoting diversity and indigenous engagement across the SMR workforce develop a pan-Canadian SMR Supply Chain, promote to use of advanced manufacturing methods to reduce SMR cost.
- Hosted the 'Growing the NB Nuclear Supply Chain – October 30, 2020.
- MOU between OCNI and FNPA to collaborate, promote and support indigenous engagement and participation in nuclear.
- Options for NB indigenous business to enter the SMR supply chain – partners with existing nuclear suppliers, or acquire skills, technologies, nuclear QA programs. Ie. 'fit4SMRNuclear' program to grow the NB SMR Supply Chain
- Seeking Fed. Government funding (Atl. Innovation Fund)
- NB Power – supply chain sectors include: construction and site development, manufacturing and assembly, engineering and technology support, materials, labour, planning and management, quality assurance, environment and safety, transportation, ongoing technical and maintenance support.
- As much as 50% exist in NB today.
- FNPA - there are difference in the nuclear vs. non-nuclear supply chain.
- Opportunities and gaps for indigenous peoples can occur across the supply chain.
- Roadmap to Nuclear – 'prize is worth the perspiration'.
- Q: Does Sunny Corner have (or are they open to having) Indigenous participation targets. A: Absolutely need to work better together. Committed to working better – signing targets. Have not figure it out yet, but yes – willing to work in any way that helps.
- Need to make the trades more attractive to youth.
- Many indigenous trades people are heading out West – but if the opportunities aren't here, now, then how will we get them back.
- Institute of Energy Excellence in New Brunswick – NB Power is willing to make those connections with North Shore.

Adjournment

s.19(1)

Subject:	ARC update & check-in
Location:	Microsoft Teams Meeting
Start:	Tue 2022/11/15 1:00 PM
End:	Tue 2022/11/15 1:25 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Kalie Hatt-Kilburn
Required Attendees:	Josh Jenkins;

Microsoft Teams meeting

Join on your computer, mobile app or room device
Click here to join the meeting

Meeting ID:
Passcode:
Download Teams | Join on the web

Join with a video conferencing device
teams@acoa-apeca.video.canada.ca
Video Conference ID:
Alternate VTC instructions

Or call in (audio only)

Canada, Toronto
Canada (Toll-free)

Phone Conference ID:
Find a local number | Reset PIN

Learn More | Meeting options

Organized by / organisée par :

Krista Hicks

Executive Assistant of the Vice-President, New Brunswick Region

s.16(2)(c)

s.19(1)

Atlantic Canada Opportunities Agency, Government of Canada
Krista.Hicks@acoa-apeca.gc.ca / Tel: 506-238-4493 / TTY: 7-1-1

Adjointe exécutive de la vice-présidente, Bureau du Nouveau-Brunswick
Agence de promotion économique du Canada atlantique, Gouvernement du Canada
Krista.Hicks@acoa-apeca.gc.ca / Tél. : 506-238-4493 / ATS : 7-1-1

Pages 600 to / à 617

are withheld pursuant to sections

sont retenues en vertu des articles

20(1)(b), 20(1)(c), 20(1)(d)

of the Access to Information Act

de la Loi sur l'accès à l'information

From: Manon Maurice
To: Manon Maurice
Subject: SMR mtg with NB Power
Sent: 5/23/2025 9:26:25 AM

Meeting Subject: NB Power & ACOA: SMR updates
Meeting Date: 2023/02/27 2:00 PM
Location: ACOA NB, Waverley Place, 81 Regent St, Achorage Boardrrom (Rm 608); ACOA CONF NB-Fre-81Regent-608-Anchorage-MEDIUM CONF APECA
Link to Outlook Item: *click here*
Invitation Message
Participants

- Kalie Hatt-Kilburn (Meeting Organizer)
- Nathalie Cavanaugh
- Spires, Joanne
- ~~Laura DeLong~~
- Josh Jenkins
- [redacted]@nbpower.com (Accepted in Outlook)
- [redacted]@nbpower.com

VP NB & Sr Advisor	
STATUS (Ongoing, Firm, Declined, Assigned, Cancelled)	Firm
AGENDA	
Host MATERIALS/RESOURCES/LINKS	
Internal MATERIALS/RESOURCES/LINKS	Laura Delong's last draft of SMR briefing
CONSIDERATIONS/SPEAKING POINTS (Programs/Policy)	
NOTES/ACTION ITEMS	• CAN conference last week. Asked by

s.19(1)

- Federal:
  - 30-50% incentives through the US IRA
  - Still unclear about the Canadian 30% investment tax credit and how that will be applied.
  -
  - FOAK to NOAK cost
  -
  - License to prepare site to go be issued in June.
  -
  -
  - HALEU fuel doesn't have the enrichment capacity in Canada. We have a line on the fuel for the FOAK at Lepreau. Belledune first unit in 2031, with another every 6 months up to 8 units. Need the HALEU fuel.
  -
  -
  -
  -
  - is the chair of the CEO working group.

s.14
s.19(1)
s.20(1)(b)
s.20(1)(c)
s.21(1)(b)
s.21(1)(c)

- In order for a common study around SMR waste that benefits everybody. There's an opportunity for the feds to share in that.
-
-
-
- ARC unit is high temperature industrial unit. A solution to industrial decarbonization.
-
-
- Financial guarantees. CIB has been great working with NBPower. Very willing to support and potentially to provide some accelerator money.
-
- Indigenous - some funding to get studies in place to go

s.14
s.20(1)(b)
s.21(1)(b)
s.21(1)(c)

ahead. Equity stake interest in SMRs.

- Initiative going on in the country to set up a trust fund for indigenous people in a certain jurisdiction. Encouraging the wolostaquey and mi'kmaq to look at something similar.
-
-
-
-
-
- last week. Comprehensive, integrated plan on how to get to net zero here in Canada. Nuclear is different than other renewables.
- Regulatory streamlining. The impact assessment takes 5.5 to 8 years. This is impossible to meet the timelines for deployment. UK and US are talking 2 years. Regulatory process is designed for very large, unique projects. Need to be right sized. Technology assessment, then site

s.14
s.19(1)
s.20(1)(c)
s.21(1)(b)
s.21(1)(c)

	assessment. 6 yrs to get a micro-reactor through impact assessments. •
FINAL MINUTES	Kalie shared Min LeBlanc's office contacta info w/ as follow-up (Mar 2)

Created with OneNote.

s.14

s.19(1)

s.21(1)(b)

s.21(1)(c)

From:	Manon Maurice
To:	Manon Maurice
Subject:	ARC mtg w/
Sent:	5/23/2025 9:24:01 AM

Meeting Subject: ARC/ACOA Discussion
Meeting Date: 2023/07/21 2:30 PM
Location: Microsoft Teams Meeting
Link to Outlook Item: *click here*
Invitation Message
Participants

(Meeting Organizer)

Kalie Hatt-Kilburn

Krista Hicks

Josh Jenkins

VP NB & Sr Advisor	
STATUS (Ongoing, Firm, Declined, Assigned, Cancelled)	Firm
AGENDA	• how to work together to attract businesses to New Brunswick as it relates to ARC's activities in the province
Host MATERIALS/RESOURCES/LINKS	
Internal MATERIALS/RESOURCES/LINKS	• Update fr Josh J • ARC update & check-in - Nov 15, 2022 • ARC Canada update fr · Jun 17, 2022
CONSIDERATIONS/SPEAKING	

s.19(1)

Pages 624 to / à 628

are withheld pursuant to sections

sont retenues en vertu des articles

20(1)(a), 20(1)(b), 20(1)(c), 20(1)(d), 21(1)(b), 21(1)(c)

of the Access to Information Act

de la Loi sur l'accès à l'information

From:	Manon Maurice
To:	Manon Maurice
Subject:	MINO call with ACOA NB VP Kalie Hatt-Kilburn - 2023/09/27
Attachments:	Moltex Update 09.26.2023.docx;Business plan Sep 2023 .docx;
Sent:	5/23/2025 9:38:48 AM

Meeting Date: 2023/09/27 2:30 PM
Location: Microsoft Teams Meeting
Link to Outlook Item: *click here*
Invitation Message
Participants

- Nicholas Charney (Meeting Organizer)
- Kalie Hatt-Kilburn (Accepted in Outlook)
- Jacob Beal (Accepted in Outlook)
- Harry Burton
- Christopher Haley
- Kafa El Zamer
- Jeanetta Hill
- Rima Thomeh
- Krista Hicks

VP NB & Sr Advisor

STATUS (Ongoing, Firm, Completed)	Firm
CONSIDERATIONS/SPEAKING POINTS (Programs/Policy)	**KALIE**

TOPIC	DETAILS	MINO FEEDBACK/ ACTION ITEMS	ATTACHMENTS
Moltex Project Application	Subject: Moltex Energy Canada Update Purpose: The purpose of this information note is to provide an update on Moltex Energy Canada. Background • The world's energy systems are undergoing rapid transition triggered by simultaneous shifts in technological development, regulations, consumer preferences, and investor sentiment. • Moltex Energy Canada (Moltex) is a company developing two complementary technologies to		<<Moltex Update 09.26.2023.docx>> <<Business plan Sep 2023 .docx>>

Not relevant to the request

s.20(1)(b)
s.20(1)(c)
s.20(1)(d)
s.21(1)(b)
s.21(1)(c)

address nuclear waste and produce carbon-free energy.

- WAste To Stable Salt (WATSS) is a small-footprint facility for recycling spent fuel bundles from Canada's existing CANDU reactors, producing safer end products and fuel for a molten salt advanced small modular reactor (aSMR).

- The Stable Salt Reactor – Wasteburner (SSR-W) is an aSMR that uses the fuel produced by WATSS, in an inherently safe facility that occupies much less space than required by a conventional reactor.

- As with any new technology the first-of-a-kind commercial aSMRs will cost more to develop.

Current Status

- On September 25, 2023 several First Nations communities in New Brunswick, led by the North Shore Mi'kmaq Council, announced they are investing $3 million in small modular nuclear reactors (SMRs) as part of an environmental and economic initiative. They have signed an equity agreement to buy $2 million in shares with Moltex Energy and $1 million with ARC Clean Energy. Details of the equity agreements are not yet known.

What is Moltex Asking for?

Economic Impact

- Moltex is the only fully Canadian SMR technology being developed with a utility and the only SMR technology that is not subject to US export control restrictions.

Position of ACOA

- Investment in new clean energy technologies such as nuclear innovation is essential to achieving the decarbonization needed to achieve Canada's climate goals.

- The Agency continues to work collaboratively across a range of Federal Departments to advance the SMR file.

s.20(1)(b)

s.20(1)(c)

s.20(1)(d)

s.21(1)(b)

s.21(1)(c)

	• CBC new article • • • On Monday Sept. 25, Pabineau Chief Terry Richardson announced the NSMDC and its seven FN member communities are investing $3M in SMR technology with Moltex and ARC Clean Energy (Saint John). This is part of an environmental and economic initiative and will allow the communities to receive equity, which is significant. • The communities have signed an equity agreement to buy $2M in shares with Moltex Energy and $1M with ARC Clean Energy. • • *First nations power authority - Saskatchewan - pair them with NDMDC - for knowledge sharing on equity investment. Build capacity to participate.* *Now they are ready to option in on this investment.*		

JEANETTA

TOPIC	DETAILS	MINO FEEDBACK/ ACTION ITEMS	ATTACHMENTS
Moltex - NB First Nation SMRs Projects with NSMDC: Project: Project Assessment: Engage expertise to conduct an economic development plan for First Nations in Northern NB - Dynamics 365	CBC Article: 7 First Nations in N.B invest in small modular nuclear reactors	CBC News • On Monday Sept. 25, Pabineau Chief Terry Richardson announced the NSMDC and its seven FN member communities are investing $3M in SMR technology with Moltex and ARC Clean Energy (Saint John). This is part of an environmental and economic initiative and will allow the communities to receive equity, which is significant. • The communities have signed an equity agreement to buy $2M in shares with Moltex Energy and $1M with ARC Clean Energy. • • • *First nations power authority - Saskatchewan - pair them with NDMDC - for knowledge sharing on equity investment. Build capacity to participate.* *Now they are ready to option in on this investment.*	Move to Kalie	

Not relevant to the request

Not relevant to the request

s.21(1)(b)

s.21(1)(c)

s.21(1)(b)

s.21(1)(c)

Not relevant to the request

s.21(1)(b)

s.21(1)(c)

Not relevant to the request

Not relevant to the request

s.21(1)(b)

s.21(1)(c)

Atlantic Canada Opportunities Agency | Agence de promotion économique du Canada atlantique

INFORMATION NOTE

Prepared by
Laura DeLong
Date submitted
September 26, 2023

Subject: Moltex Energy Canada Update

Purpose: The purpose of this information note is to provide an update on Moltex Energy Canada.

Background

- The world's energy systems are undergoing rapid transition triggered by simultaneous shifts in technological development, regulations, consumer preferences, and investor sentiment.
- Moltex Energy Canada (Moltex) is a company developing two complementary technologies to address nuclear waste and produce carbon-free energy.
  - WAste To Stable Salt (WATSS) is a small-footprint facility for recycling spent fuel bundles from Canada's existing CANDU reactors, producing safer end products and fuel for a molten salt advanced small modular reactor (aSMR).
  - The Stable Salt Reactor – Wasteburner (SSR-W) is an aSMR that uses the fuel produced by WATSS, in an inherently safe facility that occupies much less space than required by a conventional reactor.
- As with any new technology the first-of-a-kind commercial aSMRs will cost more to develop.
-
-

Current Status

-
-
-
-
- On September 25, 2023 several First Nations communities in New Brunswick, led by the North Shore Mi'kmaq Council, announced they are investing $3 million in small modular nuclear reactors (SMRs) as part of an environmental and economic initiative. They have signed an equity agreement to buy $2 million in shares with Moltex Energy and $1 million with ARC Clean Energy. Details of the equity agreements are not yet known.

s.20(1)(b)
s.20(1)(c)
s.20(1)(d)
s.21(1)(b)
s.21(1)(c)

What is Moltex Asking for?

-

Economic Impact

- Moltex is the only fully Canadian SMR technology being developed with a utility and the only SMR technology that is not subject to US export control restrictions.

Position of ACOA

- Investment in new clean energy technologies such as nuclear innovation is essential to achieving the decarbonization needed to achieve Canada's climate goals.
-
- The Agency continues to work collaboratively across a range of Federal Departments to advance the SMR file.
-

s.20(1)(b)

s.20(1)(c)

s.20(1)(d)

s.21(1)(b)

s.21(1)(c)

Pages 637 to / à 638

are withheld pursuant to sections

sont retenues en vertu des articles

20(1)(a), 20(1)(b), 20(1)(c), 20(1)(d), 21(1)(b), 21(1)(c)

of the Access to Information Act

de la Loi sur l'accès à l'information

From:	Jeanetta Hill
To:	Kalie Hatt-Kilburn
Cc:	Lindsay Walker
Subject:	FW: Moltex
Sent:	11/13/2024 10:12:51 AM

Follow Up Flag:	Follow up
Flag Status:	Flagged

Some early observations as info for you. Laura will be point on preparing more briefings but these bullet were shared with Nadine in advance of the Presdident's meeting with NRCAN.

Thanks
Jeanetta

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Tuesday, November 12, 2024 9:55 AM
To: Jeanetta Hill <Jeanetta.Hill@ACOA-APECA.GC.CA>
Subject: FW: Moltex

Fyi – early takeaways from the Moltex visit last week (some bullets to support a DM meeting with NRCan)

More detailed notes will be available later in the week,

Josh

From: Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Sent: Tuesday, November 12, 2024 9:50 AM
To: Nadine Cormier <Nadine.Cormier@ACOA-APECA.GC.CA>
Cc: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>; Roger Miranda <Roger.Miranda@acoa-apeca.gc.ca>; Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>; Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>; Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>
Subject: RE: Moltex

Nadine: I hope that these are helpful – happy to discuss in more detail if you'd like. Also, over the week when time permits, I will be pulling together all my notes from the trip and am happy to share those too.

Laura

**

- The Agency will be monitoring both the scientific outcomes, as well as the commercialization path of the company going forward (in partnership with our federal funding partners).

s.20(1)(b) Timeframe

s.20(1)(c)

s.20(1)(d)

s.21(1)(b)

Event	Timeframe
Testing at CNL continues	Mid December
Report provided to NB Power	By December 31st
Results available publicly	Second week of January

From: Nadine Cormier <Nadine.Cormier@ACOA-APECA.GC.CA>
Sent: Tuesday, November 12, 2024 8:59 AM
To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Cc: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>; Roger Miranda <Roger.Miranda@acoa-apeca.gc.ca>
Subject: RE: Moltex

Thank you! Nadine

Nadine Cormier (her/elle)

Senior Policy Analyst | Analyste principal des politiques
Green Economy Policy | Politiques Economie Verte
Atlantic Canada Opportunities Agency (ACOA) | Agence de promotion économique du Canada atlantique (APECA)
506-227-3076 | nadine.cormier@acoa-apeca.gc.ca

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Thursday, November 7, 2024 4:25 PM
To: Nadine Cormier <Nadine.Cormier@ACOA-APECA.GC.CA>
Cc: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>; Roger Miranda <Roger.Miranda@acoa-apeca.gc.ca>
Subject: Re: Moltex

Great timing; Laura and I are attending the company's test of their technology at CNL tomorrow, along with colleagues from NRCan and SIF.

Should be able to get you a few bullets on the 12th

Josh
Sent from my iPhone

> On Nov 7, 2024, at 1:43 PM, Nadine Cormier <Nadine.Cormier@acoa-apeca.gc.ca> wrote:
>
> Hi Josh
>
> Hope you are well.
>
> I have been tasked with preparing a meeting note for our President for her monthly meeting with NRCan.
>
> Do you have a few bullets you could share with me on the current status of this project and any involvement we have that may interest NRCan?
>
> My note is due November 13. If I could get something by **noonish on November 12**, this would provide sufficient time for me to complete the note.
>
> Thanks,
> Nadine

s.21(1)(b)

From:	Peta Fussell
To:	Patrick Lacroix
Subject:	SMRs - Meeting Notes - Aug 2019
Attachments:	SMR Update.docx;SMRs - Meeting Notes - Aug 2019.docx;
Sent:	5/4/2020 10:51:10 AM

Hi Patrick,
Attached is the most recent update on SMRs from January as well as a meeting note from last August which provides an useful overview.
There have been many meetings between the President, Kalie, Moltex, ARC and NB Power on this topic over the last year.
Thanks,
Peta

Small Modular Reactors

Topic

- Funding proposals under SIF for the development of small modular reactors (SMR) in Atlantic Canada.

Background

- Small Modular Reactors (SMRs) are proposed to be a smaller and less expensive alternative to conventional nuclear fission reactors.
- In August 2018, the provincial government of New Brunswick created a Nuclear Research Cluster and signed MOU's with two companies developing Small Modular Reactor (SMR) technology, ARC and Moltex. Through the New Brunswick Energy Solutions Corporation (NBESC), the government of New Brunswick (GNB) invested $10 million ($5M for ARC / $5M for Moltex) to foster research and development in these two SMR designs.
- GNB hopes that this provincial investment in SMR technology development will lead to a demonstration SMR unit being constructed at Point Lepreau - after completion of all Vendor Design Review (VDR) stages, regulatory requirements and adequate consultation.

Significance of SMR Development to Atlantic Canada

- SMRs are of particular interest to New Brunswick as a source of safe, clean and reliable baseload energy, which is of concern once the Belledune coal-fired generating station comes offline in 2030 and the Point Lepreau nuclear facility reaches its end of life in 2040.
- Currently, all four Atlantic provincial governments and utilities are collaborating along with Quebec on an Atlantic Clean Power Roadmap. SMRs are included among the future generation options being considered to supply the future clean energy needs of an interconnected regional grid, particularly as it relates to addressing baseload concerns.

SIF Program Requests

-

- Given the degree of technical sophistication involved in assessing proposals for the nuclear industry, NRCan has been engaged to provide advice in consideration of these and other SMR-related asks.
-

-

Key Considerations

-

-

s.20(1)(b)

s.20(1)(c)

s.20(1)(d)

s.21(1)(b)

s.21(1)(c)

-
-

s.20(1)(b)

s.20(1)(c)

s.20(1)(d)

s.21(1)(b)

MEETING NOTE

MEETING/EVENT: Deputy Ministers Roundtable on Small Modular Reactors (SMRs)

DATE: August 15, 2019

TIME: 14:00 – 15:30

LOCATION: Main Boardroom, 21st Floor
580 Booth Street, Ottawa

PARTICIPANTS:

- Deputy Ministers from various departments and agencies including: NRCan, ISED, GAC, ECCC, Finance, PCO, TBS, AECL,ACOA, Cannor, DND, INFC, and SDTC.

PURPOSE:

With the release of it's SMR Roadmap, NRCan is seeking to develop a whole-of-government strategy for the development and deployment of SMR technology.

BACKGROUND:

In June 2017 Canadian Nuclear Laboratories (CNL) invited expressions of interest in SMRs, as CNL aims to have a SMR at its Chalk River site by 2026.

In August 2018, the provincial government of New Brunswick (GNB) created a Nuclear Research Cluster and signed MOUs with two companies developing SMR technology, *ARC* and *Moltex*. Through the *New Brunswick Energy Solutions* Corporation (NBESC), GNB committed $10 million ($5M for ARC / $5M for Moltex) to foster research and development in these two SMR designs.

Currently, eleven international SMR developers have engaged with the Canadian Nuclear Safety Commission's (CNSC's) three stage pre-licensing vendor design review (VDR) process, which identifies fundamental barriers to licensing new SMR designs in Canada. The pre-licensing review is essentially a technical discussion, phase 1 of which involves about 5000 hours of staff time, considering the conceptual design and charged to the developer. Phase 2 is twice that, addressing system-level design. As of

February 2019, CNL announced that only *StarCore Nuclear* and *Terrestrial Energy* had qualified to enter the due diligence (second) stage of the VDR process. Phase 3 of the VDR is a pre-construction follow-up stage, which is optional.

GLOBAL SMR LANDSCAPE

Since 2012, private sector and the *US Department of Energy* (DOE) have invested over $1 billion in the development of SMRs. A demonstration SMR developed by NuScale, is projected to be operational by 2024 at the DOE's Idaho National Laboratory (INL).

In March 2016 the *UK Department of Energy & Climate Change* (DECC) called for expressions of interest in a competition to identify the best value SMR for the UK and committed at least £250 million over five years in nuclear R&D including SMRs.

Currently, the most advanced small modular reactor project is in *China*, where Chinergy is starting to build a 210 MWe high-temperature gas-cooled SMR reactor.

ECONOMICS OF SMRs

"First-of-a-kind" (FOAK) costs will likely make the early SMR units considerably more expensive than alternative sources of power.

A key driver of SMRs are the alleged improved economies of scale when compared to larger reactors, which stems from the ability to prefabricate them in a manufacturing plant/factory. However, the modular construction and the economies of scale can only be realised if the factory is built in the first place, which some experts think unlikely as there is currently hundreds of theoretical designs models for various SMR technologies resulting in a very wide range of necessary capital costs, operational expenses, and production methodologies, all resulting in significant uncertainty.

According to some studies, the capital cost between SMRs and conventional larger reactors are practically equivalent as licensing for SMRs in relation to design certification, construction and operation licence costs are not necessarily less than for large reactors.

KEY POINTS TO RAISE:

- The size of ACOA's funding envelope would make it challenging for the Agency to provide assistance given the magnitude of the investments required to see SMR technology through to demonstration.
- ACOA's role with respect to technological innovation is more squarely focused on commercialization and technology adoption, rather than early stage R&D.
- ACOA can play an important role in building research capacity at UNB's Centre for Nuclear Energy Research, which partners with companies like ARC and Moltext to augment their R&D.

- The Agency is actively engaged with NBPower and UNB to explore opportunities to foster the development of New Brunswick's existing nuclear supply chain resources.

Date: 2019.08.08

From:	Peta Fussell
To:	Patrick Lacroix
Subject:	FW: SMR Update
Attachments:	SMR Update_June 3 2020.docx;FW: RECORDING -- Webinar - New Brunswick's Nuclear Future: Advanced Small Modular Reactors -- June 3, 2020;
Sent:	6/5/2020 1:52:40 PM

FYI

From: Hicks, Hugh (ACOA/APECA)
Sent: Friday, June 05, 2020 1:22 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA)
Cc: Parisé, Ted (ACOA/APECA) ; Fussell, Peta (ACOA/APECA)
Subject: RE: SMR Update

Hi Kalie,
Thanks for the update - very helpful. Good to hear that NBP is advancing on the studies at LePreau as I know this was an item on the time line. Here is some feedback from an NB Power discussion I had yesterday with he did have quite a bit to say regarding CNER and the direction they should take.
Ted is working on the note and can use your input and the stuff I noted below to craft it.
Do you know when the meeting with the Premier and Francis will take place?
Peta - I am copying you in a as well as well.
Thanks,
Hugh

Key points regarding the CNER lab and its future focus:

-R&D in the nuclear/SMR space runs over a significant period of time. There is R&D work to be done from the early design stage to the end of life stage. So SMR reactors will require significant R&D investment from cradle to grave.
-UNB has capacity around corrosion testing and chemical property analysis. This skillset is useful particularly when it comes to nuclear molten salt technologies. Chemical property analysis can be used not just by ARC and Moltex, but other companies in the SMR development business such as Terrestrial.

s.14
s.19(1)
s.20(1)(b)
s.21(1)(b)

Current Needs:
UNB need s to upgrade its lab infrastructure and establish a QA regime. Beyond this, the facility needs to attract a few key people that can support the lab work and improve ties to the private sector.

How can CNER play a role in economic development:
It is important that CNER identify where is can play a strategic part in the nuclear/SMR landscape and focus its activities to support it areas of specialization.

From: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Sent: Friday, June 05, 2020 10:25 AM
To: Hicks, Hugh (ACOA/APECA) <hugh.hicks@canada.ca>
Subject: FW: SMR Update

s.14
s.19(1)
s.20(1)(b)
s.21(1)(b)

Hugh,
For the briefing note on the SMR file, you'll find attached an update that I sent to Francis yesterday, along with a summary of the webinar that took place yesterday. Thought I might save you some digging/typing by providing.

Let me know if you have any questions or would like to discuss.
Thanks,
Kalie

From: Hatt-Kilburn, Kalie (ACOA/APECA)
Sent: Wednesday, June 03, 2020 6:37 PM
To: McGuire, Francis (ACOA/APECA) <francis.mcguire@canada.ca>
Cc: Estabrooks, Kent (ACOA/APECA) <kent.estabrooks@canada.ca>
Subject: SMR Update

Francis,
As promised, you will find attached an updated SMR briefing. The updates are highlighted in blue and include: the project scoping issue leaving a funding gap; as well as ACOA's recent involvement (Moltex project, support to Northshore District Mik'maq Council and development work to strengthen UNB's capacity). If you need anything further or would like to discuss, please let me know.
Kalie

s.14

s.19(1)

s.20(1)(b)

s.21(1)(b)

Small Modular Reactors

Topic

- Development of small modular reactors (SMR) in New Brunswick.

Background

- Small Modular Reactors (SMRs) are proposed to be a smaller and less expensive alternative to conventional nuclear fission reactors.
- In August 2018, the provincial government of New Brunswick created a Nuclear Research Cluster and signed MOU's with two companies developing advanced Small Modular Reactor (SMR) technology, ARC and Moltex. Through the New Brunswick Energy Solutions Corporation (NBESC), the government of New Brunswick (GNB) invested $10 million ($5M for ARC / $5M for Moltex) to foster research and development in these two SMR designs.
- The Province of New Brunswick hopes that this provincial investment in SMR technology development will lead to a demonstration SMR unit being constructed at Point Lepreau - after completion of all Vendor Design Review (VDR) stages, regulatory requirements and adequate consultation.

Significance of SMR Development to Atlantic Canada

- SMRs are of particular interest to New Brunswick as a source of safe, clean and reliable baseload energy, which is of concern once the Belledune coal-fired generating station comes offline in 2030 and the Point Lepreau nuclear facility reaches its end of life in 2040.
- Currently, all four Atlantic provincial governments and utilities are collaborating along with Quebec on an Atlantic Clean Power Roadmap. SMRs are included among the future generation options being considered to supply the future clean energy needs of an interconnected regional grid. Because of the intermittence of renewables like wind and solar, SMRs are seen as particularly important in helping to address concerns with sourcing a supply of a clean, reliable baseload power.

SIF Program Requests

-
-
- Given the degree of technical sophistication involved in assessing proposals for the nuclear industry, NRCan has been engaged to provide advice to ISED in consideration of these and other SMR-related asks.
-
-
-

s.20(1)(b)
s.20(1)(c)
s.20(1)(d)
s.21(1)(b)
s.21(1)(c)

- [redacted]
- [redacted]

ACOA Involvement

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

s.20(1)(b)
s.20(1)(c)
s.20(1)(d)
s.21(1)(b)
s.21(1)(c)

June 3, 2020

From:	Kalie Hatt-Kilburn
To:	Patrick Lacroix
Subject:	FW: SMR Update
Attachments:	SMR Update_June 3 2020.docx;SMR Update_April 30 2020.docx;
Sent:	6/5/2020 5:23:50 PM

Hi Patrick,
You will find attached the latest briefing on the SMR. I've also included a previous email that was sent to Francis for a last minute briefing with the Minister on April 30th ahead of a conversation she was having with Premier Higgs.

The Premier also had a conversation with Minister Bains last week According to Kelly they had an animated conversation about the future of SMRs and the Premier is very engaged on the file. Both companies have separate market segments and applications that NBPower sees as important for the future of clean energy, not only in NB, but in the Atlantic region.

If you need anything further from me or would like to discuss to get more context on the file, just let me know.
Thanks,
Kalie

From: Hatt-Kilburn, Kalie (ACOA/APECA)
Sent: Wednesday, June 03, 2020 6:37 PM
To: McGuire, Francis (ACOA/APECA)
Cc: Estabrooks, Kent (ACOA/APECA)
Subject: SMR Update
Francis,
As promised, you will find attached an updated SMR briefing. The updates are highlighted in blue and include: the project scoping issue leaving a funding gap; as well as ACOA's recent involvement (Moltex project, support to Northshore District Mik'maq Council and development work to strengthen UNB's capacity). If you need anything further or would like to discuss, please let me know.
Kalie

s.14

s.21(1)(b)

s.21(1)(c)

From:	Madonna Kent
To:	Patrick Lacroix
Cc:	Kent Estabrooks
Subject:	RE: Update on meeting with the Premier
Attachments:	NB Profile - September 25, 2020.docx
Sent:	10/30/2020 4:15:40 PM

Patrick
The attached was provided by INFC back in September . Francis had an exchange with Kelly Gillis DM at INFC and she had her staff provide this ……
Thanks
Madonna

From: Lacroix, Patrick (ACOA/APECA)
Sent: Thursday, October 29, 2020 8:00 PM
To: Kent, Madonna (ACOA/APECA)
Cc: Estabrooks, Kent (ACOA/APECA)
Subject: FW: Update on meeting with the Premier
Hi Madonna, could you please provide us insight or sources of information as it pertains to the unused amount of infrastructure funding?
Thank you,
Patrick

From: McGuire, Francis (ACOA/APECA) <francis.mcguire@canada.ca>
Sent: Thursday, October 29, 2020 4:59 PM
To: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>; Estabrooks, Kent (ACOA/APECA) <kent.estabrooks@canada.ca>
Cc: Nowlan, Daryell (ACOA/APECA) <daryell.nowlan@canada.ca>; Kent, Madonna (ACOA/APECA) <madonna.kent@canada.ca>; Lacroix, Patrick (ACOA/APECA) <patrick.lacroix@canada.ca>
Subject: RE: Update on meeting with the Premier
I will raise these nuclear issues with the Chief of staff tomorrow as Minister LeBlanc is involved.

From: Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Sent: Thursday, October 29, 2020 3:26 PM
To: McGuire, Francis (ACOA/APECA) <francis.mcguire@canada.ca>; Estabrooks, Kent (ACOA/APECA) <kent.estabrooks@canada.ca>
Cc: Nowlan, Daryell (ACOA/APECA) <daryell.nowlan@canada.ca>; Kent, Madonna (ACOA/APECA) <madonna.kent@canada.ca>; Lacroix, Patrick (ACOA/APECA) <patrick.lacroix@canada.ca>
Subject: RE: Update on meeting with the Premier
Thanks you for the update on their discussion – very helpful.
On the SMR front, we're working on a briefing that we would propose you bring forward with the Chief of Staff to sensitize MINO to the broader Clean Power Atlantic strategy and position the Moltex, UNB and NBP projects within that context. It would be helpful to raise their awareness before routing these projects up.
I'm copying Patrick on this response as well so that he can respond re: the infrastructure funding since I believe Peta had already looked into the unused portion and may have the answers to

those questions.
Kalie

From: McGuire, Francis (ACOA/APECA) <francis.mcguire@canada.ca>
Sent: Wednesday, October 28, 2020 5:24 PM
To: Estabrooks, Kent (ACOA/APECA) <kent.estabrooks@canada.ca>; Hatt-Kilburn, Kalie (ACOA/APECA) <kalie.hatt-kilburn@canada.ca>
Cc: Nowlan, Daryell (ACOA/APECA) <daryell.nowlan@canada.ca>; Kent, Madonna (ACOA/APECA) <madonna.kent@canada.ca>
Subject: Update on meeting with the Premier

I spoke with Kevin Lavigne about Minister LeBlanc's meeting with the Premier. The Premier committed to give ARC $10 million in support at the same time that SIF announces $32 million for Moltex.

s.21(1)(b)

s.21(1)(c)

NEW BRUNSWICK

PROVINCIAL FUNDING PROFILE OF INFRASTRUCTURE CANADA PROGRAMS

INVESTING IN CANADA INFRASTRUCTURE PROGRAM (ICIP): $673.2 million (Total Initial Allocation)
Canada-New Brunswick Integrated Bilateral Agreement signed on March 15, 2018; Canada-New Brunswick IBA Amendment No. 1 signed on August 6, 2019.
Allocation-based program – Province has specific funding envelope as per IBA – Province prioritizes projects – INFC reviews projects for eligibility and alignment with IBA requirements – INFC is responsible for compliance with the IBAs but is not responsible for project management.

Stream	Project Funding Envelope	All Approved		Under Review		Unallocated (%)	Planned		Unallocated (%) including planned
		Project Count	Program Contribution	Project Count	Program Contribution		Estimated Project Count	Estimated Program Contribution	
Public Transit Infrastructure Stream	$163,479,251	0	$0	0	$0	100%	0	$0	100%
Green Infrastructure Stream	$343,529,716	8	$11,709,653	4	$10,313,000	94%	6	$29,968,400	85%
45 % Sub-stream Climate Change Mitigation	$156,218,054	0	$0	0	$0	100%	1	$2,145,000	99%
Rural & Northern Infrastructure Stream	$113,437,766	36	$98,812,059	1	$7,200,000	7%	2	$5,035,020	2%
Community, Culture & Recreation Infrastructure Stream	$45,747,762	5	$4,282,900	2	$7,422,256	74%	1	$3,600,000	67%
COVID-19 Response Stream	TBC								
Stream Total	**$666,194,495**	**49**	**$114,804,612**	**7**	**$24,935,256**	**79%**	**9**	**$38,603,420**	**73%**

* Information reflects data as of September 23, 2020.

For the 5 projects currently under review (not currently with the Minister's office):

- Week of October 5 – Minister Monsef can expect 1 RNIS project
- Week of October 12 – Minister McKenna can expect 1 CCRIS project
- Late October – Minister McKenna can expect 1 CCRIS project and 2 GIS projects

New Brunswick - ICIP Public Transit Sub-Allocation Status (Data as of: September 9, 2020 – updated monthly)								
Ultimate Recipient	Initial Allocation	Proportional Administrative Funds	Final Allocation	Funds Approved	Funds Under Review	Remaining Allocation	Planned (Estimated Program Contribution)	Unallocated (including Planned)
Moncton	$62,506,721.52	$659,032.24	$62,506,721.52	N/A	N/A	$62,506,721.52	0	100%
St John	$61,152,987.08	$644,727.93	$61,152,987.08	N/A	N/A	$61,152,987.08	0	100%
Fredericton	$38,318,300.94	$403,967.46	$38,318,300.94	N/A	N/A	$38,318,300.94	0	100%
Miramichi	$1,501,241.77	$15,683.06	$1,501,241.77	N/A	N/A	$1,501,241.77	0	100%
TOTAL NB	**$163,479,251.31**	**$1,723,410.69**	**$163,479,251.31**	**$0.00**	**$0.00**	**$163,479,251.31**	**0**	**100%**

OTHER KEY CONSIDERATIONS	
Provincial elections were held on September 14, 2020, with the NB Minister to be sworn in on September 29, 2020. It is expected that NB will wish to sign the IBA amendment immediately after, as well as see projects that were on hold in the approval process. On July 10, 2020, NB submitted a list of 35 potential projects that could be submitted under the new COVID-19 stream. Two-thirds of the list is comprised of projects that would be submitted by the New Brunswick Regional Development Corporation with the other third from the Department of Transportation and Infrastructure. INFC continues to work with NB to review eligibility of projects on the list. The last ICIP intake in NB took place in between May and June, 2019. The date for next intake has not been set. NB indicated that to date, the impacts of the COVID-19 pandemic on the construction industry have been minor. In most cases, work is proceeding with social distancing and strict safety guidelines on work sites. NB regularly informs INFC of any changes to project status as a result of the pandemic.	
MERIT-BASED PROGRAMS *As DMAF is a merit-based, competitive program, projects are submitted directly to Infrastructure Canada by eligible applicants (such as municipalities, provinces, and Indigenous organisations), provinces and territories do not prioritize projects for approval. Eligible projects are those with a minimum of $20M in total eligible costs.*	
Disaster Mitigation and Adaptation Fund	**Projects Approved:** 3 **Total Federal Contribution of** $36,9 million
OTHER PROGRAMS	
Legacy Programs New Building Canada Fund: National and Regional Projects (NRP), National Infrastructure Component (NIC), Small Communities Fund (SCF);	**Projects Approved:** 37 **Total Federal Contribution:** $362,193,611
Gas Tax Fund **Ongoing, permanent source of funding to provinces and territories, who in turn flow funding to municipalities* **Municipalities can pool, bank, and borrow against funding – providing significant financial flexibility* **Communities select how best to direct funds across 18 project categories*	**Allocation 2019-2020:** $45,1 million with a one-time top-up of $47,1 million **Allocation 2019-2020:** $45,1 million
Public Transit Infrastructure Fund (PTIF) and Clean Water and Wastewater Fund (CWWF) *PTIF and CWWF is are allocated-based funds where provinces and territories were responsible for identifying projects, in collaboration with municipalities. Both funds are now closed to new applications, however, project monitoring is ongoing. The program end date is March 31, 2020 with the exception of certain projects being extended beyond this deadline.*	
PTIF **Initial Allocation:** $8,7 million **Total Projects:** 4	**CWWF** **Initial Allocation:** $79,4 million **Total Projects:** 133

s.21(1)(b)
s.21(1)(c)

Projects With Indigenous Ultimate Recipients since 2015 – Data as of September 23, 2020

Indigenous Recipient Type	All Approved		Under Review	
	Project Count	Program Contribution	Project Count	Program Contribution
First Nation - on reserve	4	$4,026,793	1	$4,354,256
Overall - Total	**4**	**$4,026,793**	**1**	**$4,354,256**

From:	Hatt-Kilburn, Kalie (ACOA/APECA)
To:	Nowlan, Daryell (ACOA/APECA)
Cc:	Estabrooks, Kent (ACOA/APECA); Dubé, Kevin (ACOA/APECA); Adams, Lynn (ACOA/APECA); Fussell, Peta (ACOA/APECA);
Subject:	Upcoming Launch of SMR Action Plan
Attachments:	AGENDA - ADM Discussion on federal chapter of SMR AP 2020-10-26.docx;BRIEF - OUTLINE - Federal SMR Action Plan Chapter - 2020-10-29.docx;REPORT - Draft GoC section - 2020-10-29.docx;
Sent:	1/1/4501

Daryell,

I am reaching out to make you aware of NRCan's upcoming launch of Canada's Small Modular Reactor (SMR) Action Plan, and its reference to RDA and ACOA involvement. I participated in a this afternoon chaired by Mollie Johnson on the launch , which is planned for announcement by Minister O'Regan on November 18th, which will include a new website designed to raise the profile on Canada's ambitions in this space by publishing the Action Plan.

The Action Plan contains a federal chapter, which refers to RDAs, including ACOA. We have been working in collaboration with Lynn Adams on this and she was involved in discussions with other RDAs to determine the wording for the RDA section. We are comfortable with the proposed wording; however, Lynn advises me that there was no discussion among RDAs as to a coordinated approach to brief up to MINO on this.

We have developed a backgrounder on SMRs to follow up on Francis's discussion with the Chief of Staff today, which will outline ACOA's position and planned projects in this area. We have added some additional detail on the launch so that this can be highlighted for her attention. I wanted to flag this for you in case there is any discussion on the matter at your ADM table with the other RDAs and ISED.

I'm also copying Kevin because NRCan mentioned on the call its intention to reach out to the communications departments of each of the federal departments to coordinate efforts around the launch. We can certainly work with your team on any media lines or supporting documents required.

If you have any questions or would like to discuss further, please let me know.

Thanks,

Kalie

-----Original Appointment-----

From: Aubry, Jocelyne (NRCan/RNCan) **On Behalf Of** Johnson, Mollie (NRCAN/RNCAN)

Sent: Friday, October 30, 2020 8:26 AM

To: Johnson, Mollie (NRCAN/RNCAN); Kapoor, Anoop (FDO); Cousineau, Linda (FDO); Paul.Halucha@pco-bcp.gc.ca; Hargrove, Glenn (NRCan/RNCan); Ritchot, Jeannine (NRCAN/RNCAN); Des Rosiers, Frank (NRCan/RNCan); Leclerc, Gilles (ASC/CSA); Preville, Mary (ASC/CSA); Hatt-Kilburn, Kalie (ACOA/APECA); Buist, Margaret (CANNOR); Chan, Isabella (HC/SC); Ahier, Brian (HC/SC); Moffet, John (EC); Botham, Richard (FIN); Campbell, Glenn (INFC); Johnston, Andrea (IC); Davies, Mitch (IC); Motzney, Barbara (WD/DEO); Leyburne, Drew (NRCan/RNCan); Labonté, Jeff (NRCan/RNCan); Kerry.Buck@tbs-sct.gc.ca; Cameron, Jason (CNSC/CCSN); Presutti, Marco (NRCan/RNCan); Cameron, Diane (NRCan/RNCan); Delaney, Jim (NRCAN/RNCAN); Harrop,

Darroch (NRCan/RNCan); Melnyk, Micah (NRCAN/RNCAN); Wilhelm, Brent (NRCAN/RNCAN)
Cc: Vermette2, Richard (CANNOR); Martel, Denis (IC); Kaminsky, Colette (IC); Jammal, Ramzi (CNSC/CCSN); Cloutier, Matthew (EC); Bowlby, Mark (INFC); Iqbal, Mariam (INFC); Vanderlip, Daniel; Abagis, John (Ext.); Campbell, Melanie (NRCan/RNCan); Hum, Patrick (IC)
Subject: 11:00 Canada's SMR Action Plan -- ADM-level Interdepartmental Meeting **Material Attached
When: Friday, October 30, 2020 11:00 AM-12:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: Teleconference: Access Code:

Colleagues,

As you may know, we at NRCan are working with PT governments, power utilities, industry, and civil society to launch Canada's Small Modular Reactor (SMR) Action Plan on November 18, 2020, which will lay out progress and ongoing efforts across the country to make Canada a world leader on this technology. Close partnerships within the federal government will be key to the success of the initiative, and we appreciate your ongoing support through your teams' contributions to the Government of Canada chapter, which includes a narrative piece and a comprehensive set of actions being taken to support SMR deployment.

This ADM-level discussion on the federal chapter of the Action Plan is a follow up on a Director-level discussion held earlier this month. At the meeting, we will provide a briefing on the initiative and our next steps, before we have a discussion on the chapter's narrative and actions being outlined. If any of you are unable to attend, I'd ask that you send a representative to speak to your team's contribution in outlining key aspects of Canada's SMR opportunity.

I look forward to our discussion and towards the launch of the SMR Action Plan.

Best,

Mollie

s.16(2)(c)

ADM DISCUSSION ON THE FEDERAL CHAPTER OF CANADA'S SMALL MODULAR REACTOR (SMR) ACTION PLAN

October 30th, 2020
11:00AM-12:00PM
Microsoft Teams – Link TBD
Dial in info - TBD

MEETING AGENDA

1. **Opening Remarks** (10 minutes)
   NRCan – Mollie Johnson (ADM, Low Carbon Energy Sector)

2. **Federal Chapter of Canada's SMR Action Plan** (15 minutes)
   NRCan – Diane Cameron (Director, Nuclear Energy Division)

3. **Discussion** (25 minutes)
   All

4. **Closing Remarks** (10 minutes)
   NRCan - Mollie Johnson (ADM, Low Carbon Energy Sector)

DISCUSSION DES SMA SUR LE CHAPITRE FÉDÉRAL DU PLAN D'ACTION CANADIEN POUR LES PETITS RÉACTEURS MODULAIRES (PRM)

30 octobre 2020
11H00-12H00
Microsoft Teams – Link TBD
Dial in info – TBD

ORDRE DU JOUR DE LA RÉUNION

1. **Mot d'ouverture** (10 minutes)
   RNCan – Mollie Johnson (SMA, Secteur de l'énergie à faible émissions de carbone)

2. **Chapitre fédéral du Plan d'action canadien pour les petits réacteurs modulaires** (15 minutes)
   RNCan – Diane Cameron (Directrice, Division de l'énergie nucléaire)

3. **Discussion** (25 minutes)
   Tous

4. **Mot de la fin** (10 minutes)
   RNCan – Mollie Johnson (SMA, Secteur de l'énergie à faible émissions de carbone)

From:	Vienneau, Ryan (DNRED/MRNDE - DAAF/MAAP)
To:	Laura DeLong
Subject:	RE: SMR Q&A
Sent:	3/15/2021 12:08:11 PM

Hi Laura, we don't have any specific Q&A documents on SMRs, but I can provide some general background information we have. Let me know if you need any additional details, or looking for specific information not found below.

ARC Clean Energy (www.arcenergy.co):

- Sodium coolant
- Metallic uranium alloy fuel
- 100MW electric
- Passive safety features
- 20-year re-fueling cycle
- High temperature high quality steam – on-grid electricity and industrial applications

Moltex Energy (www.moltexenergy.com):

- Salt coolant
- Molten salt fuel from reprocessed nuclear waste
- 300MW electric
- Passive safety features
- Stable Salt Reactor – Wasteburner (SSR-W)

In 2018, NB invested $10 Million split between, and matched by two Advanced SMR Vendors - ARC Clean Energy and Moltex Energy.

Both have established offices in Saint John, NB, and are progressing designs and achieving milestones in Canadian Nuclear Safety Commission's voluntary Vendor Design Review process.

ARC and Moltex - completed phase 1 of the CNSC Pre-licensing Vendor Design Review.

In February 2021, the Province announced an additional $20 million in funding to ARC, with $30 million in private matching funds.

The Province and NB Power continue to monitor progress and provide oversight of the SMR vendors through regular committee meetings

Both have developed strategic partnerships with Academia, Canadian Nuclear Labs, and private sector to maximize value of investment dollars, building capacities where gaps exist,

Target First-of-a-kind demonstration units deployed in NB in the 2030-35 time frame.

NB also participated in the SMR Roadmap, SMR Action Plan, and signed an MOU with Ontario and Saskatchewan to collaborate on SMR development.

Again, let me know if there is any other information I can provide!

Best,

Ryan

From: DeLong, Laura (ACOA/APECA)
Sent: Monday, March 15, 2021 10:57 AM
To: Vienneau, Ryan (DNRED/MRNDE - DAAF/MAAP)
Cc: Sollows, David (DNRED/MRNDE)
Subject: FW: SMR Q&A

ATTENTION! External email / courriel externe.

Ryan: My apologies, I sent this along to Dave because I'm clearly not well caffeinated this morning. I know that you're now the lead on the SMR file. Not sure if you're able to assist with this. No worries if you can't – I'm in the process of drafting Q&As for end of day.
Laura

From: DeLong, Laura (ACOA/APECA)
Sent: Monday, March 15, 2021 10:32 AM
To: 'Sollows, David (DNRED/MRNDE)' <David.Sollows@gnb.ca>
Subject: SMR Q&A

Hey Dave – do you have NB Power and DNRED Q&A on SMRs that you're able to share? I understand that there is potential for a Federal Government announcement this week and in the process of doing up Q&As on the topic don't really want to reinvent the wheel. Anything you're able to share would be awesome, and what I will do is share our final with additions (from an ACOA perspective) once we have them drafted.
Laura

From:	Kalie Hatt-Kilburn
To:	Laura DeLong
Cc:	Peta Fussell
Subject:	FW: Feasibility study
Attachments:	Provincial SMR FS Mar 25 2021 Final.pdf
Sent:	6/28/2021 9:30:40 AM

See attached and below. The exchanges continue...

From: Kalie Hatt-Kilburn
Sent: Monday, June 28, 2021 9:29 AM
To: Plummer, Brett
Subject: RE: Feasibility study

Thanks Brett. I think it does provide a big picture, as you have suggested. Both documents lay out the overall need/request and timelines.

Although it's not ideal, I think the central task before us is demonstrating how we can fit the request into the specific requirement of the SIF program under Stream 5. This requires answering:

- how the utilities will work together as a formal consortium (i.e. governance)
- how the distribution of funding will be managed/overseen through a single entity
- what funding is being contributed from other sources (since the program cannot fund project costs at 100%);
- what the estimated GHG reduction potential is (since NetZero Acceletor funds have to be directly tied to GHG reductions)

If you would like to have a quick chat to discuss just to be sure we're on the same page, I can ask my office to connect with yours to find us a few minutes. We could also do an MS Teams call to include other folks on your team, if that would be helpful.

Kalie

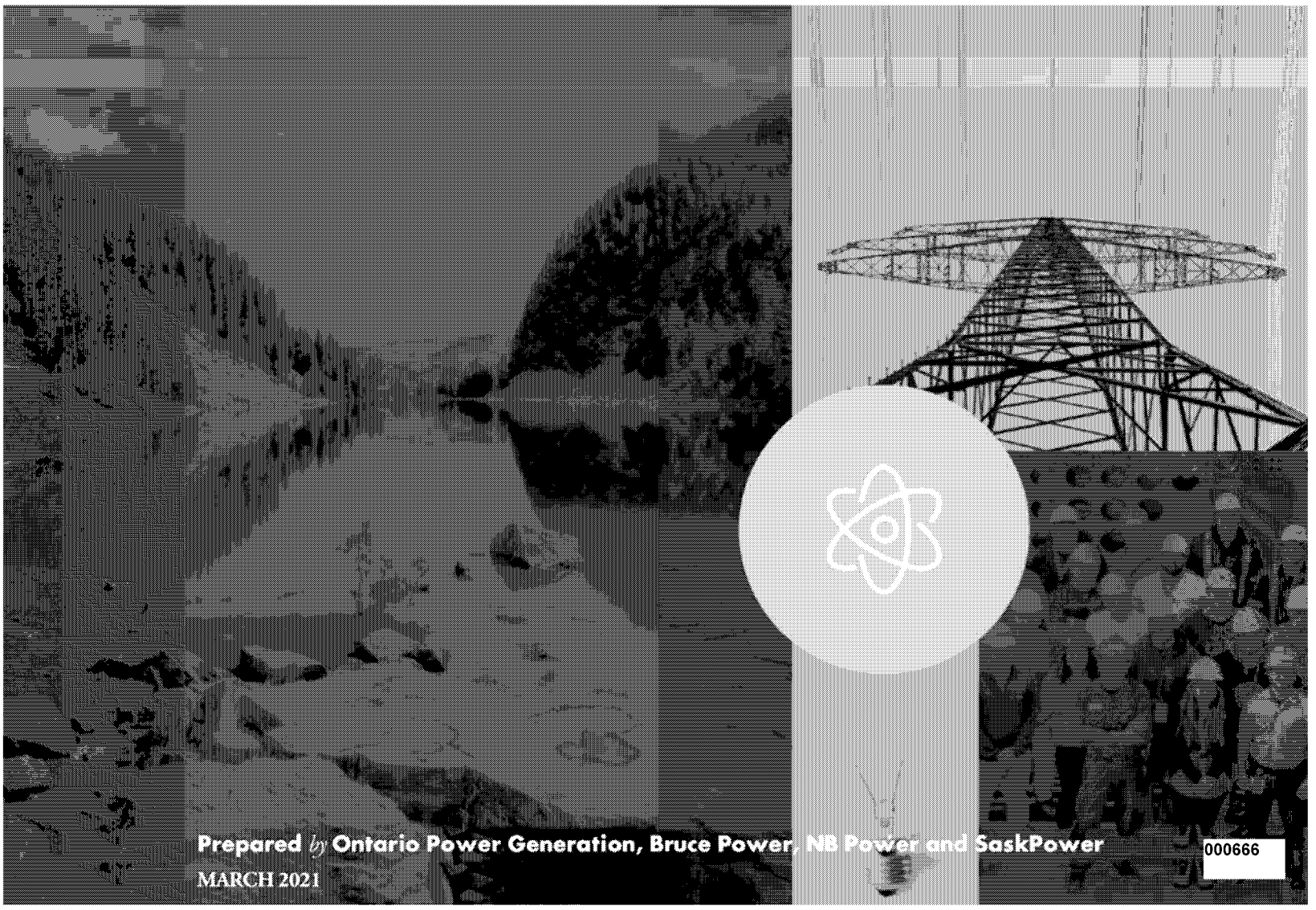
From: Plummer, Brett <[redacted]@nbpower.com>
Sent: Monday, June 28, 2021 8:43 AM
To: Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>
Subject: Feasibility study

Kalie, please take a look at the attached feasibility study. I believe it has the big picture we are looking for.

FEASIBILITY OF

Small Modular Reactor

DEVELOPMENT AND DEPLOYMENT IN CANADA



Prepared *by* Ontario Power Generation, Bruce Power, NB Power and SaskPower

MARCH 2021

[this page left intentionally blank]

Executive Summary

This feasibility report was prepared by Ontario Power Generation (OPG), Bruce Power, NB Power and SaskPower for the governments of Ontario, New Brunswick and Saskatchewan. The report provides a feasibility assessment of Small Modular Reactor (SMR) development and deployment and contains the power companies' business case for SMR implementation in each of the three provinces.

Background

SMRs are the next generation of nuclear energy innovation, with the potential to help address challenges and opportunities related to climate change and economic growth. The 2018 Canadian SMR Roadmap[1] concluded that SMRs provide a source of safe, clean, affordable energy, with the ability to contribute towards a resilient, low-carbon future. SMRs can promote key benefits for Canada and Canadians, such as:

- meeting Canada's climate change commitments;
- unlocking opportunities for job creation and economic growth; and
- sustaining and expanding Canada's leadership in research and innovation.

With these drivers in mind, the provinces of Ontario, New Brunswick and Saskatchewan signed a Memorandum of Understanding (MOU)[2] on December 1, 2019, that establishes a framework for deployment of SMRs in each respective jurisdiction. This feasibility report represents one of the early deliverables from the MOU.

The three provinces share a collective interest in SMRs as a clean energy option to address climate change and meet regional energy demands, while responding to the need for economic growth and innovation. The provinces have also agreed to engage with the federal government on key issues related to SMR deployment, including technological readiness, regulatory frameworks, economics and financing, nuclear waste management and public and Indigenous engagement.

Canada and its provinces are already home to a world-class nuclear industry with extensive experience in the design, construction and servicing of reactors in Ontario, New Brunswick and around the globe. The nuclear sector plays a key role in Canada's economy, contributing $17 billion annually, while supporting 76,000 Canadian jobs[3] (i.e. direct, indirect and induced). In addition, Canada is home to the planet's richest uranium resource – the Athabasca basin in Saskatchewan – and is the second-largest producer of uranium in the world.

The SMR Advantage

SMRs are nuclear reactors that produce 300 megawatts (MW) of electricity or less. Much smaller than traditional nuclear power plants, SMRs are cheaper to mass produce and easier to deploy. Their modular design allows for deployment in large established grids, small grids, remote off-grid communities and as an energy source for resource projects. SMRs provide

---

[1] Canadian Small Modular Reactor Roadmap Steering Committee (2018). *A Call to Action: A Canadian Roadmap for Small Modular Reactors*. Ottawa, Ontario, Canada. www.smrroadmap.ca

[2] https://news.ontario.ca/opo/en/2019/12/premier-ford-premier-higgs-and-premier-moe-sign-agreement-on-the-development-of-small-modular-reacto.html

[3] https://cna.ca/news/new-study-finds-nuclear-industry-accounts-for-76000-jobs-across-canada/

non-greenhouse gas (GHG) emitting energy that can meet new electricity demands and support renewable sources, such as wind and solar. Other countries have recognized nuclear power as a clean energy source, and with growing interest in SMRs there is an exciting opportunity for Canada to export technology and expertise to address global issues such as climate change and energy security.

Feasibility of SMRs

Economics: The power companies assess that SMRs have the potential to be an economically competitive source of energy. However, that will depend on other low-carbon alternatives available to each jurisdiction. Natural gas prices and carbon pricing also play a significant role in potential feasibility. Solar and wind generate energy intermittently, meaning they produce only some of the time and not always when needed. As provinces reduce reliance on fossil fuels in electricity generation, an optimum capacity mix will need to be achieved – with nuclear playing a potentially larger role in the future.

Energy generated by SMRs in Ontario and Saskatchewan is expected to be economical compared to other low-carbon alternatives and could be used to support reduction in carbon emissions and meet new energy demands. The choice of SMR technology and speed of commercialization will play a significant role in the cost of deployment.

For off-grid applications, such as remote mines or communities, SMRs need to be economically competitive with diesel generation (i.e. including the cost of fuel and transport). SMRs could potentially reduce energy costs for remote sites and communities with electricity demands between 10 and 20 MW. For smaller communities (e.g. those with demands of 3 MW), the costs are near break-even. As with on-grid applications, the choice of technology and speed of commercialization will play a key role in the cost of SMR deployment and its ability to compete with diesel.

Technology: SMRs cover a wide range of power levels, designs, technological readiness levels and end-user applications. To meet Canada's broad needs, the four power companies have been working collectively over the last two years to develop three streams of SMR project proposals. As such, the SMR projects being proposed to the governments of Ontario, New Brunswick and Saskatchewan are based on the following assessments and assumptions:

- **Stream 1** proposes a first grid-scale SMR project of about 300 MW constructed at the Darlington site by 2028, followed by up to four subsequent units in Saskatchewan, with the first unit in Saskatchewan being in service in 2032. This "fleet" approach would identify a common SMR technology to be more quickly and efficiently deployed in multiple jurisdictions.
    - OPG, Bruce Power and SaskPower are collaborating to select the technology and developer by the end of 2021.
    - SMRs can be economically competitive in both jurisdictions as additional sources of clean energy.
    - The shovel-ready status of the Darlington site makes it a vital strategic asset, providing opportunity for an SMR developer to launch a fleet of units.
    - Stream 1 can create economic benefits for Canada from a single unit in Ontario and four units in Saskatchewan over their lifetime of:

- direct, indirect, and induced employment on an average annual basis as follows:
    - 1,528 jobs during project development
    - 12,455 jobs during manufacturing and construction
    - 1,469 jobs during operations and
    - 1,193 jobs during decommissioning
- a positive impact on GDP of $17 billion; and
- an increase of government revenue of $5.4 billion.

- **Stream 2** involves two 4th generation, advanced small modular reactor designs that will be developed in New Brunswick through the construction of demonstration units at the Point Lepreau nuclear site in NB. By fostering a strong collaboration among the various research, manufacturing, federal and provincial agencies, New Brunswick will see the completion of an initial ARC Clean Energy demonstration unit by 2030, and a second unit by Moltex Energy Canada Inc. by 2035. With these timelines, New Brunswick will be supporting the additional clean energy needs within Atlantic Canada and with partnering jurisdictions starting in 2030. New Brunswick is positioned to become the leader in the development and deployment of these 4th generation technologies through its efforts, its partnerships and its support. These designs represent a significant opportunity for advancing domestically produced energy within Canada and around the world that is both clean and safe. Through ongoing support and collaborations, these advanced technologies can start being deployed as early as 2030 in support of the industrial needs in areas like Saskatchewan and Alberta, and indeed, around the globe. The made in New Brunswick designs represent significant economic diversification opportunities for the province and will place New Brunswick as a world leader in the deployment of 4th generation advanced SMR technologies.
    - With funding of $30 million from the provincial government, two developers (Moltex Energy and ARC Clean Energy Canada Inc.) have opened offices in New Brunswick. Companies are developing delivery capability in New Brunswick with the promise of local economic development.
    - These two designs are expected to result in new lower-cost units that recycle nuclear waste, have more inherent safety attributes and are attractive for global deployment.
    - Stream 2 can create economic benefits for Canada for demonstration units in New Brunswick (2020 – 2035) of:
        - 21,870 person-years of direct and indirect employment;
        - a positive impact on GDP (direct and indirect) of $2.15 billion; and
        - an increase of government revenue of $198 million.

      with the opportunity to expand this through a fleet of both Canadian and export units to 2060 of:

        - 537,000 person-years of direct and indirect employment;
        - a positive impact on GDP (direct and indirect) of $59 billion; and
        - an increase of government revenue of $5.2 billion.

- **Stream 3** proposes a new class of micro SMRs designed primarily to replace diesel use in remote communities and mines. To advance this technology, a 5 MW gas-cooled reactor project by Ultra Safe Nuclear Corporation (USNC) is underway at the Chalk River site in Ontario and is expected to be in service by 2026.
    - OPG has partnered with USNC for this demonstration project on the basis of shared investment from OPG, USNC and expected funding from the federal government.
    - This project is not intended to be commercially economical, but analysis shows that future two-unit 10 MW plants will be economically competitive with diesel and will provide the opportunity for returns to cover demonstration project costs.
    - Looking to advance nuclear in remote communities, Bruce Power and its partners at the Nuclear Innovation Institute have been exploring opportunities with the Westinghouse Canada eVinci Micro-Reactor.
    - Stream 3 can create economic benefits for Canada from a four-unit commercial deployment (20 MW) of USNC reactors at a mining site over its operating life of:
        - direct, indirect, and induced employment on an average annual basis as follows:
            - 240 jobs during project development
            - 638 jobs during manufacturing and construction
            - 282 jobs during operations and
            - 180 jobs during decommissioning
        - a positive impact on GDP (direct, indirect, and induced) of $877 million; and
        - an increase of government revenue of $311 million.

These projects are advancing rapidly and are all demonstrating commercial and technical feasibility.

There are three other factors the power companies have identified in assessing SMR feasibility:

Federal support: An important part of project feasibility is cost and risk-sharing with the federal government. These projects would support Canada's goals of phasing out coal by 2030, becoming carbon net zero by 2050 and providing affordable clean energy to remote communities. Additionally, these projects would create a new sub-category of nuclear industrial activity that would see Canada well placed to be a major player in the global

deployment of SMR technologies. Securing support from the federal government in a timely manner is essential to continued progress.

In addition to cost and risk-sharing, the federal government can provide policy support for nuclear energy as a clean technology, ensure regulatory processes are in place to recognize the unique characteristics of SMRs, support research and development through Canada's national laboratories, and ensure a robust framework for the management of nuclear waste from all reactors.

Provincial support: Provincial governments will need to establish policy and regulatory frameworks to enable SMRs as a clean energy option and support training programs to enhance the skilled workforce needed for an SMR industry. In addition, provincial governments can work with power companies to ensure project development is carried out with appropriate oversight, and that public and Indigenous engagement is conducted in a responsible and respectful manner.

Nuclear industry support: A critical success factor for the deployment of SMRs in Canada is a strong domestic supply chain. This includes Canadian small and medium-sized nuclear suppliers, uranium mining, and world-leading nuclear research. The flexibility and experience of these suppliers will be valuable to SMR deployment and complement the capabilities of Canada's manufacturing and engineering companies. Once selection of a fleet model is determined, the power companies would engage suppliers and leverage skilled workforces to ensure readiness for SMR deployment.

Next Step

The next step under the provincial MOU is to develop a strategic plan for deployment of SMRs. This plan will identify steps required within each stream to achieve project commitments in a timely manner, while identifying key risks, mitigation measures, as well as the policy and regulatory analysis required to enable and govern expanded deployment of nuclear technology in Canada.

The strategic plan is to be completed in the spring of 2021.

The provinces of Ontario, New Brunswick and Saskatchewan are proud to lead the way on SMR development in Canada. They will continue to work together and across the nuclear industry, to help ensure Canada remains at the forefront of nuclear innovation, while creating new opportunities for jobs, economic growth and innovation and a lower carbon future.

Contents

List of Tables

List of Figures

1 Introduction

Canada has a long and proud history in nuclear energy having been in the global nuclear sector since its inception. Nuclear energy is a strategic asset for Canada. Canada is one of the world's few Tier 1 nuclear nations (Tier 1 is defined as those with a full-spectrum nuclear capabilities). The nuclear sector contributes $17 billion to the economy and provides 76,000 direct and indirect jobs[4]. The current refurbishment at the Darlington and Bruce sites are two of the largest infrastructure projects in the country and enable Canada to maintain a strong, innovative, and growing domestic nuclear industry ensuring the province of Ontario has clean, affordable electricity for decades to come. In June 2020, the first refurbishment was completed on budget by OPG at Darlington Unit 2, a strong start to the plans to refurbish 10 units at Darlington and Bruce. At the same time, units at both the Darlington and Bruce site continue to achieve operational records of excellence, the most recent being Darlington Unit 1 which became the world record holder for continuous operation on September 15, 2020 after operating continuously for 963 days. It then continued to operate until it was shut down for a maintenance outage on February 5, 2021, achieving an incredible 1,106 continuous days of operation. New Brunswick is currently the only other province in Canada with grid connected nuclear power, as home to the CANDU6 unit located in Point Lepreau, New Brunswick, owned and operated by NB Power.

Nuclear energy is also an important part of Canada's non-emitting mix and will be critical to achieving Canada's climate change goals. The country is blessed with great resources and while several provinces can use hydro to provide clean electricity, others will need nuclear energy to provide the non-emitting electricity necessary to reduce carbon emissions. The prime example is Ontario, where the closure of coal fired electricity generation enabled by the restart of six nuclear reactors, led to the largest single reductions in GHGs in North America. As Canada moves to eliminate coal fired electricity by 2030 and meet its 2050 emissions targets, nuclear energy is poised to play a valuable role in that transition. In New Brunswick, 80% of in-province electrical energy consumption was supplied from clean energy sources, with 44% from renewable sources, and 36% from nuclear generation (fiscal year 2019/20).

In Canada and indeed the world, electricity markets are demanding smaller, simpler, and lower cost nuclear energy. SMRs are well positioned to lead this transition and Canada has a tremendous opportunity to play a leading role. SMRs are innovative technologies that are designed to provide more flexibility than their predecessors. Smaller plants mean they are more flexible and can be deployed not only in large established grids but also in smaller grids, remote off grid communities and for resource projects. Their innovative designs and features mean they cannot only provide non-emitting baseload generation but their ability to load follow means they can support intermittent renewable sources like wind and solar. SMRs are capable of not only producing electricity but also steam for industrial purposes. In addition, the development of very small modular reactors (under 10 MW) is going to revolutionize the ability to deploy power quickly and virtually everywhere.

SMRs have the potential to become a new industrial subsector, one that is not only Pan-Canadian in nature but with the opportunity to become an international leader. The

[4] https://cna.ca/news/new-study-finds-nuclear-industry-accounts-for-76000-jobs-across-canada/

development of SMRs will provide a post refurbishment growth opportunity for Ontario's nuclear supply chain while creating a SMR manufacturing/export business in New Brunswick. Looking to new domestic markets, SMRs are likely to be deployed in Saskatchewan, Alberta and northern Canada providing not only the benefit of low cost, reliable, clean electricity to enable economic development but the potential to add new, innovative, high value jobs. Like all new economic opportunities, there is a significant first-mover advantage and Canada must move now to secure that advantage.

In November 2018, the Canadian SMR Roadmap was issued[5]. The SMR Roadmap used a collaborative approach to bring together industry, federal, provincial, and territorial governments, as well as utilities and other interested stakeholders that wanted a pan-Canadian conversation about new options for nuclear energy.

The roadmap clearly set out the opportunity for Canada and concluded that collaborative activities in each of four pillars are required to turn this roadmap into reality:

- Demonstration and deployment – to realize benefits for Canadians and for Canada.
- Capacity-building and indigenous and stakeholder engagement – to increase access to information.
- Policy, legislative and regulatory measures – to make the framework more efficient.
- International partnerships and marketing – to position Canada for leadership in global value chains.

In addition to participating in the development of the SMR Roadmap, The Government of New Brunswick invested $10 million to establish the Advanced Nuclear Research Centre to progress the research and design of two Advanced Generation IV (Stream 2) SMR designs. This initial funding was matched by two technology vendors: ARC Clean Energy Canada and Moltex Energy who subsequently opened offices in Saint John. The vendors continue to progress research and design activities necessary to proceed through the appropriate regulatory processes. The Government of New Brunswick and NB Power are overseeing the progress and planning necessary to unlock the market potential for these technologies.

Since the release of the Canadian SMR roadmap, work amongst the provincial governments, power utilities and technology vendors has accelerated. On December 1, 2019, the Provinces of Ontario, New Brunswick and Saskatchewan signed a Collaboration Memorandum of Understanding (MOU)[6] that puts in place a framework for action on deployment of SMRs in their respective jurisdictions including:

1. Addressing climate change, regional energy demand, economic development (e.g., supply chain, fuel manufacture, skilled employment and export opportunities) and research and innovation opportunities;

---

[5] Canadian Small Modular Reactor Roadmap Steering Committee (2018). *A Call to Action: A Canadian Roadmap for Small Modular Reactors*. Ottawa, Ontario, Canada. www.smrroadmap.ca

[6] https://news.ontario.ca/opo/en/2019/12/premier-ford-premier-higgs-and-premier-moe-sign-agreement-on-the-development-of-small-modular-reacto.html

2. Addressing key issues for SMR deployment including technological readiness, regulatory frameworks, economics and financing, nuclear waste management and public and Indigenous engagement; and
3. Working cooperatively to engage with the federal government to provide policy support for nuclear as clean energy and funding support for SMR development.

This MOU set out concrete steps to move this initiative forward. To fulfil a key commitment under the MOU, the respective power utilities in the three provinces (i.e., OPG, Bruce Power, NB Power and SaskPower) have prepared this feasibility report for the three provincial ministries, including a business case for the development and deployment of SMRs in their jurisdictions.

The next step under the provincial MOU will be to develop a strategic plan for deployment of SMRs including market opportunities across Canada and globally. This plan will identify the steps required within each stream to achieve project commitments in a timely manner while identifying the key risks and the approach to their mitigation and the policy analysis required to clearly set out the requirements for government support. This next report will be completed in the spring of 2021.

2 SMR Market Evolution

The SMR Roadmap assessed the market for SMRs and a preliminary projection was made of their global potential. The result was an estimate of a market of approximately **CDN$150 billion** per year by 2040. This includes applications for electricity generation, remote mine sites, island nations, and off-grid communities. Given the need for time to develop and bring SMRs to market, the opportunity is primarily for delivery after 2030 when full scale SMR production can be in place.

Since the SMR Roadmap was issued, the case for nuclear in general, and SMRs in particular, has continued to develop as the world recognizes that decarbonization goals cannot be met by following a path based on renewables alone.

The International Energy Agency's (IEA) World Energy Outlook (WEO) 2019[7] opens with a stark reality, stating "*the energy world is marked by a series of deep disparities. The gap between the promise of energy for all and the fact that almost one billion people still do not have access to electricity. The gap between the latest scientific evidence highlighting the need for evermore-rapid cuts in global greenhouse gas emissions and the data showing that energy related emissions hit another historic high in 2018. The gap between expectations of fast, renewables-driven energy transitions and the reality of today's energy systems in which \reliance on fossil fuels remains stubbornly high.*"

In its Stated Policies Scenario (SPS), that represents the future based on government policies that have been announced, primary energy demand continues to grow increasing 25% by 2040. Carbon emissions grow by about 7% while fossil fuels continue to dominate, accounting for about 75% of global energy use.

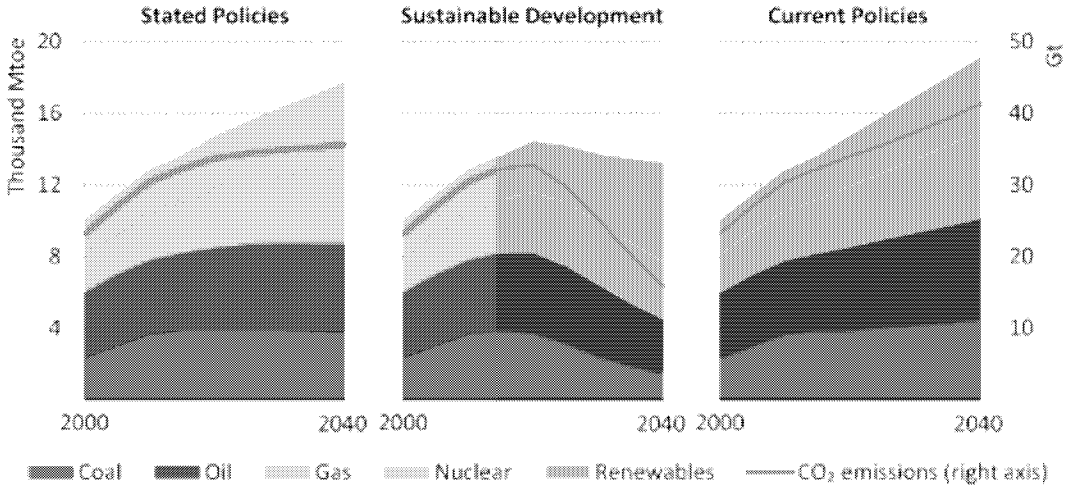


Figure 1 World primary energy demand by fuel and related CO_2 emissions by scenario (WEO Fig 1.1)

The WEO also includes a Sustainable Development Scenario (SDS) to consider how low carbon targets may be achieved. In this scenario electricity use grows at twice the rate of overall energy as it becomes the energy currency of choice in efforts to transition the system into a low carbon one. It is characterized by dramatic increases in energy efficiency resulting

[7] https://www.iea.org/reports/world-energy-outlook-2019

in a 7% drop in demand by 2040 (compared to a 25% increase in the SPS) and huge increases in renewable energy, while maintaining the gas share, to meet this goal. With one billion people needing electricity and society's ever-increasing dependence on energy, it is hard to imagine a scenario in which the world uses less energy in 2040 than it does today.

The challenge in meeting the ever-growing energy needs of the world while reducing its carbon footprint is huge. As stated by the IEA, "*More than ever, energy decision makers need to take a hard, evidence-based look at where they stand and the implications of the choices they make.*"

Earlier in 2019, in its first report on nuclear power in many years, "Nuclear Power in a Clean Energy System"[8], the IEA acknowledges the important role that nuclear power must play. As stated," *Nuclear power can play an important role in clean energy transitions. Today, it provides 18% of electricity supply in advanced economies, where it is the largest low-carbon source of electricity. Alongside renewable energy and CCUS (Carbon Capture and Sequestration) technologies, nuclear power will* ***be needed*** *for clean energy transitions around the world. Nuclear power also contributes to electricity security as a dispatchable source.*"

For nuclear power to meet its full potential in supporting global decarbonization a broad approach is required. This includes:

- Working to ensure the current operating nuclear fleet continues to operate for its full lifetime. Early retirements generally set back decarbonization as these plants are most often replaced with fossil generation. Canada is playing its part in refurbishing its nuclear fleet so that it will operate into the 2060s.
- Continue to build traditional large nuclear plants to meet energy needs. With most Generation III[9] designs having come into service over the past year, they are available for deployment where there are utilities that can accommodate units of these sizes along with their higher capital requirements. Today there are 55 such nuclear units under construction around the world[10].
- Embark upon a program of new SMRs to expand the available market by making nuclear projects more manageable in size, shorter in duration and less in total cost, putting these new projects into the realm of possibility for more utilities, both reducing the capital required for a single project and reducing the overall risk of implementation. This opens up a range of new possibilities and is the basis of the SMR Roadmap market assessment.

In a new report issued in June 2020 (Tracking Clean Energy Progress - Assessing critical energy technologies for global clean energy transitions[11]), the IEA notes that the world is far from on track to meet its Sustainable Development Scenario as set out in its 2019 WEO.

---

[8] https://www.iea.org/reports/nuclear-power-in-a-clean-energy-system

[9] Most existing operating nuclear units are considered Generation II plants. Generation III units are evolutions of these operating units building on the decades of lessons learned. Examples are the AP1000, EPR, VVER1200 and APR1400.

[10] https://www.world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-and-uranium-requireme.aspx (Updated May 2020)

[11] https://www.iea.org/topics/tracking-clean-energy-progress

Renewables are making progress but not fast enough, needing to further accelerate their growth rate. Nuclear power is not on track to meet its goals in this Sustainable Development Scenario. At the current rate of expansion, the nuclear share will fall about one third below 2040 targets.

The key driver for falling short of the goal is nuclear policy uncertainty, partly the result of inconsistencies between stated policy goals – such as climate change mitigation – and policy actions. While the existing nuclear fleet remains the world's second most important low-carbon source of electricity (after hydro), new nuclear construction is not on track with the SDS. Additional lifetime extensions and a doubling of the annual rate of capacity additions are therefore required.

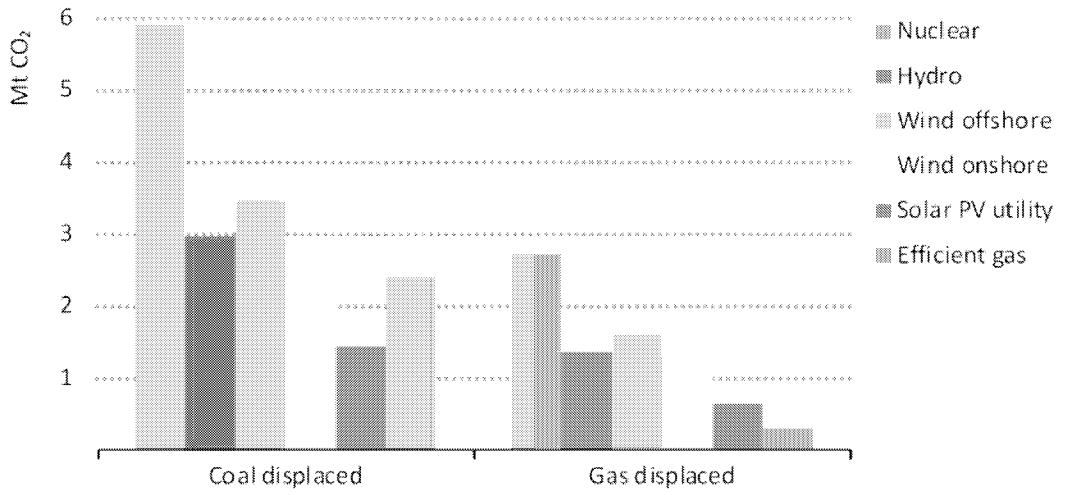
In a just released WEO special report on Sustainable Recovery[12] from the COVID crisis, the IEA notes the critical role played by the energy sector, particularly electricity, in the global response. Uninterrupted energy supplies have been essential to hospitals providing needed health care, delivering food and other essentials, and enabling millions of people to work and study from home while maintaining social contact online. Without access to reliable and affordable electricity, the lockdowns needed to manage the crisis would have resulted in far greater human impact and economic damage.

Now, governments are responding to the economic crisis on a massive scale having announced measures worth about USD 9 trillion, focusing first on emergency financial and economic relief to prevent an even deeper crisis. But with more stimulus coming, attention is now turning to longer-term recovery plans. The IEA is showing that substantial stimulus packages will offer a unique opportunity to put the energy sector on a more sustainable path.

As shown in the figure below, no technology has more impact on carbon reduction than nuclear power.

[12] https://www.iea.org/news/iea-offers-world-governments-a-sustainable-recovery-plan-to-boost-economic-growth-create-millions-of-jobs-and-put-emissions-into-structural-decline

Figure 2.8 ▷ Annual direct CO_2 emissions avoided per 1 GW of installed capacity by technology and displaced fuel



Nuclear power avoids more CO_2 emissions per GW of capacity than other fuels.

Notes: Mt CO_2 = million tonnes of carbon dioxide. Efficient gas refers to combined-cycle gas turbines. Applied capacity factors are current global fleet averages for nuclear power, hydro and efficient gas, and global averages for new projects completed in 2019 for wind offshore, wind onshore and solar PV.

Figure 2 CO2 Emissions Avoided by technology and displaced fuel

This is why this newest report once again recommends investing in nuclear and for the first time in an IEA report specifically discusses the potential advantages and benefits of developing and deploying SMRs, with the next critical step being the successful deployment of prototypes and first-of-a-kind plants.

Other countries are progressing their SMR programs

Maintaining first mover advantage is critical to ensure Canada receives the full benefits from developing SMRs. And since the SMR Roadmap was issued, others have not been standing still.

Russia has recently made the news announcing its floating nuclear power plant, the Akademik Lomonosov, has reached its destination in Siberia and has now been declared in service.

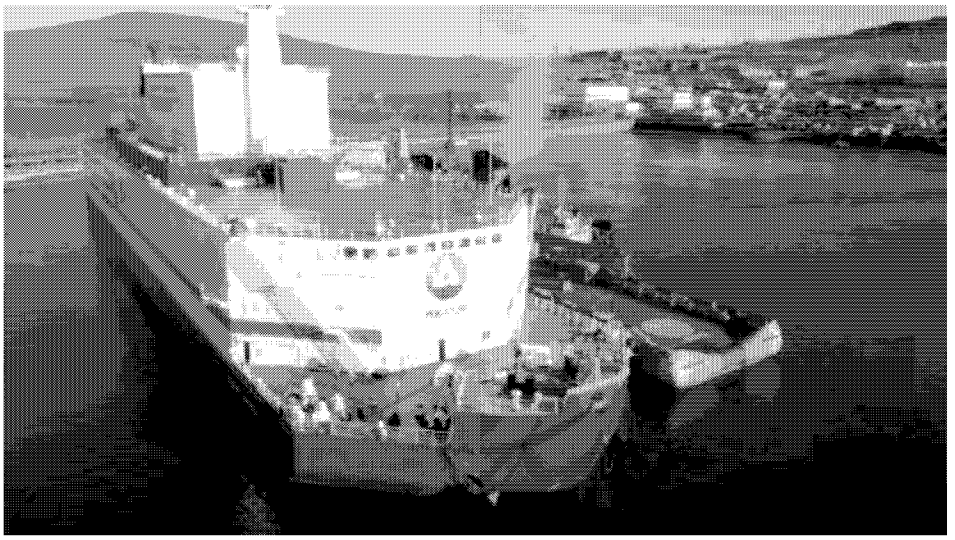


Figure 3 Akademik Lomonosov floating nuclear power plant

Closer to home, the USA and the UK have continued to increase their investments into SMRs.

USA

The Nuclear Energy Leadership Act (NELA) was passed on 23 July 2019. This act was designed to help the industry develop new products that will allow them to continue to compete and instructs the Secretary of the Department of Energy to take certain actions to re-establish America as a leader including:

- To set up at least one Power Purchase Agreement (PPA), before the end of 2023.
- To complete at least two advanced reactor demonstrations by the end of 2025 and up to five before 2035.
- To develop a 10-year strategic plan that supports advanced nuclear R&D goals and will foster breakthrough innovation to help advanced reactors reach the market.
- To create the capacity for fuel production that will ensure commercial availability of High-Assay Low-Enriched Uranium (HALEU) fuel.
- To create a University Nuclear Leadership Program/Workforce Development Scheme that will provide a world-class, highly skilled workforce

On February 6, 2020 the USDOE published a Request for Information (RFI)/Notice of Intent (NOI) on its Advanced Reactor Demonstration Program in which they indicated that they would spend US$160million (C$210million) for the first year of two advanced reactor demonstrations contributing up to 50% of the costs and a further US$30million (C$40million) for the first year of risk reduction on a range of other advanced reactor developments where they would contribute 80% of the costs. The RFI/NOI is issued to "*solicit information from advanced reactor developers and other interested parties that DOE requires to inform its aggressive strategy to demonstrate two advanced reactor designs within five to seven years of award, and two to five smaller awards to address technical risks in other advanced designs*". On May 8, 2020 the formal request for bids was issued with proposals due in August 2020.

This work, as with all other work paid for by the USDOE (US Department of Energy), must be performed in the United States.

This funding is of a scale that will ensure progress towards demonstration.

In parallel the US Department of Defence has initiated "Project DiLithium" to investigate small (1-10 MWe), transportable (<40 tonnes) SMRs to support tactical deployments. With a clear customer, full funding, and the possibility of fast track licensing this could bring about the first fully developed SMR units and a guaranteed early fleet market.

Further, in April 2020, based on the work of the US Nuclear Fuel Working Group, the Secretary of Energy announced The Strategy to Restore American Nuclear Energy Leadership which recommends:

- Taking ***immediate and bold action to*** strengthen the uranium mining and conversion industries and ***restore the viability of the entire front-end of the nuclear fuel cycle.***
- Utilizing American technological innovation and advanced nuclear RD&D investments to consolidate technical advances and ***strengthen American leadership in the next generation of nuclear energy technologies.***
- Ensuring that there will be a ***healthy and growing nuclear energy sector*** to which uranium miners, fuel cycle providers, and reactor vendors can sell their products and services.
- Taking a whole-of-government approach to ***supporting the U.S. nuclear energy industry in exporting civil nuclear technology in competition with state-owned enterprises***.

In May 2020, the DOE Announced $27 Million for Advanced Nuclear Reactor Systems Operational Technology. And in June, the US International Development Finance Corporation (DFC) has proposed policy changes that would remove a prohibition on it providing support for nuclear power projects. This would enable the DFC to offer financing for projects to deploy technologies such as small modular reactors (SMRs) in developing countries. On October 13, 2020 the USDOE announced[13] that X-energy and TerraPower were selected under the Advanced Reactor Demonstration Program (ARDP) and will each receive $80 Million of funding towards deploying their designs in the US within 5 to 7 years. They plan to invest $3.2 Billion over 7 years in support of this program. On October 16[14], the USDOE approved a multi-year cost share award that could provide up to $1.4 billion to help demonstrate and deploy a 12-module NuScale power plant located at Idaho National Laboratory with the first power module operating at the lab by 2029.

[13] https://www.energy.gov/ne/articles/us-department-energy-announces-160-million-first-awards-under-advanced-reactor

[14] https://www.energy.gov/ne/articles/doe-approves-award-carbon-free-power-project

The United Kingdom

The United Kingdom is also seeking to re-establish itself as an international leader in nuclear technology and sees SMRs as one route to achieving this ambition. It expressed support for domestic SMR development in the 2016 budget. That phase of development concluded in December 2017, with the publication of a series of techno-economic assessments of SMRs.

Figure 4 Rolls Royce SMR

In November 2019, the government confirmed that it is investing £18 million (C$31million) match funding, through the Industrial Strategy Challenge Fund, in the UK SMR consortium led by Rolls-Royce. Just recently in June 2020, the consortium has submitted proposals to Ministers to accelerate the building of a new fleet of up to 16 SMRs in the North of England by 2050. The plan could see construction of high-tech factories to build the small reactors begin as early as next year.

The government is also offering a range of targeted support for advanced nuclear technologies, including small reactors, as part of the nuclear sector deal. Having completed a feasibility study on 8 reactors BEIS is expected to invest up to a total of £44 million (C$75million) in a short list of these designs through the Advanced Modular Reactor (AMR) Feasibility and Development project.

On June 23, 2020, the UK Nuclear Industry Association (NIA) has released "Forty by '50: A Nuclear Roadmap," an assessment produced for the Government/Industry body, the Nuclear Industry Council. This NIC-endorsed report says that, in addition to helping meet long term goals, prompt decisions on a new nuclear power program could unlock mega-projects delivering immediate benefits to help tackle the impact of COVID-19. It recommends an ambitious program—based on existing and new technologies—to provide up to 40% of clean power by 2050 and drive deeper decarbonization through the creation of hydrogen and other clean fuels, along with district heating.

Most recently, on July 10, 2020 the UK government announced the award of £40 million to kick start next-gen nuclear technology going to three advanced reactor developers and for research activities.

3 Commercial Availability of SMR Technologies for Deployment in Canada

As identified in the Pan-Canadian SMR Roadmap, SMRs cover a wide range of power levels, designs, technological readiness levels and end user applications. In Canada, that can range from traditional on-grid generation to co-generation, heavy industry, mining, and remote community applications.

To meet this broad-based Canadian need, the four Utilities (SaskPower, OPG, Bruce Power and NB Power) have been working collectively and investing over the last two years to develop three streams of SMR projects. The three streams of projects will help create flexibility and growth opportunities for communities connected to the grid (Stream 1), will support advancement in nuclear technology and innovative methods to reduce nuclear by-products (Stream 2), and will bring affordable, clean energy to remote communities and mines (Stream 3).

OPG, Bruce Power and SaskPower are planning for design selection for an on-grid Stream 1 reactor in 2021 that will be deployed at the Darlington site in Ontario targeting first power by 2028. Taking advantage of the availability of the licensed facilities at Darlington and Bruce Power site would confirm Canada's first mover advantage and support the next phase of the Stream 1 fleet for Saskatchewan to enable its electricity decarbonisation starting in the early 2030s.

NB Power continues to develop two advanced reactor designs in Stream 2 with the potential deployment timeline at their Point Lepreau Nuclear Generating Station site between 2030 - 2035. These advanced SMR designs bring additional benefits such as enhanced levels of safety which lead to simple low-cost designs and the ability to effectively recycle their own used fuel and reduce current inventories of used CANDU fuel. They have co-generation capabilities for potential application with heavy industry, desalination or hydrogen production, superior load following characteristics to support the intermittent nature of renewable forms of electricity production and have the potential of a substantial export market.

Stream 3 are micro SMRs that can be used for displacing diesel generation currently used in remote areas for mining, and in northern remote communities for heat and electricity generation. These could be demonstrated at the Canadian Nuclear Laboratory site(s) with a first project, a USNC Micro Modular Reactor (MMR) demonstration unit supported by OPG, completed as early as 2026. In addition, Bruce Power and its partners have been exploring opportunities in remote communities for deployment of additional micro-SMR's.

Unlike the development of the CANDU reactor in the past, the majority of the costs to develop and deploy these three streams will come from the private sector, however financial and policy support from the Government of Canada is critical to provide a clear signal to investors.

The following sections provide more details on the streams and high-level plans.

3.1 Stream 1 – Developing SMRs in the short term to provide a clean and innovative energy option

Stream 1 represents an opportunity for early deployment of grid sized SMRs in Canada. Work is underway to move forward with a fleet of grid-scale SMRs with technologies that are ready to deploy thus enabling a clean and innovative energy option for electricity systems which will

provide economic, reliable generation for decades, all while further developing the Canadian nuclear supply chain. OPG, Bruce Power and SaskPower are collaborating to complete design selection for an on-grid Stream 1 reactor in 2021 that will first be deployed at the Darlington site in Ontario targeting first power in 2028. Taking advantage of the "shovel ready" status of the licensed nuclear site at Darlington would confirm Canada's first mover advantage and support the next phase of the Stream 1 SMR development in Saskatchewan to support its electricity decarbonization plans with the potential for SMR deployment in the early 2030s. Part of the first mover advantage is the ability to sustain and build Canada's nuclear supply chain which has been strengthened by the CANDU reactor refurbishments in Ontario.

Meeting the need for energy in Saskatchewan while enabling decarbonization requires new low carbon generation from the first SMR to be available as early as 2032. This can be followed by a fleet of similar units about every three years to 2042 to continue the province's move away from fossil generation. Deciding on a first nuclear plant is a big decision for a nonnuclear jurisdiction. Although Saskatchewan is home to the world's highest-grade uranium ore and best-known non-government owned uranium mining company, it currently has no nuclear generation. Almost 75% of its generation is fossil – coal and gas. As part of its plan to introduce nuclear generation and to mitigate its risk of going forward with this new technology, it would like to benefit from the vast expertise already available in other parts of Canada, in Ontario and New Brunswick, by companies who have been operating nuclear plants for decades.

Ontario currently meets about 60% of its electricity needs from nuclear energy and is home to much of the well established Canadian nuclear industry. It is currently in the midst of a large life extension program for its current nuclear fleet. The $26 Billion refurbishment projects at OPG's Darlington site and Bruce Power's Bruce site are the largest clean energy projects underway in Canada. This has reinvigorated and recapitalized the Canadian supply chain which is in an excellent position to take on the development and deployment of a new technology to follow these refurbishments.

OPG has just recently declared the first of its units to be refurbished, Darlington Unit 2, back in service after completing a 44-month refurbishment outage on budget. This demonstrates the strong capability within Ontario to deliver large complex nuclear projects to cost and schedule. In addition to this very recent success, OPG has other important attributes that make it suitable to launch the first of a kind (FOAK) of a new SMR technology. Combined with the nuclear expertise and excellence brought to the table by Bruce Power, the collaboration between these two companies make Ontario the ideal site for the FOAK SMR technology.

Of most importance, the Darlington site is already licensed to prepare for a new build. The environmental assessment has been performed and the regulator has provided a Power Reactor Site Preparation License (PRSL). This means that OPG can move quickly to help Canada maintain the important first mover advantage to demonstrate a new SMR technology at the site. The next step in the CNSC licensing process after site preparation is the application of a license to construct based on the SMR technology to be selected by OPG. The willingness to consider a FOAK unit and the ability to get started now has attracted interest from a number of SMR developers. In exchange, it is anticipated that Canada will receive economic benefits from the selected developer by providing it an opportunity for FOAK build followed by a Canadian fleet in terms of locating supply in Canada to make use of its already

strong and ready supply chain. This will maximize the benefits to Canada of SMR deployment and provide the necessary demonstration to launch the SMR industry.

A study undertaken for Ontario and Saskatchewan by the Conference Board of Canada (CBOC)[15] assesses the economic impact of SMRs in both provinces.

A single demonstration unit built in Ontario and operated for 60 years would result in the following economic impact to Ontario and Canada as whole:

For Ontario:

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 684 jobs during project development
  - 1,604 jobs during manufacturing and construction
  - 210 jobs during operations and
  - 163 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect and induced) of over $2.5 billion
- Result in an increase of provincial revenues of over $870 million

For all of Canada (including ON):

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 742 jobs during project development
  - 1,939 jobs during manufacturing and construction
  - 296 jobs during operations and
  - 183 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect, and induced) close to $3.4 billion
- Result in an increase of government revenue of over $1.1 billion

Following this demonstration unit in Ontario, a fleet of four units in Saskatchewan each operated for 60 years would result in the following economic impact:

For Saskatchewan

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 718 jobs during project development
  - 7,042 jobs during manufacturing and construction
  - 728 jobs during operations and

[15] "A New Power: Economic Impacts of Small Modular Nuclear Reactors in Electricity Grids", Conference Board of Canada, March 2021

- 833 jobs during decommissioning

- Have a positive impact on GDP (direct, indirect, and induced) of over $8.8 billion
- Result in an increase of provincial revenues of over $3 billion

For all of Canada (including ON):

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 786 jobs during project development
  - 10,516 jobs during manufacturing and construction
  - 1,173 jobs during operations and
  - 1,015 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect, and induced) of $13.5 billion
- Result in an increase of government revenue of over $4.3 billion

In a post COVID world, this is the most shovel ready SMR project anywhere and will be the first of a pan Canadian fleet. In summary the Stream 1 pathway:

- Provides a clean energy option for meeting future electricity demand and reducing emissions on provincial electricity systems
- Ensures the advantages of the Darlington site are exploited to secure the best economic development for Canada from a potential SMR developer
- Leverages the expertise and existing infrastructure of the two Ontario based operators, OPG and Bruce Power
- Supports the development of the Saskatchewan market together with SaskPower to be ready to meet the Saskatchewan requirements for low carbon capacity
- Moves quickly to demonstrate SMR deployment with a product that is near ready today being in a position to select a technology by the end of 2021 followed by a decision for the first project in 2023 (subject to licensing approval)
- Supports a SMR fleet to 2050 creating opportunity for other new jurisdictions to follow
- Ensures Canada remains a first mover and leader in SMR development

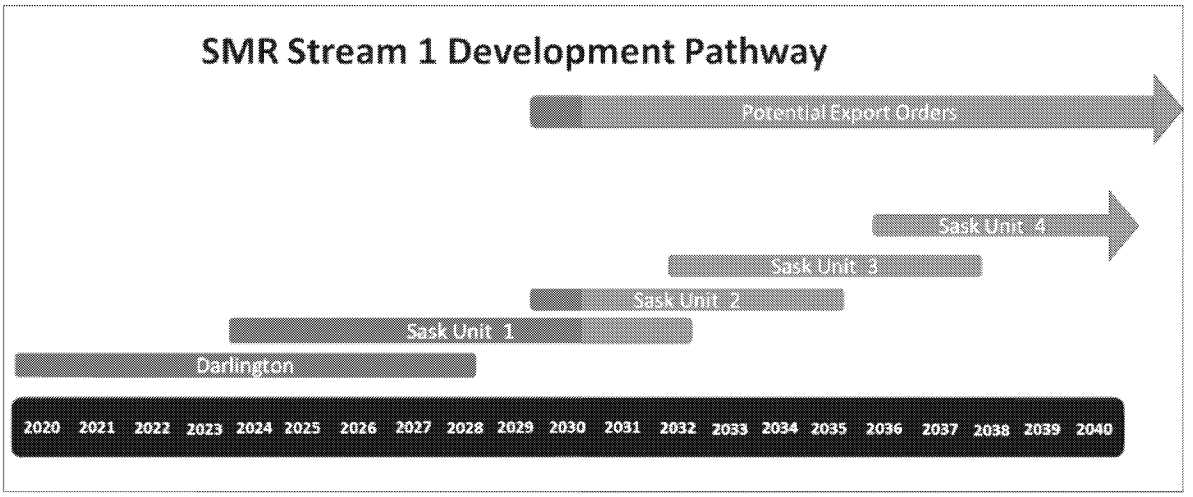


Figure 5 Stream 1 Development Pathway

The current state of development for Stream 1 is to select a technology that can meet this shovel ready project timeline and be a first mover amongst SMR developers. To date, OPG, Bruce Power and SaskPower have been leading a process to identify technologies that can meet their requirements for deployment with a manageable risk profile.

In October 2020, OPG announced it is advancing engineering and design work with three grid-scale Small Modular Reactor (SMR) developers: GE Hitachi, Terrestrial Energy and X-Energy. The utilities will go through a rigorous review to determine who can best meet the Stream 1 requirements with regards to technology readiness, economics, and potential for Canadian content, with a final technology selection planned to be made at the end of 2021.

3.2 Stream 2 - Advanced On-grid SMRs being developed in New Brunswick

As part of the overall energy supply planning and to address the requirements for green-house gas emission reductions, starting in 2017, NB Power reviewed various nuclear supply options. The potential benefits of the emerging SMR market was noteworthy and warranted further assessment. As a result, NB Power examined the potential benefits of various grid sized SMR technologies for New Brunswick.

NB Power reviewed a large selection of small modular reactors technologies for on-grid application. Based on a number of criteria such as increased level of nuclear safety, proliferation resistance, reliability, environmental sustainability, reduction in waste volumes, fuel supply, cost competitiveness, technological readiness, public acceptance and potential for economic benefits, NB Power focused on advanced fast neutron spectrum reactors.

Advanced fast spectrum SMRs are generally known as Generation IV reactors. They use a coolant other than water, such as molten salt or sodium and have inherent safety characteristics, simpler design, lower cost, ability to recycle their own used fuel, and will have superior ability to follow the intermittent output from renewable power sources. Conventional nuclear reactors do not produce much high-level radioactive waste (HLRW) because they are a high-density power source. Advanced fast reactors can reuse their own used fuel many times over to produce up to about 100 times less (HLRW) than their Generation III predecessors and with a relatively shorter life cycle for disposal. Furthermore, these SMRs

have the ability to reuse CANDU used fuel reducing the volume and associated long term storage requirements.

Reactor designs that have the above-mentioned attributes, when combined with today's advanced manufacturing and modularization techniques are expected to be cost competitive with fossil fuel generation and would present a tremendous opportunity for New Brunswick and Canada.

Aware of this opportunity, and the advantages that Canada has to progress the development and deployment of SMRs as identified in the Pan-Canadian SMR Roadmap, in the summer 2018, the Government of New Brunswick committed $10 million toward the establishment of an advanced SMR Research Cluster in New Brunswick[16]. Based on the earlier technology review, Moltex Energy and Advanced Reactor Concepts (ARC) through its subsidiary ARC Clean Energy Canada, Inc. (ARC Clean Energy), were selected and elected to join the cluster, each investing matching funds of $5 million to progress research and development of their advanced technologies[17]. In early 2021 the Government of New Brunswick committed $20 million towards the next phase of development of an advanced SMR research cluster in New Brunswick, which will be supplemented by $30 of developer funding to progress development activities of their advanced technologies[18]. In March of 2021, the Federal Government announced funding to progress the development of advanced SMR development in New Brunswick[19].

In addition to the broad benefits of SMRs such as low carbon emissions and factory build supporting rapid deployment, these advanced reactors share the following specific characteristics;

- The reactivity feedback is such that if they get too hot the power automatically decreases without any intervention, so the fuel can't overheat avoiding fission product release from the fuel
- They are non-pressurized pool type reactor designs so there is no large pressure difference to provide a motive force for fission product transport should the fuel fail for any reason
- The coolants have excellent fission product retention characteristics should fuel fail for any reason
- More inherent safety characteristics and use of low-pressure reactor vessels means the reactor requires many less engineered systems and components leading to lower construction costs and less operating and maintenance staff leading to lower Operating and Maintenance costs

---

[16] https://www2.gnb.ca/content/gnb/en/departments/erd/news/news_release.2018.06.0832.html
[17] https://www2.gnb.ca/content/gnb/en/news/news_release.2018.07.0906.html.
https://www2.gnb.ca/content/gnb/en/departments/erd/news/news_release.2018.07.0930.html
[18] https://www2.gnb.ca/content/gnb/en/departments/premier/news/news_release.2021.02.0094.html.
https://www.arcenergy.co/news/31/39/ARC-Canada-Awarded-20-Million-in-Funding-from-the-Province-of-New-Brunswick
[19] https://www.canada.ca/en/innovation-science-economic-development/news/2021/03/government-of-canada-invests-in-research-and-technology-to-create-jobs-and-produce-non-emitting-energy.html

- The physical nature of the designs provides excellent load following capability leading them to support a grid with a larger component of renewable energy
- They produce high temperature steam which allows them to have co-generation capability for use with either industrial applications as well as hydrogen production.
- They can recycle their used fuel repeatedly leading to significantly lower volumes of high-level radioactive waste and wastes with significantly shorter decay times.

In terms of their unique attributes:

The ARC-100 is a 100 MW(e) liquid sodium cooled fast reactor. It uses HALEU metallic fuel and has a 20-year refuelling cycle. It is a proven technology as demonstrated by the Experimental Breeder Reactor II (EBR-II) at Argonne National Laboratories. This prototype ran safely and effectively for more than 30 years. EBR-II also demonstrated the ability to recycle its used fuel and the use of other types of fuel.

The Moltex SSR-W is a 300MW(e) stable salt fast reactor. Its liquid fuel is derived from used Uranium Dioxide fuel, such as used CANDU fuel using the WAste to Stable Salt (WATSS) process. The fuel salt is in individual fuel tubes and as such, is separate from the liquid coolant salt. This improves corrosion control, simplifies safeguard accounting and verification, simplifies reactor physics modelling and avoids fission products circulating though out the coolant system. It uses on-power refuelling and will recycle its used fuel, allowing existing inventories of used CANDU fuel to be used to generate power and be recycled again and again converting it largely to shorter lived fission products. The plant design incorporates a Grid Reserve System for storing heat, which allows the plant to provide peaking power for shorter periods of time up to three times the nominal power. This supports the use of intermediate renewable energy sources as well as smoothing out daily power peaks. The use of salt tanks for storing heat is a much lower cost way of storing energy relative to battery storage commonly associated with the use of renewable energy.

Since 2018, both vendors have established offices in Saint John New Brunswick and hired staff, progressed their designs, progressing through the CNSC Vendor Design Review process, advanced their project planning, and worked with UNB to establish chair positions, curriculum, and plans for R&D to be performed at CNER/UNB. Both vendors have performed supply chain studies and have held discussions related to establishing a supply chain in New Brunswick. They have also been active in discussions and engagement within the province to increase understanding of advanced Small Modular Reactor technologies.

NB Power has been actively progressing engagement activities with First Nations representatives and the general public to both inform and to listen to potential concerns. They are also providing technical support to the vendors, and progressing project planning activities.

Both Vendors have also been actively progressing activities to ensure that fuel will be available in a timeline to supply the demonstration units.

- Moltex is working on the conceptual design for WATSS and validation activities at UNB and CNL are underway to demonstrate the economics of the process and to develop the design of the industrial scale facility. The plan is to co-locate the WATSS facility alongside the SSR-W on the Point Lepreau site to avoid the unnecessary transportation of used CANDU fuel.

- ARC Clean Energy is working with fuel suppliers to ensure a secure supply of HALEU and with Canadian fuel manufacturers for the manufacture of the metallic fuel bundle assemblies for the first unit. It should be noted that several different reactor designs use HALEU fuel and it is a priority of the US Department of Energy to assist fuel suppliers establish this capability. Further, conceptual work is occurring regarding a reconstitution facility to allow the reuse of the ARC-100 fuel as well as the ability to deal with used CANDU fuel. Given the 20-year fuel cycle, this facility is not required for the first unit.

No technical impediment is foreseen in providing the supply of fuel for either design. Discussions with NRCan are on-going to ensure there are no inhibitors for the import of HALEU from countries capable of supplying HALEU. Discussions with NRCan are also on-going to ensure there are no inhibitors for the type of fuel reprocessing associated with these two technologies, which by the nature of the processes used, are more proliferation resistant than the processes used more widely around the world.

The ARC Clean Energy ARC-100[20] and the Moltex SSR-W[21] technologies have different market applications and are well suited for Canadian and international markets. The SSR-W provides a solution to those countries with existing inventories of used fuel, and its larger size is well suited for countries such as Canada, UK, US and Europe. The ARC-100, with its smaller size, cogeneration capability and 20 year fuel cycle and capability to recycle its used fuel and use other fuels, is ideal for application in western Canada. Its relatively low expected cost should be affordable for smaller utilities. It is ideal for applications such as desalination and hydrogen production, for which there is demand all around the globe. Like the SSR-W, it can be an excellent clean energy replacement for stranded fossil fuel assets. Both vendors are engaged in discussions in Canada and abroad to obtain finances that are required to progress subsequent phases of their project. NB Power staff are supporting this endeavor by engaging with the vendors, Government and NB academia to provide assistance to increase the likelihood of success and to progress overall planning. NB Energy and Resource Development staff resources continue to support the initiative through regular engagement with the vendors, NB Power, Government, and NB academia.

New Brunswick is an attractive location because it has a population that is generally supportive of nuclear power and has an experienced nuclear operator with a solid reputation with the regulator and for innovation. The Point Lepreau Nuclear Generating Station site is attractive and is a valuable strategic asset to the province. It is well characterized and can accommodate at least two demonstration reactors in addition to the existing well run nuclear plant. There have also been a number of environmental and ecological risk assessments performed over the years providing an excellent base to draw upon.

The motivation or value proposition for the province of New Brunswick for the development and deployment of advanced Generation IV SMRs is the establishment of a new industrial supply sector and fleet support services to supply modules, equipment, and services for these advanced designs aimed at both the Canadian and international markets. This supply sector

[20] https://www.arcenergy.co/technology
[21] https://www.moltexenergy.com/stablesaltreactors/

would be largely based in New Brunswick and would build upon and leverage the existing strong Canadian Nuclear Supply chain that is largely centered in Ontario.

This is possible due to the market opportunities arising from the additional advantages the Stream 2 advanced generation IV SMRs designs bring.

Recognizing both the need for ever increasing energy demand around the world, and the need to reduce the carbon footprint, these designs address many of the current reservations the general public has towards nuclear and are projected to be cost competitive with other forms of energy and affordable in terms of capital cost. This results in a potential market not only within New Brunswick with potential export to neighbouring jurisdictions, but elsewhere in Canada and more significantly internationally.

Supply chain assessment studies by both vendors have shown that between 50 to 60% of the components could be manufactured in New Brunswick, and this figure could be increased with some capability development. Much of the remaining components can be supplied within the rest of Canada. This high percentage is made possible due to the simplicity of design resulting from the inherent safety characteristics of these advanced designs; however, the capacity of the New Brunswick facilities will need to be expanded considerably to meet the anticipated demand.

Information from market studies, supply chain assessments, construction, site operation and fleet services operation were used to produce an economic impact assessment of the potential of the Stream 2 technologies. Based on the results of the NB SMR Economic Impact Analysis[22], the activities required to develop the technologies, finalize the designs, construct/commission, and complete the owner/operator pre-operational activities for the two NB advanced on-grid SMR demonstration units at Point Lepreau will have the following one-time economic impact during the 2020-2035 timeframe:

Table 1 NB SMR Technology development and two demonstration units (2020-2035)

Technology development and demonstration units	**Person-years of employment**	**GDP**	**Government Revenue**
New Brunswick	11,280	$1.06B	$120M
Canada	21,870	$2.15B	$198M

The successful development of the technologies and operation of the demonstration units will lead to fleet deployment in New Brunswick, Canada and Internationally. The graphs in Figure 6 and Figure 7 include the potential economic impact of the deployment of the two fleets. They include impacts from engineering, supply chain, construction, commissioning, operation, and on-going fleet technical support and assume a fleet size of 1 GW(e), 4 GW(e), and 50 GW(e) in New Brunswick, rest of Canada and Internationally respectively.

[22] small reactors, big opportunities – Investing in Small Modular Reactor (SMR) technology is a made in New Brunswick contribution to the low carbon economy. https://www.nbpower.com/en/about-us/in-the-community/point-lepreau-nuclear-generating-station

New Brunswick

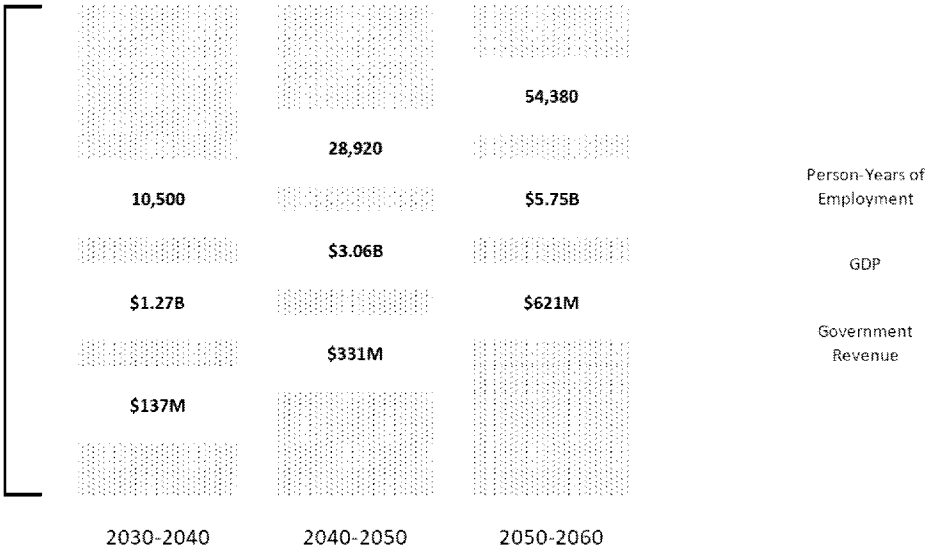


Figure 6 New Brunswick economic impact of fleet deployment

Canada

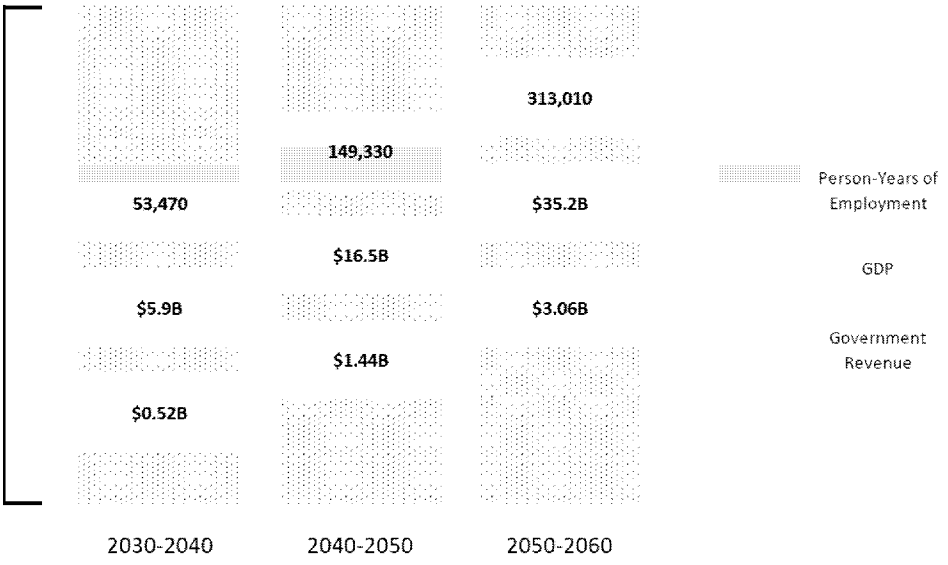


Figure 7 Canadian economic impact of fleet deployment

The all of Canada results indicate the value proposition for Canada is analogous to that for New Brunswick; that being economic development, clean energy to meet demand and fight climate change, and fuel the growth of science and innovation.

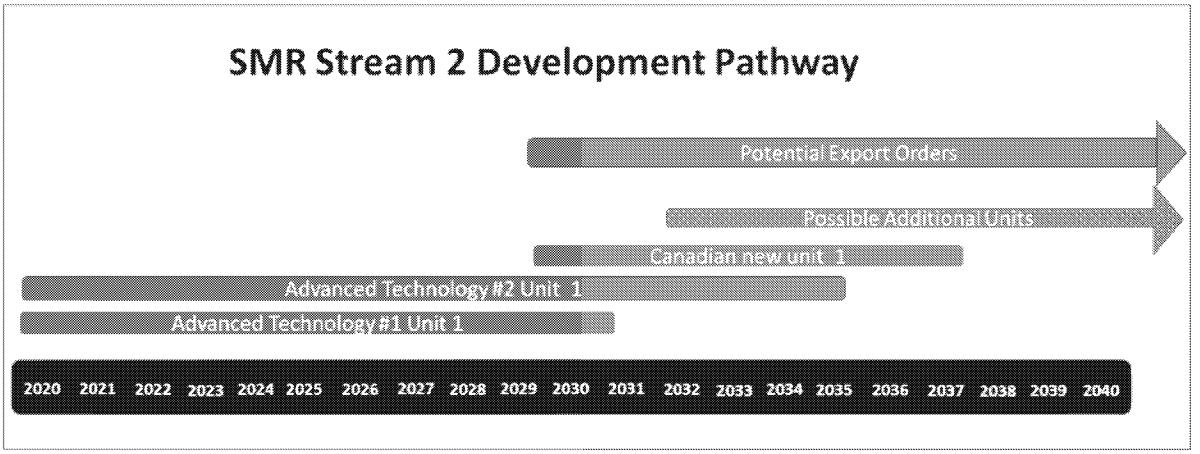


Figure 8 Stream 2 Development Pathway

Central to the ability to attract the export market is the need for a commercial demonstration of these two technologies. This is envisioned to take place at the Point Lepreau Nuclear Generation Station site which already houses Atlantic Canada's only CANDU 6 reactor. This additional nuclear capacity is one of the options being considered to meet the energy needs for the province which considers projected demand, GHG reduction, SMART grid evolution and retirement of generation assets such as the Belledune coal fired station. It is envisioned the owner consortium would sell electricity to NB Power under a Power Purchase Agreement. Several different business models are being investigated however all of them rely on spreading the development costs over a number of units. Federal support in providing financial backstops for risk mitigation for the FOAK projects, such as loan guarantees, cost overrun protection and risk sharing some of the life cycle costs of management and disposal of radioactive waste is also viewed as essential.

3.3 Stream 3 – small micro reactors for off grid use

The small micro-reactors of stream 3 range in size from approximately 2 - 15 MW thermal energy although they can be joined in parallel to increase the net output. These reactors offer the possibility of significant portability that has not been possible in civilian nuclear power until now. The portability can be achieved not only by transporting the smaller modules to a remote site by road or rail but also by constructing both the reactor and the deployment platform in a central site and then transporting both to site as a single unit ready to operate. A number of different platforms are possible but one of the most promising is a marine platform constructed at a shipyard with the small reactor installed before it is towed to site.

The reactors are very safe and simple to operate. This combined with their small size offers the possibility of installation in industrial facilities or in larger marine vessels.

The primary market in Canada for these very small reactors is for off-grid use, to support mining or other industrial applications, and to power remote, mostly indigenous communities. Currently these markets are dependent upon diesel fuel to meet their energy needs resulting in relatively high carbon emissions and increasing risks of ensuring adequate fuel supply at their sites due their remote locations.

Both reactor designs, currently being reviewed in Canada use high temperature gas as the reactor coolant with a variety of secondary side outputs. The eVinci, being explored by Bruce

Power and its partners, uses heatpipe technology to operate a small Brayton cycle turbine to produce electricity in a very small unit compared to today's reactors. The USNC reactor likewise uses high temperature gas as the reactor coolant to provide process heat to an adjacent plant, via a molten salt heat exchange system. OPG is partnering with USNC as Global First Power (GFP) to construct a reactor prototype on the CNL site and is currently pursuing an environmental assessment to support CNSC Licensing. Many vendors make claims about their designs allowing for electricity generation that is cost-competitive with diesel generation: one of the primary goals of the GFP project is to test that claim and determine a commercial model for off-grid deployment of vSMRs.

Building a four-unit 20 MW USNC plant at a single mining site would create the following economic impact[23]:

For Ontario:

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 221 jobs during project development
  - 525 jobs during manufacturing and construction
  - 199 jobs during operations and
  - 154 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect, and induced) of over $659 million
- Result in an increase of provincial revenues of over $235 million

For all of Canada (including ON):

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 240 jobs during project development
  - 638 jobs during manufacturing and construction
  - 282 jobs during operations and
  - 180 jobs during decommissioning
- a positive impact on GDP (direct, indirect, and induced) of $877 million
- Result in an increase of government revenue of over $311 million

The first micro SMRs likely to be deployed as commercial demonstrators as early as 2026 have the capability to truly transform the nuclear industry by providing energy to those that have never considered the nuclear option before.

---

[23] "Emerging Frontiers: Economic Impacts of Very Small Nuclear Reactors in Remote Off-Grid Mining" Conference Board of Canada, October 28, 2020

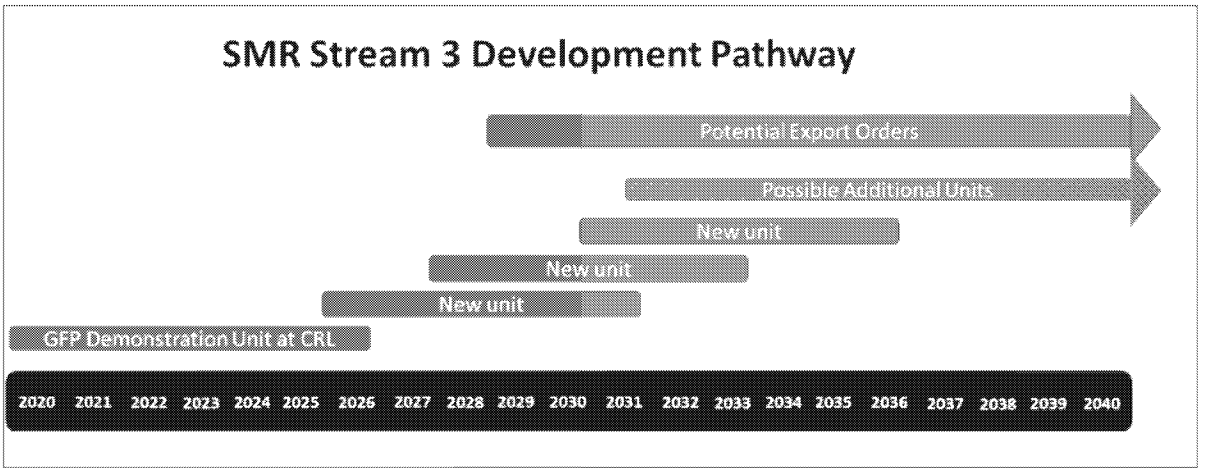


Figure 9 Stream 3 Development Pathway

4 Economic Competitiveness of SMR Technologies

The global nuclear industry is working to disrupt the market with the development of SMRs. The objective is to simplify designs, reduce overall capital requirements and enable shorter project construction times, to the benefit of the market. Traditional economies of scale are to be overcome through the economies of numbers, where large fleets of standard plants should give rise to lower costs in both capital and operation.

The lower outputs mean they can access markets not previously open to conventional nuclear power while proximity to the customer and higher operating temperatures open the possibility of providing both heat and power. SMRs will target not only traditional on-grid electricity generation to replace fossil fuels as the fuel of choice; but also, the needs of heavy industry and mining, as well as support remote communities who do not have ready access to energy. The economic assessments are different for each market segment.

The Economic and Financing Working Group (EWFG) performed a rigorous economic analysis as part of the Canadian SMR Roadmap. It included an exhaustive literature search resulting in numerous inputs based on developer data, academic studies and other literature. Since the roadmap was issued, there has been little new published data to drive any great change to the SMR roadmap analysis and, as such, it remains valid today, especially given the uncertainty in SMR cost inputs.

As shown in the roadmap, the range of capital cost estimates is large. The estimates for more advanced designs that are earlier in their development cycle tend to be lower than those for more traditional light water designs who have done more work to substantiate their cost estimates. This may be due to more optimism by their developers at this stage of development. Or, as proposed by advanced design proponents, it may be that the additional inherent safety and other features will reduce costs, making these designs more economic than scaled down light water reactors. In all cases, there is insufficient work completed to date to provide reliable cost estimates.

The economics of potential on grid SMRs is shown in Figure 10. SMRs have the potential to be economically competitive, especially compared to other low carbon alternatives. Not shown in the figure is the variation specific to a given province. The economics for on-grid application of SMRs will depend upon the alternative low carbon emitting options available to each jurisdiction. For example, gas prices vary considerably throughout the country with very low prices in the west and higher prices in Ontario and the Maritimes. In some scenarios, SMRs compete with gas even without carbon pricing. Adding a price for carbon or carbon capture technology to gas fired generation will enhance the competitiveness of SMRs.

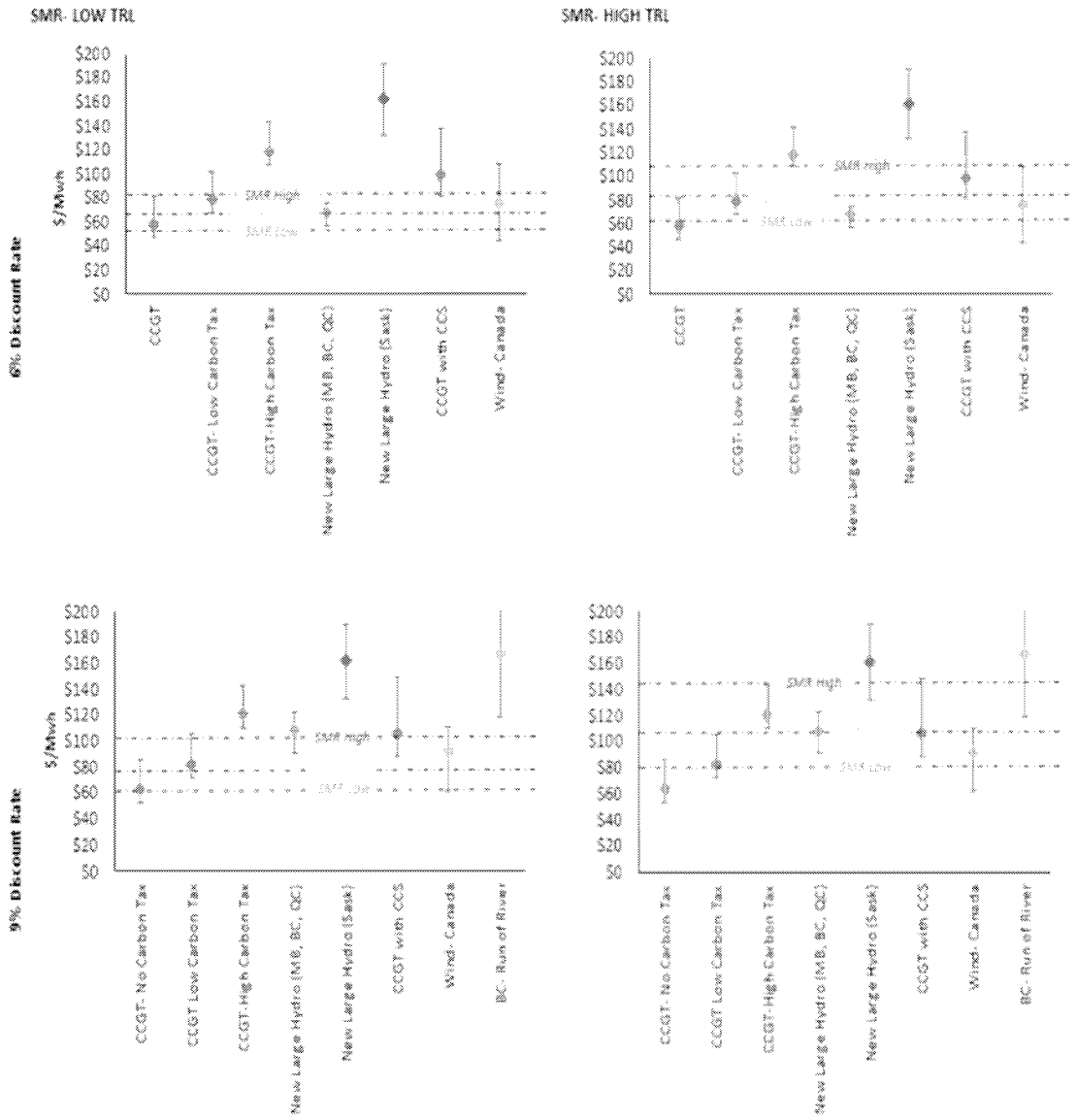


Figure 10 On-grid LCOE at 6% and 9% discount rates

One issue is that Levelized Cost of Electricity (LCOE) is no longer the best approach to determining competitiveness. It is intended to compare similar alternatives to be implemented in a single spot on the system with similar system characteristics. With variable, intermittent, renewables on the system, LCOE alone no longer provides a basis for direct comparison. System costs to maintain the reliability of renewable generation as delivered by dispatchable resources like nuclear, hydro and fossil generation are substantial and increase the larger the penetration of renewables.

A 2018 study undertaken by MIT "The Future of Nuclear Energy in a Carbon Constrained World" considers the impact of nuclear power on the cost of electricity systems when deep decarbonization is desired. It looks at various jurisdictions around the world and the

conclusion is always the same; the cost of electricity is lower with a larger nuclear share than trying to decarbonize with renewables alone.

This MIT study looks at a range of scenarios, first varying the cost of nuclear power to illustrate its impact on its future share, and then looking at deeper and deeper decarbonization from a reference system that emits 500 g/kWh all the way down to a fully decarbonized system emitting only 1 g/kWh. The figures below show that as each system is decarbonized the scenarios with nuclear tend to reduce the average cost of generation with the largest impact being once systems reach deep decarbonization of 10 g/kWh, or less, as using predominantly intermittent energy sources with storage becomes more and more difficult.

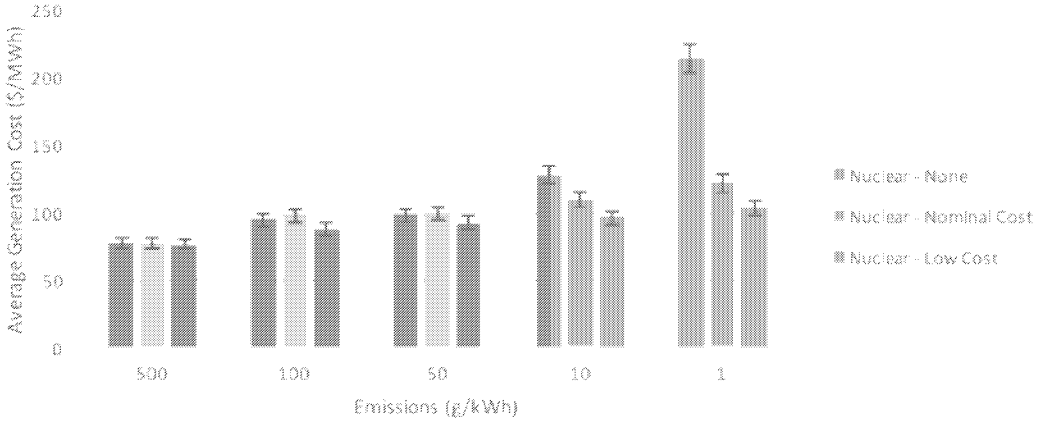


Figure 11 New England cost of electricity generation (MIT Fig 1.5a)

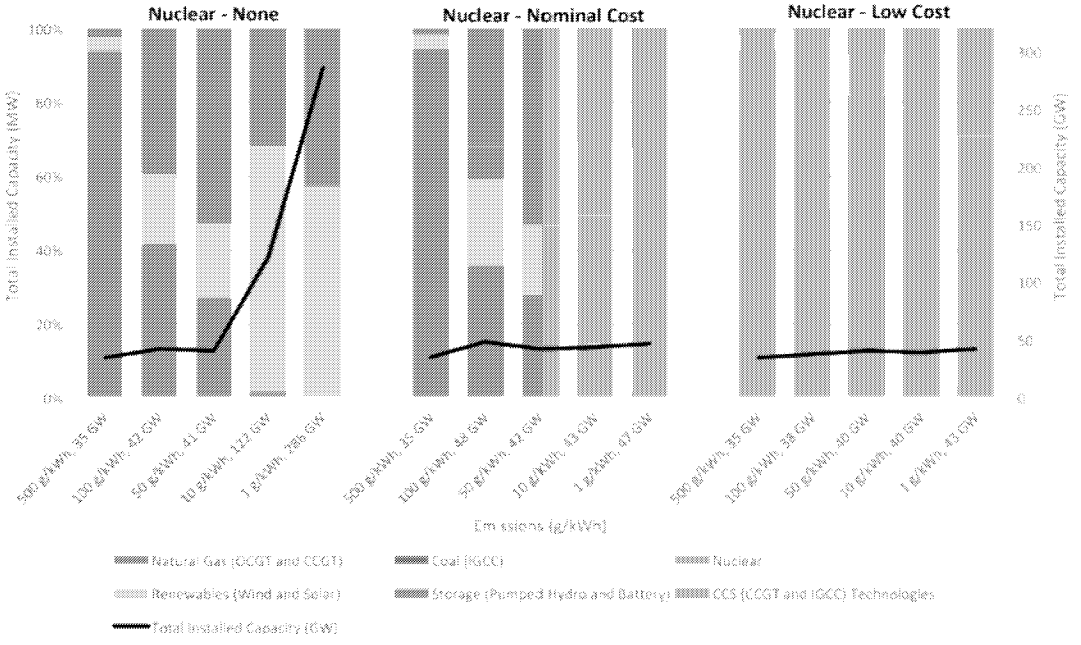


Figure 12 Optimal capacity mixes for New England (MIT Fig 1.6)

The reason for this impact is more clearly shown in the figure looking at the optimal capacity mixes. As the amount of dispatchable fossil generation is reduced, in the case of New England, which is currently predominantly gas, the share of renewables increases. Since renewables are intermittent and have relatively low capacity factors, the amount of renewables required, as they become an increasing share of the total systems, rises dramatically.

Solar and wind only generate when the sun shines and the wind blows, meaning they produce only some of the time and not always when needed. Figure 13 below from the WEO shows the average capacity factors of these technologies in various countries with the world average capacity factor of 17% for solar and 29% for wind. Contrast this with the 24/7 availability of nuclear power, which can operate at capacity factors of more than 90%.

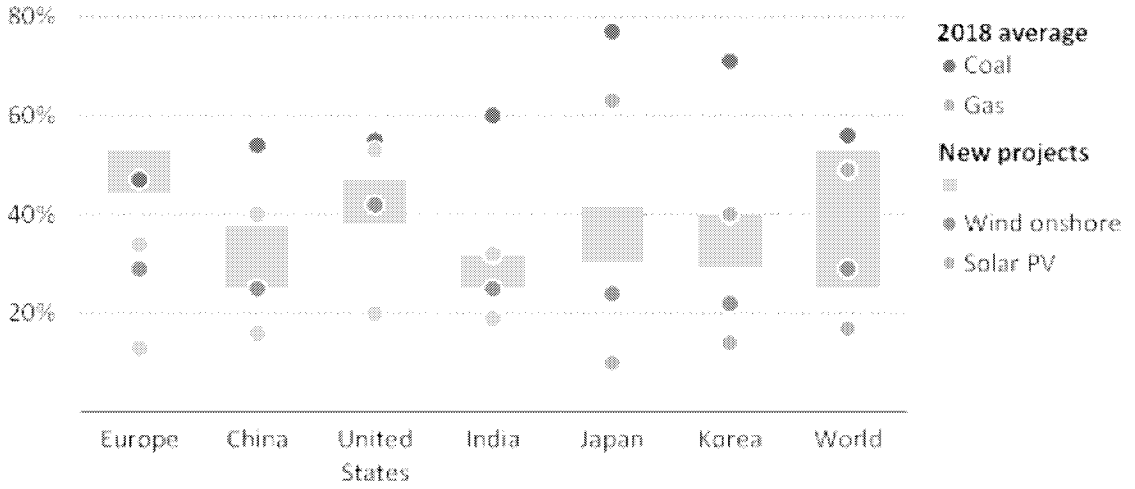


Figure 13 Average annual capacity factors for various power generation technologies by country (WEO Fig 1.16)

The impact on electricity systems is clear. In New England, in the base case the total system capacity is 35 GW but grows to 286 GW for a fully decarbonized system without nuclear while only growing to 43 to 47 GW depending upon the nuclear costs (lower nuclear costs increase the nuclear share and reduce the size of the system). This confirms that nuclear should play a larger role in the future electricity mix.

This was further substantiated by Staffan Qvist (co-author of "A Bright Future") in a study presented at the WNA Annual Symposium in September 2019 for Sweden, which from a resource perspective, is in a better position than most to achieve 100% renewables. The results of his modelling (using a similar model to the MIT study), looking at about 20 different scenarios for full decarbonization, always come out the same; in every scenario the most cost-effective system has continued long-term operation of existing nuclear.

With the potential established, the real question becomes what must be done to ensure this outcome? The LCOE for SMRs is most sensitive to two parameters, cost of capital and capital cost. Each is considered in more detail below.

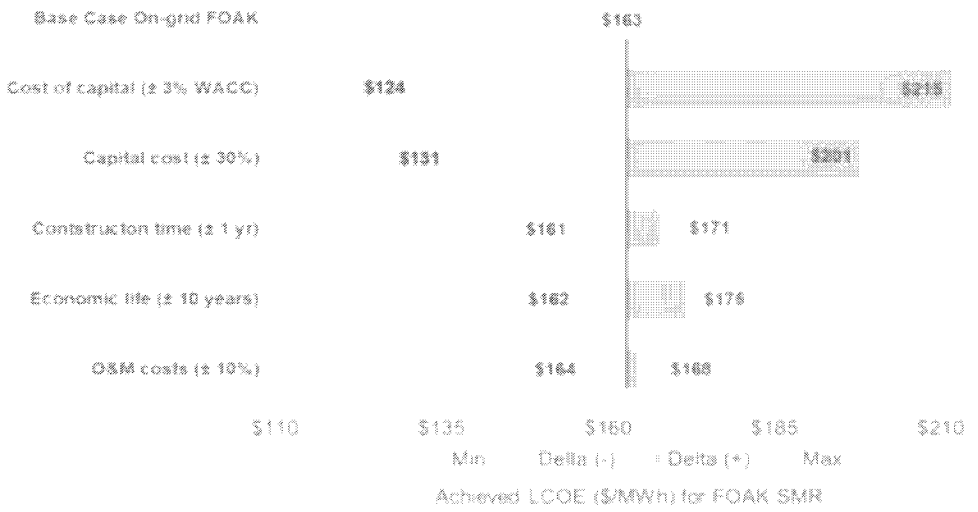


Figure 14 Sensitivity of LCOE for on grid SMRs to key parameters (source: SMR Roadmap)

The following figure shows that the LCOE from a FOAK unit can be almost double the expected outcome for an Nth of A kind (NOAK), fully developed, commercial unit which would be achieved following a number of units being deployed (the number varies for different designs). Significant improvements in delivery are needed to achieve these reductions.

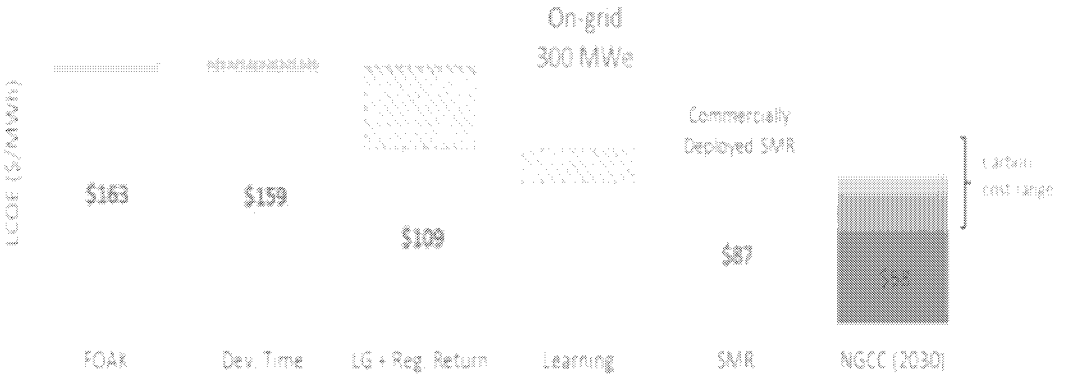


Figure 15 Estimated cost reductions from first SMR to commercial deployment (Source: SMR Roadmap)

In Saskatchewan, Ontario, New Brunswick and Nova Scotia, the utilities are regulated, although they do allow some private generation with the specific approach depending upon the jurisdiction. Only Alberta has a fully de-regulated market. It is managed by the AESO. With regulated cost of capitals applied to an SMR project there can be a big improvement in cost (LG + Reg Return bar in chart). Then comes the reduction in capital cost attributed to learning. This is where the use of factory build, repeating the same tasks in a controlled environment for a large fleet, is essential to product success.

Canada already benefits from the relatively low cost of nuclear energy. Table 2 shows that nuclear is the second lowest cost source of electricity on Ontario next to hydro.

Table 2 Ontario Cost of Energy by type

Generation	Total unit cost ¢/kWh
Nuclear	8.9¢
Hydro	6.0¢
Gas	14.3¢
Wind	14.8¢
Solar	49.7¢
Bioenergy	25.1¢

Source: Regulated Price Plan, Price Report, November 1, 2020 to October 31, 2021, Ontario Energy Board, October 13, 2020

For off-grid SMRs to be implemented in remote communities, the main source of competition is diesel generation creating a different competitive target than for on-grid units.

The figure below shows the results in the SMR roadmap analysis when comparing the costs of SMRs versus diesel in these remote communities. The results show a strong potential for SMRs to save communities a considerable amount from their energy bills. The only exception is for very small communities where the costs are near breakeven.

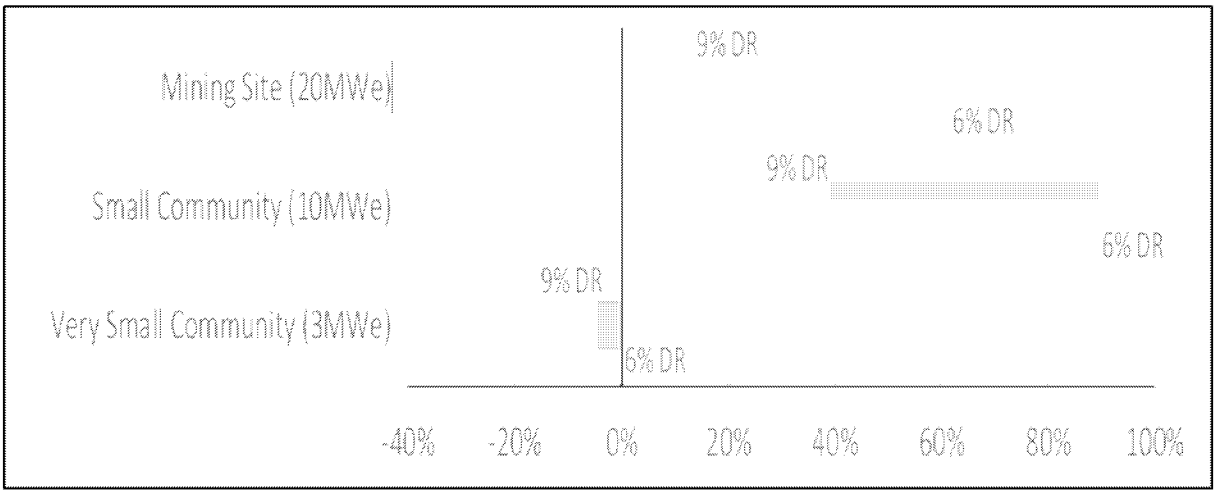


Figure 16 Potential Savings when implementing SMRs in remote communities (LCOE)

For off-grid communities there is a more recent study conducted by the US Nuclear Energy Institute (NEI)[24]. This study confirms the analysis previously performed for the SMR roadmap and estimates the cost to generate electricity, from these very small reactors, will fall by about a third as factories build capacity and experience, once again supporting the need to build these units repetitively in significant numbers. The range of costs is due to variations in transport accessibility, site conditions, the technology, the ability to reduce future costs through lessons learned and the type of owner, i.e., private or public. The diesel generation costs are primarily driven by the cost of fuel and the cost to transport the fuel to remote locations.

[24] https://www.nei.org/resources/reports-briefs/cost-competitiveness-micro-reactors-remote-markets

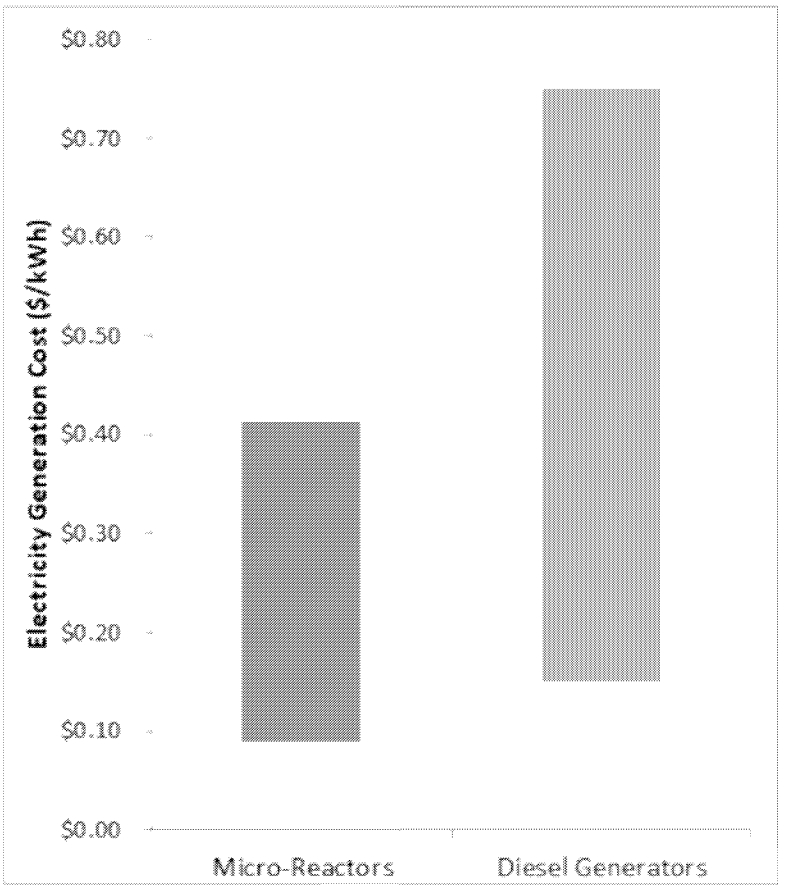


Figure 17 Estimated LCOE of Micro-Reactors and Diesel Generators
Source: NEI Study 2019

5 Key Requirements for SMR Feasibility in Canada

It is widely acknowledged that climate change is one of the greatest challenges facing the world. For Canada and the world to meet the Paris Accord climate targets, Canadians must change their production and use of energy.

Canada is fortunate to have an abundance of energy sources and a highly skilled, innovative energy sector. Canada can lead the way by using that knowledge and by harnessing all of its energy sources to not only meet its targets but help the world meet its targets as well.

For that to happen, greater electrification in areas like transportation, industrial processes and resource development will be required as electricity becomes the clean energy currency of the future. While several provinces can use hydro to provide clean electricity, others will need nuclear energy to provide the non-emitting electricity necessary for greater electrification.

SMRs are as their name implies smaller plants but they are more flexible and can be deployed not only in large established grids but also in smaller grids, remote off grid communities and resource projects. SMRs can play a critical role in reducing the emissions intensity of resource projects such as oil sands and natural gas thus enabling continued development of those critical sectors.

As stated in the SMR Roadmap, SMRs are a clear route to addressing Canada's climate change targets and represent an essential tool in decarbonizing the electricity sector. Once this new technology is adopted to achieve climate goals, it becomes so much more. The additional potential benefits for Canada include:

- Creation of a new industrial sub-sector
- Anchoring cutting-edge research in Canada
- Canada at the centre of a global export market
- Leadership in the mining sector
- Global leadership in SMR policy expertise
- Canada as an international standard-setter
- Meeting Canada's climate change commitments
- Unlocking regional growth opportunities
- Constructive partnerships and a positive energy dialogue

It is this broad range of benefits that have supported a pan Canadian vision for SMR technology. As a result, the SMR Roadmap recommended that there is an essential role for the Canadian government in supporting SMR success. It recommended that:

- The federal government and provincial governments interested in SMRs should provide funding to cost share with industry in one or more SMR demonstration projects for advanced reactor designs.
- Federal and provincial governments should implement measures to share risk with private investors to incentivize first commercial deployment of SMRs in Canada, with the potential of exporting SMR technologies and related innovations developed in Canada to international markets.
- The federal government should work to align the modernization of Canada's federal impact assessment process with other initiatives to develop and deploy SMRs.

- The federal government should review liability regulations under the *Nuclear Liability and Compensation Act*, in order to ensure that nuclear liability limits for SMRs are aligned with the risks they pose, using a graded scale based on risk informed criteria.
- Building on the constructive dialogues that were launched under the Roadmap, federal, provincial and territorial governments and utilities interested in SMRs should continue with meaningful, two-way engagement with Indigenous peoples and communities on the subject of SMRs, well in advance of specific project proposals.
- The federal government, with support from industry, labs, and academia, should continue strong and effective international engagement on SMRs. In particular, to influence the development of international enabling frameworks for these technologies.

This support from the government of Canada can be summarized as falling into two broad categories: a) policy support, and b) financial support.

5.1 Policy support

Canada is continuing to lead when it comes to supportive nuclear policy. Its SMR Roadmap issued in 2018 is seen across the world as an example of how to proceed with new SMR development. Since that time government has committed to preparing an SMR Action Plan to be issued later this year.

Of most importance, the government, through the Minister of Natural Resources Canada, has stated unequivocally that nuclear is clean energy, and that the government's ambitions to achieve carbon net zero by 2050 can only be achieved with nuclear energy as part of the solution. This is in stark contrast to that stated by the IEA in its clean energy progress report issued this June, that nuclear is falling behind its potential due to the lack of policy action by government.

Further policy action is needed at a more detailed level, to ensure that regulatory processes in place to support SMR development are not a barrier for SMR development and licensing. Again, this is an area where Canada can be a world leader. One of the advantages Canada is generally seen to have in the effort to become a world leader in SMR development is a regulatory process that is more safety goal oriented than rule based. While Canada's existing regulatory framework is capable of handling SMRs there are still some regulatory and procedural changes necessary to recognize the lower inherent risk and safety of SMRs.

As SMR projects will be smaller and less complex than existing nuclear projects, regulatory certainty remains a critical consideration for investors and operators. Because SMRs have a smaller output and therefore smaller revenue stream, it is essential that the regulatory process acknowledge and credit their inherent safety and reduced risk. For SMRs to be successful, investors and operators must have certainty in the regulatory process with respect to transparency, costs, and timelines. And given the smaller cost and shorter schedules to deploy this technology, regulatory costs and schedules need to be shortened when compared to traditional larger units. For example, to deploy an SMR as the power source for a mine in a remote community, the cost and time to secure approval for the SMR cannot be longer and more complex than securing approval for the mine itself. This would create an impediment to considering this option rather than choosing the well-known and understood, but carbon intense, diesel for generating this energy.

Similarly, once a reactor is licensed and operational, the licensing of subsequent units should be significantly more efficient provided there are no design changes. This will provide investors and operators the certainty necessary to move forward with a fleet approach which is necessary to make the business case for SMRs.

Among the advantages of SMRs is a reduced inherent risk, improved safety margins and design improvements that lead to reduced maintenance and staffing requirements, including security and emergency staff but these changes need to be reflected in CNSC policies and regulations. The CNSC's framework applies a risk informed and graded approach to SMRs. The result of this approach for specific SMR projects is subject to regulatory decision-making but would allow for a licensing strategy that is proportional to the safety risk of each SMR technology.

5.2 Financial support

The real measure of government support for SMR development is making funding available for needed activities. The decision in Ontario to proceed with life extending the nuclear fleet through refurbishment at Darlington and Bruce at a cost of $26 Billion, and the earlier life extension of Point Lepreau in New Brunswick, is testament to the commitment to a nuclear future.

Developing a new generation of technology that meets pan Canadian needs for clean energy while bringing economic benefits to those communities that implement these projects and the broader Canadian supply chain requires investment.

Financial support required includes:

Stream 1

- Support for the CNSC licensing of the FOAK technology to be deployed as part of Stream 1 in Ontario (four-year funding commitment, starting in 2021)
- Support for site selection, SMR vendor selection, development of site and construction license applications, impact assessment and engagement required to support SMR deployment in Saskatchewan (five-year funding commitment starting in 2020 and matched by SaskPower).

Stream 2

- Support for each of the two advanced SMR technologies being developed in New Brunswick for On-grid application:
    - Complete preliminary design, R&D, CNSC VDR Phase 2, progress waste discussions with NWMO and input into the environmental studies and begin work on detailed design.
    - Support for demonstration of ONWARD project to demonstrate conversion of used CANDU fuel to molten salt fuel (WATSS) technology
    - Provide backstops for the commercial demonstration unit (loan guarantees, cost overruns, long term waste liability)
    - Includes existing SIF and/or SDTC applications. Recommended the applications be approved as soon as possible

- Support for NB Power to conduct environmental studies, site placement studies, pre-licensing activities, Engineering support and work to secure private financing for two commercial FOAK demonstrations at the Point Lepreau Nuclear Generating site
    - Government of New Brunswick's initial investment, which was matched by the vendors is fully allocated, and NB Power's operating budget is subject to Energy and Utilities Board approvals. This support is critical to being able to continue to leverage NB power's nuclear expertise while respecting the existing regulatory rate setting process.

Stream 3

- Support for the OPG GFP demonstration project at Chalk River by sharing costs with OPG and the private sector
- Support for a federally sponsored Westinghouse Canada eVinci Micro Reactor demonstration project within Canada by 2026.
- Recognition that Stream 3 technologies could reduce GHG emissions by replacing fossil-fueled energy for remote communities and for industrial and resource extraction operations (e.g., mining, oil sands, and hydrogen production). Federal cost-sharing of Stream 3 projects could lead to Canadian job creation & supply chain maturity, as well as position Canada with an early mover advantage in the SMR export market.

6 Key Requirements for SMR Feasibility in Ontario

6.1 On-grid SMR development at the Darlington nuclear site

6.1.1 Project Objectives

The Objectives of an SMR project at the Darlington site include:

- To maintain a diverse generation supply mix to minimize carbon emissions from electricity generation in the province
- To demonstrate a FOAK SMR to be ready for deployment across Canada by 2030
- To ensure economic development by securing Canadian content both for domestic and export projects from the developer in exchange for providing the opportunity to deploy their FOAK unit and be a first mover towards an SMR fleet

6.1.2 Project Description

The project is to build a 300 MW class SMR at the Darlington site

Project Schedule: To be in service by 2028. A preliminary project schedule is shown in the figure below.

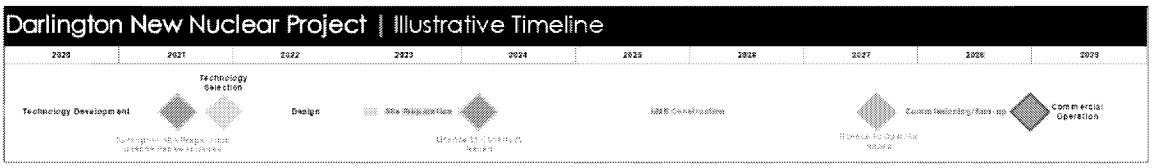


Figure 18 DNNP Potential Milestones and Timeline

Technology: To be selected through a collaboration between OPG, Bruce Power and SaskPower planned for 2021. A FOAK design is acceptable. A review process is underway, and based on progress to date, it is anticipated that a suitable technology will be available.

Project Cost: The capital cost of the project is expected to be less than $3 Billion (overnight capital cost) resulting in an LCOE of less than $100/MWh.

Additional Support: OPG and its partners Bruce Power and SaskPower are requesting support from the federal government over 4 years to support FOAK costs and risks in licensing and to acknowledge the costs incurred that will benefit future customers across Canada such as SaskPower.

6.1.3 Assessment of Feasibility

a. *The market* - Ontario's system operator's (IESO) reference case planning assumes modest but positive load growth: approximately 1% annually through 2040 in both energy and summer peak load. With the scheduled Pickering closure in 2024/2025, 3000 MW of baseload low carbon generation will be lost. OPG's assessment is that undertaking this opportunity to deploy an SMR, essential to SMR success across Canada, will meet anticipated energy and capacity needs in Ontario. Adding baseload generation capability post 2030 will allow the system to meet demand growth largely driven by modest growth in the residential, commercial and agricultural sectors, as well as the increased electrification of transportation, with non-carbon emitting generation. In addition, OPG's assessment is that SMRs can provide stable backup support for wind and solar generation

on the system to contribute to system reliability. The alternative is to continue to use gas as a flexible generation option that will increase carbon emissions as demand and capacity needs arise. The IESO high growth scenario further supports implementing an SMR. This will also ensure that the Ontario based operators will be in a good position to deploy further units should decisions be taken to increase electrification of transport and home heating in the years ahead to meet carbon net zero targets by 2050.

b. *Economic benefits* - Ontario is home to a mature, multi-billion dollar nuclear industry that is a source of innovation in nuclear and non-nuclear applications. Ontario's nuclear supply chain consists of more than 200 companies that manufacture major components and specialized equipment as well provide engineering services for nuclear power stations in Canada and around the world. Development and deployment of SMRs represent new opportunities for Ontario's world-class nuclear industry to grow further and export their products and services around the world.

A study undertaken for Ontario and Saskatchewan by the Conference Board of Canada[25] assesses the economic impact of a SMR unit at Darlington operated for 60 years as:

For Ontario:

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 684 jobs during project development
  - 1,604 jobs during manufacturing and construction
  - 210 jobs during operations and
  - 163 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect, and induced) of over $2.5 billion
- Result in an increase of provincial revenues of over $870 million

For all of Canada (including ON):

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 742 jobs during project development
  - 1,939 jobs during manufacturing and construction
  - 296 jobs during operations and
  - 183 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect, and induced) close to $3.4 billion

---

[25] "A New Power: Economic Impacts of Small Modular Nuclear Reactors in Electricity Grids", Conference Board of Canada, March 2021

- Result in an increase of government revenue of over $1.1 billion

c. *Technology readiness* – During 2020, OPG, Bruce Power and SaskPower have been reviewing developers and their proposed SMR technologies. In October 2020, OPG announced it is advancing engineering and design work with three grid-scale SMR developers: GE Hitachi, Terrestrial Energy and X-Energy. The reviews undertaken so far demonstrate the schedule can be achievable for more than one technology. Risk remains related to the time required to license a new technology in Canada (see below) and the ability to move forward the design and ready the supply chain. The utilities continue to work with the developers to fully assess the work required to meet the schedule. This work will be critical over the next year to make the final technology selection by the end of 2021.

d. *Cost and competitiveness* - A preliminary assessment based on the data provided by the developers under consideration results in potential LCOE values less than $100 /MWh supporting economic feasibility (with estimates currently at a Class 5 level). This compares well to the prices for wind ($91/MWh) and solar ($162/MWh) based on the latest LRP2 clearing prices escalated to 2019 $'s. Lower costs for wind and solar are being projected in other jurisdictions. The impact on future costs in Ontario is unknown. More work is required to confirm project costs and economics as the selection is made and the project develops.

e. *Regulatory readiness* – All designs under consideration have their vendor design reviews (VDR) with the CNSC underway. The CNSC has never licensed a commercial reactor design that is not CANDU. As the global standard for nuclear, light water designs are considered low risk and the CNSC VDR process is a valid approach to determining regulatory risk prior to final technology selection.

f. *Schedule risk* – OPG's assessment is that the timing of the project both meets the need for capacity in Ontario and importantly, completes the FOAK project in time to provide the necessary risk mitigation to Saskatchewan. As a nonnuclear jurisdiction, Saskatchewan is looking to Ontario as an expert in nuclear operations to support it taking the step to implement SMRs and a commitment by OPG and Bruce Power to be first goes a long way to alleviating concerns.

g. *Fuel availability* – Consideration of different designs needs to account for whether they use traditional light water reactor fuel or a more advanced fuel. Most SMR designs require enrichment which also has a healthy international market. Light water reactor fuel is unlikely to be localized in Canada but is readily available on the open market. Other SMRs that might be considered require fuel that has more development ahead of it (e.g., advanced reactor designs using metallic, ceramic or intermetallic fuels). However, if the technology is selected, the fuel may be more likely to be produced in Canada although the enrichment services would be imported. One of them uses a fuel which requires High Assay Low Enriched Uranium (HALEU), for which the supply chain requires some development.

6.1.4 Summary

A 300 MW SMR would be a clean source of energy and deliver needed capacity to the Ontario electricity system. The energy generated by the SMR would maintain generation diversity to support ongoing reductions in carbon emissions.

An SMR is likely to be economic compared to low carbon alternatives and it is anticipated the project can meet the desired schedule.

An SMR project at Darlington is expected to generate thousands of jobs and billions of dollars in economic activity in Ontario and across Canada, as well as create new growth and export opportunities for Ontario's nuclear companies.

Public and Indigenous engagement efforts around the Darlington site have been ongoing, in addition to Indigenous consultations required under the Federal duty to consult as part of Canada's regulatory processes. Building and maintaining relationships with the public and Indigenous communities remains an important and ongoing aspect of the project.

Federal support for up front design selection and licensing is required to mitigate these risks as the benefits of success apply beyond Ontario to other provinces.

6.2 Off-Grid Development Project at the Chalk River site

6.2.1 Project Objectives

The Objectives of building the FOAK MMR at the Chalk river site include:

- To demonstrate the technology in Canada
- To serve as the model for potential future deployment under commercial contracts to energy end users in the heavy industry/mining and remote community markets
- To secure economic benefits for Canada from being a first mover

6.2.2 Project Description

OPG has entered into a relationship with USNC to be known as Global First Power (GFP) for the deployment of a FOAK micro SMR at the Canadian Nuclear Laboratories' Chalk River site.

Technology - The project will be to build the MMR reactor designed by USNC. A single 5 MWe unit (15 MWth) will be built to demonstrate the technology. Future units will be two-unit 10 MW plants to replace diesels at mines and for remote communities.

Project schedule – To be in service in 2026.

Project cost – Estimated to be less than $200 M (overnight capital cost). The demonstration unit is expected to be jointly funded by OPG, USNC and the Federal Government. A PPA to cover the ongoing operating costs is required to mitigate operating risk. Investment costs would be recovered from future commercial units.

6.2.3 Assessment of Feasibility

a. *The market* – MMRs are intended to replace diesel, which is the current energy source in the north. The benefits relate to combating climate change and improving the quality of life in remote communities. There are currently 200-300 MW of remote mines that are

candidates for vSMRs, but some of these mines will likely be at or nearing end of life by the time the SMR market develops. The potential exists for SMRs at future mines, but this has been conservatively excluded from the current assessment. A market exists for remote community uses in a small number of larger communities. Below is the projected demand for the 10 MW USNC MMR units in the remote mining and remote community markets, based on the different market studies. Each market study assumed the levelized cost of an MMR would be equal to diesel, therefore displacing it.

Below is an aggregate summary of the two markets:

Table 3 Project Demand for 10 MW USNC MMR Units

	2031-2040	**2041-2050**	**Total**
Remote Mining	1-3 units	2-4 units	3-7 units
Remote Communities	1-2 units	3-4 units	4-6 units
Total	**2-5 units**	**5-8 units**	**7-13 units**

The above is a conservative estimate of the market. As this is a new market for nuclear power, product success is expected to support further market expansion.

b. *Economic Benefits* – Providing the opportunity for USNC to construct its first MMR at Chalk River and lay the groundwork for a Canadian fleet is expected to result in most of the supply coming from Canadian companies

A study undertaken for Ontario by the Conference Board of Canada[26] assesses the economic impact of a four-unit USNC 20 MW plant at a mining site operated for 20 years as:

For Ontario:

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 221 jobs during project development
  - 525 jobs during manufacturing and construction
  - 199 jobs during operations and
  - 154 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect, and induced) of over $659 million
- Result in an increase of provincial revenues of over $235 million

[26] "Emerging Frontiers: Economic Impacts of Very Small Nuclear Reactors in Remote Off-Grid Mining" Conference Board of Canada, October 28, 2020

For all of Canada (including ON):

- Create direct, indirect, and induced employment on an average annual basis as follows:
  - 240 jobs during project development
  - 638 jobs during manufacturing and construction
  - 282 jobs during operations and
  - 180 jobs during decommissioning
- Have a positive impact on GDP (direct, indirect, and induced) of $877 million
- Result in an increase of government revenue of over $311 million.

c. *Technology readiness* – The technology to be used is a gas cooled graphite moderated reactor using TRISO fuel. This technology has a good technical basis and the technology itself is relatively proven. Some key components require further development and testing. This may add risk to the project schedule.

d. *Cost and competitiveness* – The cost estimate is based on a well-developed cost model. The first unit at Chalk River is a demonstration unit. A power purchase agreement (PPA) with Canadian Nuclear Laboratories and/or Atomic Energy of Canada Limited is required to recover ongoing operating costs. OPG is staging its investment over time with off ramps should the project not meet agreed milestones.

   Further units have been assessed and at a projected cost of $200 million (overnight capital cost) for a 10 MW two-unit configuration, analysis shows the units will be competitive with diesel. There will also be some additional profit potential to support repaying some of the investment for the demonstration unit.

e. *Regulatory readiness* – USNC has completed Phase 1 of the CNSC vendor design review (VDR) process and is working towards Phase 2 completion is 2021. This should reduce the timeframe for the formal licensing process. This is necessary for general SMR success but remains a risk. Fuel qualification will be on the regulatory critical path.

f. *Schedule risk* – As a FOAK design, there is schedule risk. It is mostly associated with design progression, licensing, and fuel development. Plans are in place to mitigate these risks.

g. *Fuel availability* – Fuel is USNC proprietary FCM TRISO fuel. This is the strength of the design and what provides the high level of inherent safety. Fuel development is on the critical path and requires prompt review and approval by the regulator. It is possible to develop a manufacturing facility for the fuel in Canada. However, given this reactor does not require refuelling for 20 years, the new projects in the pipeline would need to support such a facility. Enrichment is at 13%. Acquiring this level of enrichment remains an issue to be resolved.

6.2.4 Summary

OPG has established a partnership with USNC to implement a demonstration MMR single unit at the Chalk River site by 2026.

The demonstration unit will be jointly funded by OPG, USNC and the Federal Government. A PPA to cover the ongoing operating costs is required to mitigate operating risk.

Economic analysis shows that subsequent two-unit 10 MW plants would be competitive with diesel for remote communities and mines and support some repayment of investment into the demonstration unit.

Commercial deployment of micro SMRs also represents an important opportunity for Ontario's nuclear companies, with the potential to generate thousands of jobs and billions of dollars for Ontario's and Canada's economy.

7 Key Requirements for SMR Feasibility in New Brunswick

7.1 Project Objectives

The objectives of developing and constructing advanced SMR reactor designs in New Brunswick at the Point Lepreau site include:

- Developing generation options to support New Brunswick decarbonizing its electricity grid by replacing and avoiding new fossil generation
- Developing new advanced nuclear technologies that offer the potential for increased safety, reduced cost and use of existing used nuclear fuel as a fuel both extracting value from this resource and reducing nuclear waste streams
- Economic development to the province and the rest of Canada to support this new industry of advanced reactor deployment

7.2 Project Description

NB Power has agreements with both Moltex Energy and Advanced Reactor Concepts (ARC Clean Energy) for the development and potential deployment of commercial demonstrations of their respective designs at the Point Lepreau site.

Technology - The project is for the development and deployment of both the Moltex SSR-W, a 300MW(e) stable salt fast reactor, including the WATSS fuel conversion facility, and the ARC-100, a 100 MW(e) sodium cooled fast reactor. In addition to developing the New Brunswick supply chain, facilities to support operations are also anticipated.

Project schedule – to be in service between 2030 and 2035, with a currently envisioned initial submission for an application to prepare site as early as the summer of 2022, assuming timely Federal support.

Project cost – It is premature to state costs of the potential demonstration projects as these technologies remain in the product development phase. Federal investment spread over the next three years, with the initial instalment starting this year, is required to unlock the necessary private investment to continue development and keep the New Brunswick option viable. This amount is considerably less than the total project costs, which in turn is significantly less than the overall development costs. For the demonstration projects, it is envisioned the owner consortium would sell electricity to NB Power under a Power Purchase Agreement. Several different business models are being investigated.

7.3 Assessment of Feasibility

The model for previous reactor development in Canada has been through government investment with support from various utilities. The model for the advanced Generation IV SMRs designs is based on a private investment model with limited support from government. While limited, this government support in clean energy technology is essential to advance the designs and instill confidence on the part of the investor community.

As identified in section 3.2, the New Brunswick provincial government has made a $30M investment into two leading advanced SMR technologies that was matched with private investment. This New Brunswick investment provided the ability for two vendors to move forward with their conceptual design and the CNSC phase 1 VDR Process. At this time, ARC

Clean Energy has completed Phase 1 and is ready to proceed into preliminary design and phase 2, and Moltex is completing its final input to the CNSC and preparing for preliminary design. NB Power continues to provide assistance to both vendors through expert advice. Federal investment is now required to protect the investment made by New Brunswick into both technologies, and to get these designs through the preliminary design and CNSC Phase 2 of the VDR processes. Such a Federal investment should unlock the private investment needed for the commercial demonstrations.

While there are many activities that need to happen to take a conceptual design through to demonstration and establishment of a viable export industry, the following fundamental outcomes will be needed.

Firstly, is the strong indication of **support from the Federal Government**. This includes financial support for the preliminary designs and financial backstops such as loan guarantees, cost overrun protection and risk sharing some of the life cycle costs of management and disposal of radioactive waste. In addition, a clear policy statement that nuclear is a clean form of energy is required. Support from the Federal Government for first of a kind demonstration is related to *recommendations 01 and 02 from the Pan Canadian SMR Roadmap report.*

Secondly, **both vendors need to successfully complete VDR2**. This provides confidence to investors that there are no fundamental barriers to licensing these designs in Canada. The fact that these are non-water based designs does not pose a regulatory barrier since the CNSC regulatory processes are more safety goal oriented than rule based as pointed out by the SMR Roadmap. The VDR process also provides an excellent opportunity for CNSC to become familiar with the underlying technologies which will be beneficial during the downstream formal licensing process.

Thirdly, as a result of completing the preliminary design and VDR2, **the designs are sufficiently simple so that the Nth of a kind designs are confirmed to be cost competitive with gas**, opening up the potential international market and providing sufficient margin to recover development costs.

The fourth is **a clear path forward for the supply of fuel is established**. Both designs use advanced fuels. The ARC-100 uses High Assay Low Enriched Uranium metallic fuel for the initial core load. It has the capability to recycle its used fuel. Moltex SSR-W uses a molten salt produced from converted spent CANDU or oxide fuel, as well as will recycle its used fuel. Although there are activities that still need to be done, as indicated in Section 3.2, no technical impediments to the supply of fuel is envisioned. However due to the nature of these advanced fuels and how they are produced, policy support from the Federal Government will be required. It should be noted that paving the way for the use of advanced fuels *was recommendation 08 from the Pan Canadian roadmap report.*

The fifth is related to **a clear path forward for the long-term storage of radioactive wastes from these designs**. Although both reactors can recycle their used fuel and thus produce a much reduced volume of long term radioactive wastes and with a relatively shorter life cycle, there is still a need for storage of radioactive waste from the fuel conversion and recycling processes, as well as the final core load. These are in different forms than the current oxide used fuel upon which the DGR has been designed around. Discussions with the NWMO and the Federal Government are necessary to determine the appropriate strategies and costs

associated with managing the radioactive waste. This will be important for those that will need to establish the financial guarantees. This is associated with *recommendations 03,30 and 45 from the Pan Canadian roadmap report.*

All of the above are necessary to **attract additional private investors and or partnerships to finalize the designs and form the owner consortium for the commercial demonstrations**. Partnerships may involve EPC companies interested in the FOAK and subsequent units in the fleet. *This is related to recommendations 38, 41 and 46 from the Pan Canadian roadmap report.*

Supply chains principally located in New Brunswick and elsewhere in Canada will need to be established. This sets the foundation for the supply chain for the fleet.

The **FOAK designs are finalized, licensed, constructed, and commercial operation demonstrated at the Point Lepreau site in a timeline of 2030 to 2035**. This is related *to recommendation 40 from the Pan Canadian roadmap report*. While a lot of activities are required to achieve this goal, this is necessary to demonstrate the technologies on this timeline so that they can be deployed to other areas in Canada and around the world.

Subsequent orders are received, and fleet technical services established. *This is related to recommendation 47 from the Pan Canadian roadmap report.*

7.4 Summary

New Brunswick is investing in the development of two complementary advanced reactor designs to meet the needs of diversity, supporting intermediate renewables and decarbonizing the provincial electricity system while creating a new supporting industry in the province.

With appropriate financial and policy support one or both designs may be able to have first units in service by 2035 and create opportunity for New Brunswick and other Canadian supply for follow on units both in Canada and for export.

The Stream 2 advanced SMR development and deployment in New Brunswick is feasible but relies on certain fundamental outcomes as identified above. Work continues to maximize the likelihood of these outcomes being positive. Building on existing investment from the province, utility, vendors and private industry, limited support is required from the Federal Government in a timely fashion to ensure the potentially significant economic impact materializes.

8 Key Requirements for SMR Feasibility in Saskatchewan

8.1 Project Objectives

The primary objectives of SaskPower's SMR evaluation are to assess:

- The economic and technical feasibility of deploying nuclear power from SMRs in Saskatchewan;
- the role of SMRs in support of an economically sustainable transition from coal and gas fired electricity generation to achieve a zero-emissions electricity grid;
- the impact of SMR deployment in Saskatchewan in terms of new job creation, increased economic development; and
- the potential for SMR deployment in Saskatchewan to support an expansion of the global market for Saskatchewan uranium.

8.2 Project Description

SaskPower is evaluating the economic and technical feasibility of deploying 300 MW of nuclear power from SMRs by 2032 following the successful deployment of the same SMR design by Ontario Power Generation (OPG) at its Darlington Nuclear Power Station in 2028.

For planning purposes, SaskPower is also evaluating the potential deployment of an additional 900 MW of generating capacity from SMRs between 2035 and 2042.

Technology - SaskPower is collaborating with OPG and Bruce Power to evaluate leading North American SMR technologies with the objective of selecting an SMR design by the end of 2021 for fleet-based deployment in Ontario by 2028 and then in Saskatchewan between 2032 and 2042.

Project Schedule – SaskPower expects to complete its SMR evaluation and make a recommendation on whether to proceed with the planning phase of Saskatchewan's first SMR deployment in 2021. Planning phase activities in Saskatchewan are expected to take eight to nine years and would include:

- SMR site selection;
- SMR technology selection including evaluation nuclear fuel availability;
- Evaluation of the business case for including SMRs in SaskPower's long-term electricity supply plan;
- Preparation, submission and approval of a *License to Prepare a Site* from the CNSC;
- Preparation, submission and approval of a *Licence to Construct* an SMR from the CNSC;
- Preparation of a *License to Operate* an SMR from the CNSC;
- Environmental, social, economic and Indigenous impact assessment as required by federal and provincial regulators; and
- Extensive and ongoing Indigenous, stakeholder, customer and public engagement.

Construction phase work is expected to take approximately three years and would result in the completion of the first Saskatchewan SMR in 2032.

However, a final decision to construct the first 300 MW of SMR generation in Saskatchewan would not be made until 2029 following the successful completion of OPG's first SMR deployment at Darlington.

8.3 The Opportunity for SMRs in Saskatchewan's Long-Term Electricity Supply Plan

SaskPower is committed to develop and execute a long-term energy supply strategy that delivers electricity to its customers at the lowest cost while meeting all federal and provincial regulatory requirements and achieving the standards for system reliability and security set by the North American Electric Reliability Corporation (NERC).

In 2020, conventional coal and natural gas accounted for 73% of SaskPower's total generating capacity with renewables (hydro, wind and solar) and coal with carbon capture contributing the remaining 27% of generating capacity.

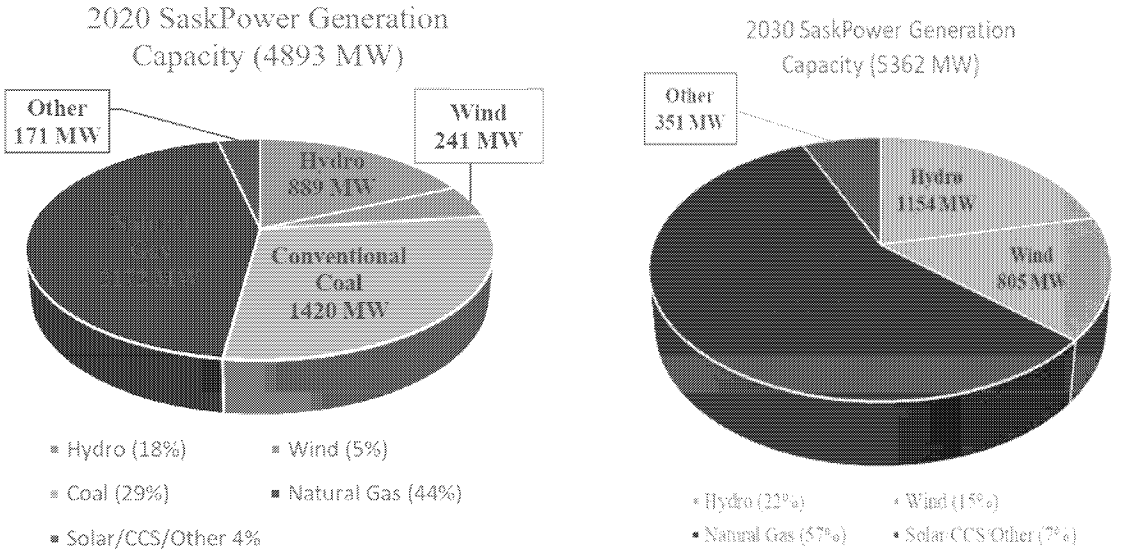


Figure 19 SaskPower Generation Capacity in 2020 and 2030

Federal regulations require SaskPower to retire 1,420 Megawatts (MW) of conventional coal fired power generation by 2030[27]. SaskPower has also committed to increase its renewable power generation to 40% of total generating capacity by 2030. To achieve these two objectives and meet Saskatchewan's growing demand for electricity, SaskPower plans to add 1,118 MW of natural gas generation, 685 MW of wind generation, 190 MW of hydro imports from Manitoba and 183 MW of solar/other between 2021 and 2029.

---

[27] Conventional coal fired power generation refers to the generation of electricity by burning coal in a boiler without technology that captures the carbon dioxide (CO2) that is a biproduct of coal combustion. SaskPower operates one of the world's first and largest carbon capture and storage (CCS) facilities in the world at Boundary Dam Power Station in southeast Saskatchewan. The Boundary Dam CCS facility has the capacity to capture up to 90% of the CO2 emitted by a 150 MW conventional coal generation unit. SaskPower is evaluating the feasibility of retrofitting additional conventional coal generation units in Saskatchewan with carbon capture and storage technology as part of the company's long terms supply plans.

This adjustment to SaskPower's electricity generation mix will eliminate 100% of conventional coal generation in Saskatchewan while achieving our renewable generation capacity target and reducing greenhouse gas (GHG) emissions by at least 40% from 2005 levels by 2030. However, it will also result in natural gas generation making up almost 60% of SaskPower's electrical generation capacity by 2030 which will make further reductions in GHG emissions from power generation difficult until the 2040s.

At the same time, SaskPower anticipates 1) an increase in demand for zero emissions electricity to support the electrification of transportation and other key sectors; and 2) increasingly stringent regulations that will require further reductions in CO2 emissions from power generation after 2030. In response, SaskPower is re-evaluating its long-term electricity supply strategy with a view to limiting the deployment of new natural gas generation in the 2025 - 2030 timeframe.

SaskPower is evaluating several potential alternative low emissions pathways that could include a combination of some or all of the following: expanded electricity imports, expanded generation from solar and wind, expanded application of carbon capture and storage technology and the deployment of nuclear power from SMRs.

8.4 Assessment of Feasibility

8.4.1 Competitive Price for Power

One of the key drivers of SMR feasibility in Saskatchewan is a competitive price for power—the electricity from SMRs must be competitive with alternative large scale zero-emissions, base load generation options available to Saskatchewan including hydro and, in the future, wind and solar supported by energy storage. While feasibility work to date in collaboration with OPG and Bruce Power has been promising with regard to the potential for SMRs to generate competitively priced power, more detailed cost estimates will be developed as SMR developers progress with their designs and OPG progresses with construction of its FOAK SMR project at Darlington.

8.4.2 Commercial Deployment of First-of-a-Kind (FOAK) SMR in Ontario

With no experience in licensing, building or operating nuclear power plants, it is not feasible for SaskPower or the Government of Saskatchewan to shoulder the significant financial, licensing and deployment risks associated with deploying the first utility scale SMR in Canada. Saskatchewan needs partners with nuclear operating experience in Canada and at least one completed SMR project in Canada at a commercial scale to adequately assess the economic feasibility of deploying SMRs in Saskatchewan.

To address this challenge, SaskPower has engaged with all three of Canada's existing nuclear power plant operators -- Ontario Power Generation, New Brunswick Power and Bruce Power – to assess the potential for SMR deployment in all three jurisdictions.

In 2017, SaskPower signed an MOU with OPG to collaborate on the evaluation of SMR deployment in both Ontario and Saskatchewan. In 2019, the Premiers of Saskatchewan, Ontario and New Brunswick signed an MOU to collaborate on the development and deployment of SMRs in all three provinces and in Northern Canada.

As noted in Section 6 of this Feasibility Report, OPG is advancing a plan to build Canada's first utility scale 300 MWe SMR at the existing Darlington Nuclear Generating Station approximately 75 kilometers east of Toronto, Ontario. The goal is to have its first SMR in commercial operation by the end of 2028. OPG and SaskPower are collaborating closely in the assessment of the SMR technology that will be selected for the FOAK project. OPG's experience in licensing, construction and commissioning a first SMR project at Darlington has the potential to reduce the cost and schedule for deployment of a second SMR project in Saskatchewan and to provide detailed information on the capital and operating costs.

8.4.3 Fleet-based deployment of SMRs in Canada

Fleet-based deployment, where the same SMR design is deployed in multiple Canadian jurisdictions, is another key requirement of SMR feasibility in Saskatchewan.

The completion of a FOAK SMR project in Ontario is the first step to fleet-based deployment where the same SMR design is deployed in Ontario and then in Saskatchewan.

Fleet-based deployment will drive the cost of electricity from SMRs lower by reducing the timeframe and cost of licensing as well as reducing capital and operating costs. It will also support the potential for deployment of additional SMR generation in Saskatchewan and in other provinces.

Fleet-based deployment also creates the potential to maximize the supply chain opportunities for Canadian businesses and to support the eventual export of SMR technology developed and demonstrated in Canada to international markets where it's deployment could lead to meaningful global reductions in GHG emissions while creating good, high-paying jobs for Canadians.

In 2020, SaskPower signed a Collaboration Agreement with OPG and Bruce Power to evaluate the business case and potential business models for fleet-based deployment in Canada.

8.4.4 Strong Risk-Sharing Partnership with the Government of Canada

Another key condition of SMR feasibility in Saskatchewan is a strong risk sharing partnership with the Government of Canada.

The Pan-Canadian benefits of fleet-based deployment of SMRs in Ontario and Saskatchewan -- including deep reductions in GHG emissions, support for decarbonization of the western electricity grid and expansion of Canada's nuclear industry – make a strong case for federal risk-sharing in the planning phase of SMR deployment.

SaskPower has worked with OPG, Bruce Power and NB Power to develop an SMR funding proposal that includes a proposed 50-50 cost-share of SMR planning phase costs in Saskatchewan. Without a clear federal commitment to cost-sharing the planning phase of SMR development, SMR deployment in Saskatchewan is unlikely to proceed.

8.4.5 Expanded Regional Electrical Transmission Capacity

Expanding regional transmission capacity by the mid to late 2020s is also key to the feasibility of deploying nuclear power from SMRs in Saskatchewan in the early 2030s. Without access to expanded electricity imports by the mid to late 2020s, SaskPower will likely be forced to replace retiring coal generation with new natural gas generation and would therefore eliminate the need for baseload nuclear power from SMRs until the mid-2040s.

The net impact of a pivot from Saskatchewan's current dependence of coal and natural gas for electricity to a future combination of cleaner electricity imports and nuclear power from SMRs in Saskatchewan is that SaskPower could achieve emission reductions from electricity generation of as much as 70% below 2005 levels by 2040 and zero emissions by 2050 or sooner.

In addition, the combination of expanded electricity imports and the addition of reliable, zero emissions power from SMRs could facilitate an expansion of intermittent renewable generation from wind and solar in Saskatchewan after 2030.

8.5 Potential Benefits of SMR Deployment in Saskatchewan

The fleet-based deployment of SMRs in partnership with Canada's existing nuclear operators (OPG, New Brunswick Power and Bruce Power) and the Government of Canada could also deliver significant economic and environmental benefits for Saskatchewan including:

8.5.1 Deep GHG Emission Reduction

The deployment of SMRs in Saskatchewan as part of a diversified generation mix that also includes electricity imports along with expanded wind and solar generation, could avoid the emission of as much as 73 Megatonnes of CO2 in Saskatchewan between 2025 and 2050 while supporting the economically sustainable decarbonization of Saskatchewan's electrical grid.

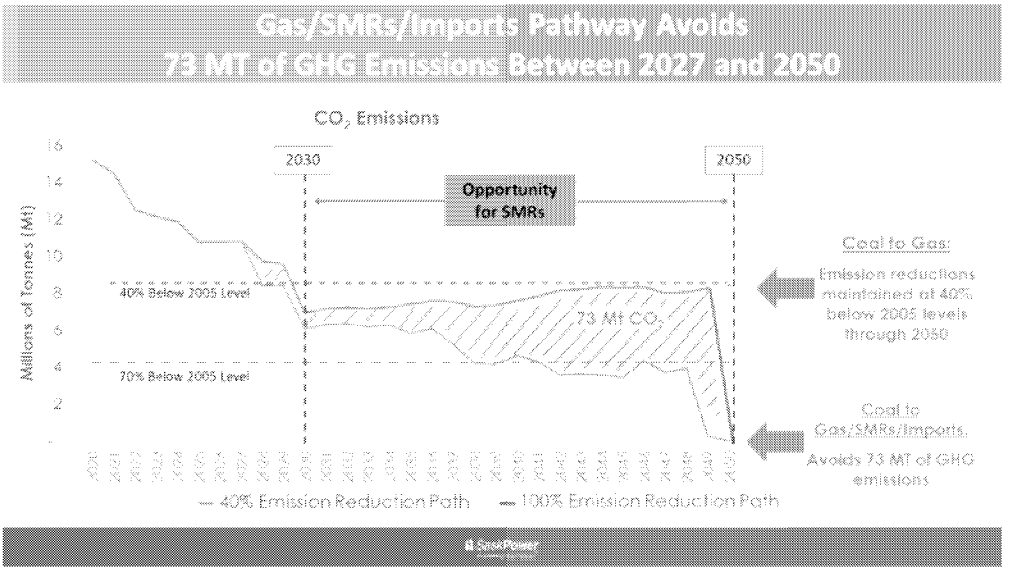


Figure 20 SaskPower Emissions Profile to 2050

8.5.2 Economic Support for the Phase-out of Conventional Coal

The deployment of SMRs in Saskatchewan starting in the early 2030s could substantially offset the negative economic impact in Saskatchewan of the Government of Canada's mandated phase-out of conventional coal fired power generation. A study undertaken for Ontario and Saskatchewan by the Conference Board of Canada (CBOC)[28] assesses the economic impact of deploying four SMR units each with 300 MW of generating capacity (total of 1,200 MW) in Saskatchewan between 2032 and 2042 and then operating each SMR unit for 60 years as follows:

Table 4 Economic Impact in Saskatchewan

	GDP ($million)	Wages ($million)	Taxes ($million)
2021-2032	1,649	944	526
2033-2042	2,765	1,637	910
2043-2104	4,441	3,032	1,521
Total	8,855	5,613	2,958

Deployment of 1,200 MW of nuclear power from SMRs between 2032 and 2042 in Saskatchewan would also create thousands of new jobs in the province:

Table 5 Job Creation in Saskatchewan 2021-2104

2021-2036	2029-2040	2032-2099	2092-2104
Project Development	Manufacturing & Construction	Plant Operation	Plant Decommissioning
179 jobs per plant, per year	1,760 jobs per plant, per year	182 jobs per plant, per year*	208 jobs per plant, per year
*728 jobs per year when all four SMR units are operational			

8.5.3 Economic Benefits to the Rest of Canada

The CBOC analysis shows that SMR deployment in Saskatchewan would deliver significant positive economic benefits to the rest of Canada as summarized in the table below.

Table 6 Economic Impact - Rest of Canada

Economic Impact - Rest of Canada			
	GDP ($million)	Wages ($million)	Taxes ($million)
2021-2104	4,675	2,447	1,375

[28] "A New Power: Economic Impacts of Small Modular Nuclear Reactors in Electricity Grids", Conference Board of Canada, March 2021

The CBOC Report also shows that SMR deployment in Saskatchewan would support job creation in the rest of Canada as follows:

Table 7 Job Creation - Rest of Canada

Job Creation – Rest of Canada			
2021-2036	2029-2040	2032-2099	2092-2104
Project Development	Manufacturing & Construction	Plant Operation	Plant Decommissioning
17 jobs per plant, per year	868 jobs per plant, per year	111 jobs per plant, per year*	46 jobs per plant, per year
*445 jobs per year when all four units are operational			

Further comparative analysis is required to evaluate 1) the net economic impact on Saskatchewan as a result of the phase-out of the coal mining and coal fired power generation business in the 2020s followed by the deployment of SMRs in the 2030s. The same comparative economic impact analysis will also be applied to other potential low emissions pathways including 1) the replacement of conventional coal generation in Saskatchewan with increased electricity imports from Manitoba, Alberta and/or the United States; 2) renewables (wind and solar) with energy storage; and 3) refitting emitting generation with carbon capture and storage technology.

8.5.4 Reduced Dependence on Natural Gas Price

An electricity supply strategy that deploys SMRs in the early to mid-2030s would reduce SaskPower's dependence on natural gas, support the phase-out of natural gas for base load generation between 2030 and 2050 and reduce the risk of stranding capital investments in natural gas generation resulting from more stringent future GHG emissions regulations.

8.5.5 Indigenous Participation in Clean Energy Development

The development of nuclear power from SMRs creates an opportunity for participation by Saskatchewan's Indigenous communities in sustainable, emissions-free energy development which could provide stable, long term financial returns and create high quality jobs for Indigenous people for generations to come.

8.5.6 Creation of New Markets for Saskatchewan Uranium

The 2018 Canadian Roadmap for Small Modular Reactors report estimated the global market for SMRs at approximately $150 billion per year between 2030 and 2040. If even a fraction of this market is achieved, it would significantly increase demand for Saskatchewan's rich uranium resources.

8.5.7 Adding Value to Saskatchewan's Uranium Resources

Saskatchewan has the richest deposits of uranium in the world. With the deployment of a fleet of SMRs in Canada comes the opportunity to source Saskatchewan uranium and use it to fabricate the nuclear fuel that will be required to operate the fleet. While nuclear fuel fabrication is not a condition of SMR feasibility, fleet-based deployment in Canada, where multiple SMRs are deployed in Saskatchewan, creates an

opportunity for fuel fabrication capacity to be developed in Saskatchewan, not only to supply the Canadian-based SMR fleet but also to supply nuclear fuel using Saskatchewan uranium to SMRs deployed globally while creating hundreds of high paying jobs in Saskatchewan.

Further evaluation of the business case for development of nuclear fuel fabrication capacity in Saskatchewan is required including engagement and consultation with provincial and national stakeholders, Indigenous communities and Rights Holders, Canada's existing nuclear utilities, CAMECO and the Government of Canada.

8.5.8 Expanding Saskatchewan's Nuclear Research Capacity:

SMR deployment in Saskatchewan will also create research, development and training opportunities for a wide range of organizations including the University of Saskatchewan, University of Regina, Saskatchewan Polytech, Saskatchewan Indian Institute of Technologies, the Fedoruk Canadian Centre for Nuclear Innovation, the Saskatchewan Centre for Cyclotron Sciences, the Canadian Light Source, the Saskatchewan Research Council and the Johnson Shoyama Graduate School of Public Policy.

8.6 Summary

Based on feasibility work to date by SaskPower in collaboration with other interested Canadian utilities and provinces, nuclear power from Small Modular Reactors (SMRs) could provide competitively priced, emissions free, baseload electricity in Saskatchewan by the early 2030s and could also deliver significant economic and environmental benefits to Saskatchewan and Canada.

However, further planning and evaluation work by SaskPower and the Province of Saskatchewan accompanied by ongoing public engagement regarding the province's future electricity generation options is required to inform a decision to deploy SMRs for power generation in Saskatchewan.

9 Recommendations

SMRs represent an opportunity for Canada to be part of the next phase of global nuclear development. These new smaller nuclear plants disrupt the market by offering new approaches to support global decarbonization with designs that can be deployed by new customers who are not in a position to implement more traditional large nuclear units, either due to their large size, the associated large capital outlays and relatively long project schedules, or both.

Canada is in an ideal position to take the lead in SMR development and deployment. The 2018 SMR Roadmap makes the case and establishes the requirements for success. Since the roadmap was issued, Canadian Nuclear Utilities and vendors have continued to progress the development of SMRs for use in Canada and for export. The MOU signed by New Brunswick, Ontario and Saskatchewan December 1, 2019 is testament to the both the commitment to SMRs and the need to collaborate to develop pan Canadian solutions.

Considerable progress has been made in the development of SMRs following a three-stream approach to SMR development.

- **Stream 1** proposes a first grid-scale SMR project of about 300 MW constructed at the Darlington site by 2028, followed by up to four subsequent units in Saskatchewan, with the first unit in Saskatchewan being in service in 2032. This "fleet" approach would identify a common SMR technology to be more quickly and efficiently deployed in multiple jurisdictions.
    - OPG, Bruce Power and SaskPower are collaborating to select the technology and developer by the end of 2021.
    - SMRs can be economically competitive in both jurisdictions as additional sources of clean energy.
    - The shovel-ready status of the Darlington site makes it a vital strategic asset, providing opportunity for an SMR developer to launch a fleet of units.
    - Stream 1 will create economic benefits for Canada from a single unit in Ontario and four units in Saskatchewan over their lifetime of:
        - direct, indirect, and induced employment on an average annual basis as follows:
            - 1,528 jobs during project development
            - 12,455 jobs during manufacturing and construction
            - 1,469 jobs during operations and
            - 1,193 jobs during decommissioning
        - a positive impact on GDP (direct, indirect, and induced) of $17 billion; and
        - an increase of government revenue of $5.4 billion.

- **Stream 2** involves two 4th generation, advanced small modular reactor designs that will be developed in New Brunswick through the construction of demonstration units at the Point Lepreau nuclear site in NB. By fostering a strong collaboration among the various research, manufacturing, federal and provincial agencies, New Brunswick will see the completion of an initial ARC Clean Energy demonstration unit by 2030, and a second unit by Moltex Energy Canada Inc. by 2035. With these timelines, New Brunswick will be supporting the additional clean energy needs within Atlantic Canada and with partnering jurisdictions starting in 2030. New Brunswick is positioned to become the leader in the development and deployment of these 4th generation technologies through its efforts, its partnerships and its support. These designs represent a significant opportunity for advancing domestically produced energy within Canada and around the world that is both clean and safe. Through ongoing support and collaborations, these advanced technologies can start being deployed as early as 2030 in support of the industrial needs in areas like Saskatchewan and Alberta, and indeed, around the globe. The made in New Brunswick designs represent significant economic diversification opportunities for the province and will place New Brunswick as a world leader in the deployment of 4th generation advanced SMR technologies.
    - With funding of $30 million from the provincial government, two developers (Moltex Energy and ARC Clean Energy) have opened offices in New Brunswick. Companies are developing delivery capability in New Brunswick with the promise of local economic development.
    - These two designs are expected to result in new lower-cost units that recycle nuclear waste, have more inherent safety attributes and are attractive for global deployment.
    - Stream 2 can create economic benefits for Canada for demonstration units in New Brunswick (2020 – 2035) of:
        - 21,870 person-years of direct and indirect employment;
        - a positive impact on GDP (direct and indirect) of $2.15 billion; and
        - an increase of government revenue of $198 million.

      with the opportunity to expand this through a fleet of both Canadian and export units to 2060 of:
        - 537,000 person-years of direct and indirect employment;
        - a positive impact on GDP (direct and indirect) of $59 billion; and
        - an increase of government revenue of $5.2 billion.
- **Stream 3** proposes a new class of micro-SMRs designed primarily to replace diesel use in remote communities and mines. To advance this technology, a 5 MW gas-cooled reactor project by Ultra Safe Nuclear Corporation (USNC) is underway at the Chalk River site in Ontario and is expected to be in service by 2026.

- OPG has partnered with USNC for this demonstration project on the basis of shared investment from OPG, USNC and expected funding from the federal government.
- This project is not intended to be commercially economical, but analysis shows that future two-unit 10 MW plants will be economically competitive with diesel and will provide the opportunity for returns to cover demonstration project costs.
- Looking to advance nuclear in remote communities, Bruce Power and its partners at the Nuclear Innovation Institute have been exploring opportunities with the Westinghouse Canada eVinci Micro-Reactor.
- Stream 3 can create economic benefits for Canada from a four-unit commercial deployment (20 MW) of USNC reactors at a mining site over its operating life of:
    - direct, indirect, and induced employment on an average annual basis as follows:
        - 240 jobs during project development
        - 638 jobs during manufacturing and construction
        - 282 jobs during operations and
        - 180 jobs during decommissioning
    - a positive impact on GDP of $877 million; and
    - an increase of government revenue of $311 million.

These project proposals are advancing rapidly and demonstrate the potential to be both commercially and technically feasible. An important part of these projects' feasibility is cost and risk sharing with the Federal government as these projects support its goals of phasing out coal by 2030, becoming carbon net zero by 2050 and providing affordable clean energy to indigenous communities. Additionally, these proposed projects would create a new subcategory of nuclear industrial activity that would see Canada well placed to be a major player in the global deployment of these technologies. Securing Federal government support in a timely manner is essential to continued good progress along all pathways.

Provincial governments will need to establish policy and regulatory frameworks to enable SMRs as a clean energy option and support training programs to enhance the skilled workforce needed for an SMR industry. In addition, provincial governments can work with power companies to ensure project development is carried out with appropriate oversight, and that public and Indigenous engagement is conducted in a responsible and respectful manner.

It is recommended that provincial governments support a collaborative approach with the Federal government to reducing emissions and growing the economy in a manner that meets the specific needs and economic priorities of each province. Working together on the opportunities provided by SMR deployment, industry and governments will continue to find innovative energy solutions while creating an ideal business environment to attract jobs and growth in regions across the country and for the export market.

From:	Walker, Kelsea (NRCAN/RNCAN)
To:	Campbell, Melanie (NRCan/RNCan); Oue, Shirley (NRCAN/RNCAN); Lynn Adams; Stephen Bushby; MacPhail, Heather (SAC/ISC); Mackey, William (ASC/CSA); Lange, Christian (ASC/CSA); Cloutier, Matthew (EC); Kim, Duck (EC); Robson, Amber (EC); Bevan, Allan (FIN); Naina.Thoppil@international.gc.ca; Tanya.Hinton@international.gc.ca; Quayle, Debora (HC/SC); Asante, Virginia (IC); La Carte, Brandon; Dalzell2, Matthew (WD/DEO); Heapy, Ernest (WD/DEO); Compton, Julie (WD/DEO); Kowalsky, Sena (WD/DEO); Lever, Rod (IC); Brunarski, Lee (CNSC/CCSN); Christie, Victoria (IC); Pillon, Janice (IC); Laura DeLong; Ali, Nardia (EC); Windfeld, Erik (CANNOR); Pronovost, Stephane (CANNOR); Neumark, Devora (CANNOR); Ali, Nardia (EC); Taylor, Ginger (WD/DEO); Rashapov, Rinat (ASC/CSA);
Cc:	Brady, Daniel (NRCan/RNCan); Hawkins, Griffith (NRCAN/RNCAN); Delaney, Jim (NRCAN/RNCAN); Clarotto, Lauren (NRCAN/RNCAN); Wilhelm, Brent (NRCAN/RNCAN); Stronach, John (NRCAN/RNCAN); Christie, Victoria (IC); Kauf, Natalie (NRCAN/RNCAN); Fairchild, Jamie (NRCAN/RNCAN); Way, Laura (CANNOR); Melnyk, Micah (NRCAN/RNCAN);
Subject:	RE: NRCan - Canada's Small Modular Reactor Action Plan - Federal Chapter Stock-take
Attachments:	ADMIN - SMR Action Plan - Federal Chapter Action Tracker.xlsx
Sent:	7/21/2021 6:47:15 PM

Good afternoon,
I am sharing an updated copy of the Federal Action Tracker ahead of our meeting tomorrow that includes the written updates that we have received thus far.
Thank you to everyone who shared updates on your organization's actions. We look forward to speaking with you tomorrow morning!
All the best,
Kelsea

Kelsea Walker
(she/her/elle)
Policy Analyst
Nuclear Energy Division | Direction de l'énergie nucléaire
Natural Resources Canada | Ressources naturelles Canada
Kelsea.walker@canada.ca

-----Original Appointment-----
From: Marrison, Curtis (NRCAN/RNCAN) **On Behalf Of** Melnyk, Micah (NRCAN/RNCAN)
Sent: July 6, 2021 10:08
To: Melnyk, Micah (NRCAN/RNCAN); Campbell, Melanie (NRCan/RNCan); Oue, Shirley (NRCAN/RNCAN); Adams, Lynn (ACOA/APECA; Stephen Bushby; MacPhail, Heather (SAC/ISC; Mackey, William (ASC/CSA; Lange, Christian (ASC/CSA; Cloutier, Matthew (EC; Kim, Duck (EC; Robson, Amber (EC; Bevan, Allan (FIN; Naina.Thoppil@international.gc.ca; Tanya.Hinton@international.gc.ca; Quayle, Debora (HC/SC; Asante, Virginia (ISED/ISDE; La Carte,

Brandon; Dalzell2, Matthew (WD/DEO; Heapy, Ernest (WD/DEO; Compton, Julie (WD/DEO; Kowalsky, Sena (WD/DEO; Lever, Rod (ISED/ISDE; Brunarski, Lee; Victoria Christie; Pillon, Janice (ISED/ISDE); nardia.ali@canada.ca; erik.windfeld@canada.ca; stephane.pronovost@canada.ca
Cc: Walker, Kelsea (NRCAN/RNCAN); Brady, Daniel (NRCan/RNCan); Hawkins, Griffith (NRCAN/RNCAN); Delaney, Jim (NRCAN/RNCAN); Clarotto, Lauren (NRCAN/RNCAN); Wilhelm, Brent (NRCAN/RNCAN); Stronach, John (NRCAN/RNCAN); Ali, Nardia (EC); Christie, Victoria (IC); Ginger Taylor (WD/DEO) (ginger.taylor@canada.ca); Rashapov, Rinat (ASC/CSA); Kauf, Natalie (NRCAN/RNCAN); Fairchild, Jamie (NRCAN/RNCAN); Laura DeLong; Way, Laura (CANNOR); Neumark, Devora (CANNOR)
Subject: NRCan - Canada's Small Modular Reactor Action Plan - Federal Chapter Stock-take
When: July 22, 2021 10:00-11:30 (UTC-05:00) Eastern Time (US & Canada).
Where: Microsoft Teams Meeting
Good morning,
I would first like to thank everyone for their responses back to this SMR Federal Chapter Stock-take meeting invitation. I have confirmed the date to be Thursday July 22nd @10:00-11:30am EST.
*AGENDA UPDATED
AGENDA
- Roundtable introductions
- Federal chapter stock-take by action item
- Additional commentary

Regards,
Curtis Marrison

Microsoft Teams meeting

Join on your computer or mobile app
Click here to join the meeting
Or call in (audio only)
+1 647-557-1766,, Canada, Toronto
Phone Conference ID:
Find a local number | Reset PIN
Learn More | Meeting options
From: Melnyk, Micah (NRCAN/RNCAN) <micah.melnyk@canada.ca>
Dear colleagues,
I hope all is well and you are keeping safe at this time.
I am writing for two purposes:

1) to provide an update on the SMR Action Plan, including a draft tracker of federal actions
2) to convene a meeting to take stock of progress made thus far in achieving the actions laid out in the federal Action Plan chapter (see below for info, if you can respond by Friday July 9th with availability).

First of all, we would like to extend our thanks once again to our federal family colleagues for your support and participation in Canada's Small Modular Reactor Action Plan and the SMR Roadmap.
Since it officially launched on December 18th 2020, the SMR Action Plan has received an overwhelmingly positive reception from stakeholders and the public. Following the launch NRCan has continued to receive expressions of interest from a wide range of organizations, and has since added seven new partner chapters to the website, bringing us to a total of 513 actions and 117

s.16(2)(c)

partners. NRCan is currently making plans for how we will continue to engage with our partners on the implementation of the commitments made in the Action Plan, opportunities for collaboration, and priorities related to SMRs going forward.

To that end, we would like to convene a working-level meeting in the coming weeks with representatives from federal departments and agencies that were engaged in the writing of the Federal Government SMR Action Plan chapter to take stock of progress made by contributing departments to the actions in which they are implicated.

I have attached a draft table that outlines some of the status of each action committed to in the federal government chapter, for discussion at the upcoming meeting. Note that this 1) currently a draft and reflects NRCan's understanding as it stands, and 2) this for internal tracking purposes only, and is not a public facing document. We would appreciate your reviewing to ensure that it reflects actions taken by your departments to achieve the actions committed to in the federal chapter, as we reach the half-year point post Action Plan launch. We have noted places where it would be helpful to receive an update from specific departments.

Please respond to Curtis (copied) by the end of this week (Friday, July 9th) with which of the following dates would work for you or another representative from your team to attend:

A. 1:00-2:30 EST on Tuesday July 13th
B. 3:00-4:30 EST on Wednesday July 14th
C. 3:00-4:30 EST on Thursday July 15th
D. 1:00-2:30 EST on Monday July 19th
E. 10:00-11:30 EST on Thursday July 22nd

Many thanks,
Micah

Micah Melnyk
Acting Director | Directeur par intérim
Nuclear Energy Division | Division de l'énergie nucléaire
Natural Resources Canada | Ressources naturelles Canada
Micah.Melnyk@canada.ca | 613-295-2339

Action #	Status*	Pillar	Action Name	Federal Lead	Action Description text	Expected Results text	Status and potential implementation, including resource availability and needs
GC01	In Progress	Demonstration and deployment	Federal support for SMRs	ISED + NRCan	The Government of Canada has accepted the spirit of Roadmap recommendation (#1) on cost-sharing SMR projects, and has acknowledged the recommendation (#2) on risk-sharing for first-commercial projects. The Government of Canada understands the important role it has to play in advancing SMR technology in time for Canada to be a world leader and to provide a clean alternative for jurisdictions that must phase out conventional coal-fired power plants by 2030. The Government of Canada also recognizes the leadership of provincial and territorial governments and power utilities in SMR deployment, and plans to continue working together to make Canada a world leader in SMR technology. To that end, in October 2020, the Government of Canada announced a $20 million investment through the Strategic Innovation Fund that will enable Terrestrial Energy Inc., an innovative Ontario company, to take a critical step toward commercializing its cutting-edge SMR technology, creating significant environmental and economic benefits for Canada. This investment is one part of the Government of Canada's plans to promote Canada's global leadership in SMRs by supporting Canadian research and bringing technologies to market that will create good jobs and economic prosperity.	Federal investment supports SMR projects moving forward in Canada.	Two SMR projects have been announced by SIF for $67.5M total (Terrestrial Energy $20M, Moltex Energy $47.5M), and there is potential subsequent SMR projects to be supported (2 in progress, possible additional applications). An additional $8M was provided to Moltex Energy by ACOA through the Regional Economic Growth through Innovation program. The SIF Net Zero Accelerator has $8B over 7 years. Minister O'Regan made clear to the Canadian Nuclear Association at their June 8th, 2021 Annual General Meeting that SMRs are eligible technologies for Net Zero Accelerator funding. However, no SMR projects have been announced under the Net Zero Accelerator yet.
GC02	In Progress	Policy, legislation and regulation	Review of Canada's Radioactive Waste Policy Framework	Natural Resources Canada	The Government of Canada has acknowledged the Roadmap recommendation on radioactive waste risk-sharing. The Government of Canada understands the need for a robust framework to manage all of Canada's nuclear waste in order to maintain the confidence of Canadians. We have listened to recommendations that now is the time to review our radioactive waste policy. In February 2020, the Minister of Natural Resources announced plans to work with stakeholders and talk to Canadians to ensure that Canada has a strong policy framework and a clear plan in place for the safe, long-term management of all of our nuclear waste, including any future waste from SMRs. A review of the existing policy for radioactive waste will be undertaken to consider how it may be enhanced, including the establishment of an associated strategy.	Canada's radioactive waste policy aligns with international best practices, the best available science, and reflects the values and principles of Canadians; and, a clear plan is in place for long-term management of all radioactive waste.	In progress. Since the launch of the Action Plan, NRCan has released four discussion papers and received comments from wide variety of stakeholders. The comment period closed on May 31, 2021. The discussion topics include waste minimization, storage, decommissioning and disposal. On July 19 2021, NRCan released the second of two Engagement Summary Reports that provide a snapshot of views and perspectives received during the comment period. All the submissions and comments received have now been published on the Radioactive Policy Review website. Roadmap recommendation on 'risk-sharing' was acknowledged by the GoC in this commitment, but no commitment to address it was made. Under Canada's existing policy, waste owners are responsible for the management of their wastes.
GC03	Complete	Policy, legislation and regulation	Canada's SMR Action Plan	Natural Resources Canada	The Government of Canada has accepted the Roadmap recommendation to finalize an SMR Action Plan. The Government understands the need for coordinated action by all essential enablers if Canada is to be a world leader on SMRs. In response, in 2020, Natural Resources Canada convened partners from across the country to develop Canada's SMR Action Plan, including a full response to the Roadmap's recommendations.	Partners from across Canada outline their roles and plans on SMRs for the coming years. Public and private decisions are informed by a strategic, action-oriented plan and investors have a clear signal of pan-Canadian buy-in. The plan respects and builds on the respective roles and responsibilities of essential enabling partners and sets out timelines for action to maximize benefits to Canada.	Completed. Canada launched the SMR Action Plan in December 2020. NRCan is currently managing updates to the Action Plan, including adding new partners. Since the launch of the Action Plan, seven new partners have joined for a total of 187 partners committing to 513 actions.
GC04	Upcoming	Policy, legislation and regulation	Convening SMR Action Plan senior leadership	Natural Resources Canada	The Government of Canada has accepted the spirit of the Roadmap recommendation and will meet annually with senior leadership of Canada's SMR Action Plan, working with partners to review progress on the Action Plan and discuss strategic priorities going forward. These meetings would convene the Canadian nuclear family, from mining to production, as well as Indigenous representatives.	Progress on development and commercialization of SMRs in Canada is advanced in a manner that respects shared roles, responsibilities and jurisdictions – and leverages benefits to Canada and supports strategic partnerships. Key decision-makers have a venue for discussing progress and priorities on nuclear innovation and nuclear energy matters broadly.	In progress. NRCan is working to launch an SMR Leadership Table that will meet annually to take stock of progress in achieving the commitments made across the partner organizations that are signatories to the Plan. It will be chaired by the DM or DMA of NRCan. NRCan has reached out to industry and PT governments to get their views on membership.
GC05	In Progress	Policy, legislation and regulation	Nuclear Liability and Compensation Act	Natural Resources Canada	The Government of Canada has accepted the Roadmap recommendation on nuclear liability. The Government of Canada understands the importance of a robust, risk-informed, and proportionate nuclear liability framework. Effective January 1, 2017, the Nuclear Liability and Compensation Act came into force, providing a strong legislative framework to better address the question of liability and compensation in the unlikely event of a nuclear incident. Canada is also taking action internationally. Canada is one of 13 countries that has ratified the Convention on Supplementary Compensation for Nuclear Damage (CSC). Canada hosted the first meeting of the parties and signatories of the CSC in Ottawa in June 2019. In response to the recommendation, the Government of Canada is engaging with key federal partners and stakeholders to understand the risks associated with SMRs. Following engagement, proposed amendments to the Nuclear Liability and Compensation Regulations would be considered.	The timely clarification of regulations to support SMR applications, particularly for the smallest reactors in off-grid markets, based on their risk assessment, appropriate classes and liability amounts for different SMR categories will be made in the regulations under the Nuclear Liability and Compensation Act.	In progress. A 5-year review of the NLCA liability limit for power reactors was launched on February 16th 2021. Submissions are currently being reviewed, and an update on the five-year review of the liability limit will be available in the fall of 2021. In addition to the review of the NLCA, a Clean Technology Regulatory Review Roadmap was published on June 23, 2021. Led by NRCan, the objective of the Clean Technology Regulatory Review is to address regulatory barriers and develop new regulatory approaches to enhance clean innovation and competitiveness. Reviewing the liability limits for SMRs was one of the profiled regulatory readiness initiatives, and NRCan has begun engaging federal partners in its assessment of the potential risks and regulatory gaps for SMRs.

GC06	Complete	Policy, legislation and regulation	Nuclear energy projects under the Impact Assessment Act	Natural Resources Canada + CNSC, IAAC	The Government of Canada has partially accepted the Roadmap recommendation on impact assessments, including the principle of a threshold approach for inclusion on the Project List. In August 2019, the Impact Assessment Act came into force, putting in place stronger rules for major projects that protect the environment and communities, advance reconciliation with Indigenous peoples, and ensure good projects can go forward, creating good jobs and economic opportunities for middle-class Canadians. In a mature regulatory environment such as Canada, federal impact assessment provides a comprehensive and rigorous framework through which to review those major projects with the greatest potential for adverse environmental effects on areas that fall within federal jurisdiction and encourages best possible project designs that take into consideration a range of environmental, health, social and economic effects. The Physical Activities Regulations (Project List) under the Impact Assessment Act, which came into force in August 2019, includes a two-part threshold for SMRs, which is stricter than that recommended in the Roadmap to further ensure that SMR development in Canada takes place in an environmentally responsible way. Projects that exceed the thresholds are "designated projects" and enter into the planning phase under the Act. Non-designated projects will be assessed by the lifecycle regulator, the CNSC, and, if they take place on federal lands, may require an assessment of environmental effects under the Act. Pursuant to the two-part threshold, the following physical activities are "designated projects": The site preparation for, and the construction, operation and decommissioning of, one or more new nuclear fission or fusion reactors if: a) that activity is located within the licensed boundaries of an existing Class IA nuclear facility and the new reactors have a combined thermal capacity of more than 900 MWth; or b) that activity is not located within the licensed boundaries of an existing Class IA nuclear facility and the new reactors have a combined thermal capacity of more than 200 MWth.	Canada has a robust process for assessing the impacts of major projects and projects carried out on federal lands or outside of Canada that is balanced and informed by risk, forming part of a long-term sustainable development strategy for Canada and allowing good projects to move forward. SMRs are developed and deployed in an environmentally safe and responsible way.	Complete. Nuclear energy projects (and SMRs specifically) are reflected under the Impact Assessment Act.
GC07	In Progress	Policy, legislation and regulation	SMR fuel supply working groups	Natural Resources Canada	The Government of Canada has accepted the Roadmap recommendation to convene partners to develop options and recommendations for addressing SMR fuel supply security. The Government understands that a stable and secure supply of SMR fuel will be a key factor in enabling future SMR deployment in Canada. Building on the work of the SMR Roadmap Working Groups in 2018, in July 2020, NRCan and partners launched an SMR Fuel Supply Working Group, which is co-chaired by NRCan and AECL, with participation from Ontario Power Generation (OPG), Bruce Power, SaskPower and NB Power. The Working Group will prepare a report for Federal, Provincial, Territorial governments and industry leaders, that: • Maps current SMR fuel supply chain capabilities in Canada and in other countries; • Identifies gaps and risks in the supply chains; • Enumerates options for addressing gaps and risks; and • Makes recommendations for actions to ensure a safe and secure supply of SMR fuel to meet Canada's strategic objectives for SMR demonstration and deployment in Canada.	Establish a strong cross-functional working group to evaluate technical and policy considerations associated with SMR fuel cycles Establish baseline fuel manufacturing and supply capabilities in Canada and internationally Revised problem statements for candidate SMRs Identify and engage key partners in SMR fuel supply Established plan for addressing and overcoming gaps in supply chain to meet SMR deployment timelines (aspirational goal)	In progress. NRCan established the SMR Fuel Supply Working Group in June 2020 to ensure there are no impediments for fuel to be available for the first of a kind (FOAK) demonstrations and then for subsequent SMR units. The SMR Fuel Supply Working Group is co-chaired by AECL and NRCan and membership includes stakeholders from AECL, CNSC, ISAC, Saskatchewan Ministry of Environment, Bruce Power, CNA, COG SMRTF, NB Power, NWMO, OPG, Sask Power as well as observers from CNL. The Working Group is subdivided into two task teams made up of industry/utilities and government stakeholders, respectively. The Fuel Supply Working Group was initiated in June 2020 with a biweekly meeting schedule. After the completion and publication of the HALEU supply issues paper by the industry task team in summer 2021, to be formally issued by the COG, the Working Group will move to quarterly meeting updates. Meanwhile, the industry task team continues to meet independently to complete subsequent technical papers to fill knowledge gaps on reprocessing technologies and SMR wastes.
GC08	In Progress	Policy, legislation and regulation	Nuclear energy as part of Canada's clean energy mix	Natural Resources Canada	The Government of Canada agrees with the Roadmap recommendation to include nuclear energy in programs and policies that target the development of clean, non-emitting sources of energy, recognizing nuclear as part of the solution as Canada transitions toward net-zero emissions by 2050. SMRs present opportunities to build on nuclear's existing role by providing a clean alternative to coal and supporting broader decarbonization throughout the economy. This is supported by recent reports and evidence from the United Nations' Intergovernmental Panel on Climate Change, the International Energy Agency, and Bloomberg New Energy Finance, all of which highlight the important role that nuclear energy must play in meeting global climate targets. The Government of Canada recognizes nuclear energy as a clean source of energy, as evidenced by its inclusion in Canada's Mission Innovation clean energy R&D commitments, its leadership during the 10th Clean Energy Ministerial, and recent Government of Canada policy speeches and statements (including the Action Plan itself). Nuclear energy is eligible for support through a variety of federal programs and organizations, such as through the Canada Commercial Corporation (CCC), Export Development Canada (EDC), the Business Development Bank of Canada (BDC), Innovation, Science and Economic Development Canada (ISED)'s Strategic Innovation Fund (SIF), and Global Affairs Canada (GAC)'s Trade Commissioner Service, and will be considered in future programs as well. The Government of Canada will continue to explore opportunities to further include nuclear energy in federal initiatives.	Nuclear energy continues to be recognized as an essential part of Canada's clean energy mix. Increased number of jobs within Canada's clean energy economy.	In progress. Depends on continued inclusion of nuclear energy in funding programs, such as the SIF NZA and other programs, and clean energy related plans, such as Canada's climate planning.

GC09	In Progress	Policy, legislation and regulation	Consideration of SMRs in the Pan-Canadian Framework	ECCC + ISED/GAC/NRCan	The Government of Canada agrees with the Roadmap recommendation to include nuclear energy in programs and policies that target the development of clean, non-emitting sources of energy. Led by ECCC, the Government is including SMRs in policy development for economy-wide decarbonization through the Pan-Canadian Framework on Clean Growth and Climate Change. This includes actions such as including nuclear as a non-emitting source of energy in its planning, integrating SMRs into Canada's climate change modelling, and engaging with nuclear stakeholders in the development of policies and products that impact the sector.	A clear signal to industry and innovation groups to take steps towards a future based on non-emitting generation. Implementing a long term policy framework for greenhouse gas emissions will send a clear signal to industry and innovation groups to start planning for a future based on non-emitting generation. The Government of Canada will consistently identify nuclear as a form of non-emitting electricity and heat in official products and communications. The Government of Canada will consistently consider the role that SMRs may play alongside other non-emitting sources to contribute to meeting environmental objectives in all future policy development. The Government of Canada will continue to engage nuclear stakeholders in the development of policies and products that impact the sector. SMRs will be included in economic modelling assessments of potential climate actions.	In progress. Depends on continued inclusion of nuclear energy in funding programs, such as the SIF-NZA and other programs, and clean energy related plans, such as Canada's climate planning. **ECCC, GAC, and ISED to provide update if available.** ECCC: SMRs were included in the Enhanced Climate Plan that was released in December 2020. "Launch a Small Modular Reactor (SMR) Action Plan by the end of 2020, following on the SMR Roadmap released in 2018, to lay out the next steps to develop and deploy this technology. Numerous provincial partners, including New Brunswick, Ontario, Alberta and Saskatchewan have expressed a clear interest in utilizing these technologies to reduce emissions, decarbonize heavy industry, and spur economic development. The Government of Canada intends to work with interested parties to advance this important work, including Indigenous communities and organizations. The Government will also work with partners from the United States, the European Union and the United Kingdom to explore the advancement of safe and secure zero-emission SMR technology. Canada has a long history of expertise in nuclear energy. SMRs represent a new field of innovation with designs that are smaller and less expensive. They are a potential tool to reduce emissions within Canada and abroad." ECCC: As ECCC is currently exploring policy frameworks and a set of tools to achieve a net-zero economy by 2050, SMR is one of the technologies being considered in the policy development process. It could play an important role in an economy-wide decarbonization by providing non-emitting electricity and heat for the grid, industry, and remote locations. We also look forward to continuing to work with NRCan on nuclear waste management issues.
GC10	In Progress	Policy, legislation and regulation	Emergency preparedness	Health Canada	The Government of Canada places top priority on health, safety, security and the environment in relation to nuclear activities in Canada. It has established a comprehensive legislative framework for nuclear emergency preparedness which focuses on protecting health, safety, security and the environment. Health Canada, through the Radiation Protection Bureau, informs and advises Canadians, other federal departments and stakeholders (e.g., Provincial/Territorial governments, health professionals, industry) about the health risks from exposure to ionizing radiation and strategies to manage those risks. Health Canada is staying abreast of technological developments in Small Modular Reactors (SMRs) to ensure that we are prepared to assess the radiological health risks from deploying and operating the units in Canadian communities, under routine and emergency situations. Health Canada is also responsible for the leadership and coordination of the Federal Nuclear Emergency Plan – Canada's federal plan to respond to a radiological or nuclear emergency in Canada or abroad. The FNEP identifies and coordinates the roles of 18 federal institutions and their contributions to nuclear emergency response. Health Canada will continue to assess and review its monitoring strategies as well as Canada's federal nuclear emergency response plans to ensure they address the unique requirements and risk profiles associated with the development, demonstration and deployment of SMRs in Canada.	Canada continues to be well-prepared to respond in the unlikely event of a nuclear emergency. Canada's nuclear emergency plans address the unique requirements and risk profiles of SMRs.	**Health Canada to provide update if available.**
GC11	In Progress	Capacity, engagement and public confidence	Indigenous engagement on SMRs	Natural Resources Canada	The Government of Canada has accepted the Roadmap recommendation (#8) on the importance of engagement with Indigenous peoples, reflecting a commitment to walk the pathway of Indigenous reconciliation, partnerships, and benefits sharing. The Government of Canada has also acknowledged recommendations 33 and 32. In 2020, NRCan launched an Indigenous engagement process with Indigenous Peoples and communities on SMRs to enable meaningful, two-way dialogue. Engagement plans build on the initial engagement sessions that were held under the SMR Roadmap in 2018, expanding and deepening our reach and engagement efforts. Plans have been developed in partnership with Provincial and Territorial governments and power utilities across Canada to ensure alignment and cooperation. Fair and transparent criteria were developed to identify Indigenous communities and groups across Canada and letters of introduction were distributed widely. Letters invite discussions about how Indigenous peoples would like to be engaged on SMRs. NRCan is committed to fairly and equitably responding to requests for a range of engagement activities including, for example, video conferences, workshops, and development of materials such as videos, slide decks, and Indigenous translation. NRCan will enable inclusion of nuclear sector partners in engagement plans on SMRs as appropriate, based on the interests and priorities of Indigenous peoples.	The Government of Canada enables transparency and information sharing about SMRs with an ever-broadening number of Indigenous groups and organizations. The Government of Canada fosters meaningful two-way engagement with Indigenous peoples on SMRs, leading to greater understanding of Indigenous issues, views, concerns, and opportunities related to SMRs within the Government of Canada and the nuclear sector. Engagement underpins the development of partnerships with Indigenous peoples and benefits sharing.	The GoC commitment specific to inclusion of Indigenous participation in engagement related to SMRs is in progress. NRCan is working to fund Indigenous capacity building for new activities under this commitment. In working to establish a potential SMR Indigenous Advisory Council for the SMR Senior Leadership Table (SCA) through the capacity building stream of NRCan's Smart Renewables and Electrification Pathways (SREPs) program ii) NRCan examining other opportunities for supporting Indigenous engagement such as ISC's Strategic Partnerships Initiative (SPI) for broader Indigenous engagement activities. **RDAs to provide update if available.** **OGDs to suggest opportunities for funding for Indigenous engagement activities if funding sources known.**
GC12	Complete	Capacity, engagement and public confidence	National SMR Forum with Indigenous Communities	Natural Resources Canada	The Government of Canada has accepted the Roadmap recommendation for Indigenous engagement. The Government of Canada supported the National Small Modular Reactor (SMR) Forum with Indigenous communities, organized by the First Nations Power Authority (FNPA), which brought together industry, governments, and Indigenous communities interested in the development of SMRs and other clean energy technologies. The Forum provided an opportunity for meaningful engagement and dialogue between Indigenous communities, industry and governments in the spirit of reconciliation.	The Forum provided an opportunity for meaningful engagement and dialogue between Indigenous communities, industry, and governments in the spirit of reconciliation.	Complete. This forum was held October 2020.

GC13	In Progress	Capacity, engagement and public confidence	Engagement with the public and civil society	Natural Resources Canada	The Government of Canada has accepted the Joint of the Roadmap recommendation on better understanding the views of the public on nuclear energy. An engaged, informed citizenry is the cornerstone of our democracy, and transparency, accountability and evidence-based discussions improve outcomes for Canadians and Canada. We recognize that trust and public confidence, created through transparent and open engagement is necessary to achieving public support for SMRs in Canada. The Government of Canada and its partners have important roles to play to convene these exchanges and enable public discussions among Canadians. The Government of Canada is committed to transparency and engaging Canadians beyond just the nuclear sector. Recent activities to broaden our reach include: • Partnering with the United Nations Association in Canada (UNAC) to engage youth in a discussion about how SMRs can support the UN Sustainable Development Goals and to learn from the perspectives of young Canadians. • Collaborating with Mad Science, an organization that runs science clubs and camps for kids of all ages reaching millions of children around the world, to develop nuclear science education materials for their clubs and camps. The Government of Canada is also working with civil society organizations internationally under the Flexible Nuclear Campaign of the NICE Future initiative under the Clean Energy Ministerial framework to build capacity and an evidence base for flexible nuclear operations.	Nuclear energy is better understood by the public at large. Public confidence and trust in nuclear energy is built and maintained.	This activity is ongoing. NRCan continues to engage with international audiences on Nuclear issues through the CEM NICE Future Initiative and it's Flexible Nuclear Campaign (FNC). Since January 2021, NRCan has participated in an workshop under the FNC along with 55 experts from over a dozen countries. Minister O'Regan of NRCan delivered opening remarks at the 12th Clean Energy Ministerial NICE Future Pathways to 2050 event hosted virtually by Chile this past June 2021. NRCan has enhanced its support of civil society engagement through the funding of a contribution agreement with the Pembina Institute. Pembina, an environmental NGO, is currently using this funding to conduct research and increase their capacity on SMRs in Canada. NRCan is working collaboratively with UNAC to plan and host a virtual New Diplomats of Natural Resources event in early February 2022 that will engage key stakeholders and youth in conversations around SMRs. The workshop will have a regional focus in one of the western provinces as Western Diversification is also funding a portion of this event. [e.g. Saskatchewan, Alberta].
GC14	In Progress	Policy, legislation and regulation	National SMR R&D work	Atomic Energy of Canada Limited + NRCan	The Government of Canada has acknowledged Roadmap recommendation for a national SMR R&D program. The Government has made significant investments to build SMR R&D capacity in Canada. This includes investments to revitalize AECL's facilities, which aim to host an SMR demonstration project by 2026. Additionally, $76 million per year until 2025 is being invested in the Federal Nuclear Science and Technology program, to maintain necessary nuclear knowledge, capabilities and expertise at CNL, including on SMRs. AECL is working with CNL to support its Canadian Nuclear Research Initiative (CNRI) – a program to accelerate the deployment of SMRs in Canada by enabling research and development.	Federal Nuclear Science and Technology program participants are able to optimize resources, share technical knowledge, and gain access to CNL's expertise to help advance the commercialization of SMR technologies.	This activity is ongoing. **AECL to provide update on FNST funded SMR-related activities if available.**
GC15	Complete	International partnerships and markets	Global SMR market validation	Natural Resources Canada	The Government of Canada has accepted the Roadmap recommendation on validating the global market for SMRs. NRCan contracted McKinsey & Company to validate the estimates of the global SMR market. McKinsey & Company's report validated these estimates and project that the actual market is likely to exceed the estimates of the Economics and Finance Working Group.	The Government of Canada and its partners have information on the size and potential applications for SMRs globally, and the value that Canada could capture in global supply chains.	Complete. Report delivered.
GC16	In Progress	International partnerships and markets	International engagement on SMRs	Natural Resources Canada + CNSC/GAC	The Government of Canada has accepted the Roadmap recommendation on engaging with key partners and strategic multilateral initiatives to develop international enabling frameworks for SMRs: regulation, transportation, liability, and waste management. The Government understands that there is a global market for SMRs, and that there may be opportunities for Canadian exporters to deploy fleets of SMRs abroad. This will require appropriate enabling frameworks that adequately address security, non-proliferation, safety and waste management concerns, while being flexible, open to innovation, and risk-informed. The Government of Canada, through NRCan, GAC, CNSC and AECL, is working with international partners to develop models for international enabling frameworks for global deployment of SMRs. Canada is an active participant in multilateral fora where global SMR demonstration and deployment are discussed, including the IAEA, OECD-NEA, G7 and IFNEC. Canada is also working bilaterally and plurilaterally, to advance the development of models for international enabling frameworks for SMRs. For example, earlier this year NRCan convened a global webinar to discuss opportunities for international collaboration and share best practices on how to work across borders to develop enabling policy frameworks for SMR deployment. The CNSC is also engaged in bilateral and multilateral collaborative efforts to ensure readiness for the regulation of innovative nuclear technologies. These collaborative efforts seek to find efficiencies in regulatory reviews and information sharing, and to avoid duplication by leveraging other regulators' technical assessments. For example: • In 2019, the CNSC signed a memorandum of cooperation with the United States Nuclear Regulatory Commission that could support more efficient reviews of SMRs, • The CNSC is by developing a similar memorandum of cooperation with the Office for Nuclear Regulation in the United Kingdom, aiming to enhance existing collaboration through technical exchanges and sharing of training programs and development activities, and • The CNSC is also committed to working with others to advance Canada's priorities on international enabling frameworks, including bilaterally and multilaterally. The Canadian Space Agency (CSA) is also exploring the opportunities for international collaboration in the use of nuclear technology for space-based applications.	Viable pathways are developed to enable international deployment of SMRs—in both newcomer and existing nuclear countries. Canada is strategically positioned to enable access to export markets for technologies with supply chains anchored domestically.	This activity is ongoing. **CNSC** The CNSC and the USNRC continue to collaborate and make good progress under the Memorandum of Cooperation (MOC). An Advanced Reactors Technologies and Small Modular Reactors Sub Committee (the Sub Committee) was established under the MOC to coordinate, approve, prioritize and oversee work plans to accomplish specific cooperative activities. Between January 2021 and June 2021, 2 work plans for projects were finalized (one specific to a vendor's technology and the other concerning the USNRC's Licensing Modernization Project); working group meetings were held and joint reports were drafted. A first staff exchange was also initiated in January 2021 and is expected to last 10 months. Members of the Sub Committee continue to work collaboratively and will meet every 5-6 weeks to discuss progress, communications and any challenges related to completing work plans. The CNSC and the United Kingdom Office for Nuclear Regulation (UK ONR) had an introductory meeting on July 26, 2021 to discuss what collaboration will be possible within the confines of the MOC. It is expected that the collaboration will follow a similar course to that with the USNRC. Under CNSC President Velshi's chairpersonship of the IAEA's Commission on Safety Standards (CSS), the CSS has agreed to prioritize work to establish harmonized international standards for SMRs that are technology-neutral, commensurate with the risks presented, and minimally sufficient for the needs of all countries. The CSS' work in this respect will be informed by the IAEA's consultancy on technology neutral framework. The CNSC participates in NEA working groups including on the Regulation of New Reactors and for Safety of Advanced Reactors. In December 2020, the CNSC collaborated with the NEA on a Multi-Sector Workshop on Innovative Regulation: Challenges and Benefits of Harmonizing the Licensing Process for Emerging Technologies. The CNSC is also participating in discussions facilitated by the NEA on its trilateral licensing initiative with the CNSC, UK ONR, and USNRC to learn from existing bilateral work to help establish the foundation for future work in harmonization. The CNSC continues to participate in the IAEA SMR Regulators' Forum. The IAEA SMR Regulators' Forum published 3 reports in June 2021 on the licensing process, design and safety analysis, and manufacturing, construction, commissioning and operation. The Forum's next phase of work has already begun and includes issues such as long lead items, Integration of Design for Safeguards and Security into Safety Considerations, and the methodology and factors for regulators to mutually recognize each other's work. **CSA to provide update on exploration of opportunities for international collaboration in the use of nuclear technology for space-based applications if available.**
GC17	In Progress	International partnerships and markets	Taking Canadian SMR technology abroad	Global Affairs Canada / NRCan	The Government of Canada has accepted the Roadmap recommendation on engaging with key partners and strategic multilateral initiatives to develop international enabling frameworks for SMRs: regulation, transportation, liability, and waste management. The Government is committed to continuing to advocate for Canada's nuclear industry across the globe. GAC's Trade Commissioner Service network will support innovation and exporting goals of Canadian SMR companies, promoting global exports of Canadian SMR technologies and positioning Canada as a leader in nuclear and emissions-free energy generation.	Canadian SMR companies are connected to export and funding programs to support international business development. Canadian SMR companies export their capabilities in foreign markets, with the support of the Trade Commissioner Service and other federal partners. Canadian leadership in global climate change efforts and the clean energy transition.	These activities are ongoing. **GAC to provide update if available.**

GC18	In Progress	International partnerships and markets	Nuclear energy in international clean energy and climate change dialogues	Natural Resources Canada	The Government of Canada is committed to positioning nuclear energy in international clean energy and climate change dialogues, including CEM and COP. Nuclear energy should be included alongside other options in discussions about energy transition in order to maintain the integrity and the evidence base of the policy dialogue. Where appropriate, the Government of Canada will proactively raise nuclear energy as a solution in international clean energy and climate change dialogues, alongside other clean energy options. Canada worked with partners in the US and Japan, among others, to develop the first-ever nuclear energy initiative under the Clean Energy Ministerial framework. Together, we launched the "NICE Future" initiative, and Canada led on the development of a nuclear energy program for CEM-10, which Canada hosted in Vancouver in May 2019. Our aim was to mainstream consideration of nuclear energy in broader policy discussions under CEM, and for the first time, nuclear energy was a fully integrated part of the event. Key outcomes for the initiative included: • Two official CEM side events focused on nuclear energy, plus inclusion of nuclear in several other side events. • The Canadian premiere of "The New Fire" a documentary film on nuclear energy, by Canadian award-winning film-maker David Schumacher. • The release of a high-profile report by International Energy Agency (IEA) Director Fatih Birol on "Nuclear Energy in Clean Energy Systems", the first report by IEA on nuclear energy in 20 years. • The release of Breakthroughs, a book for ministers and policy makers on near-term nuclear innovation, with stories to spark imagination and challenge preconceptions about nuclear energy's role in clean energy systems. • Global participation that included representatives from 33 countries and the European Union; 125 nuclear energy private sector representatives, including 24 SMR developers and 4 operators; 15 civil society organizations involved in nuclear; 4 national nuclear laboratories from 3 countries; and, 4 international organizations involved in nuclear. • Since CEM 10, Canada has continued to pursue opportunities to build awareness of nuclear in broader clean energy and climate change discussions, including bringing nuclear energy to GLOBE 2020, the largest sustainable business and innovation summit.	Nuclear energy is included as a solution in international clean energy and climate change dialogues that Canada is part of, alongside other clean energy options.	In progress. Depends on continued inclusion of nuclear energy in Canadian positions related to clean energy and climate dialogues. NRCan continues to engage with international audiences on Nuclear issues through the CEM NICE Future Initiative and it's Flexible Nuclear Campaign (FNC). Since January 2021, NRCan has participated in an workshop under the FNC along with 55 experts from over a dozen countries.
GC19	In Progress	International partnerships and markets	International enabling frameworks for SMRs	Global Affairs Canada + NRCan	The Government of Canada has accepted the Roadmap recommendation on engaging with key partners and strategic multilateral initiatives to develop international enabling frameworks for SMRs: regulation, transportation, liability, and waste management. The Government recognizes that the adoption of new nuclear energy technology must continue to meet the highest standards of safety, security and non-proliferation, in accordance with Canada's legislative and regulatory requirements. The Government will continue to engage with international partners through the Nuclear Suppliers Group (NSG) to assess the international export control framework readiness for SMRs. The Government will also continue to engage with SMR vendors to understand various technologies and potential international markets, to ensure adequate nuclear non-proliferation frameworks are in place.	SMR-specific challenges in the international export control framework are identified and initiatives are proposed to address them. Prospective Canadian SMR vendors have an understanding of the existing international nuclear export control framework and understand the importance of nuclear non-proliferation. Negotiation of bilateral Nuclear Cooperation Agreements, as appropriate.	These activities is ongoing. GAC to provide update if available.
GC20	In Progress	Policy, legislation and regulation	Coordination with the Hydrogen Strategy for Canada	Natural Resources Canada	The Government of Canada has announced plans to develop a comprehensive hydrogen strategy. We will coordinate efforts between Canada's SMR Action Plan and the Hydrogen Strategy for Canada as it is developed, and will seek opportunities for the two initiatives to be mutually-reinforcing. Meeting our climate change objectives will require many different clean energy sources and technologies, including both SMRs and hydrogen, as part of our low carbon future. In particular, SMRs can produce electricity and high temperature steam, which could enhance the overall efficiency of hydrogen production by electrolysis (water splitting). Hybrid thermochemical-electrolysis methods are actively being researched in Canada and are expected to further improve efficiencies. During off-peak times, when supply exceeds demand, electricity produced from nuclear reactors can be diverted to produce inexpensive clean hydrogen.	Canada leverages its Tier 1 nuclear energy expertise to become a leader in the hydrogen economy by improving non-emitting production technologies for hydrogen.	In progress. The Hydrogen Strategy identified synergies with nuclear energy, as it can be used to produce low carbon intensity hydrogen via electrolysis or high temperature processes. NRCan is taking action on the recommendations found within the Hydrogen Strategy, to establish a Nuclear Working Group with the mandate to foster coordination and collaboration among its stakeholder participants, form recommendations in support of the implementation of the Hydrogen Strategy, and report back on activities to the overarching Strategic Steering Committee. The Industry Co-Chair of the Nuclear Working Group will be John Gorman of the Canadian Nuclear Association, who also sits on the Hydrogen Strategy Strategic Steering Committee.
GC21	In Progress	Demonstration and deployment	Support from regional development agencies	Regional Development Agencies	Canada's regional development agencies work to create opportunities for economic growth, innovation and economic diversification to build stronger and more innovative businesses and communities in regions across Canada. Regional development agencies support business-scale-up and productivity, as well as regional innovation systems that include businesses, universities and not-for-profit organizations. As part of this, regional development agencies invest in clean technologies in a broad range of sectors to advance Canada's economic development and climate change objectives. By supporting technology advancement and commercialization, programming delivered by regional development agencies could help advance SMR development and deployment in Canada. For example, funding from regional development agencies could support the development, commercialization, scale-up and demonstration of SMR-enabling technologies.	Regional businesses and academic institutions are involved in SMR Demonstration and Deployment projects. Regional firms contribute to SMR supply chains, increased levels of expertise in this high-tech field.	RDAs to provide update if available. WD: WD-Sask plans to assist SaskPower with pathfinding for support within GC for their SMR planning and predeployment activities
GC22	In Progress	Capacity, engagement and public confidence	Regional convening and intelligence gathering	Regional Development Agencies	Regional development agencies could act as convenors and/or play a role in regional intelligence gathering by: • providing support for conferences and events create opportunities for engagement stakeholders related to SMR development, including but not limited to Indigenous businesses and communities; and/or • working with stakeholders to identify opportunities and barriers to developing and commercializing SMR technology at the local level.	Regional stakeholders' and Indigenous views, interests, and concerns are valued. Investment decisions are targeted and informed through direct engagement with regional players.	RDAs to provide update if available. WD: WD has convened a group of SMR stakeholders from the Government of Saskatchewan and Government of Alberta for regular information sharing. WD has started to compile an asset map of businesses, academic institutions, and associations/non-profits who could potentially contribute to SMR supply chains in western Canada, with input from our stakeholder group. WD will use this information to inform a supply chain study. WD has had some discussions with OCNI about western Canadian participation in their SMR supply chain readiness initiative
GC23	In Progress	Demonstration and deployment	Opportunities in Atlantic Canada	Atlantic Canada Opportunities Agency	Canada's regional development agencies work to create opportunities for economic growth, innovation and economic diversification to build stronger and more innovative businesses and communities in regions across Canada. Regional development agencies support business-scale-up and productivity, as well as regional innovation systems that include businesses, universities and not-for-profit organizations. As part of this, regional development agencies invest in clean technologies in a broad range of sectors to advance Canada's economic development and climate change objectives. By supporting technology advancement and commercialization, programming delivered by regional development agencies could help advance SMR development and deployment in Canada. The Atlantic Canada Opportunities Agency (ACOA) will work with specific vendors and provinces to identify opportunities for broad-based results in the Atlantic region.	Better identification of supply chain opportunities. Increased R&D capacity. Better coordination among relevant parties/levels of government.	ACOA provided $565k to University of New Brunswick to support the SMR cluster development in New Brunswick. ACOA to provide update if available.

GC24	In Progress	Demonstration and deployment	Support for New Brunswick's Advanced SMR Nuclear Energy Research Cluster	Atlantic Canada Opportunities Agency	The Atlantic Canada Opportunities Agency (ACOA) will provide direct support, including nuclear industry certifications and registrations, to Atlantic firms identifying business growth opportunities as part of New Brunswick's Advanced SMR Nuclear Energy Research Cluster.	A growing and robust SMR supply chain in Atlantic Canada.	**ACOA to provide update if available.**
GC25	In Progress	Demonstration and deployment	SMR R&D in Atlantic Canada	Atlantic Canada Opportunities Agency	The Atlantic Canada Opportunities Agency (ACOA) will work with research institutions in Atlantic Canada to identify and take advantage of SMR R&D opportunities in that region, as an essential part of Canada's national nuclear science and technology ecosystem.	Strengthened Atlantic capacity within Canada's nuclear research community.	ACOA provided $565k to University of New Brunswick to support the SMR cluster development in New Brunswick. **ACOA to provide update if available.**
GC26	In Progress	Capacity, engagement and public confidence	Indigenous engagement in Atlantic Canada	Atlantic Canada Opportunities Agency	The Atlantic Canada Opportunities Agency (ACOA) will encourage and support SMR proponents to engage with Indigenous communities to understand views on nuclear, as well as identifying opportunities for the Indigenous community share in the economic benefits.	Ongoing, and more inclusive input to decision-making on nuclear energy use in New Brunswick.	In progress. **ACOA to provide update if available.**
GC27	In Progress	Policy, legislation and regulation	SMRs in the Atlantic Clean Power Roadmap	Atlantic Canada Opportunities Agency	Through the ongoing Atlantic Clean Power Roadmap exercise, the Government of Canada will continue to position potential regional SMR development as an important element of Atlantic energy capacity building.	SMRs are positioned within the range of energy options available to reduce GHG intensity in Atlantic electricity generation.	**ACOA to provide update if available.**

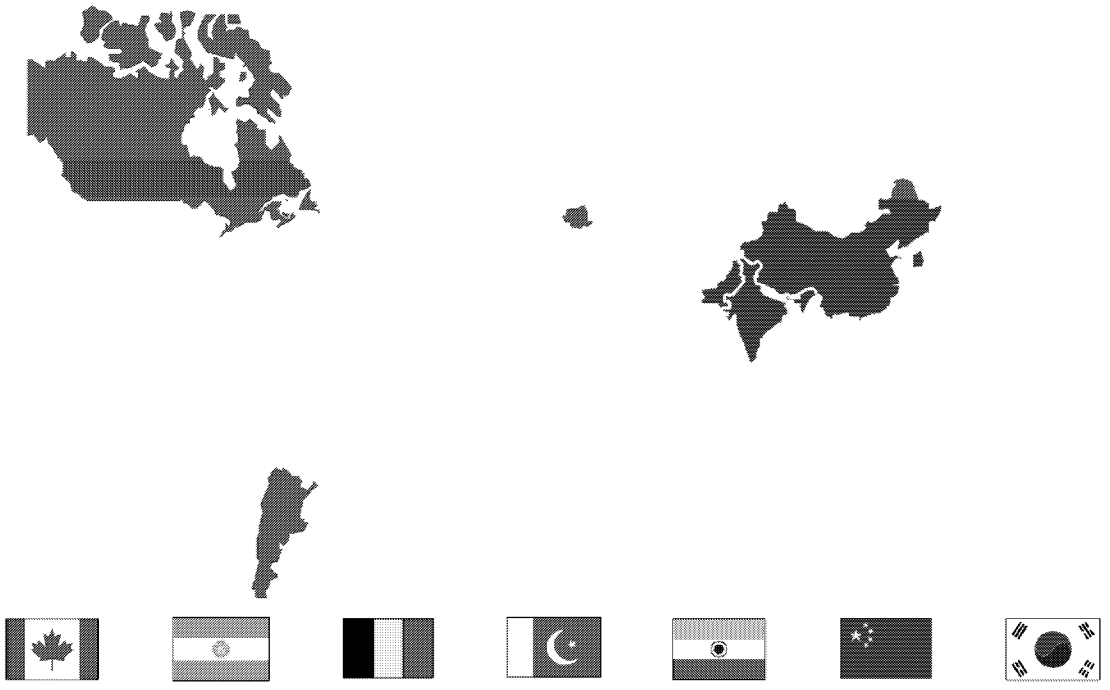
CANDU Owners Group Inc.

"Excellence Through Collaboration"

COG-20-9024

The Introduction Of The Use Of High Assay Low Enriched Uranium Fuels For Small Modular Reactors In Canada

COG SMR Fuel Supply Task Team



May 2021

PROTECTED INFORMATION

Contents of this COG Report shall not be disclosed without the consent of COG Inc.

CANDU Owners Group Inc.

"Excellence Through Collaboration"

COG-20-9024

The Introduction Of The Use Of High Assay Low Enriched Uranium Fuels For Small Modular Reactors In Canada

COG SMR Fuel Supply Task Team

The work reported in this document was work done in kind as a task team under the joint participation of Bruce Power, COG, CNA, CNL, NBP, OPG and SaskPower.

The work was sponsored by the COG SMR Technology Forum.

May 2021

COG SMR Fuel Supply Task Team

The Introduction Of The Use Of High Assay Low Enriched Uranium Fuels For Small Modular Reactors In Canada

Signatures

Prepared by:

New Brunswick Power
Chair, COG SMR Fuel Supply Task Team

Peer Review by:

COG SMR Fuel Supply Task Team
(List of task team on the next page)

Approved by:

DocuSigned by:

Ontario Power Generation
& Chair of COG SMR Technology Forum

Publication Approved by COG Inc.:

DocuSigned by:

CANDU Owners Group

s.19(1)

COG SMR Fuel Supply Task Team

The Introduction Of The Use Of High Assay Low Enriched Uranium Fuels For Small Modular Reactors In Canada

Task Team Members:

Bruce Power L.P.
Canadian Nuclear Association
Canadian Nuclear Laboratories
Canadian Nuclear Laboratories
CANDU Owners Group Inc.
CANDU Owners Group Inc.
New Brunswick Power - Chair
Ontario Power Generation
SaskPower

Revision History: (if required)

Revision Number	Revision Date	Details of Revision
0	May 2021	Original Issue

TABLE OF CONTENTS

Section **Page No.**

Executive Summary

Many SMR designs being considered for use by the Canadian Nuclear Utilities as well as potential demonstration projects at Canadian Nuclear Laboratories (CNL) use fuels with Uranium-235 (^{235}U) enrichment levels above 5% but less than 19.75%. This is referred to as High Assay Low Enriched Uranium (HALEU). HALEU cannot currently be produced in Canada. Likewise, Canada does not currently have facilities that can manufacture HALEU fuel products for direct use in the reactors. This poses a number of challenges and risks both for the initial introduction and to the longer-term security of supply.

An evaluation of the current global HALEU production capabilities in various jurisdictions was performed. It was determined that for Canada's near-term SMR needs, the HALEU will most likely be sourced from Russia, where the only commercial production capability exists, globally[1]. The production capacity in Russia is currently limited to about 3 Metric Tons U/Y. This annual production limit poses a challenge for Canada to meet the timelines for the planned demonstration and deployment of SMRs. This limited supply situation is exacerbated by potential competition between development projects outside Canada. The projected demand for HALEU in Canada was estimated with input from utilities and SMR vendors and is presented in this paper.

The possible routes of acquiring HALEU from enrichment source location, to fuel fabricator, to end-user are identified in the report and commentary is provided on various regulatory aspects. The report also identifies a staged approach to establish a longer term more secure supply as shown in Figure 1.

The report was produced mainly for the Canadian Nuclear Utilities by a group of industry representatives and reflects the outcomes of general discussions with various Canadian Federal Government Agencies and Departments. Risks and recommendations for follow-up by the Utilities are also identified.

The report concludes there are no Policy or legal inhibitors to the introduction of HALEU fuels in Canada for power reactors (SMRs) however there are logistical supply issues that could impact the timelines for deployment. It must be stressed that while this report provides valuable information, each organization planning to use HALEU fuel will need to conduct specific detailed discussions with the relevant Federal agencies and departments regarding the specific aspects of their project.

[1] The US has some HEU supply, but this is set aside for the Military and for some research reactors.

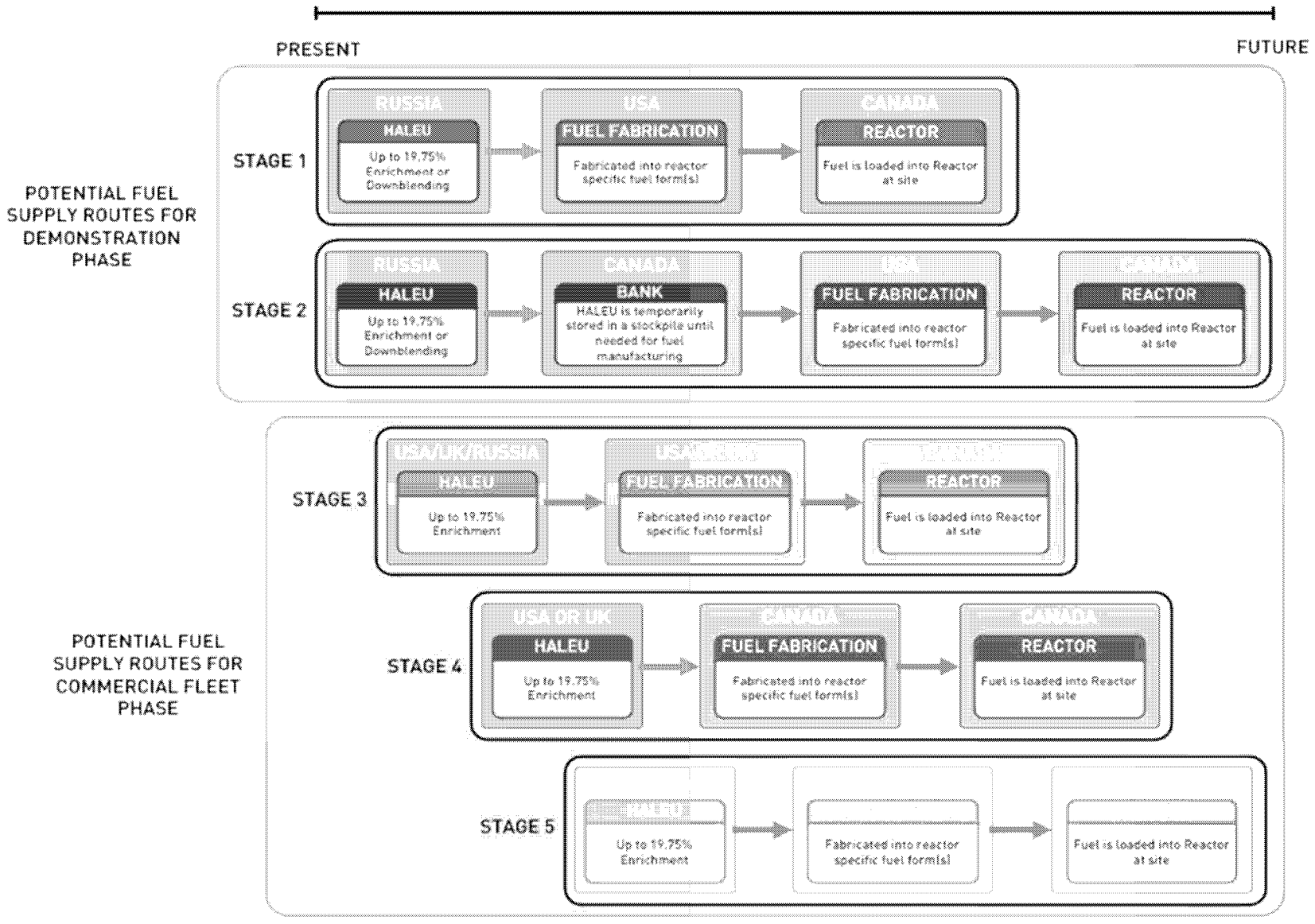


Figure 1: Staged Approach to Potential HALEU Fuel Supply Routes

1.0 INTRODUCTION

The small modular reactor (SMR) Roadmap identified that most SMR designs use fuels not currently manufactured or available in Canada, and recommended this shortcoming be addressed. In response to this recommendation, a Fuel Supply Working Group was established under the leadership of Natural Resources Canada (NRCan) and Atomic Energy of Canada Limited (AECL). This is reflected in the Federal Government chapter of Canada's SMR Action Plan [1]. Action GC07 identifies that the Government of Canada has convened partners in a Fuel Supply Working Group to develop a report with options and recommendations for addressing SMR fuel supply security.

This document provides some industry input to the committee as it relates to the short-term acquisition of HALEU and HALEU fuel forms for use in the initial demonstrations and early refuelling of SMRs. It also identifies a staged approach for increasing the security and diversity of supply and increasing the economic development potential for Canada.

2.0 BACKGROUND

Most of the SMR designs being considered for use by the Canadian Nuclear Utilities as well as potential demonstrations at Canadian Nuclear Laboratories (CNL) use fuels not currently manufactured or available in Canada. In most cases, the fuel is not manufactured anywhere in commercial quantities. The majority of these reactor designs use a value of uranium-235 (^{235}U) enrichment in the range from 5 to 19.75%. Uranium with a ^{235}U content of 20% and greater is defined as High Enriched Uranium (HEU). Uranium with a ^{235}U content of less than 20% is classified as Low Enriched Uranium, with the portion greater than 10% being of greater scarcity[2]. This material, between 5 and 19.75%[3] enrichment, is referred to as HALEU. HALEU is common to many of the different reactor designs although there are notable differences in the levels of enrichment, volumes required and their final fabricated fuel forms likely leading to different manufacturing processes (e.g., TRi-structural ISOtropic (TRISO) versus metallic). While a small number of research reactors use a form of HALEU fuel, it is important for the Utilities to understand the issues around introducing HALEU fuels into commercial SMRs and to develop a high confidence that there are no HALEU fuel supply related Policy inhibitors for the early deployments.

Canada does not have and is unlikely to obtain, uranium enrichment capability in sufficient time to support the initial demonstrations projects and early refuelling of those SMRs. Thus, the initial supply of HALEU must come from sources outside of Canada. These HALEU sources can be produced by either enriching natural uranium or

[2] The current fleet of PWRs and BWRs use fuel with a ^{235}U enrichment of just below 5% and thus is readily commercially available. A number of units are exploring increasing this level to about 8%. Facilities that handle ^{235}U material with enrichment levels below 10% still fall under the Category II class licence, hence why material with ^{235}U enrichment above 10% is scarce, as a facility would be required to meet Category I requirements. The enrichment range up to just below 10% is sometimes referred to as LEU+).

[3] 19.75% is selected to allow a margin for uncertainty to ensure it stays below the 20% threshold.

downblending highly enriched uranium that was produced for military or research applications.

The immediate focus of the utilities interested in deploying advanced SMR technologies is to ensure an adequate supply for the demonstration of these technologies and their first commercial applications, as well as early refuelling needs for those projects. While fuel supply security and diversity will likely be achieved in the longer term, it will take significant time for the market to evolve. Likewise, it is expected that activities that could be performed in Canada will most likely need to develop over time.

There is currently no commercial supply of HALEU in the US or the UK, the two countries with which Canada has the strongest nuclear cooperation and would normally be the first choices to obtain nuclear technology, material and know-how not available within Canada. Potential investors of SMR designs need confidence that there will be a secure supply of fuel and fuel producers and manufacturers need confidence of a potential long-term market to make the necessary investments to produce the fuel. This presents a "chicken and egg" scenario requiring an integrated plan; one that is best suited to be driven by, most likely involving cooperation between, utilities who will be the ultimate purchasers, suppliers who will be required to make large capital investments to support a new HALEU fuel infrastructure, and the government agencies within multiple countries.

Within Canada, support from a number of Federal Government agencies and departments will be required to ensure Canada has access to both the needed HALEU as well as the manufactured fuel products, particularly in navigating the bi-lateral and multinational nuclear agreements Canada is party to on safeguards, non-proliferation and the peaceful uses of nuclear energy.

This paper is intended to outline the necessary background information, the various gaps, recommended course of action, and to provide input to the Fuel Supply Working Group.

Given the long lead time associated with fuel qualification and manufacturing, as well as the confidence required from potential reactor development investors, immediate action is required to ensure a clear pathway exists to securing HALEU fuel and fuel products. This sense of urgency cannot be over emphasized.

3.0 REACTOR DESIGNS BEING PURSUED IN CANADA

Through the Chief Executive Officer (CEO) SMR Forum working group, a three parallel equal priority stream approach was developed for the development and deployment of SMRs in Canada.

Stream 1, a near term grid size SMR planned to be deployed by Ontario Power Generation (OPG) at the Darlington Site by 2028 which could de-risk potential subsequent deployment of at least 2 units by SaskPower in Saskatchewan in the early 2030s. Currently three reactor designs are under consideration; the GE-Hitachi BWRX-300 (low enriched boiling water reactor (BWR) type fuel), the X-energy Xe-100 high temperature gas reactor utilizing TRISO fuel, and the Terrestrial Energy Integral Molten Salt Reactor (IMSR). A decision on the final technology selection is targeted by the end of 2021.

Stream 2 are the advanced Generation 4 grid sized technologies of the ARC-100 sodium cooled fast reactor, and Moltex Stable Salt Reactor (SSR-W (including the WATSS fuel conversion facility)) being developed in New Brunswick. These would bring additional benefits above those in Stream 1 but have a longer deployment timeline in the early to mid 2030 range.

Stream 3 are the micro reactors to be used for mineral extraction and remote community applications. OPG, in partnership with technology developer Ultra Safe Nuclear Corporation (USNC) is pursuing the development and potential demonstration of the USNC designed Micro Modular Reactor (MMR), through the Global First Power joint venture at CNL, which has begun licensing under the Canadian Nuclear Safety Commission (CNSC) requirements for first of a kind deployment by 2026. Bruce Power has entered into an agreement to pursue applications of the Westinghouse eVinci heat pipe micro reactor in Canada.

Four of seven of these designs use HALEU fuel:

- Stream 1, the Xe-100 (conditional on OPG selecting it as the final technology, a decision that is expected in late 2021)
- Stream 2, the ARC-100
- Stream 3, both the GFP MMR, and the eVinci heat pipe designs

In addition, U-Battery, which uses a TRISO form of HALEU, also has expressed an interest in demonstrating their technology at CNL.

Note: while there are some other designs requiring HALEU currently going through the CNSC Vendor Design Review (VDR) process, these are not included in this report as they are not, currently, being actively pursued for deployment in Canada.

4.0 HALEU SUPPLY

HALEU can be produced from either enrichment of natural or low enriched uranium, or downblending of existing high enriched uranium. Much of the natural uranium for enrichment originates in Canada. U_3O_8 is converted to UF_6 which is then used in the enrichment process. UF_6 is highly reactive and poses a number of safety challenges that must be managed[4]. It should be noted that UF_6 has been produced in Canada and shipped safely around the world for many years. However there is currently no commercial supply of HALEU in the US or the UK.

Appendix I provides the current understanding of the HALEU supply situation. The HALEU supply chain will evolve from the different sources over time as the demand and market becomes more mature. There is also the potential to lever the overall expected market to coax various manufacturers into the market.

The following discussion applies to the needs of the initial core load and early refuellings up to 2035. The much smaller supply of HALEU for fuel qualification that might be done in Canada at CNL could potentially come from a lab to lab agreements with

[4] Further details can be found in IAEA-TECDOC-771, "*Manual on safe production, transport, handling and storage of uranium hexafluoride*" [2].

potential sources from the US Department of Energy (US DOE) and is not discussed further in this paper.

While there are on-going efforts to establish commercial HALEU production capability in the US, all of which is expected to be funded by the US DOE, success is not guaranteed and at best will take several years to develop and with limited production capability. It is worth noting one potential option for future HALEU capacity is Global Laser Enrichment LLC (GLE) which is owned, in part, by Canada's Cameco Corporation. Given the short timelines to support the proposed demonstrations, it is expected that HALEU would need to be procured from Russia from TENEX, the nuclear fuel division of Rosatom, and then sent to either Canada or the US to fabricate the fuel pellets or stack, and possibly the assemblies (although there are no fuel fabricators in Canada that currently make these fuel forms, this could be done in the future). To transport the necessary fuel supply, a number of CNSC transport, import and export licences and Global Affairs Canada (GAC) export permits will be required, as well as certified transport packages required to handle the volumes and form of HALEU required.

Table 1 presents the estimated annual requirements for HALEU in Canada up to 2035, assuming initial deployment projections. The amounts include refuelling of the plants over the timeline considered. The HALEU data collected from SMR vendors was converted to 19.75% ^{235}U equivalent enrichment for the purpose of compilation of the demand table, and to anonymize the data.

Table 1: Estimated Annual Requirements for HALEU (Metric Tons U/Y) for Initial Deployment in Canada up to 2035

	Annual	Cumulative
Enrichment %	**19.75%**	
Year	**Metric Tons U**	
2021	1.12	1.12
2022	0.55	1.67
2023	0.50	2.17
2024	2.77	4.94
2025	1.61	6.55
2026	17.55	24.10
2027	1.50	25.60
2028	1.50	27.10
2029	1.50	28.60
2030	1.50	30.10
2031	4.52	34.62
2032	3.11	37.73
2033	3.00	40.73
2034	5.77	46.50
2035	4.61	51.11

Appendix II provides further details of the HALEU demand analysis summarized above. It also presents an additional HALEU demand scenario considering deployment projections predicted by SMR vendors in Canada.

In the longer term, if the end user market materializes as expected, it is possible, with the appropriate level of government funding, that enrichment manufacturers in the US (GLE, URENCO or Centrus) could invest in facilities capable of producing commercial quantities of HALEU. If appropriate public private partnerships are established, North American utilities will not have to rely exclusively on imports from Russia. Likewise, more of the fuel fabrication could take place in Canada as the markets develop, more so if opportunities within Canada justify local manufacturing to offset costs associated with transportation and risks of geopolitical disruptions in crossing international borders. This approach may have an impact on final cost of fuel and this will need to be accepted by the key decision makers as utilities would prefer lower cost options that are reliable sources. It is also possible that in the longer term, Canada might be interested in producing HALEU, however that would be a much larger step.

There are three potential scenarios for the import and manufacturing of fuel in the short term. These are:

1. Russia directly to the US where the fuel is manufactured and then sent to Canada
2. Russia to Canada where it is temporarily stored in a bank and then later sent to the US where the fuel is manufactured and then sent back to Canada.
3. Russia to Canada where it is manufactured

The US limits the amount of Russian enriched uranium that can be imported into the US for use in the US through the use quotas specified in the Russia Suspension Agreement (RSA). However, import of Russian enriched uranium for processing and subsequent export is permissible under the RSA's processing and re-export provisions (Section IV.H) [3]. Under the RSA's 36-month re-export track, up to 6 million lbs. U_3O_8 equivalent can enter the US for processing and re-export within 36 months at any one time. This means it is not an annual quota, but a rolling quota, that is immediately replenished with every re-export. There is also a 12 month track which requires the Russian imports to be re-exported within 12 months. This material is limited to no more than 3 million lbs. U_3O_8 equivalent at any one time. The total limit under both tracks is no more than 6 million at one time.

5.0 IMPORT AND EXPORT ISSUES

As a Party to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) [4], Canada has committed: not to manufacture or acquire nuclear weapons; to accept International Atomic Energy Agency (IAEA) safeguards on all nuclear activities in Canada; and to facilitate nuclear cooperation with other states, while ensuring that Canadian nuclear exports are used solely for peaceful purposes. To facilitate this cooperation, Canada has 31 Nuclear Cooperation Agreements (NCAs) in place covering 48 countries, many of whom have commercial nuclear power reactors and/or mine and process uranium. The NCAs provide assurances that Canadian nuclear exports, including uranium, are used solely for peaceful purposes and vice versa, as the NCAs are reciprocal.

When Canadian uranium is exported, a CNSC export licence and GAC export permit are required. At the time of licensing, a Canadian-obligation is placed on the uranium by making it subject to the relevant NCA. This obligation remains on the material as it goes through the nuclear fuel cycle.

The *Nuclear Non-proliferation Import and Export Control Regulations* outline the CNSC requirements for an application for a licence to import or export a controlled nuclear substance, including uranium enriched in ^{235}U. In addition, an export permit would be required from GAC who administers the Export and Import Permits Act (EIPA) [5], which governs Canada's system of export and import controls for military and strategic goods and technology, including nuclear and nuclear related dual-use items. In crossing borders, approvals are required from the responsible agencies in each country. The approvals, or permitting processes, are subject to domestic policy and regulations. To help facilitate and streamline this process, the CNSC has established Administrative Arrangements (procedures) with our nuclear cooperation partners, including Russia, the UK and the US.

It is important to understand the origin of the uranium which is being enriched as there may be obligations from other countries attached to the material, depending on the country of origin. Additional obligations may also be imposed by the country performing the enrichment or fuel manufacturing. For example, uranium that is mined in Australia, enriched in Russia to produce HALEU, that is exported to the US for fuel manufacturing, will have the obligations related to Australia (from the originating uranium) as well as the US (from the fuel manufacturing), and could have Russian obligations placed on it (from the enrichment), and the Government of Canada will be asked to confirm that this material will be made subject to each of these bilateral NCAs before the export will be authorized by the US. When uranium is made subject to a bilateral NCA, Canada confirms that it will be used solely for peaceful purposes and tracks the country of obligation for reporting purposes while in Canada. This tracking is done through the submission of CNSC Inventory Change Documents.

Nuclear weapon states are not required by the NPT to accept IAEA safeguards on all nuclear activities; however, they have all voluntarily offered certain facilities to be eligible for the application of IAEA safeguards. It is therefore important to identify which facilities HALEU will be produced in.

The NCAs consider uranium enriched to less than 20% Uranium-235 as low enriched uranium. This would include HALEU and HALEU fuel products. HALEU that might come from downblending of high enriched uranium is seen as a win from a non-proliferation perspective, as it reduces the global stocks of HEU. All this said, uranium and nuclear fuel products are routinely imported and exported, so no special non-proliferation complications are envisioned for HALEU and HALEU fuel products.

It should be noted that while Canada has NCAs in place with Russia, the UK and US, uranium exported from Canada to Russia to produce HALEU at a facility that is not under IAEA safeguards is required to be processed and exported from the Russian jurisdiction within 12 months, noting that the tailings can stay in Russia. There is no time limit if the HALEU is produced at a facility that is under IAEA safeguards. There is also no limit on the quantity of uranium that can be shipped.

Under the US-Russia suspension agreement, there is a limit on how much material can be accepted by the US from Russia. There are both consumption quotas (for end-use by U.S. utilities) as well as processing and re-export quotas. If the fuel can be manufactured in the US and exported within 12 or 36 months, then it is exempt from the consumption quota as long as it does not exceed the 6 million lb. U_3O_8 equivalent limit at any one time, as discussed earlier on in the report.

In most cases the SMR operators or domestic fuel suppliers will apply for the export and import licences from the CNSC as well as the export permits from GAC. CNSC licence applications and GAC permit applications (when required) can be submitted well in advance of any potential imports or exports as long as the information required for the application is known. While the applications can be submitted to the CNSC and Global Affairs in parallel, they make independent decisions. Assuming the application is complete, it normally takes up to six weeks (30 business days) to obtain a CNSC import or export licence, and up to eight weeks (40 business days) to obtain a GAC permit. It should be noted that if fuel is US obligated and is intended for subsequent export, then the time for the US to grant consent could take up to a year. It is recommended that the Utilities engage in discussions with Nuclear Fuel shipping companies when developing their overall plan.

6.0 TRANSPORTATION OF HALEU AND HALEU FUEL PRODUCTS

HALEU can be obtained from Russia in a variety of forms. Different fuel types use different forms. It should be noted that while Canada currently possesses facilities to convert U_3O_8, to UF_6 which is needed for the enrichment process, it does not currently have facilities to re-convert the enriched UF_6 back to U_3O_8, or to UO_2 for fuel pellet/rod production, or to UF_4 for production of uranium metal.

Enriched fuel must be shipped in transport packages that are certified and approved in both the country of origin and receipt. As per IAEA Safety Standards Series SSR- 6, *Regulations for the Safe Transport of Radioactive Material* [6], transport packages have capacity limits and must be certified for a specific activity and fuel form. Following the IAEA regulations has allowed for the international community to harmonize transport regulatory requirements.

For HALEU in the form of UF_6, DAHER-TLI is developing a new version of the DN30 overpack to support HALEU production and packaging for the transport of UF_6 with enrichments of up to 20 wt.% ^{235}U. A design dedicated to a higher limit of 20 wt.% ^{235}U has a payload of up to 1250 kg UF_6. The plans for licensing this package in the U.S. are unclear. It is important that this transport package design also be certified for use in Canada by the CNSC.

The TNBGC-1 transport package design F/313/B(U)F-96 (Rev. Lbj) has been certified by the CNSC (Certificate CDN/E177/-96 (Rev 11)) and the certification is valid up to March 01, 2024 [7], however an amendment would be required to transport HALEU. In addition, the capacity for HALEU is quite limited implying that it is impractical for the large quantities of HALEU required to be transported in the case of a grid sized reactor.

The OPTIMUS-L transportation package is also under evaluation in the US [8].

For small quantities of HALEU for lab use originating from the US DOE that might be used for qualification purposes at CNL, the NNSA Y-12 group uses the ES-3100 package. The Canadian package design certificates are valid until July 31, 2025.

Based on the above information, for grid sized reactors requiring large volumes of HALEU fuel, there are two approaches that can be pursued,

- Transport HALEU in the form of UF_6, noting it will need to be re-converted at the fuel manufacturing facility, and/or
- Work with the manufacturer to modify one of the existing packages to have it certified for transporting much larger amounts of U_3O_8 or UO_2 HALEU, noting the additional cost and schedule required.

Recognizing that the higher levels of ^{235}U in HALEU pose additional risks, such as security and criticality control, above that associated with CANDU fuel bundles or Pressurized Water Reactor (PWR)/Boiling Water Reactors (BWR) fuel assemblies, a safety case will need to be prepared for the manufactured HALEU assemblies, or other final fuel form/core to determine the extent of the specific requirements around transport. Assuming the fuel is likely to be initially manufactured in the US, this will involve regulators in both countries. It is recognized that the industry will need to engage with recognized fuel service and transport companies such as Tam, Edlow, or Orano, etc. to assist in this area.

In Canada such shipments fall under Class 7 of Transport Canada's Transportation of Dangerous Goods Regulations [9]. They also fall under CNSC's Nuclear Safety and Control Act [10] and are regulated under the Packaging and Transport of Nuclear Substances Regulations [11], which in turn is in alignment with IAEA Safety Standards Series No. SSR-6, Regulations for the Safe Transport of Radioactive Material [6]. Transport Canada and the CNSC cooperate in regulating the transport of nuclear substances through a Memorandum of Understanding (MOU) [12].

Transport of category I, II or III radioactive material, as defined in the CNSC Nuclear Security regulations, requires a certified transportation package in both the country of origin and receipt. Initial certification of a new transportation package is performed in the county in which it has been designed. It can be subsequently endorsed or approved for use in another country. Significant effort needs to go into the design, analysis and testing of transportation packages to meet the regulations. If a transportation package has been designed in the United States, then either the US-Nuclear Regulatory Commission or the US Department of Energy perform the technical assessment and certification. If the shipment is international, the US – Department of Transport issues the certificate with either the US-NRC or US-DOE certificate attached to their certificate. It is estimated that a response to an application could be expected within one year. The subsequent timing of certification depends on the completeness and complexity of the application, as well as the extent of follow up questions.

CNSC document RD-364, Joint Canada – United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages [13], outlines the process required to obtain certification or endorsement of transportation packages of radioactive material

within the US and Canada. For transportation packages certified in the US, CNSC review of an application for endorsement is normally completed within a one year period for a new package, six months for an amendment to an existing design, and 3 months for a straight renewal. It should be noted that for a new transportation package some reviews can be done in parallel but the approval in the second country can not be granted until it has been completed in the country of original design.

Nuclear substance must be transported in CNSC certified packages that are designed, tested and certified for the nuclear substances to be transported, with consideration for their activity and physical and chemical properties. Further, the user of the certified package is required to be registered with the CNSC before they can use the package. Registration to use a certified package confirms that the user of the package has the proper instructions to prepare the package for transport. CNSC and Transport Canada's regulations also require that anyone involved in transport of radioactive materials have the necessary programs in place and are trained to carry out their duties.

As part of preparing an application for a licence to transport a proponent must have an approved security plan. CNSC Regulatory document REGDOC-2.12-3, Version 2, Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material [14], outlines how to prepare and submit a written transportation security plan that meets the requirements of section 5 of the Nuclear Security Regulations. It is expected that a review of the licence to transport application can be performed by the CNSC Transport Division within 20 business days provided that the security plan has already been approved.

7.0 HALEU BANK

It should be noted that HALEU could be ordered directly by a Utility on a per project basis or the industry might consider establishing a HALEU bank with storage at a facility like CNL. Such a bank could provide benefits such as an increased likelihood of availability to meet the demand and potential discount pricing, however it would only be practical if there were several large (grid sized) projects with a real line of sight to deployment. Appendix III provides additional information on this HALEU bank option. It is recommended that the industry should jointly discuss the potential interest and details surrounding the establishment of a HALEU bank.

8.0 RISKS ASSOCIATED WITH THE ABILITY TO SUCCESSFULLY INTRODUCE HALEU FUEL AND FUEL PRODUCTS FOR USE IN CANADA

The primary risk identified is meeting the timelines to support the envisioned grid sized projects given the current capacity limitations due to the limited sources of HALEU.

Secondary risks include:

- Potential competition for HALEU given the limited source of supply and manufacturing capacity.
- Availability of certified transport packages depending on the form of HALEU

- Availability of licenced manufacturing facilities for certain HALEU fuel product forms.

9.0 RECOMMENDATIONS FOR UTILITIES

1. Explore potential for capacity limitations from TENEX from downblending, or upgrading the capacity of their facilities, potential for US production, and/or potential benefits and costs for establishing a HALEU bank.
2. Establish a dialogue with the various federal agencies on a project specific basis regarding the specific plans for HALEU, including confirming industries understanding of the application of the US quotas on import of enriched uranium from Russia
3. Investigate secondary risks associated with each project and the specific form of HALEU and fabricated fuel product.

10.0 CONCLUSION

Many of the SMR designs currently being pursued in Canada use HALEU fuel. HALEU is not currently available within Canada and will therefore need to be purchased from a foreign country and exported. The final fuel form will most likely need to be fabricated initially in the US and then imported to Canada.

There are no Policy or legal inhibitors to the introduction of HALEU fuels in Canada for power reactors (SMRs) however there are logistical supply challenges that could potentially impact the timelines for deployment. It must be stressed that while this report provides valuable information, each organization planning to use HALEU fuel will need to conduct specific detailed discussions with the relevant Federal agencies and departments regarding the specific aspects of their project.

11.0 REFERENCES

[1] SMR Action Plan, Government of Canada Chapter, December 2020, https://smractionplan.ca/content/government-canada, accessed 2021 March 31.

[2] International Atomic Energy Agency, Manual on Safe Production, Transport, Handling and Storage of Uranium Hexafluoride, IAEA-TECDOC-771, IAEA, Vienna (1995).

[3] United States Government, International Trade Commission, 85 FR 64112, Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation, (Section IV.H), https://www.federalregister.gov/documents/2020/10/09/2020-22431/2020-amendment-to-the-agreement-suspending-the-antidumping-investigation-on-uranium-from-the-russian.

[4] United Nations Office for Disarmament Affairs, Treaty on the Non-Proliferation of Nuclear Weapons (NPT), https://www.un.org/disarmament/wmd/nuclear/npt/text, accessed 30 April 2021.

[5] Government of Canada, Export and Import Permits Act (EIPA) Export and Import Permits Act, (R.S.C., 1985, c. E-19), https://laws-lois.justice.gc.ca/eng/acts/e-19/, accessed 30 April 2021.

[6] International Atomic Energy Agency, Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series No. SSR-6 (Rev.1), IAEA, Vienna (2018).

[7] Canadian Nuclear Safety Commission, Certification of Transport Packages and Special Form Radioactive Material, https://nuclearsafety.gc.ca/eng/nuclear-substances/certification-transport-packages-special-form-radioactive-material.cfm?pedisable=true, accessed 2021 March 31.

[8] Idaho National Laboratories, UO_2 HALEU Transportation Package Evaluation and Recommendations, INL/EXT-19-56333, Revision 0, November 2019, https://inldigitallibrary.inl.gov/sites/sti/sti/Sort_20375.pdf.

[9] Government of Canada, Transportation of Dangerous Good Regulations, https://tc.canada.ca/en/corporate-services/acts-regulations/list-regulations/transportation-dangerous-goods-regulations, accessed 2021 March 31.

[10] Government of Canada, Nuclear Safety and Control Act, (S.C. 1997, c. 9), https://laws-lois.justice.gc.ca/eng/acts/n-28.3/, accessed 30 April 2021.

[11] Government of Canada, Packaging and Transport of Nuclear Substances Regulations, 2015 (SOR/2015-145), https://laws-lois.justice.gc.ca/eng/regulations/sor-2015-145/index.html.

[12] Memorandum of Understanding Between Transport Canada and the Canadian Nuclear Safety Commission, 2018, http://www.nuclearsafety.gc.ca/eng/pdfs/MoU-Agreements/2018-Memorandum-of-Understanding(MOU)-Between-Transport-Canada-and-the-CNSC-eng.pdf?ver=2.

[13] Canadian Nuclear Safety Commission, RD-364, Joint Canada – United States Guide for Approval of Type B(U) and Fissile Material Transportation Packages, https://nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/published/html/rd364/, accessed 30 April 2021.

[14] Canadian Nuclear Safety Commission, REGDOC-2.12-3, Version 2, Security of Nuclear Substances: Sealed Sources and Category I, II and III Nuclear Material, Version 2, https://nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/history/regdoc2-12-3.cfm, accessed 30 April 2021.

[15] Consolidated Appropriations Act, Division Z, Energy Act of 2020, December 2020, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR133SA-RCP-116-68.pdf, accessed 30 April 2021.

[16] TerraPower, "TerraPower announces plan to invest in domestic advanced nuclear fuel production to ensure U.S.-based fuel supply for advanced reactors", 15 September 2020, https://www.terrapower.com/terrapower-announces-plan-to-invest-in-domestic-advanced-nuclear-fuel-production/.

[17] ARC Clean Energy, "ARC and Centrus Energy Sign Letter of Intent for HALEU Supply", 28 April 2020, https://www.arcenergy.co/news/1/39/ARC-and-Centrus-Energy-Sign-Letter-of-Intent-for-HALEU-Supply.

[18] Nuclear Energy Institue, "NEI Letter to Secretary Perry on Need for High-Assay Low-Enriched Uranium", 5 July 2018, https://www.nei.org/resources/letters-filings-comments/nei-letter-perry-need-haleu.

APPENDIX I

HALEU Supply Situation

This appendix identifies current enrichment situation in the US and potential plans for HALEU.

- USDOE funding of Centrus and the America Centrifuge Project for a pilot project:
  - 900 kg production by the end of 2022 for use by DOE, with initial production of about 1 MTU thereafter.
  - Could have up to 10 MTU/YR capacity by 2026 if they have the appropriate level of investment from the US government or other sources.
  - Unclear what happens without investment after the pilot program is complete in 2022.

- URENCO claim ability to produce 3-6 MTU/Y with 2 years signal of commercial demand provided they have the necessary level of investment.

- USDOE may release legacy spent fuel (naval cores or EBRII) for use by commercial US market (unlikely could be used in Canada due to residual fission products in the fuel)

- USDOE is processing spent EBR-II fuel to create about 10 MTU of HALEU for use at the Idaho National Laboratory site. About half of this has already been allocated to an advanced reactor developer. DOE may consider processing other material to produce HALEU if funding is available. However, it is expected that projects in the US would have priority access to this material.

- In December 2020, the Energy Act of 2020 [15] was enacted in the US. This law contains an "Advanced Nuclear Fuel Availability" section that instructs DOE to establish a HALEU program with the provisions outlined below. In order for DOE to execute this program, funding will have to be provided separately by Congress in annual appropriations bills. Funding was not provided for fiscal year 2021 which ends on September 30, 2021.
  - DOE shall develop, in consultation with the NRC, criticality benchmark data to assist the Commission in the licensing and regulation of fuel and enrichment facilities
  - By January 1, 2024, DOE shall support commercial submission of HALEU transportation package designs to the NRC

- DOE shall consider options for acquiring or providing HALEU from a stockpile of uranium owned by the Department, or using enrichment technology. Potential sources include:
    - High-enriched uranium that is downblended to become HALEU
    - HALEU that is produced by DOE research, development, and demonstration activities
    - HALEU that is produced in the United States by either 1) a United States-owned commercial entity operating United States-origin technology; 2) a United States-owned commercial entity operating a foreign-origin technology; or 3) a foreign-owned entity operating a foreign-origin technology
- Not later than 1 year after the date of enactment of this Act, and biennially thereafter, DOE shall conduct a survey of stakeholders to estimate the quantity of HALEU necessary for domestic commercial use for each of the 5 subsequent years
- DOE shall establish a consortium with entities in all parts of fuel cycle
- Not later than 3 years after consortium is formed DOE shall have the capability to acquire and provide HALEU to members of the consortium not later than January 1 2026.
  The program shall expire on the earlier of a) September 30, 2034; or
  b) 90 days after the date on which HALEU is available to provide a reliable and adequate supply for civilian domestic advanced nuclear reactors in the commercial market

Demand in the US

- Natrium (US) MOU with Centrus, backed by USDOE under the Advanced Reactor Demonstration Program (ARDP), for available capacity until 2026 and beyond [16]
- ARC-100 MOU for supply of HALEU from Centrus [17]

APPENDIX II

Concept of a Central HALEU Bank

Information has been collected from leading SMR reactor vendors in Canada to develop projections on High-Assay Low-Enriched Uranium (HALEU) demand over the coming decade to 2035. The following summarizes this input for projected HALEU requirements in metric tons of uranium (MTU) by year over in aggregate to protect the confidential information of individual vendors.

The following information was requested from all vendors active in Canada who may have HALEU needs:

1. Up front qualification and research needs,
2. First core load,
3. Fuel needs per year to support a single unit,
4. Enrichment level %Uruanium-235,
5. Projection of #of units added by year based on your conservative deployment and commercialization scenario.

Individual vendor responses have been anonymized and the compiled information is presented below for inclusion in the paper.

It is understood that this information is a crucial input to inform government funding and policy decisions that may be required to enable the successful large-scale deployment of SMRs in Canada.

Assumptions:

Vendors have identified specific enrichment needs. In some cases, the need is for 19.75% in others the need is a lower percentage of ^{235}U. The numbers presented below have been converted to a consistent 19.75% enrichment for the purpose of comparison. Vendors publicly acknowledging fuel enrichment levels less than 5% were not contacted as part of this data gathering as this feedstock materials is available commercially through established supply chains.

Scenarios:

Scenario 1 presents annual and cumulative quantities of 19.75% enrichment normalized to initial deployments (in some cases a single plant has multiple units) informed by both vendor data and conservative deployments envisioned by Canadian utilities. This data includes refuelling if within the timeframe presented.

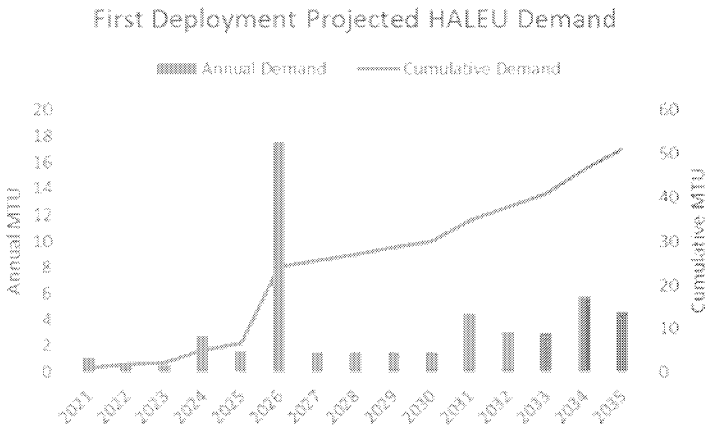
Scenario 2 presents annual and cumulative quantities of 19.75% enrichment needed as provided by the vendors and including their projections on deployment schedules and numbers of units anticipated in Canada. Note: these values have not been filtered or adjusted and are used as provided by the vendors.

Scenario 1 – Initial Deployment Projection

Scenario 1 presents annual (year by year) and cumulative quantities normalized to initial contemplated deployments (in some cases a single plant has multiple units). This projection is informed by both vendor data and conservative deployments envisioned by Canadian utilities. This data includes refuelling if within the timeframe presented. Table A.1 represents data converted to 19.75% equivalent. Vendor supplied projections beyond this initial deployment projection is included in Scenario 2.

Table A.1: Estimated Annual Requirements for High Assay Low Enriched Uranium (Metric Tons U/yr) for Initial Deployment in Canada

	Annual	Cumulative
Enrichment %	**19.75%**	
Year	**Metric Tons U**	
2021	1.12	1.12
2022	0.55	1.67
2023	0.50	2.17
2024	2.77	4.94
2025	1.61	6.55
2026	17.55	24.10
2027	1.50	25.60
2028	1.50	27.10
2029	1.50	28.60
2030	1.50	30.10
2031	4.52	34.62
2032	3.11	37.73
2033	3.00	40.73
2034	5.77	46.50
2035	4.61	51.11



US projections are documented in a letter from NEI to the US DOE [18].

Notes:

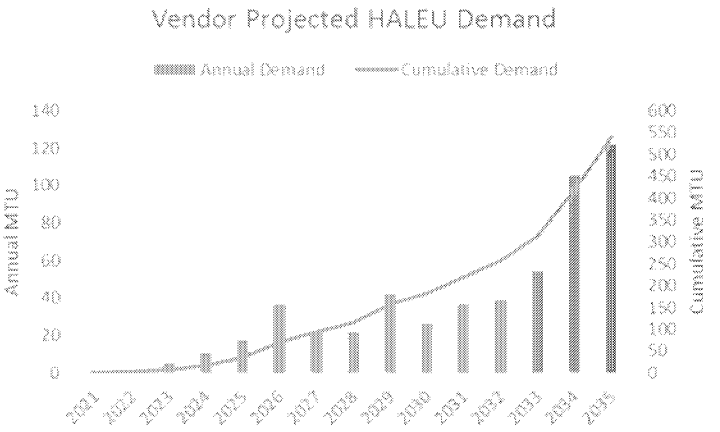
- Individual vendor data held confidential by CNL. Aggregate values reported here.
- The material needs listed above are in metric tons of uranium per year.
- The year the material is needed is for fuel fabrication. Insertion in the reactor and reactor operations will occur in a later year.

Scenario 2 – Vendor Projections

Scenario 2 presents annual (year by year) and cumulative quantities of 19.75% enrichment as provided by the vendors and including their internal projections on deployment schedules and numbers of units anticipated in Canada. Note: these values have not been filtered or adjusted and are used as provided by the vendors.
Table A.2 represents data converted to 19.75% equivalent using the vendor supplied projections on number of units and timings.

Table A.2: Estimated Annual Requirements for High Assay Low Enriched Uranium (Metric Tons U/yr) in Canada using Vendor Projections

	Annual	Cumulative
Enrichment %	**19.75%**	
Year	**Metric Tons U**	
2021	1.12	1.12
2022	0.55	1.67
2023	4.90	6.57
2024	10.37	16.94
2025	17.61	34.55
2026	36.75	71.30
2027	21.70	93.00
2028	21.70	114.70
2029	41.80	156.50
2030	26.00	182.50
2031	36.82	219.31
2032	38.71	258.02
2033	54.39	312.42
2034	105.22	417.63
2035	122.05	539.69



US projections are documented in a letter from NEI to the US DOE [18].

Notes:

- Individual vendor data held confidential by CNL. Aggregate values reported here.
- The material needs listed above are in metric tons of uranium per year.
- The year the material is needed is for fuel fabrication. Insertion in the reactor and reactor operations will occur in a later year.

APPENDIX III

Concept of a Central HALEU Bank

In the event there is a clear line of sight of a few grid sized projects requiring HALEU fuel, then provided necessary contractual agreements are in place, a bulk order for HALEU could be made and the HALEU stored for subsequent use at a licenced facility such as CNL. This could have the advantage of increasing the likelihood of availability when needed and possible pricing advantages of a bulk order. Such a bank is envisioned to be in effect for only a few years, hence there would be a clearly defined timeline.

The concept assumes the participants would deposit a sizable down-payment and payout when the HALEU is needed, however a large Utility such as OPG would take the lead and backstop the overall financial commitment. There would have to be additional interested Utilities in Canada, although potential Utilities from the US could be considered.

While it would simplify the ordering, transport and storage if all the participants agree to purchase the same form of HALEU, this would not strictly be required. The group would also need to agree on the degree of enrichment, noting it could be possible to down blend a higher enrichment at the storage facility.

A logical place for the HALEU bank to be located would be CNL as they are an existing licenced facility and familiar with handling, monitoring and safeguarding higher levels of enriched uranium. The exact location at the site where the HALEU would be stored would depend on the amount that is needed to be stored, noting the bank could be of significant volume (many metric tons).

From:	Laura DeLong
To:	Ted Parisé; Luke Bulmer; Peta Fussell; Patrick Lacroix; Richard Lincoln;
Cc:	Lindsay Walker
Subject:	Information Note SMR Strategic Plan 2022
Attachments:	Information Note SMR Strategic Plan 2022.docx
Sent:	3/30/2022 2:00:10 PM

All: Please find attached a draft overview of the Strategic Plan for the Deployment of Small Modular Reactors which was released this past Monday March 28, 2022 by the governments of Ontario, Saskatchewan, New Brunswick and Alberta. The Plan itself is 60 pages so this one-pager is a very high level overview of some of the key points.
Laura

Issue: Release of A Strategic Plan for the Deployment of Small Modular Reactors on March 28, 2022.

Context: The governments of Ontario, Saskatchewan, New Brunswick and Alberta have agreed to a joint strategic plan outlining the path forward on small modular reactors (SMRs). The report, entitled A Strategic Plan for the Deployment of Small Modular Reactors (*the Report*) highlights how SMRs can provide safe, reliable and zero-emissions energy to power a growing economy and population, while creating new opportunities to export Canadian knowledge and expertise around the world.

The Report identifies five (5) key priority areas for SMR development and deployment:

1. Positioning Canada as an exporter of global SMR technology by propelling three separate streams of SMR development, covering both on-grid and off-grid applications.
2. Promoting a strong nuclear regulatory framework that focuses on the health and safety of the public and the environment while ensuring reasonable costs and timelines.
3. Securing federal government commitments on financial and policy support for new SMR technologies that would lead to vast economic benefits across the country and help meet our emissions reduction targets.
4. Creating opportunities for participation from Indigenous communities and public engagement.
5. Working with the federal government and nuclear operators on a robust nuclear waste management plan for SMRs.

Background: Since December 2019, Ontario, New Brunswick and Saskatchewan have been working together to advance SMRs in Canada through an inter-provincial Memorandum of Understanding (MOU). Alberta joined the MOU in April 2021.

The *Report* builds on the provincial power utilities' SMR Feasibility Study, requested by the provinces as part of the MOU, which concluded that SMR development would support domestic energy needs, curb greenhouse gas emissions, and position Canada as a global leader in clean technologies and the fight against climate change.

Considerations: New Brunswick is focused on Stream 2 – two fourth-generation, advanced SMRs that would be developed in the province. ARC Clean Energy is targeting to be fully operational at the Point Lepreau nuclear site by 2029, and Moltex Energy will have both its spent fuel recovery system and reactor in operation by the early 2030s, also at the Point Lepreau site.

The *Report* indicates that Stream 2 can create the following economic benefits for Canada for demonstration units in New Brunswick:

- Average of 1,458 direct and indirect jobs per year;
- $2.15 billion positive impact on GDP (i.e., direct and indirect); and
- $198 million in increased government revenue.

With the opportunity to expand this through a fleet of Canadian and globally exported units to 2060 of:

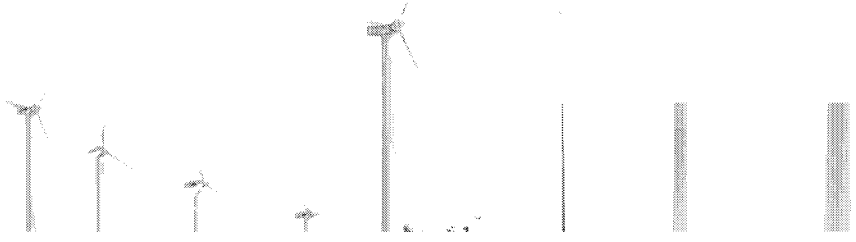
- Average of 17,900 direct and indirect jobs per year;
- $59 billion positive impact on GDP (i.e., direct and indirect); and
- $5.2 billion in increased government revenue.

MARINER

New Brunswick Clean & Green Economy Roadmap

Final Report

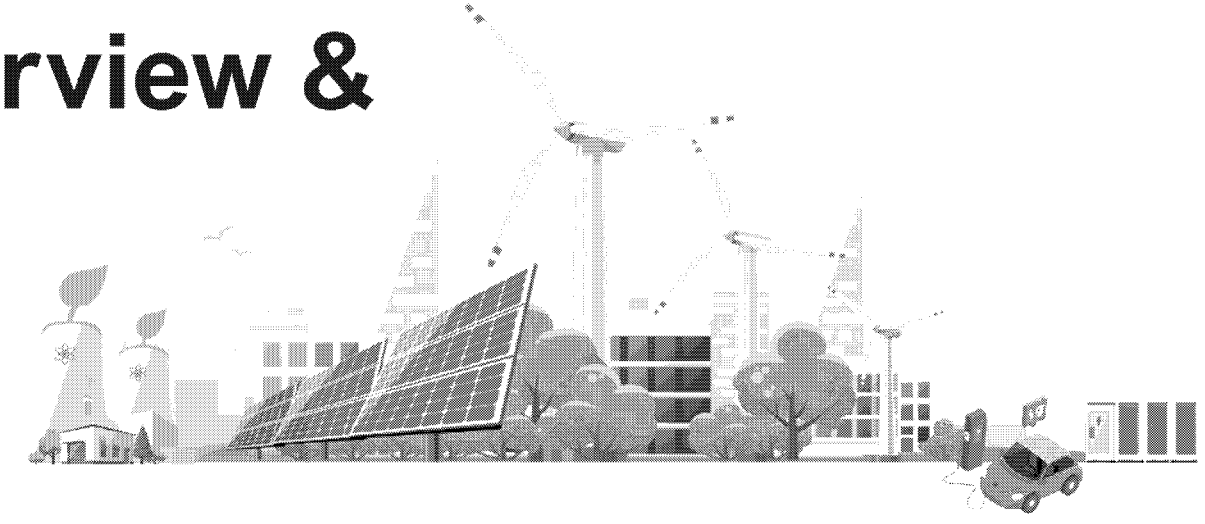
February 2022



CONTENTS

SECTION 1

Project Overview & Approach.



Executive Summary

BACKGROUND

2021 has witnessed the global climate change crisis reach a critical inflection point requiring coordinated radical action as we move closer and closer toward the irreversible juncture set for 2050. Most recently, with the outcomes of COP26, Canada's ongoing commitments to contribute to global decarbonization have generated challenges, and have also spurred economic opportunities. Since the 2015 Paris Accord, the Government of Canada has invested $60 billion toward clean and green initiatives, with an additional investment of $15 billion for Canada's strengthened climate plan[1] - investment which is expected to increase in support of increased commitments. New Brunswick has traditionally been entrepreneurial and adept at taking measured risks to capitalize on economic and industry developments. This capability and ecosystem of support are crucial to maximizing the opportunity presented by this global crisis.

New Brunswick is well-positioned to emerge as a leader on the nation's stage to significantly reduce Canada's emissions. As outlined in the 2018 New Brunswick Climate Change Act, it is the objective of the Government of New Brunswick to drive reduction of emissions to a maximum of 10.7 megatons in 2030 and 5 megatons in 2050.

Based on work to date, New Brunswick enjoys a "head start" in the race to decarbonization, decreasing emissions by 35% as compared to 2005 levels, based on the most recent measures in the 2020 NB Climate Change Action Plan Progress Report. New Brunswick has exceeded its 2020 targets at 13.2Mt currently produced, representing a reduction level leading the nation.

There are diverse goals set out in the 2018 Climate Change Action Plan, with priorities related to decarbonization and the transition to a clean and green economy, including: energy resiliency, climate change adaptation and mitigation, investment attraction, and local company growth, all while ensuring competitiveness in critical sectors and utilities.

Today, while bilateral discussions occur between GNB departments, agencies, and other stakeholders on a siloed and project-by-project basis, there is an opportunity to apply a more whole-of-province approach to strengthen the provincial position, better align and prioritize, and maximize the benefits related to transitioning to a clean and green economy. The most significant determining factor for success is the New Brunswick stakeholder's ability to collaborate, operationalize, and execute as a single system.

PROJECT OVERVIEW

Beginning in September 2021, Mariner was engaged to facilitate consultations with key Provincial stakeholders to define and assess the current state of clean and green initiatives across the Province and investment opportunities. Based on extensive consultations across over 30 stakeholders, Mariner:

- Developed a detailed inventory of all ongoing and nascent projects and initiatives across the Province related to transitioning to a clean and green economy;
- Based on our findings, assessed and validated with stakeholders a prioritized list of critical path projects aligned to investment opportunities and focus areas to accelerate our path to clean and green economy; and,
- Developed a set of go-forward recommendations to align Provincial stakeholders and to develop a whole-of-government approach to drive transformational change and capitalize on opportunities to transition to a clean and green economy within the province of New Brunswick.

1 | A Healthy Environment and a Healthy Economy, Government of Canada 2015
2 | Climate Change Action Plan Progress Report 2020, Government of New Brunswick 2020

The purpose of this document is to provide a summary of high-level observations, key findings, and a set of recommendations to assist New Brunswick on its path toward a clean and green economy.

Engagement Scope & Approach

From September to December 2021, Mariner's scope of work was completed in four (4) phases with extensive stakeholder engagement to identify opportunities for investment, to achieve 2030 emissions targets, and to drive New Brunswick's transition to a clean and green economy.

PHASE 1

Discover & Assess.

- Through more than 25 interviews, Mariner consulted with GNB departments, agencies, utilities, industry associations, and community and project proponents.
- This included interviews, breakout sessions, and action team meetings of over 25 stakeholders.

PHASE 2

Analyze & Evaluate.

- Identified three (3) high potential opportunities (themes & projects for prioritization)
- Documented over 20 "medium to high impact" projects, at various stages with specific private sector proponents
- Captured 25 idea-stage and early-stage initiatives that are related to clean and green economic and environmental priorities.

PHASE 3

Validate Findings & Priority Opportunities.

- Performed a deep-dive on high potential opportunity projects (~20) & consultations with select stakeholders
- Validated findings, opportunities, enablers and roadblocks with stakeholders through focus groups and facilitated sessions (6 sessions involving 20+ stakeholders).

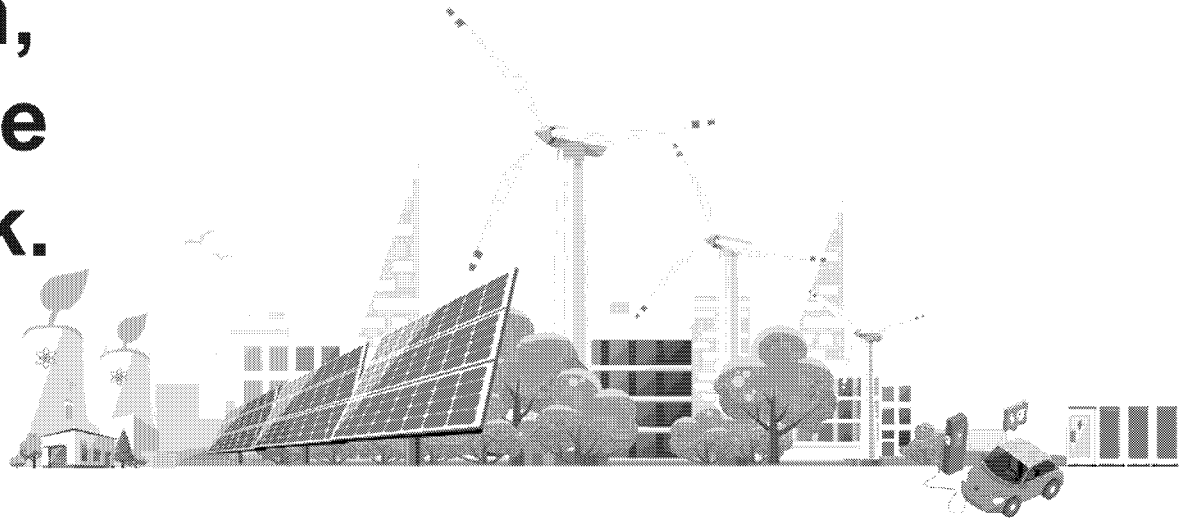
PHASE 4

Recommendations & Roadmap.

- Developed a final report of key findings and go-forward recommendations, to be shared with stakeholders.
- Prepared for alignment activities in January 2022.

SECTION 2

A Clean, Green, and Sustainable New Brunswick. For our Future.



Current Situation – Setting the Stage for Growth.

What's happening in Canada and in New Brunswick.

There is a window of opportunity to drive economic development while ensuring New Brunswick continues to demonstrate leadership in decarbonization.

Full implementation of the Pan-Canadian Framework and *A Healthy Environment and a Healthy Economy* will bring Canada's **2030 emissions to at least 31 percent below 2005 levels**

Since 2015, Canada has invested **roughly $60 billion** toward climate action and clean growth. Building on these recent investments, **Budget 2021 proposes to provide $17.6 billion.**

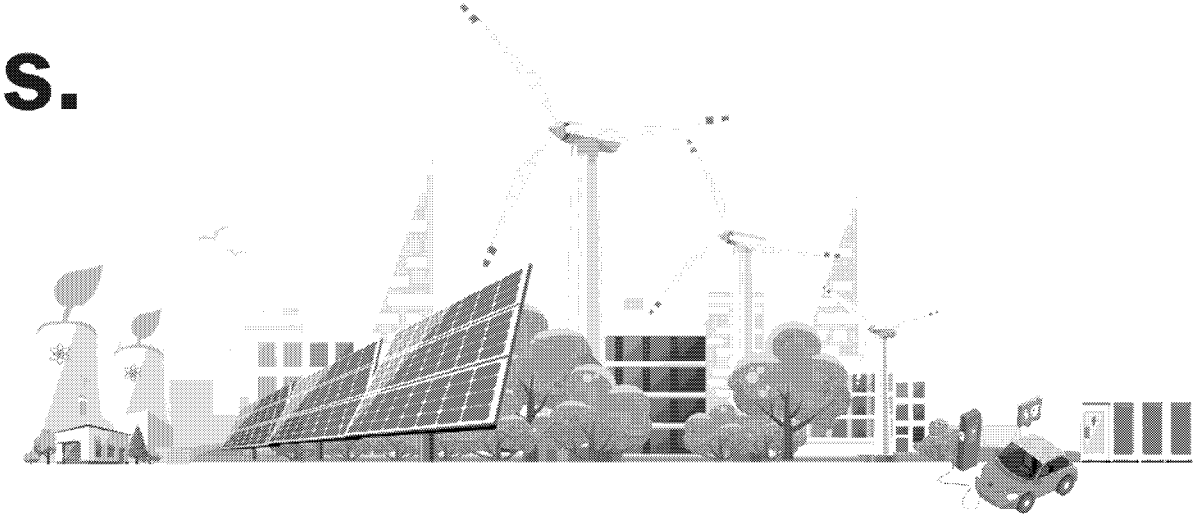
This project aims to shine a light on the "big opportunities" for New Brunswick, so we may take full advantage of the opportunity to create meaningful growth and prosperity in the changing landscape in front of us.

A whole-of-province approach will align key stakeholders around the opportunity to ensure we are informed, aligned, and coordinated.

- There is a **successful and growing model for collaboration in developing the Small Modular Reactor (SMR) cluster** that has been able to take advantage of the wealth of knowledge and expertise in the nuclear industry, one (1) of only three (3) provinces in Canada with this ability, and one (1) of four (4) that have signed onto an inter-Provincial Memorandum of Understanding MOU on SMRs. By leveraging the knowledge and lessons learned by those leading the work in that space, New Brunswick can accelerate its efforts around the biggest opportunities that represent both decarbonization and economic development.
- **New Brunswick has natural advantages** in and surrounding its ports, in both Saint John and Belledune. By leveraging the existing infrastructure, repurposing elements as needed over time, and building on the thriving transportation industry, the province can build on an attractive platform for growth.
- **Repurposing our assets** that make us unique will be key – from a **skilled workforce** with a high percentage of building trades representation, to a natural gas pipeline that can be leveraged for the exciting opportunities hydrogen represents.
- What we have learned is this: while there may have been challenges in the past with coordinated collaboration around key opportunities and clusters, the **stakeholders involved in this process are indicating they are ready**.
- **New Brunswick is poised** for meaningful growth given our advantages. Now is the time to create clarity and alignment around the big opportunities so we can better prepare ourselves to take advantage of the Clean and Green Economy, and to be a strong player at the regional table to increase our footprint on the world stage.

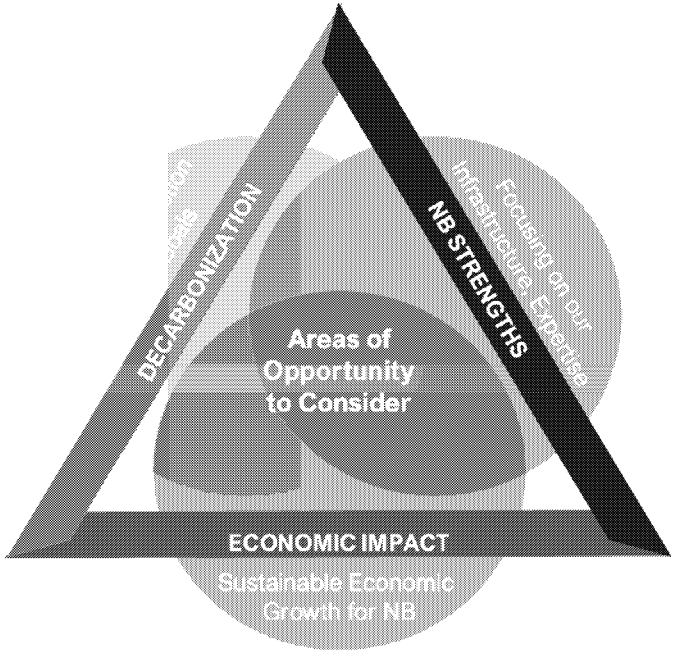
SECTION 3

Key Findings.



Project Inventory & Consultation Scope.

The scope of consultations and identifying and selecting projects that will ensure new Brunswick can capitalize on the clean and green economy.



Decarbonization. The New Brunswick Climate Action Plan is both broad and deep in its recommendations. It covers potential opportunities for decarbonization that New Brunswick must explore to meet and exceed longer term 2050 targets. Many of these projects and initiatives have been considered in this report.

NB Strengths. As a small province with limited financial and human resources, it is critical that we focus our efforts based on our strengths, and leverage successful investment opportunities and lessons learned across clusters and industries. Stakeholder discussions included consideration on our strategic advantages as a province, and are part the evaluation criteria.

Economic Impact. Through discussions and validation with individual project leads and enablers, the economic impact was included as part of the evaluation criteria where possible. In many cases, the details on the quantitative data was not available, but through consultation, economic impact was estimated.

Evaluation Criteria.

To ensure validity and prioritize projects, Mariner evaluated each project identified against evaluation criteria to qualify priority projects for the roadmap.

Based on the inventory of projects identified through stakeholder consultations, Mariner worked to analyze and rank projects based on comprehensive evaluation criteria. Mariner used the criteria to evaluate criticality of projects and earmark key transformational and economically-significant projects that were then prioritized into a focused list from the full inventory of 47 projects, narrowed down to 22 priority opportunities.

While there were three (3) main criteria – Readiness, Cluster, and Impact – others included timeframe, decision stage of project, overall change of success, NB Supply Chain opportunities, and more. The top three (3) criteria and rankings are outlined below.

EXPECTED TIMING

Implementation Timing

This set of criteria indicates when the project is expected to be implemented, live or operational, and aligned to short, medium, and long-term milestone targets from the NB Climate Action Plan 2018.

- **Long Term –** 2031-2050
- **Medium –** 2025-2030
- **Short Term –** 2021-2024

OPPORTUNITY MATURITY

Opportunity Maturity

The maturity of each opportunity is based on multiple factors including maturity of proponent, technology, sales cycle, financials, market readiness, and other known risks. These priority projects are mature, will be anticipated high impact, and are aligned to one (1) or more clusters.

- **Low –** Conceptual Opportunity
- **Moderate –** Developing Opportunity
- **High –** Mature Opportunity

ENVIRONMENTAL IMPACT

Environmental Impact

Does it help New Brunswick meet the greenhouse gas reduction targets? Evaluation criteria ranges from net increase (contributing to CO2e), net neutral, to mild, moderate, and high reduction.

- **Net Increase –** contributes to CO2e
- **Net Neutral/Mild Reduction –** Minimal change in CO2e <10kt
- **Moderate Reduction –** CO2e reduction 10-50kt
- **Large Reduction –** CO2e reduction > 50kt

ECONOMIC IMPACT

Economic Development Impact

Does it offer the potential of economic development and/or represent a strategic advantage for New Brunswick?

- Net Economic Loss
- Net Neutral/ Mild Positive Impact
- Moderate Positive Impact
- Large Positive Impact

Clean & Green Clusters

Based on our preliminary assessment, the key projects were classified across these six (6) high potential opportunity areas.

1

Small Modular Reactors.

Nuclear power generators do not produce direct carbon dioxide emissions. Advanced SMRs will be manufactured in factories and transported to sites, both within Canada and for export.

2

Bioenergy.

Bioenergy is a renewable energy source, derived from biomass, which can be used to produce transportation fuels, heat, electricity and products.

3

Heating & Storage.

Electro-thermal energy storage system is a critical enabler to alternate energy sources. It collects and stores energy for long durations from any power generation source, enabling reliable and predictable operation of the grid.

4

Hydrogen.

Hydrogen can be used as a fuel alternative for transportation, in power generation, and can be burned on its own or blended with natural gas to heat residential and commercial buildings or provide high-grade heat for industrial processes.

5

Geographic – Saint John.

The Saint John region highlights include large industry, deep, cold-water port, energy, forestry, aquaculture, and nuclear industry leadership, municipal utility, rail infrastructure, skilled workforce, and university/college knowledge cluster.

6

Geographic – Belledune.

The Belledune region is highlighted by its high-capacity port and supporting energy and forestry industry infrastructure, skilled workforce, gateway to the north of the province, and the imminent requirement to transition the existing coal plant to an alternate technology.

Clean & Green Clusters | Small Modular Reactors

1

Small Modular Reactors

The SMR cluster represents a significant and well-developed opportunity for New Brunswick at this time.

There is a team in place actively moving these opportunities forward. Roles and responsibilities are clearly defined, and much progress has been made in creating an open, transparent and collaborative stakeholder engagement process, including First Nations. Focusing effort in this cluster has resulted in forward momentum.

There is an opportunity to leverage the lessons learned from this cluster to create the environment for success in other key clusters.

PROJECTS	EVALUATION CRITERIA: Expected Timing	Environmental Impact	Economic Impact	Opportunity Maturity
1 **Small Modular Reactor, ARC-100D – ARC Clean Energy.** Phase 2 (2020 – 2023) includes a preliminary design, validation of cost estimates, and scoping fuel supply. Phase 3 (2024 – 2026) involves procurement orders and licensing and approval. The final phase, (2027 – 2030) covers the construction of the ARC-100.	Medium-term (2025-2030)	Large Reduction	Large Positive Impact	High
2 **Small Modular Reactor, Moltex SSR – Moltex.** This project is to license and construct the first of a kind (FOAK) waste-burning reactor in New Brunswick.	Long-term	Large Reduction	Large Positive Impact	High
3 **Small Modular Reactors, Manufacturing, Nth of a Kind – ARC Clean Energy & Moltex.** Due to simplicity of design, and being designed in Canada, the supply chain for SMR's can be largely centered in New Brunswick and in Canada. There is great potential to benefit from the export market.	Long-term	Net Neutral/ Mild Reduction	Large Positive Impact	Moderate

Geographic Alignment – Belledune

Geographic Alignment – Saint John

Clean & Green Clusters | Bioenergy (1/2)

2

Bioenergy

A number of potential opportunities were brought forward through stakeholder discussions.

The interest for New Brunswick in this cluster is broad, given our strength in forestry, aquaculture, and agriculture.

However, there is a lack of transparent and open information across the system, limiting our ability to have meaningful conversations that could lead to investment decisions.

PROJECTS	EVALUATION CRITERIA: Expected Timing	Environmental Impact	Economic Impact	Opportunity Maturity
4 RNG Production & Distribution Project – Liberty Utilities. The details of this project are not readily available at this time, as the project confidentially is in the proposal phase.	Short	Large Reduction	Mild Positive Impact	High
5 RNG from Waste-Water Project – Liberty Utilities & TransAqua. The details of this project are not readily available at this time, as the project confidentially is in the proposal phase.	Short	Net Neutral/Mild Reduction	Mild Positive Impact	Moderate
6 Early-Stage Alternative Energy Sources for Marine Sector Investment Attraction Project – Maersk. The proponent is in the logistics industry and has been working with Invest in Canada to identify alternative energy sources. Their primary focus is on liquid fuels that are either available today or that could be accessed before 2030.	---	Moderate Reduction	---	Low
7 Biofuel Production Plant – Secure Energy, Indigenous Canadian Energy (ICE), RDME & Active Energy Group. Proponents are co-developing multiple solid biomass fuel plants in Belledune. The proposed technology would convert wood biomass to a high energy replacement for coal.	---	Large Reduction	Large Positive Impact	Moderate

Geographic Alignment – Belledune

Geographic Alignment – Saint John

Clean & Green Clusters | Bioenergy (2/2)

2

Bioenergy (Cont'd)

A number of potential opportunities were brought forward through stakeholder discussions.

The interest for New Brunswick in this cluster is broad, given our strength in forestry, aquaculture, and agriculture.

However, there is a lack of transparent and open information across the system, limiting our ability to have meaningful conversations that could lead to investment decisions.

PROJECTS	EVALUATION CRITERIA			
	Expected Timing	Environmental Impact	Economic Impact	Opportunity Maturity
8 **Biochar Project A – Airex Energy.** A manufacturing plant to take waste wood residue and produce high energy carbon pellets or biochar. This firm is looking at starting a biochar and biocoal factory in NB.	-	-	Mild Positive Impact	Moderate
9 **Biochar Project B – SustainAgro.** This firm aims to convert waste forest biomass into sustainable energy and agricultural products.	-	-	Mild Positive Impact	Moderate
10 **Biochar Project C – Arbaflame.** Has developed a commercially operating and viable bioenergy project and has progressed several other potential bioenergy projects. They have developed technology to produce at scale bioenergy related products that are well suited to offtake markets.	-	-	Mild Positive Impact	Moderate

Geographic Alignment – Belledune

Geographic Alignment – Saint John

Clean & Green Clusters | Heating & Storage (1/2)

3

Heating & Storage

In order to enable our grid to be in a position to actively and regularly assess alternative generation sources, a sustainable solution must be found in energy storage.

In addition to storage, there is opportunity to investigate alternative heating solutions including offtake and geothermal to take the pressure off central electricity solutions and heating oil, which will support decarbonization across the province.

PROJECTS

		EVALUATION CRITERIA					
		Expected Timing	Environmental Impact		Economic Impact		Opportunity Maturity
11	**Penobsquis Site – Geothermal Park – Liberty Utilities.** Use the former potash mine site to build out the required infrastructure to allow businesses located in the Penobsquis/Sussex region to take advantage of efficiencies including low cost, low carbon, and renewable heating and cooling.	-	Large Reduction		Moderate Positive Impact		Moderate
12	**Thermal Utility (GTU) District Heating & Cooling Loop in Downtown Saint John – City of Saint John.** The City of Saint John studied the feasibility of a district energy system to serve buildings in the downtown area. These systems distribute thermal energy from a central facility to heat and cool multiple buildings.	-	Net Neutral/Mild Reduction		Mild Positive Impact		High

Geographic Alignment – Belledune

Geographic Alignment – Saint John

Clean & Green Clusters | Heating & Storage (2/2)

3

Heating & Storage Cont'd

In order to enable our grid to be in a position to actively and regularly assess alternative generation sources, a sustainable solution must be found in energy storage.

In addition to storage, there is opportunity to investigate alternative heating solutions including offtake and geothermal to take the pressure off central electricity solutions and heating oil, which will support decarbonization across the province.

PROJECTS		EVALUATION CRITERIA							
		Expected Timing		Environmental Impact		Economic Impact		Opportunity Maturity	
13	**Manganese Mine – Manganese X Energy Corporation.** The Houlton-Woodstock region has a manganese/iron deposit. These are large low-grade deposits but are recognized to be some of the 'largest known Mn reserves in North America.'		-		Net Increase		Moderate Positive Impact		Low
14	**Grid-Scale Energy Storage, Molton Salt. – Malta.** Plans to build a full-scale grid plant capable of storing 100MW of energy for up to 10 hours.		-		Large Reduction		Large Positive Impact		Moderate

Geographic Alignment – Belledune

Geographic Alignment – Saint John

Clean & Green Clusters | Hydrogen (1/2)

4

Hydrogen

Hydrogen is emerging as a potential large-scale opportunity for our province and our region. With regional activity accelerating, the formation of the Atlantic Hydrogen Alliance (AHA) is demonstrating the need for New Brunswick to become a strong voice in the region.

While opportunities are in the early stages, there is significant movement in this cluster.

With New Brunswick's natural advantages in energy industry leadership, transportation infrastructure, and strategically-positioned ports, New Brunswick is very well positioned to leverage this cluster as a key enabler to meeting our 2050 targets while creating an investment-ready environment, leveraging lessons learned from the SMR cluster.

PROJECTS

	EVALUATION CRITERIA			
	Expected Timing	Environmental Impact	Economic Impact	Opportunity Maturity
15 **ARC Energy Hydrogen Project – ARC Clean Energy.** The reactor produces high pressure steam, which could be used to make large quantities of ammonia and, in turn, hydrogen, another clean energy option.	-	Large Reduction	-	Low
16 **Hydrogen Production & Distribution Project – Liberty Utilities.** The details of this project are not readily available at this time, as the project confidentially is in the proposal phase.	Short	Net Neutral/Mild Reduction	Net Neutral/ Mild Positive Impact	Moderate
17 **Hydrogen Research Lab – WPP.** The proponent is considering establishing a research lab in New Brunswick around hydrogen.	-	-	Net Neutral/ Mild Positive Impact	Low
18 **Early-Stage Hydrogen Investment Attraction Project – Fortescu.** This project would be eventually looking for 500MW at 100% clean power for green hydrogen.	-	Large Reduction	-	Low

Belledune Saint John

Clean & Green Clusters | Hydrogen (2/2)

4

Hydrogen Cont'd

Hydrogen is emerging as a potential large-scale opportunity for our province and our region. With regional activity accelerating, the formation of the Atlantic Hydrogen Alliance (AHA) is demonstrating the need for New Brunswick to become a strong voice in the region.

While opportunities are in the early stages, there is significant movement in this cluster.

With New Brunswick's natural advantages in energy industry leadership, transportation infrastructure, and strategically-positioned ports, New Brunswick is very well positioned to leverage this cluster as a key enabler to meeting our 2050 targets while creating an investment-ready environment, leveraging lessons learned from the SMR cluster.

PROJECTS	EVALUATION CRITERIA: Expected Timing	Environmental Impact	Economic Impact	Opportunity Maturity
19 **Saint John as a Hydrogen Hub – Greenergy, Port of Saint John, Saint John Energy.** Early discussions with certain proponents on the potential partnerships and opportunities around hydrogen production in the SJ region.	-	-	-	Low
20 **Direct Air Carbon Capture Project* – Huron.** Propose to build at the Port of Belledune an air to fuels (A2F) plant capable of producing 2000 barrels/day of zero emission clean fuels.	-	Large Reduction	Large Positive Impact	Moderate

Geographic Alignment – Belledune

Geographic Alignment – Saint John

Clean & Green Clusters | Saint John

5

Geographic Cluster – Saint John

The Saint John region highlights include large industry, deep, cold-water port, energy, forestry, aquaculture, nuclear industry leadership, municipal utility, rail infrastructure, skilled workforce, and university/college knowledge cluster.

This region is particularly well-positioned to enable investment in the SMR/Nuclear cluster, as well as take a lead role in attracting and developing investment in the Hydrogen cluster.

Further opportunity can be developed through a series of pilot projects, leveraging industry leadership and infrastructure through the Port and beyond.

PROJECTS	EVALUATION CRITERIA							
		Expected Timing		Environmental Impact		Economic Impact		Opportunity Maturity
21 **Burchill Wind Project – Saint John Energy & Natural Forces.** The creation of a 42MW wind farm in Spruce Lake Industrial Park.	●	Short	●	Large Reduction		Net Neutral/ Mild Positive Impact	●	Moderate

ADDITIONAL PROJECTS

1 Small Modular Reactor, ARC-100D

2 Small Modular Reactor, Moltex SSR

3 Small Modular Reactors, Nth of a Kind

12 Thermal Utility (GTU) District Heating & Cooling Loop in Downtown Saint John

14 Grid-Scale Energy Storage

15 ARC Energy Hydrogen Project

19 Saint John as a Hydrogen Hub

 Geographic Alignment – Belledune

 Geographic Alignment – Saint John

Clean & Green Clusters | Belledune

6

Geographic Cluster – Belledune

The Belledune region is highlighted by its high-capacity port and supporting energy and forestry industry infrastructure, skilled workforce, gateway to the north of the province, and the imminent requirement to transition the existing coal plant to an alternate technology.

Key opportunities for Belledune exist in streamlining and focusing efforts in repurposing the Belledune Generating Station, leveraging energy storage and SMR projects to build out potential for alternative fuels, while further developing enablers to support large-scale clean energy and bioenergy investment.

PROJECTS		EVALUATION CRITERIA					
		Expected Timing		Environmental Impact		Economic Impact	Opportunity Maturity
22	**Acadian Peninsula Offshore Wind Power Project – ACOD.** Potential offshore wind project in the Acadian peninsula region - Capacity up to 210MW, average annual production 800 GWh.	Medium		Large Reduction		-	Low

ADDITIONAL PROJECTS

- 7 Biofuel Production Plant
- 8 Biochar Project A
- 9 Biochar Project B
- 20 Direct Air Carbon Capture Project

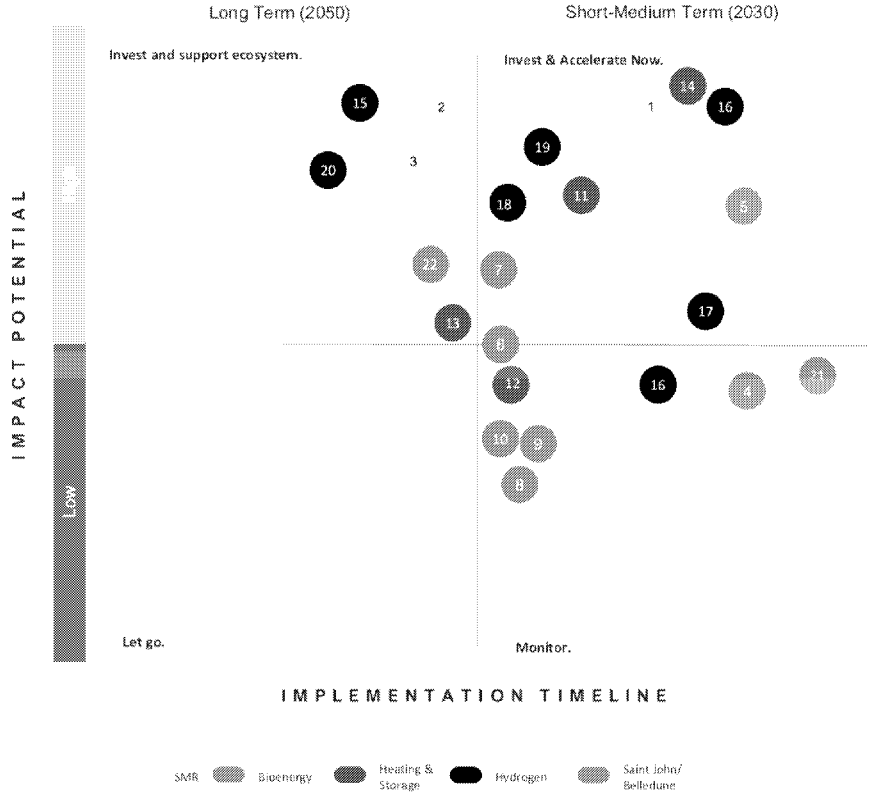
**Refer to *Appendix F – Full Project Inventory for* other projects that were identified following the initial stakeholder discussions

Geographic Alignment – Belledune

Geographic Alignment – Saint John

High Impact Projects

During consultations, a key theme emerged between balancing high impact projects for both the long term and short term, and what that means for New Brunswick's critical path to clean and green economy.



1 Small Modular Reactor, ARC-100D

2 Small Modular Reactor, Moltex SSR

3 Small Modular Reactors, Nth of a Kind

4 RNG Production & Distribution Project

5 RNG from Waste-Water Project

6 Early-Stage Alternative Energy Sources for Marine Sector Investment Attraction Project

7 Biofuel Production Plant

8 Biochar Project A

9 Biochar Project B

10 Biochar Project C

11 Penobsquis Site

12 Thermal Utility (GTU) District Heating & Cooling Loop in Downtown Saint John

13 Manganese Mine

14 Grid-Scale Energy Storage

15 ARC Energy Hydrogen Project

16 Hydrogen Production & Distribution Project

17 Hydrogen Research Lab

18 Early-Stage Hydrogen Investment Attraction Project

19 Saint John as a Hydrogen Hub

20 Direct Air Carbon Capture Project

21 Burchill Wind Project

22 Acadian Peninsula Offshore Wind Power Project

Barriers and Risks

Based on consultations, there are six (6) top barriers/risks to consider to address system-level, Province-wide gaps.

1. **Vision.**
   New Brunswick is lacking a strong, bold statement from Provincial Leadership on the importance of creating and transitioning to a Clean and Green Economy where investment thrives. For change to happen, leadership must own the vision, and then align policy, resources, and messaging around it in a consistent, clear way.

2. **Ownership, Governance, Metrics.**
   There is a lack of clear accountability and ownership of moving forward with a Clean and Green Economy. It is not clear who owns the delivery of key metrics, and indeed, what those metrics are.

3. **Policy.**
   We have consistently heard from stakeholders throughout this project that New Brunswick's policy does not create an investment-friendly environment. As part of the path forward, ownership, accountability, process, and roles must be defined to move forward in this area to better enable investors to set up and work in our province.

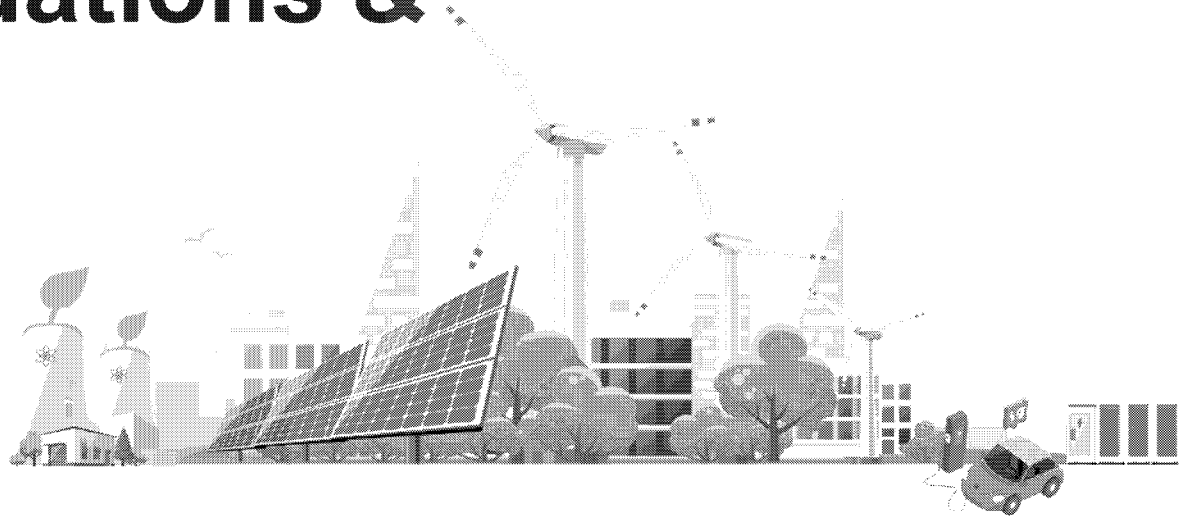
4. **Transparency/Clarity of Data, Systems, Processes, and Information.**
   In the current environment, many organizations working independently on partial solutions is generating a lack of transparency. This includes overall clarity around governance, metrics, roles/responsibilities, as well as more specific data and information required to move industry-specific initiatives forward, such as an Asset Map to support Bioenergy. Also critically important is the need to create an ongoing, sustainable process whereby clear accountability and adherence to a structured intake process is created and maintained.

5. **Workforce of the Future.**
   While there is willingness on the part of Post-Secondary Education, Training and Labour (PETL) to support the future workforce needs, those needs must have not been clearly defined nor has a holistic plan been developed in coordination with immigration and other efforts at a strategic level.

6. **Engagement Strategy.**
   A whole-of-province approach aligns key stakeholders around the opportunity to ensure we are informed, aligned, and coordinated.

SECTION 4

Recommendations & Roadmap.



Clean & Green Roadmap of Recommendations

Recommendations are mapped according to themes: Invest Now, Organize the Ecosystem, and Support the Ecosystem Development

2022 – 2023 | 2023 – 2030 | 2030+

Invest Now

- Develop and roll out longer-term sustainable prioritization process to expedite high-priority projects.
- Quickly work together with ACOA and other key stakeholders to map high-priority projects to funding and other resources needed to expedite investment and development.

Asset Map of NB

- Needed for Bioenergy Development.

Organize

- Organize provincial Hydrogen team and represent regionally.

Strategy & Vision

- Develop and Execute on Governance Model, Roles, Metrics.
- To support the Vision and Strategy, create Governance model, Ownership, and Roles and Responsibilities map.

Policy & Process Review

- Clean/Green Economy Policy Review and Sustainable Process for Review.
- Review the current process for policy changes based on Clean/Green Economy, update as per Vision, assign clear roles/resp & timing for regular review process.

Workforce Strategy

- NB's Clean and Green Economy Workforce Strategy.

Holistic Engagement Strategy & Plan

- Include all stakeholders: Political alignment and messaging, public awareness and engagement plan, ongoing engagement of key players to support strategy/plan, and federal/provincial relationships.

Expedite high-impact projects and support high-potential clusters

Organize to deliver a sustainable ecosystem for Clean/Green Investment in NB

Support the NB Ecosystem

Recommendations

Align on and mobilize recommendations key next steps.

RECOMMENDATION[1]		INSIGHTS
Execute on "Invest Now" Opportunities	**Based on findings (slide 21), ensure short-term mechanisms in place to invest in immediate opportunities.**	▪ Quickly mobilize around the high-impact opportunities; pilot a fit-for-purpose collaborative model across key stakeholder groups. ▪ Create short-term communications plan to support mobilization, collaboration, and quick decision-making on these opportunities. ▪ Map opportunities to funding where applicable; investment proportionate to size of the opportunity.
Clear Vision 2050 for NB	**Align and Communicate New Brunswick's Clean and Green Vision for 2050**	▪ Based on what we heard: Investors need a clear statement from government. This is key to enable a sustainable longer-term play for the Province.
Strategy to achieve Vision 2050 with metrics	**Bring together provincial leaders to define the path forward in a facilitated process to define the strategy to attain NB's Vision 2050.**	▪ Mobilize resources to create a coordinated and clear strategy to execute on the Vision. The strategy and plan need to prioritize clusters/regions based on this report and stakeholder engagement.
Ownership and Governance of Strategy	**Define the ownership of the strategy, metrics to support, timelines, deliverables, and accountability framework.**	▪ Feedback was clear that in order to move the Vision forward, clear ownership and metrics must be defined as part of the strategy.
Clear Roles and Responsibilities	**Define and communicate roles and responsibilities of the strategy and framework across the system.**	▪ The project team heard that while there is work happening, it is being done is silos. Effort is not coordinated, and there is lack of clarity around the end-to-end investor attraction and development process. Suggestions were made on creating a transparent process with a "one-stop-shop" approach, supported by communications across all stakeholder groups as they make investor connections. In addition, it will be important that the internal ONB team also align roles/responsibilities to support the process.

[1]Please note that recommendations are in no order of priority or sequencing.

Expedite high-impact projects and support high-potential clusters

Organize to deliver a sustainable ecosystem for Clean/Green Investment in NB

Support the NB Ecosystem

Recommendations

Align on and mobilize recommendations key next steps.

RECOMMENDATION[1]		INSIGHTS
Create Process for Policy Alignment to Vision 2050	**Clearly define the process for reviewing, recommending changes to, and moving ahead with key policies. Ties to roles/ responsibilities.**	▪ In many stakeholder engagement activities, the issue of policy came up. It will be important to align policy to vision and strategy and ensure clarity around the appropriate balance between clean/green investment and rates.
Asset Map: Resource & Maintain	**Assign clear ownership and assign appropriate resources to create an initial Asset Map, and to sustain timeliness and transparency of information in the long term.**	▪ The Bioenergy cluster represents potential high-impact investment across many sectors (forestry, agriculture, aquaculture). What is missing is a transparent view of New Brunswick's assets, which would support better and more informed investor discussions.
Conduct Clean/ Green Economy Workforce Strategy	**Once priority clusters have been defined as part of the overall strategy, create the Workforce of the Future Strategy, with clarity around roles, responsibilities, metrics, and timing.**	▪ Currently, none of the high-priority occupations that PETL is focused on relate to growing the Clean and Green Economy. Intentional and coordinated effort will be required to support the workforce of the future, including retraining our skilled workers to be prepared to contribute to the Clean and Green Economy in a meaningful way.
Holistic Stakeholder Engagement Strategy & Plan	**To mitigate risk in moving toward NB's Vision 2050, create a comprehensive Stakeholder Engagement Strategy and plan that supports the priority work activities.**	▪ To mitigate risks to investors and support the narrative in New Brunswick, a holistic strategy needs to be developed and managed strategically. It will be important to include all relevant stakeholders across the system. The plan should consider political alignment and messaging, public awareness and engagement plan, ongoing engagement of key players to support strategy/plan, and how to better create and nourish federal/provincial relationships.
Organize a Pilot Team to Support the Hydrogen Cluster	**The narrative in the region and around the world is very much focused on developing Hydrogen as a sustainable alternative.**	▪ New Brunswick needs to be part of the early strategic conversations to be in a position to determine the longer-term sustainable involvement in this cluster. Organizing quickly around this cluster can become part of the strategic advantage the province has, across our infrastructure and regions.

[1]Please note that recommendations are in no order of priority or sequencing.

Expedite high-impact projects and support high-potential clusters

Organize to deliver a sustainable ecosystem for Clean/Green Investment in NB

Support the NB Ecosystem

Key Messages & Value Statement

What does this mean for a Clean and Green Economy in New Brunswick?

New Brunswick is a small province, which can act in our favour to mobilize quickly around key priority areas if we get organized and play to our strengths.

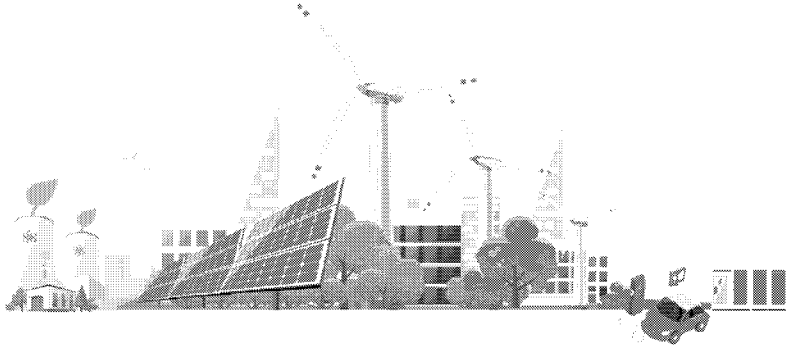
Leadership is needed to focus our efforts around a clear Clean and Green Economy Vision.

Priority should be placed around the high-potential clusters with focus on New Brunswick's two port communities. Saint John and Belledune are:

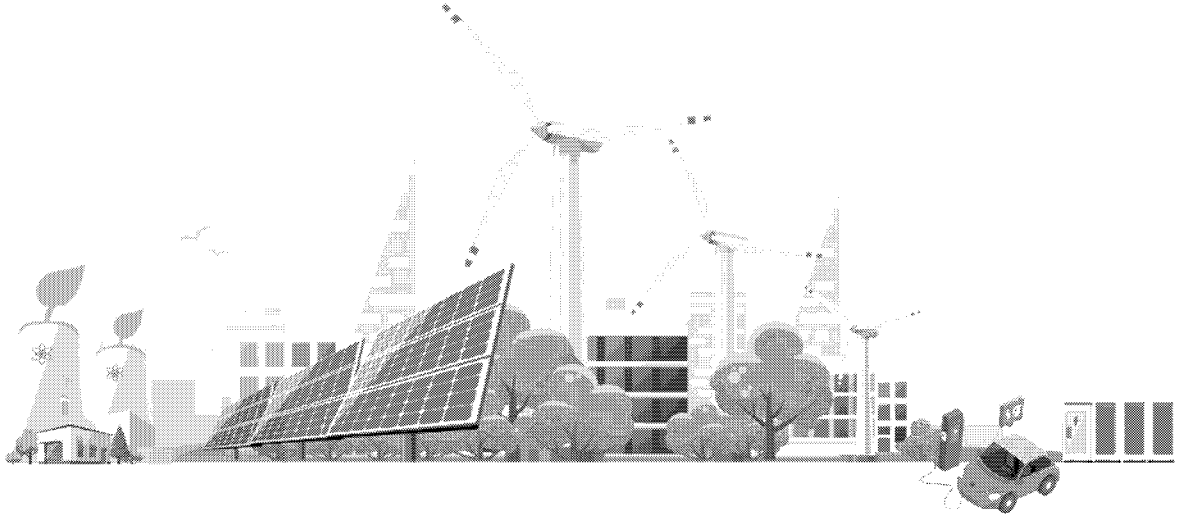
- Equipped with infrastructure and a skilled labour force that can be retrained to support the Clean and Green Economy.
- Connected to a pipeline that has the potential to be repurposed to support Clean/Green projects.
- The two highest emitting regions in the province, creating greatest potential for mass GHG reduction to meet 2050 targets.

By focusing on key clusters, New Brunswick has a better chance of creating momentum to effect real change despite limited resources.

Strategic clustering allows better collaboration and organization, leading to higher efficiency and effectiveness.



Appendix.



Appendices.

Summary of all appendices included.

A **Appendix A**
Stakeholder Involvement

B **Appendix B**
Gathering Themes & Insights

C **Appendix C**
Clean & Green Project Inventory – Complete Project Overview

D **Appendix D**
Additional & New Items

E **Appendix E**
Stakeholder List

F **Appendix F**
Full Project Inventory

Appendix A – Stakeholder Involvement.

Across a number of channels and activities, an **estimated 50 individuals** were involved in information gathering on this project.

	ACTIVITY	Description	Timing/Cadence	Involvement
1	**Action Teams**	Standing meetings designed to provide project and activity updates to key provincial department stakeholder representatives	Monthly or as required	25 individuals from across government, appointed by their DM, or appointed as an alternate
2	**Individual Stakeholder Interviews**	One-on-one discussions with key stakeholders across government, utilities, private sector, and other associations/groups	September/October 2021	30 individuals, including government representatives, NB Power, Liberty Utilities, Saint John Energy, BioNB, Atlantica Centre for Energy, Port of Saint John, Port of Belledune, Research and Productivity Council, Smart Grid Innovation Network
3	**ACOA/GNB Meeting: Energy Innovation and Decarbonization**	Report out on progress to date and discussion on opportunities/gaps with select DMs/ADMs	November 3, 2021	35 attendees, including DMs, ADMs, and other senior-level representatives assigned by their department
4	**Individual Follow-up Discussions**	Information gathering on project inventory and potential funding opportunities	Early November 2021	10 individuals asked for additional information on specific projects/initiatives, from the Port of Saint John, Port of Belledune, ONB, ACOA
5	**Cluster Discussions**	Facilitated group conversations with cluster-specific stakeholders to uncover specific barriers and opportunities within the cluster and across the ecosystem	Late November 2021	25 individuals across government, utilities, and other key stakeholder groups with subject matter knowledge specific to the cluster

Appendix A – Stakeholder Information Gathering & Discovery

Through a series of cluster-specific facilitated discussions with key stakeholders, a number of key themes and insights emerged that apply to a systems-level approach to better positioning New Brunswick for long term, sustainable investment in the Clean and Green Economy.

These were the questions asked to guide those discussions

1. **Clear Vision**
   Ownership and governance of projects in cluster: Is there an opportunity to create additional structure/ reporting/ discussions to gain momentum?

2. **Policy/ Legislation**
   Clear policy to support clean/green economy? What changes, if any, are needed? Is regulatory approval required?

3. **Engagement Process/ Buy-In**
   First Nations and other? What progress has been made? What more is needed? Timeline? Are roles/responsibilities clear?

4. **Workforce Readiness**
   Is the workforce prepared in the long run to support? What else might be needed? Workforce strategy?

5. **Supply Chain**
   Consider the opportunity for NB to build out SC for additional economic spin-off benefits.

6. **Capital Investments in Place**
   Is there an attractive business case to encourage investors?

Appendix B – Additional Themes & Insights.

Key points brought forward by Cluster in Stakeholder Discussions

	CLUSTER	Clear Vision, Governance, Ownership	Policy and Legislation to Support	Engagement Process Defined/ Stakeholder Readiness on Track	Workforce Readiness	Supply Chain in Place	Capital Investment Readiness	Other/ Key Takeaways
1	Small Modular Reactors	Y	N	Y	In Development	Y	Y	Opportunity to tap into lessons learned through a managed process
2	Bioenergy	N	N	N	N	Y	N	Process needed to set up and maintain a province-wide asset map
3	Heating and Storage	N	N	N	N	N	N	Needed for a secure grid
4	Hydrogen	In Development	N	N	N	N	N	Start connecting to the larger vision in the region
5	Saint John Region	Y	N	Y	Skilled Workforce – Needs to be Retrained	Y	Y	Leverage work being done, tap into EnvisionSJ and increase transparency
6	Belledune Region	N - Mixed Messages	N	Y	Skilled Workforce – Needs to be Retrained	Y	Y	Align to provincial mandate

Appendix C – Clean & Green Project Inventory – Complete Project Overview (1/4)

In consultation with key stakeholders across GNB, Utilities, and other Associations and organizations, Mariner identified a total of 47 projects related to the clean & green economy across New Brunswick. A complete overview of the inventory is included on this and subsequent slides.

	PRIORITY PROJECTS (TOP 22)	SMR	Bioenergy	Heating & Storage	Hydrogen	Saint John	Belledune
1	Small Modular Reactor, ARC-100D – ARC Clean Energy	✓					
2	Small Modular Reactor, Moltex SSR – Moltex	✓					
3	Small Modular Reactors, Manufacturing, Nth of a Kind – ARC Clean Energy & Moltex	✓					
4	RNG Production & Distribution Project – Liberty Utilities		✓				
5	RNG from Waste-Water Project – Liberty Utilities & TransAqua		✓				
6	Early-Stage Alternative Energy Source for Marine Sector Investment Attraction Project – Maersk		✓		✓		
7	Biofuel Production Plant – Secure Energy, Indigenous Canadian Energy (ICE), RDME & Active Energy Groups		✓				✓
8	Biochar Project A – Airex Energy		✓				✓
9	Biochar Project B – SustainAgro		✓				✓
10	Biochar Project C - Arbaflame		✓				
11	Penobsquis Site – Geothermal Park – Liberty Utilities			✓			

Appendix C – Clean & Green Project Inventory – Complete Project Overview (2/4)

In consultation with key stakeholders across GNB, Utilities, and other Associations and organizations, Mariner identified a total of 47 projects related to the clean & green economy across New Brunswick. A complete overview of the inventory is included on this and subsequent slides.

PRIORITY PROJECTS (TOP 22)		SMR	Bioenergy	Heating & Storage	Hydrogen	Saint John	Belledune
12	Thermal Utility (GTU) District Heating & Cooling Loop in Downtown Saint John – City of Saint John			✓		✓	
13	Manganese Mine – Manganese X Energy Corporation			✓			
14	Grid-Scale Energy Storage, Molton Salt – Malta			✓		✓	
15	ARC Energy Hydrogen Project – ARC Clean Energy	✓			✓	✓	✓
16	Hydrogen Production & Distribution Project – Liberty Utilities				✓		
17	Hydrogen Research Lab – WPP				✓		
18	Early-Stage Hydrogen Investment Attraction Project – Fortescu				✓		
19	Saint John as a Hydrogen Hub – Greenergy, Port of Saint John, Saint John Energy				✓	✓	
20	Direct Air Carbon Capture Project* – Huron				✓		✓
21	Burchill Wind Project – Saint John Energy & Natural Forces					✓	
22	Acadian Peninsula Offshore Wind Power Project – ACOD						✓

Appendix C – Clean & Green Project Inventory – Complete Project Overview (3/4)

In consultation with key stakeholders across GNB, Utilities, and other Associations and organizations, Mariner identified a total of 47 projects related to the clean & green economy across New Brunswick. A complete overview of the inventory is included on this and subsequent slides.

	OTHER PROJECTS IDENTIFIED	SMR	Bioenergy	Heating & Storage	Hydrogen	Saint John	Belledune
23	Advanced Metering Infrastructure – NB Power						
24	Atlantic Loop – Government of Canada						
25	Back-Office Opportunity, Moncton – Homesol						
26	Back-Office Opportunity, Saint John Expansion – Greenergy					✓	
27	Biodiesel Investment Attraction Project, Renewable Energy Group		✓			✓	
28	Biodigesters in NB		✓				
29	Biofuel Project B – BioEast Energy						✓
30	Bitumen Pucks Project – Secure Energy			✓			✓
31	Carbon Capture – Utilization						
32	Carbon Sequestration in Abandoned Mine Sites						
33	Cleaner Extraction of Minerals						
34	Coleson Cove Upgrades – NB Power					✓	

Appendix C – Clean & Green Project Inventory – Complete Project Overview (4/4)

In consultation with key stakeholders across GNB, Utilities, and other Associations and organizations, Mariner identified a total of 47 projects related to the clean & green economy across New Brunswick. A complete overview of the inventory is included on this and subsequent slides.

OTHER PROJECTS FOR FUTURE CONSIDERATION		SMR	Bioenergy	Heating & Storage	Hydrogen	Saint John	Belledune
35	Community Renewable Energy Projects – LORESS (Multiple Proponents)						
36	Electric Vehicles						
37	Mactaquac Generating Station Upgrades – NB Power						
38	Miramichi Wood Pellet Plant – Northern Energy Solutions Ltd.		✓				
39	NB Power Smart Grid – NB Power						
40	Oil Refinery Turnaround – Irving Oil					✓	
41	Hydrogen from Refinery Project – Irving Oil & TC Energy				✓	✓	
42	Precision Farming & Regenerative Agriculture						
43	Smart Grid Atlantic – NB Power						
44	Storage as Compressed Air in Abandoned Mine Sites			✓			
45	Tobique Microgrid Project – Tobique First Nations & Natural Forces						
46	Various Hydroelectricity Generation Projects – Bridge Executive Energy Solutions Ltd., etc.						
47	Various Solar Generation Projects – Smart Energy Company, etc.						

Appendix D – Additional & New Items.

Additional projects/items identified beyond the point in time that this report was conducted, have been included below. Although out of scope for this report, these items are related to the clean and green economy and should therefore be taken into consideration for future reference.

PROJECT TITLE	PROPONENT	LOCATION
Digital Initiatives	Saint John Energy	Saint John
Green Ammonia Project	AmmPower	Saint John
Ammonia Opportunity	Cross River (CRIP)	Belledune
Solar Farm Project	C2 Solar	Belledune
Biomass Carbon	N/A	Belledune
LNG Facility	LNG	Belledune

Appendix E – Stakeholder List.

Over the course of six months, key stakeholders identified below were consulted to provide input into this roadmap.

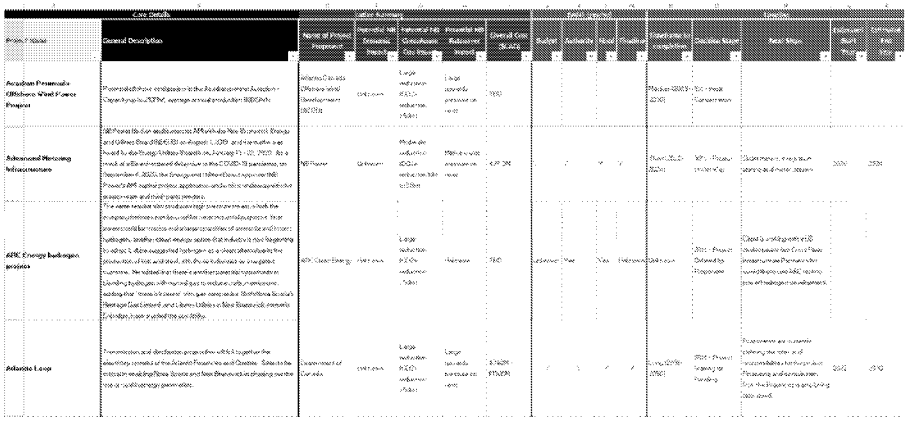
- Atlantic Canada Opportunities Agency
- Opportunities New Brunswick (ONB)
- Department of Natural Resources & Energy Development
- Department of Agriculture, Aquaculture & Fisheries
- Department of Post-Secondary Education, Training & Labour
- Department of Aboriginal Affairs
- Department of Environment & Local Government
- The Regional Development Corporation
- New Brunswick Power (NBP)
- Atlantica Centre for Energy
- BioNB
- Liberty Utilities
- Saint John Energy
- Port of Saint John
- Port of Belledune
- Research & Productivity Council
- Smart Grid Innovation Network

Appendix F – Full Project Inventory.

The full project inventory with 47 projects identified, with full evaluation criteria and mapping has been provided as a supplemental document.

Project Inventory & Evaluation Criteria (Excel)

The comprehensive Project Inventory and evaluation criteria is attached separately to supplement this report. This document includes further detail on the project inventory and projects reviewed during this process.



Mariner Partners Inc.
1 Germain Street (18th Floor), Saint John, NB, Canada E2L 4V1
www.marinerxvu.com

From:	Kowalsky, Sena (PrairiesCan)
To:	Fox, Joel (PrairiesCan); Dalzell, Matthew (PrairiesCan); Whitson, Matthew (PrairiesCan); Perras, Thomas (PrairiesCan); Luke Bulmer; McCaffery, Tom (PrairiesCan); Cameron, Arla (PrairiesCan); andrea.duncan@ised-isde.gc.ca; Angela.Chen@FedDevOntario.gc.ca; Kaitlyn.Cleary@nrcan-rncan.gc.ca; Laura DeLong; chantel.blanchette@international.gc.ca; tessa.mclean@nrcan-rncan.gc.ca; david.torre2@ised-isde.gc.ca; Sebastian-Tymchak, Wade (PrairiesCan); Ruofan.Lin@ised-isde.gc.ca; meghan.newman@nrcan-rncan.gc.ca; tom.calvert@NRCan-RNCan.gc.ca; natalie.kauf@NRCan-RNCan.gc.ca; tyler.koebel@nrcan-rncan.gc.ca; Janice.Pillon@ised-isde.gc.ca; Lynn Adams; henry.diaz@FedDevOntario.gc.ca; felicia.kislich-lemyre@NRCan-RNCan.gc.ca; Michaud, Jesse (PrairiesCan); nicole.skaf@nrcan-rncan.gc.ca; Lakhani, Shafin (PrairiesCan); antoine.delachevrotiere@NRCan-RNCan.gc.ca; brent.wilhelm@NRCan-RNCan.gc.ca; daniel.brady@NRCan-RNCan.gc.ca; john.stronach@NRCan-RNCan.gc.ca; Isis.Bozzano-bae@FedDevOntario.gc.ca; anita.kuipers@NRCan-RNCan.gc.ca; Peter, Jeffrey (PrairiesCan); tim.gauthier@NRCan-RNCan.gc.ca; Kanwal.Khokhar@nrcan-rncan.gc.ca; @naakah.ca; Candice.Jackson@nrcan-rncan.gc.ca; justin.hannah@nrcan-rncan.gc.ca; juliana.rapper@nrcan-rncan.gc.ca; Ramnarine, Kevin (PrairiesCan); darroch.harrop@ised-isde.gc.ca; Perry.Eddy@ised-isde.gc.ca;
Cc:	@hatch.com; Lucenko, Jessica (PrairiesCan); Jarosch, Megan (PrairiesCan);
Subject:	SMR Supply Chain Research Report and Presentation
Attachments:	PrairiesCan SMR Supply Chain Report.pdf;PrairiesCan SMR Supply Chain Study Presentation.pdf;
Sent:	6/10/2022 5:32:09 PM

Colleagues,

Thank you for joining us for the research presentation on Small Modular Reactor (SMR) Supply Chain development in Alberta and Saskatchewan. And a big thank you as well to from Hatch for joining us and presenting.

As promised, attached is the SMR Supply Chain research report and presentation for internal use. The presentation and discussion today touched on many critical areas related to SMR development in the west and Canada as a whole. We look forward to continuing to participate in the unfolding SMR discussion across the country.

Have a good weekend!

Sena

Sena Kowalsky
Senior Economist/Policy Analyst | Économiste principale/Analyste des politiques
Alberta Region | Région de l'Alberta
Policy, Planning and External Relations | Politiques, planification et relation extérieures
Prairies Economic Development Canada | Développement économique Canada pour les Prairies

s.19(1)

Email: sena.kowalsky@canada.ca
Cell: 587-340-9862

From:	Laura DeLong
To:	Patrick Lacroix; Louise Fiset; Jean-Francois Godin; Lynn Adams;
Cc:	Peta Fussell
Subject:	RE: Small Modular Reactors
Attachments:	Backgrounder-SMRs.docx
Sent:	10/21/2022 8:52:00 AM

Good morning all:
As Patrick has already indicated, the following are ACOA's investments to-date – perhaps the only one not mentioned thus far, is the project ACOA funded to support strategic planning for Indigenous involvement in SMR development in New Brunswick.

ACOA investments in the SMR technology cluster in New Brunswick

$3 million – Moltex (conditionally repayable)

- This project will help Moltex demonstrate the commercial viability of its proprietary technology to convert used CANDU fuel into recycled fuel for SMRs. This technology will reduce the cost, volume and toxicity of spent nuclear waste while producing clean electricity at low cost.

$5 million – NB Power (non-repayable)

- This project will enable NB Power to prepare for the deployment and demonstration of SMR technologies at its approved nuclear site. The project will focus on foundational activities such as establishing baseline site designs and addressing environmental and regulatory requirements. NB Power will also be engaging with First Nations and the public as part of this project.

$561,750 – University of New Brunswick's Centre for Nuclear Energy Research (CNER) (non-repayable)

- This project involves expanding CNER's capacity to support SMR technology cluster development in New Brunswick. The activities include hiring an Innovation Officer and engaging a consultant to develop a quality management system that would meet industry certification standards. This investment is meant to boost the centre's capacity to partner with private industry in research and development.

$13,750 – North Shore Micmac District Council (non-repayable)

- This project supports strategic planning for Indigenous involvement in SMR development in New Brunswick.

For some additional information regarding SMR should it be useful, I'm also sharing an older backgrounder (from Jan. 2022) that has some great context and background information. *Note that it hasn't recently been updated* some likely some items have evolved – but I'm happy to undertake a revamp should you wish to have something more recent.
Laura

From: Patrick Lacroix
Sent: Thursday, October 20, 2022 4:38 PM

s.20(1)(b)

s.21(1)(b)

To: Louise Fiset ; Jean-Francois Godin ; Lynn Adams
Cc: Laura DeLong
Subject: RE: Small Modular Reactors

Bonjour Louise, I am adding Laura Delong from our Policy Shop.
GNB provided ARC with $20M, but I do not believe ACOA or GofC provided any assistance to ARC.
In addition to the funding you mentioned, UNB also received $561,750 from ACOA in support of developing a quality management program that meets national nuclear certification standards, and to boost the CNER's partnership capacity in research and innovation by engaging an innovation officer. UNB receives funding to further intensify SMR cluster participation
Finally, NB Power, also an existing UNB partner and cluster participant, will receive nearly $5 million from ACOA in support of demonstration site preparation at its Point Lepreau facility.
More details here: Government of Canada invests in research and technology to create jobs and produce non-emitting energy (newswire.ca)
Patrick

From: Louise Fiset <Louise.Fiset@ACOA-APECA.GC.CA>
Sent: October 20, 2022 1:45 PM
To: Jean-Francois Godin <Jean-Francois.Godin@acoa-apeca.gc.ca>; Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>
Cc: Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>
Subject: RE: Small Modular Reactors

Merci, Jean-François. Bonjour Patrick, je pourrais aussi être disponible pour une conversation pour faire plus simple. Let me know – louisef ☺

From: Jean-Francois Godin <Jean-Francois.Godin@acoa-apeca.gc.ca>
Sent: Thursday, October 20, 2022 1:42 PM
To: Louise Fiset <Louise.Fiset@ACOA-APECA.GC.CA>; Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>
Cc: Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>
Subject: RE: Small Modular Reactors

Salut Louise,
We don't have much expertise on SMRs at HO but NB office might be able to provide more intel. Copying Patrick who may be able to redirect you to a member of his team.
Thanks,
JF

From: Louise Fiset <Louise.Fiset@ACOA-APECA.GC.CA>
Sent: Thursday, October 20, 2022 1:38 PM
To: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>; Jean-Francois Godin <Jean-Francois.Godin@acoa-apeca.gc.ca>
Subject: Small Modular Reactors

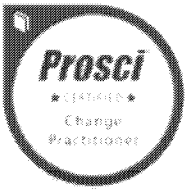
Hello Lynn and Jean-François,
I am doing a briefing for Janelle Bourgeois on small modular reactors in Atlantic Canada (mostly New Brunswick) to prepare for a meeting next week with the French Embassy's

Head of the Economic Section. I have the research well covered but wanted to verify with you 2 things:

1. ACOA's role and priorities in the sector
2. ACOA's funding to SMRs: QAccess only has $3M for Moltex but nothing for ARC Clean Technology. Moltex also received $47.5M from the Strategic Innovation Fund-Net Zero Accelerator Initiative. Is there more ACOA funding?

Thank you so much for responding as soon as you can,
louisef

Louise Fiset *(she/her/elle)*
Atlantic Canada Opportunities Agency / Government of Canada
louise.fiset@acoa-apeca.gc.ca/ Tel: 506-227-5081 / TTY: 7-1-1
I acknowledge that the lands on which I work and live are the traditional unceded territories of the Wolastoqiyik, Mi'kmaq and Peskotomuhkati Nations.
Agence de promotion économique du Canada atlantique / Gouvernement du Canada
louise.fiset@acoa-apeca.gc.ca / Tél. : 506-227-5081 / ATS : 7-1-1
Je reconnais que les terres sur lesquelles je travaille et que j'habite sont les territoires traditionnels et non cédés des nations des Wolastoqiyiks, des Micmacs et des Peskotomuhkatis.



BACKGROUNDER

Security classification N/A
Reference No. DT613093
Prepared by Laura DeLong
Date submitted October 21, 2022

Subject: Investments in Small Modular Reactors (SMRs) by the Government of Canada and the energy landscape in New Brunswick.

Purpose: the purpose of this backgrounder is to provide information on two possible upcoming announcements during the week of October 24-28, 2022:

1. Government of Canada's funding of SMRs at Darlington, ON; and
2. the possible creation of an 'Energy Secretariat' in New Brunswick.

Background

- Canada is targeting to have 100% of its power generation from non-emitting sources by 2035 and net-zero emissions across the country by 2050 under the Paris Agreement.
- SMRs are a new class of nuclear reactors of 300 megawatt or less which are designed with modular technology, resulting in enhanced safety, economies of scale and expected shorter construction schedule compared to traditional nuclear generating stations.
- Canada is in a global race with other major nuclear nations seeking to capitalize on the SMR opportunity. Early-mover advantage is critical if Canada is to become a global SMR technology hub and capture a significant share of the supply chain opportunities, increased jobs and economic benefits.

<u>New Brunswick-based developments in SMRs</u>

- New Brunswick is currently home to the development of two reactor designs undertaken by ARC and Moltex. Both are considered "Generation IV" reactors, which are attractive to the market because they are safer than earlier versions, effectively mitigating the risk of a thermal nuclear incident.
  - **ARC Clean Energy** is developing an advanced Generation IV SMR, the ARC-100, a 100 MW liquid sodium-cooled fast reactor which is expected to be operational by 2029. The reactor is based on the technology of the EBR-II fast-reactor at the Argonne National Laboratory in Lemont, Illinois, which operated for 30 years.
  - **Moltex Energy** is developing a 300 MW Stable Salt Reactor-Wasteburner. It is also developing technology to recycle used CANDU fuel at the Point Lepreau Nuclear Generating Station, lowering the amount of nuclear waste that will need long-term storage. Both the reactor and spent fuel recovery system are expected to be operational by the early 2030s.

- In the State of the Province address in January 2021, New Brunswick Premier, Blaine Higgs, underscored his commitment to non-emitting sources of energy and announced:
    - a $20 million investment in ARC (with $30 million in matching private funds);
    - a continued partnership with the federal government to support Moltex; and
    - the activation of an underutilized supply chain to participate in a worldwide SMR market.
- The SMRs being developed in New Brunswick are considered generation 4 models, which are not expected to be deployed before the 2030s, but which offer increased safety potential as well as the potential to use recycled nuclear waste as fuel.
- ACOA has also made significant investments in the SMR technology cluster in New Brunswick. (*see Appendix A*).

Current Status

SMRs

- It is understood that on October 25, 2022 Minister Wilkinson, speaking on behalf of the Federal Government, will announce an investment of $970 million by the Canada Infrastructure Bank (CIB) to help finance the deployment of the first grid-scale SMR, the GE-Hitachi BWRX-300, at the Darlington Generating Station (an OPG Nuclear Generating station in Bomanville ON).
- This is the CIB's largest investment in clean power generation to-date.
- The project at Darlington, ON is first among other Canadian SMRs being considered in New Brunswick, Saskatchewan and Alberta.
    - It is anticipated that the 300-megawatt SMR will provide enough electricity to power 300,000 homes.
    - The SMR will be built next to OPG's existing 3,500 MW Darlington Nuclear Generating Station since the site already has an existing nuclear licence.
- The CIB investment fills gaps in funding and financing on projects where public and private investment are both required.
    - In this project the economic gap is caused by higher costs associated with it being the first of a kind with unique circumstances that limit early private sector interest.

New Brunswick Energy Secretariat

- ACOA has also been made aware that on October 25, 2022 the Government of New Brunswick *may announce*, via a press release, the creation of an 'New Brunswick Energy Secretariat' encompassing nuclear, hydrogen, natural gas/LNG and other energy sources.
    - It is understood that the Secretariat will be led by Mr. Wayne Power who currently plays a coordinating role on the SMR file between NB Power, NB's Department of Natural Resources and Energy Development, the Premier's Office and the rest of the NB Government.
    - It should be noted that ACOA NB is in regular contact with provincial colleagues, including in recent weeks when personnel changes have taken place within the Department of Natural Resources and Energy Development. Although there was speculation of a potential new role for Wayne Power, no confirmation on the details or timing was provided.
    - It is anticipated that the Energy Secretariat will be responsible for ensuring effective development, coordination and monitoring of energy policy in NB, will have a leadership role in developing New Brunswick's energy priorities, and will help the province adapt to climate change while steering NB toward a greener future.

Additional Context:

- The investment demonstrates CIB's interest in supporting innovative technology that can accelerate the reduction in greenhouse gases.
- While this $970M investment will likely be widely applauded by the nuclear industry and will be of interest to other nuclear provinces (NB) and those pursuing nuclear energy (AB, SK), there is a possibility that the announcement will raise short term expectations from Provinces and industry for more federal support for SMR deployment.
- We understand that SMRs will be identified as the Province's first priority under planned discussions with NRCan related to the planned Regional Energy Tables.
    - They may raise frustrations over lack of clarity on funding pathways for SMRs, after the significant effort that was expended by all provinces and utilities targeting SMR deployment to contribute to a national framework following the 2020 release of Canada's SMR Action Plan. This is viewed as having costed important time for the advancement of "made in Canada" solutions.
    - They may also seek assurances that New Brunswick will be supported in its ongoing efforts to prepare for SMR deployment by accessing some of the $250 million in funding announced under Budget 2022 to support pre-development activities for clean electricity projects of national significance.
- New Brunswick is the next province targeting SMR deployment after Ontario and NB Power is working with ARC Clean Energy and Moltex to deploy new SMRs at Point Lepreau in the coming decade.
    - This is something that NB officials are likely to raise continually, through the Working Table on the Atlantic Loop, the newly launched Regional Energy and Resource Table with New Brunswick and in discussions on Just Transition.

Énergie NB Power | the power of possibility / débordant d'énergie

NB Power
Advanced Reactor Development Program
Hilyard Place, 600 Main St. Suite 201
Saint John, NB
E2K 1J5

September 2, 2022

Mr. Joseph Vigder
Project Manager, Atlantic Division
Impact Assessment Agency of Canada
Suite 200
1801 Hollis St.
Halifax, Nova Scotia
B3J 3N4

Dear Mr. Vigder,

Subject: Re: Designation Request for the Small Modular Reactor Demonstration Project, New Brunswick

The purpose of this letter is to provide the requested information as outlined in Reference 1 to assist in the initial review of whether the Impact Assessment Agency of Canada will designate the New Brunswick future project.

Items requested:

- **Scope of activities, separate stand alone or single multi-phased project involving multiple SMRs**

Context: New Brunswick Power Corporation (NB Power) has been working with the Province of New Brunswick, Advanced Reactor Concepts (ARC) Clean Energy Canada Inc., Moltex Energy (Moltex), and the University of New Brunswick to progress the development of Small Modular Reactors (SMRs) for potential commercial deployment within NB Power property on the Point Lepreau Site. Successful completion of the Vendor Design Review (VDR) Process Phase I and II, could result in commercial demonstrations of one ARC unit and/or one Moltex SSR-W unit with grid reserve, within the existing property. This could be followed by a subsequent deployment of additional units to be in-service prior to the retirement of the Point Lepreau Nuclear Generating Station (PLNGS); however, this is speculative at this point in time.

s.20(1)(b)

s.20(1)(c)

s.20(1)(d)

- We are currently in a pre-project phase of a single commercial demonstration unit ARC design. The ARC-100 is a sodium-cooled fast reactor that will generate 286 - 429 Mwt to yield 100 to 150 Mwe (electrical net output). ARC has completed Phase I of the VDR process (with the Canadian Nuclear Safety Commission (CNSC)) and has begun Phase II.
- The commercial demonstration unit experience will be used as input for decisions on future units.
- Such units would be proposed by a separate vendor and require separate review and approval by the CNSC; therefore, have separate approval timelines. The two vendors (ARC and Moltex) are completely separate, and the projects are not interdependent.
-

- **Role of NBP roles and responsibilities and relationships between NBP and vendors, third parties**
  - NBP will be the operator and license holder of the ARC unit.
  - ARC Energy is the technology developer, engineering support for design with third party engineering organizations.

- **Total number of SMRs proposed and Mwt and relationship between proposed SMRs**
  - One ARC commercial demonstration unit with a thermal output between 286-429 Mwt.

- **Anticipated requirements for the management, storage or disposal of irradiated nuclear fuel or nuclear waste**
  - The ARC design has a 20-year fuel load, after the 20 years the fuel will be stored internally in the periphery of the reactor vessel. The used fuel will subsequently be moved to onsite dry-cask storage. Work is underway with ARC Energy Canada and the Nuclear Waste Management Organization regarding used fuel disposal in the Deep Geological Repository.

- **Current activities underway and estimated timelines for planning approval, construction, operation and decommissioning**
  - Site evaluation activities as per CNSC *REGDOC 1.1.1. Site Evaluation and Site Preparation for New Reactor Facilities* has begun with an application for a License to Prepare Site for a single unit on June 30, 2023. This application submission will officially start the project and the environmental assessment that is required before a license to prepare site can be issued by the Canadian Nuclear Safety Commission. License applications for construction, and operation would follow in December 2024 and January 2027.
  - Baseline characterization and assessment of the biophysical and human environment in accordance with the New Brunswick *Environmental Impact Assessment Regulation* 87-83 under the *Clean Environment Act* and the Tailored Impact Statement Guidelines (TISGs) Template for Designated Projects Subject to the *Impact Assessment Act* and the *Nuclear Safety and Control Act.* The environmental impact assessment (EIA) documentation will be submitted to the New Brunswick Department of Environment and Local Government on June 30, 2023, under the Comprehensive Review Process. The estimated timeline for this EIA process is 36 months.

s.20(1)(b)

s.20(1)(c)

- **Anticipated regulatory approvals (Federal, provincial, municipal)**
  - NB Power has consulted with the province to confirm that the ARC project is listed in Schedule A of the EIA Regulation (i.e., it would have "a production rating of 3 MW or more"); therefore, the proponent must prepare an EIA and formally register the project with the NBDELG. Since the ARC SMR is subject to provincial EIA legislation, the CNSC is expected to act as a technical advisor and is an active participant at all stages of the EIA process. The CNSC will retain decision-making authority on licensing matters, and use the information gathered in the EIA process to inform its licensing decision under the NSCA.
  -

The following is a list of potential permits or approvals. Please refer to Table 2 for more details.

- CNSC License to Prepare Site, license to construct and license to operate.
- Potential additional federal approvals under the following legislation:
  - *Fisheries Act,*
  - *Species at Risk Act,*
  - *Canadian Navigable Waters Act,*
  - *Canada Shipping Act,*
  - *Migratory Birds Convention Act, 1994,*
- Provincial approvals:
  - EIA under the Comprehensive Review Process
  - Approvals to Operate/Construct,
  - Wetland and Watercourse Alteration,
  - vehicle load/mass approvals per the *NB Motor Vehicle Act*
- Local approvals: Re-zoning, Building, Blasting

- **NBP views on any proposed or potential future activities are described on project list and any other information relevant to IAA review**
  - NBP is working with Moltex Energy on a potential future unit. The Moltex Energy Stable Salt Reactor – Wasteburner (SSR-W or SSR-W300)

s.20(1)(b)

s.20(1)(c)

- Moltex would be a separate project that will require an impact assessment for fuel recycling as it would fall within the projects listed in the Physical Activities Regulations (i.e., the construction, operation and decommissioning of one of fuel processing/reprocessing with a production capacity of 100 t/year or more or use in a quantity greater than 1015 Bq per calendar year of nuclear substances with a half-life greater than one year, other than uranium, thorium or plutonium). It is understood that this separate project would be considered a Designated Project and it is anticipated that an IA could be initiated when the research and development is sufficiently underway.
- It is understood that nuclear projects to be assessed under the IAA are subject to an "integrated impact assessment" that is carried out by a review panel. A memorandum of understanding (MOU) between the CNSC and the IAAC outlines the roles and responsibilities of each organization and helps guide collaboration into conducting integrated IAs under the IAA. In addition, since the project would also require an EIA by the province of NB and given the need for a review panel, it is expected that the IAAC, the CNSC and the Province of NB would develop a form of project-specific Cooperation Agreement or a Joint Review Panel Agreement outlining the review process and the terms of reference for the review panel so that the review panel arrangement would aim to meet the process requirements of the Province of NB, and outline decision making authority/roles for all parties.
- As mentioned above, the ARC and Moltex demonstration units are being designed by separate vendors, which require separate approvals from the CNSC. They are not interdependent.

Additional requests in letter that may be requested or if available submit with this letter:

- A full assessment of effects, including input from public and Indigenous consultation, will be completed per the NB EIA process, which will involve federal regulators such as the CNSC and will comply with the spirit of the federal TISG template. The following provides some preliminary information. In addition, annual monitoring reports at Point Lepreau and CNSC environmental monitoring reports for licensing renewal could provide evidence to many of these statements.

Table 1: Potential Effects to Areas of Federal Interest

Federal Interests	Potential Effect Discussion
Potential adverse effects to fish/fish habitat, migratory birds and species at risk	• Potential for interaction with fish depends on cooling water & intake (impingement & entrainment); however, effects would not be significant at a population level. Such a design would be planned in consultation with DFO and would be mitigated and offset Potential interaction with birds as a result of cooling towers or lighting is possible. • The site is co-existing with migratory birds, SAR habitat etc. currently. Effects minimized as site is not a main flight route • There is a lot of operational experience and effects can be mitigated, e.g., with compliance with general breeding bird windows and engineering controls to avoid impacts through design.

Potential adverse changes to the environment that would occur on federal land and lands outside NB or Canada	• No federal lands or lands outside of NB or Canada will be directly impacted. • Potential Impacts are expected to be the same as currently present. • Potential indirect impacts relating to accidents and malfunctions will be managed through the CNSC licensing process and safety will be built into the design process (e.g., units shut themselves down).
Potential greenhouse gas emissions	• Emissions anticipated just during construction • Backup power e.g., diesel generators would be the main source of emissions during operations, • Impacts are positive – the purpose is to support GHG reduction. • The site is currently below thresholds
Potential adverse impacts resulting from any changes to the environment on Indigenous peoples	• No such changes are anticipated • The site is existing, no current traditional land use • Past development has already impacted the site
Potential adverse impacts on the rights of Indigenous peoples	• This is an established nuclear facility, and it is a compatible land use. • The proposed construction will not occur outside the NB Power property, with a possible exception being aquatic work, which if required, would be planned in consultation with DFO, Transport Canada and NBDELG, in consultation with Indigenous groups.
Potential adverse effects to the environment, or to health, social or economic conditions.	• Positive change economically for those that are partners in the project, engaging early for training (work and supply chain), jobs, etc. • The EIA will consider potential for impacts to marginalized peoples, including women (scoping socio-economic impact assessment to study GBA+ issues) • Adverse health impacts are not anticipated and will be considered in the EIA. • There is an opportunity for education about nuclear impacts.

In particular the IAA requests available information regarding:

1. **Key project activities, maps and layouts of the location of project components, land tenure and zoning**
   - A map of the facility (Attachment 1) is included in this letter. The proposed Point Lepreau site is owned by NB Power. Currently site evaluation activities are under way as per *REGDOC 1.1.1*, no site preparation activities will be conducted until a License to Prepare Site is issued by the CNSC.

2. **Any Federal financial assistance that would be required or has already been attained or provided**
   - NB Power has received financial assistance from ACOA (Project 217643) for preparation activities associated with the deployment of SMR technologies in New Brunswick. NB Power is seeking additional Federal assistance through the following:
   - Access to a portion of the newly established $250M Clean Electricity Fund that is being set up to support pre-development activities for clean electricity projects of national significance. Initial discussions have been held but no formal application has been submitted.
   - Potential project execution funding support from the Canadian Infrastructure Bank. Initial discussions have been held with additional discussions.
   - Other funding and financial strategies are being explored with the federal government through nuclear industry executives.

3. **For each regulator approval that would be required provide**
   i. **Name of license, permit, authorization or approval, legislative framework and responsible jurisdiction**
   - Please see Table 2 below.

s.20(1)(b)

s.21(1)(c)

Table 2: Anticipated Regulatory Requirements

Legislative Framework	Responsible Jurisdiction	Name of license, permit, authorization or approval	Status of Attaining the Regulatory Approvals	Whether it would involve assessments of any of the effects	Whether public and or Indigenous consultation would be required
Federal					
Nuclear Safety and Control Act (NSCA) and associated Regulations	Canadian Nuclear Safety Commission (CNSC)	All phases of Canadian Nuclear Safety Commission Licensing, i.e.,: • License to Prepare Site (LTPS); • License to Construct; • License to Operate; • License to Decommission	• LTPS application June 2023 • License to Construct application: December 2024 • License to Operate application: January 2027 • License to Decommission : TBD	Assessments of effects are required in a graded approach for each of the four licensing phases for Nuclear Power Plants as per the requirements set out in License Application Guides • *REGDOC 1.1.1 Site Evaluation and Site Preparation for New Nuclear Power Plants,* • *REGDOC 1.1.2 License Application Guide: License to Construct a Reactor Facility,* • *REGDOC 1.1.3 License Application Guide: License to Operate a Nuclear Power Plant and* • *REGDOC 1.1.4 License Application Guide: License to Decommission Reactor Facilities*	Yes public and Indigenous engagement is required and began in 2018. Crown consultation requirements are a function of the CNSC on behalf of the federal government and it is anticipated that some procedural aspects may be delegated to NB Power.
Fisheries Act	Fisheries and Oceans Canada (DFO)	Letter of Advice or Authorization (if required)	Requirements to be confirmed during EIA process	Yes. The *Fisheries Act* prohibits causing the death of fish and the harmful alteration, disruption or destruction (HADD) of fish habitat. For works in or near water where impacts to fish and fish habitat cannot be avoided, a DFO Request for Review may be required to determine requirements. DFO is expected to review the proposed Project to identify the potential risks to the conservation and protection of fish and fish habitat.	Yes. DFO is responsible for the duty to consult, and where appropriate accommodate Indigenous peoples of Canada in relation to Fisheries Act or Species at Risk Act regulatory decisions that may have the potential to impact Indigenous and treaty rights. DFO's Fisheries Protection Program suggests providing a summary of any: • public engagement activities and outcomes; and • Indigenous engagement activities and outcomes.

				Similarly, a request for review may be required under SARA if the Project may have adverse effects to an aquatic species at risk or its habitat. If death of fish or a HADD of fish habitat can be avoided, a Letter of Advice for the Project may be issued stating that the Project can proceed. If death of fish or a HADD of fish habitat will likely result, the Project will be required to obtain an authorization as per Paragraph 34.4(2)(b) or 35(2)(b) of the *Fisheries Act* Regulations, with or without SARA conditions.	This will help DFO determine if there is a duty to consult with Indigenous peoples relatively early in the review of the application.
Species at Risk Act	DFO and/or ECCC	Letter of Advice or Authorization (if required)	Requirements to be confirmed during EIA process	Yes. SARA requires the protection of species at risk and their habitats on federal crown lands (or other lands per Ministerial order). If federally-listed wildlife species or habitat may be impacted, authorization may be required.	Yes. If a permit application is required, applicants are asked to provide any information they may have on whether asserted Indigenous rights could be affected and any consultation or engagement work that they have done with Indigenous peoples. This will help determine if there is an additional requirement to meet the duty to consult relatively early in the process.
Migratory Birds Convention Act and regulations	Environment and Climate Change Canada (ECCC)	Compliance with the Act and regulations	Requirements to be confirmed during EIA process	Assessment will be completed as part of the EIA process, including baseline studies for potential habitat, and if so, a commitment to complete non-intrusive breeding bird surveys prior to construction.	N/A
Canadian Navigable Water Act	Transport Canada	Navigation Protection Program approval (if required)	Requirements to be confirmed during EIA process	The Act applies to projects that will interfere with navigation in Canadian navigable waters. "Major" works that are likely to substantially interfere with navigation will require approval from Transport Canada; however, "Minor" works may not require an application as long as they comply with legal requirements.	Yes. The Act includes a process to notify the public and help resolve conflicts about works on navigable waters. This process allows Canadians to have a say in projects that affect their right to travel on a waterway.

					In addition, if the work a legal duty to consult with Indigenous groups, the proponent may need to provide detailed information necessary to ensure consultations are adequate.
Canada Shipping Act and regulations	Transport Canada		Requirements to be confirmed		
Provincial					
Clean Environment Act - Environmental Impact Assessment Regulation (NB Reg 87-83)	New Brunswick Department of Environment and Local Government (NBDELG)	NB EIA Comprehensive Review Decision (approval)	EIA Registration (Comprehensive Review) submission: June 2023 Anticipated approval (Decision): September 2026	Potential adverse effects of each of the items listed will be addressed in the EIA following assessment requirements outlined in the NB EIA Regulation. NB Power has committed to complete the provincial EIA in compliance with the spirit of the federal Tailored Impact Statement Guidelines (TISGs) Template for Designated Projects Subject to the *Impact Assessment Act*, including completion of a Sustainability and Well-being Assessment and Indigenous Knowledge/Indigenous Resource and Land Use studies.	Provincial Crown consultation is also required under the EIA Regulation. We have developed an Indigenous Inclusion Guide which has been shared extensively with all Indigenous Organizations and Communities. *More information is provided after this table.*
Clean Water Act - Watercourse and Wetland Alteration Regulation (NB Reg 90-80) -	NBDELG	Watercourse and Wetland Alteration (WAWA) Permit	Requirements to be confirmed during EIA process	Potential effects to watercourses and wetlands would be assessed	
Clean Environment Act - Water Quality Regulation (NB Reg 82-126) -	NBDELG	Approval to Operate Water Quality	Requirements to be confirmed during EIA process	Potential effects to water quality would be assessed	
Municipal					
Community Planning Act		Building Permit	TBD		

The following provides more details about NB Powers Indigenous engagement and inclusion program.

- The Indigenous Inclusion Guide is based on building mutually beneficial relationships with Indigenous communities. This guide is a continually evolving document that continues to be informed and evolved as input is received through discussions and collaborations with community leadership, members and representative organizations. Our aim is to have all communities included in this opportunity.

- The Indigenous Inclusion Guide is built on five (5) key pillars:

  1. Leadership
  2. Relationships
  3. People and Culture
  4. Economic Empowerment
  5. Environmental Stewardship

  The principles underlying the guide are:

  - Listening with open minds
  - Creating an environment of collaboration
  - Delivering on commitments
  - Working toward a mutually beneficial clean energy future

Some examples of specific activities that are currently underway are:

- Indigenous Inclusion Steering Committee (includes NB members from the National SMR Action Plan Indigenous Advisory Council and Leadership Table as well as a lead from Wolastoqey Nation of NB)
- SMR Information Sessions have been held in most Indigenous Communities at least once and in some cases many times.
- Indigenous Youth Strategy has been developed and youth camps and station tours have been completed
- Indigenous Employment Strategy is being developed with *Indigenous Works Canada*
- SMR Program participates in the Indigenous Clean Energy (ICE) Generation Power Program
- Equity discussions are occurring with several Indigenous Communities
- Indigenous focused Procurement /Supply Chain workshops have occurred with more planned for future
- Indigenous Knowledge/ Indigenous Resource and Land Use Studies are underway
- Environmental Studies are being scoped through an Indigenous lens and the Aquatic and Terrestrial Studies are Indigenous Led.
- Sustainability, Well-Being, Archeological, Marine, Climate Change studies all have Indigenous inclusion

Concerns center around safety and waste management and we share those concerns and that is why we are working with advanced reactor technology. The ARC – 100 reactor generates far less waste.

- **Identify whether any license, permit, authorization or approval listed above would address the following.**
  i. Cumulative effects, effects of potential accidents or malfunctions
    - All of the four CNSC licenses for NBP will consider cumulative effects and potential accidents and malfunctions.
    - The Provincial EIA will address cumulative effects, potential accidents and malfunctions, alternatives to/means, long-term management of waste and non-proliferation. The EIA will follow the spirit of the federal guidance (CEAA 2012) regarding cumulative effects assessment, and mitigation and monitoring will take such effects into account.
    - Should a second demonstration unit be proposed in the future (e.g., a Moltex unit), it is expected to trigger a federal impact assessment process; which is anticipated to require a fulsome consideration of potential cumulative effects, including consideration of the ARC unit, should it be approved and under construction or operational at that time.

4. **For all federal licenses, permits, authorizations, approvals, and/or financial assistance that has or may be provided for the Project, describe any anticipated adverse direct or incidental effects (including changes to health, social and economic conditions) that may occur as a result.**
   - Please refer to Tables 1 and 2.

5. **What steps have you taken to consult with the public? What steps do you plan to undertake during all phases of the Project?**
   - We have developed a public engagement strategy with the primary goal to ensure information related to the health, safety, and security of the persons and environment, the potential benefits in terms of economy and climate change action, as well as any other topics associated with SMRs are effectively communicated to Indigenous rights-holders and public stakeholders.

   Our Engagement Strategy and Plan has five phases to support the development of an Advanced Nuclear Program in New Brunswick:

   - Phase 1 – Pre-Project Engagement
   - Phase 2 – Pre-Licensing
   - Phase 3 – During Licensing Process and EA
   - Phase 4 – During Project Implementation
   - Phase 5 – Post Project Engagement

   Currently, we are in Phase 1 of this plan.

   We recognize that each group with an interest in a potential advanced SMR project requires and expects different types of information and those expectations must be met in varying ways. We aim to fully understand each right-holder's and stakeholder's stated purposes, as well as their interests, concerns, information needs, and expectations of involvement in decision-making. We also consider the communication and engagement techniques best suited to each person or group. We then incorporate the lessons we learn into our overall strategy, which we will improve on as engagement activities evolve.

Some examples of specific activities that are currently underway are:

- Providing information to the general public about advanced SMRs through various accessible channels, including our company websites, social media, print materials, in-person events, and virtual presentations
- Engaging with local communities near the Point Lepreau Nuclear Generating Station through presentations at Community Liaison Committee meetings and company booths at open houses
- Partnership with the New Brunswick Department of Education's Centre of Excellence for Energy to facilitate learning opportunities for youth and educators, including presentations, classroom visits, and plant tours
- Partnerships with post-secondary education institutions for nuclear engineering research and development and program and skills development
- Exploring partnership and mentorship opportunities between existing and new suppliers to advance the advanced SMR sector.

We track public concerns related to advanced SMRs through the media, surveys, and direct correspondence. Primary concerns relate to safety, waste management, and cost. We strive to ensure our communications with the public address these concerns and provide information to demonstrate that the advanced reactor designs that we are developing in the province will address these issues.

6. **Are you aware of any public concerns in relation to the project? If yes, provide an overview of the key issues and the way in which (in general terms) you intend to address these issues.**
   - In addition to positive public feedback, NB Power is aware of public concerns as identified in interventions from recent re-licensing activities for PLNGS, community engagement, Indigenous engagement and the CRED-NB submission to request designation.

7. **Do you have any other comments in relation to environmental effects or impacts to the public or Indigenous peoples and how you intend to address and manage those?**
   - The project will displace electricity currently generated by the Belledune coal fired generating station in New Brunswick and will significantly reduce related green-house gas emissions. This in turn will assist New Brunswick and Canada to meet the national net-zero target by 2050.

8. **Explain your views on whether the Project should be designated under the IAA.**
   - The future NBP commercial demonstration ARC unit should not be designated under the IAA for the following reasons.
     i. The future project will be below the threshold for initiation as described on the project list section 27-29 of the Act
     ii. The project will not be on federal land
     iii. The ARC SMR technology is not new, this technology was successfully operated in Argonne National Lab from 1965 to 1994, a 20 Mwe (62 Mwt) experimental breeder reactor that has been upscaled to the ARC-100.

iv. We will be addressing federal environmental requirements in provincial jurisdiction (as guided by IAAC's TISG template) with the CNSCs involvement, and through consultation and permitting with federal authorities, as required. This will include consideration of potential impact to Indigenous rights and other impacts that may occur as a result of changes to the environment.

If you require additional information, please contact Rick Gauthier, Licensing Manager, Advanced Reactor Development Program at 506-651-3286 or rgauthier@nbpower.com.

Sincerely,

Rick Gauthier
Advanced Reactor Development Licensing Manager
NB Power

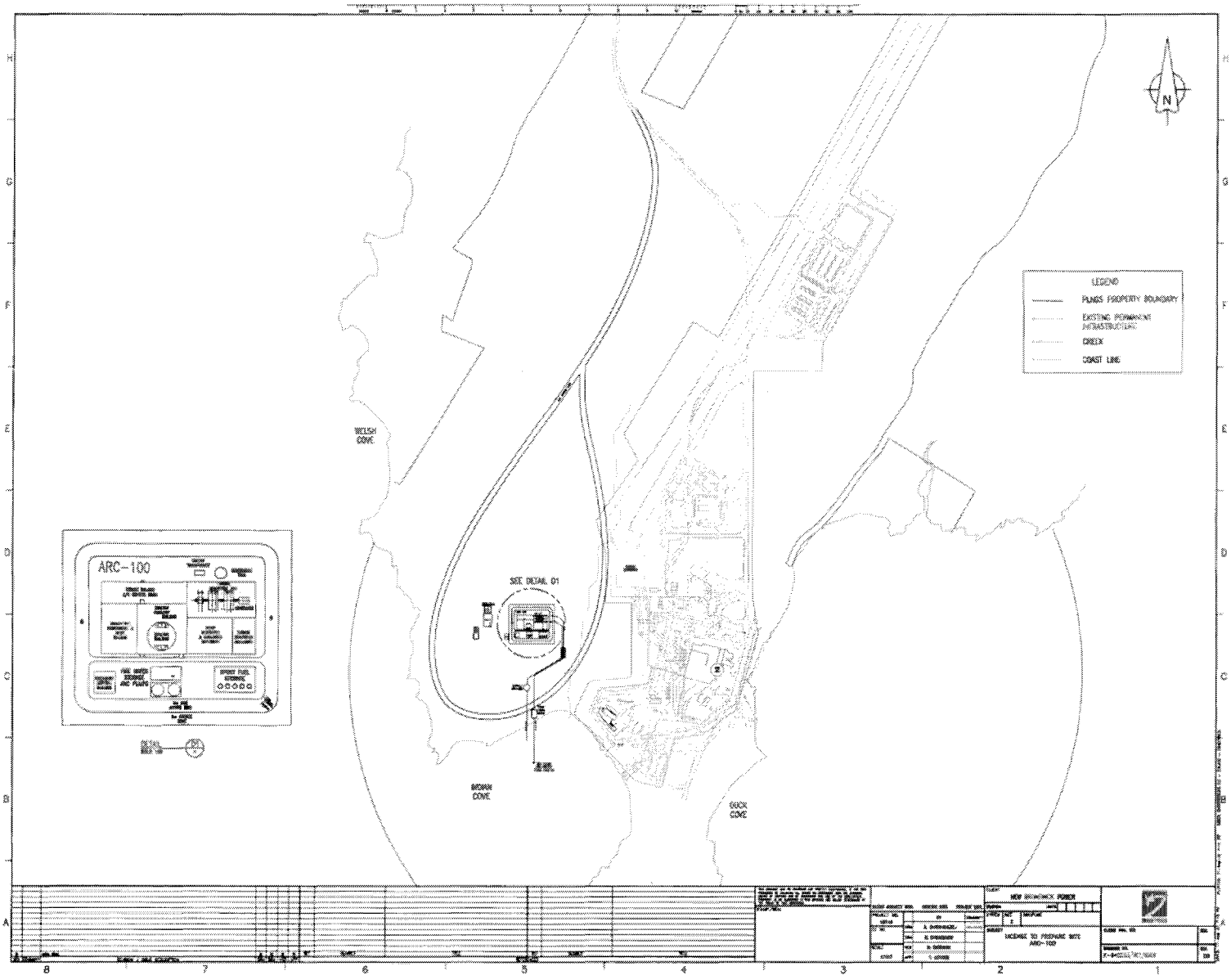
AH/RG/rg

cc: C. Harris, A. Hayward, A. McGathey (NB Power)
J. Adams, K. Katahwa, B. Belland, E. Primeau, (Impact Assessment Agency of Canada)
Sean Belyea (Canadian Nuclear Safety Commission)

References:
1. Letter: to Mr. Rick Gauthier from Mr. Joseph Vigder "Designation Request for the Small Modular Reactor Demonstration Project, New Brunswick", 2022-08-10.

Attachments:
1. Map of the ARC-100 Facility

s.19(1)


LEGEND
PLANTS PROPERTY BOUNDARY
EXISTING PERMANENT INFRASTRUCTURE
CREEK
COAST LINE
N
WELSH COVE
BROWN COVE
DUCK COVE
SEE DETAIL 01
ARC-100

From:	Peta Fussell
To:	Josh Jenkins
Cc:	Laura DeLong; Patrick Lacroix; Luke Bulmer;
Subject:	OCNI - new CEO contacted the Minister
Attachments:	Ministerial Reply - OCNI.dotx
Sent:	11/10/2022 3:01:10 PM

Hi Josh,
Heads up that the new CEO of OCNI reached out to the Minister to introduce himself. The ACE Office drafted a response which I just rewrote (see attached) and named you as a contact. I hope that's okay.
CC-ing Luke as they are a client of ours.
Thanks,
Peta

From: Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Sent: Thursday, November 10, 2022 1:13 PM
To: Peta Fussell <Peta.Fussell@ACOA-APECA.GC.CA>
Subject: Can you review and let me know your thoughts.
Peta: Blake asked for input on a letter – see my suggestions below.
I'm curious who from NB should be listed as a contact – Josh Jenkins?
Laura
**

Thanks for reaching out Blake – the note looks good. I've added some information highlighted in yellow for your consideration:
Thank you for ~~for~~ your recent letter.
Canada is a leader in nuclear energy and nuclear safety and has one of the world's most promising domestic markets for the safe and responsible development of nuclear energy. In particular, Small Module Reactors (SMR) have the potential to provide strong economic benefits to the Canadian economy and support Canada's efforts to achieve net-zero greenhouse gas emissions by 2050.
In particular, the ACOA NB regional office, based in Fredericton, is working to advance stream 2 of the Pan-Canadian SMR approach. Stream 2 is Generation IV Grid sized SMR technology. The advanced SMRs are being developed for use in Canada and internationally and parties are working towards establishing New Brunswick as the hub for supply chain and technical support. In New Brunswick's case, ARC and Moltex are developing complementary technologies and each of their designs offers passive, inherent safety features with both reactors, in different ways, contributing to addressing used nuclear fuel.
Collaboration continues amongst and between the federal and provincial governments, utility and academia. NB Power is also in active consultations with First Nations communities to discuss the potential and opportunities of this SMR technology cluster.
Best wishes in this endeavor and I encourage you to touch base with my staff in the region.
Yours sincerely,

From: Blake Mann <Blake.Mann@ACOA-APECA.GC.CA>
Sent: Thursday, November 10, 2022 10:13 AM
To: Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Subject: FW: DARRT Assigned: DT613685 - Reply - MIN PRES - CORR MIN PRES (by Christine Maillet) / SSDI assignée : DT613685 - Répondre - MIN PRES - CORR MIN PRES (par Christine Maillet)

Hi Laura,

This is pretty standard stuff, Iwanted to copy you as an fyi buy also have a quick read for any comments.

- Is the wording on SMR ok?
- Should we provide a contact at ACOA NB?
- If so, who?

My proposed answer, some wording taken from last SMR press release in Ontario last week.

Thank you for for your recent letter.

Canada is a leader in nuclear energy and nuclear safety and has one of the world's most promising domestic markets for the safe and responsible development of nuclear energy. In particular, Small Module Reactors (SMR) have the potential to provide strong economic benefits to the Canadian economy and support Canada's efforts to achieve net-zero greenhouse gas emissions by 2050.

In particular, the ACOA NB regional office, based in Fredericton, is working to build capacity in the region on SMR technology as they collaborate with our local provincial government, utility and academia.

Best wishes in this endevour and I encourage you to touch base with my staff in the region.

Yours sincerely,

Thanks.

Blake

Blake Mann, BSc. MBA
Senior Industry Development Officer, Atlantic Canada Energy Office
Atlantic Canada Opportunities Agency | Government of Canada
blake.mann@acoa-apeca.gc.ca / Tel: 902-499-3161 / TTY: 1-877-456-6500

Agent principal du développement industriel, Office de l'énergie de l'Atlantique
Agence de promotion économique du Canada atlantique / Gouvernement du Canada
blake.mann@acoa-apeca.gc.ca / Tél. : 902-499-3161 / ATS: 1-877-456-6500

From: Cheryl Powell <Cheryl.Powell@ACOA-APECA.GC.CA>
Sent: Wednesday, November 9, 2022 3:56 PM
To: Blake Mann <Blake.Mann@ACOA-APECA.GC.CA>
Subject: FW: DARRT Assigned: DT613685 - Reply - MIN PRES - CORR MIN PRES (by Christine Maillet) / SSDI assignée : DT613685 - Répondre - MIN PRES - CORR MIN PRES (par Christine Maillet)

Hi Blake,

We have received the DARRT below to respond to correspondence to the Minister. Attached is the incoming letter and the template for the response. Due date is November 16.

Thanks

Cheryl

Hi Nick, please find two notes with the attached caveats.

From:	Patrick Lacroix
To:	Nicholas Charney
Cc:	Lynn Adams; Kalie Hatt-Kilburn; Laura DeLong; Peta Fussell;
Subject:	Fwd: SMR latest briefing note
Attachments:	Backgrounder-SMRs (Jan 2022).docx;Backgrounder - SMR Implications for NB - DT613093.docx;
Sent:	12/2/2022 5:27:39 PM

We could update with more time.

Sent from my iPhone

Begin forwarded message:

> **From:** Laura DeLong
> **Date:** December 2, 2022 at 4:08:30 PM AST
> **To:** Patrick Lacroix , Peta Fussell
> **Cc:** Kalie Hatt-Kilburn
> **Subject: RE: SMR latest briefing note**

Patrick: If time is of the essence, I have two SMR notes that were previously prepared.

1. Dated October 2022 and speaks to the creation of the Energy Secretariat and forthcoming (at the time) announcement at Darlington
2. Dated January 2022 and is a general SMR backgrounder.

Both are attached. Are you sure they don't want updated bullets? Both of these documents are outdated.

I can pull that together if/as needed to highlight the OCNI and UNB CNER (Phase II) projects, the announcement last week by ONB re: Kinectrics Inc. office in Saint John and other more recent info....?

Laura

From: Patrick Lacroix
Sent: Friday, December 2, 2022 3:43 PM
To: Peta Fussell ; Laura DeLong
Cc: Kalie Hatt-Kilburn
Subject: SMR latest briefing note

Hi Peta, Laura,

Nick is looking, for the Chief of Staff, the latest briefing note on SMR, he does not want us to recreate anything new. Timeliness is more important. What do we have on hand?

Patrick

Patrick Lacroix
Director General
Policy, Planning, Advocacy, Coordination and Communication
New Brunswick Regional Office
Atlantic Canada Opportunities Agency (ACOA) / Government of Canada
Patrick.Lacroix@acoa-apeca.gc.ca Mobile: 506-478-1237 / TTY: 7-1-1
Patrick Lacroix
Directeur général
Politiques, planification, défense des intérêts, coordination et communication
Bureau régional du Nouveau-Brunswick
Agence de promotion économique du Canada atlantique (APECA) / Gouvernement du Canada
Patrick.Lacroix@acoa-apeca.gc.ca Mobile: 506-478-1237 / ATS: 7-1-1

Pages 833 to / à 834

are withheld pursuant to sections

sont retenues en vertu des articles

20(1)(b), 20(1)(c), 20(1)(d), 21(1)(b)

of the Access to Information Act

de la Loi sur l'accès à l'information

Pages 835 to / à 836

are withheld pursuant to sections

sont retenues en vertu des articles

20(1)(a), 20(1)(b), 20(1)(c), 20(1)(d)

of the Access to Information Act

de la Loi sur l'accès à l'information

From:	Kalie Hatt-Kilburn
To:	Laura DeLong
Cc:	Patrick Lacroix; Josh Jenkins;
Subject:	FW: NEW TASKING: Updating SMR Briefing Note
Attachments:	ARC Q3 2022 Investor Update (Oct 11, 2022).pdf;ARC Clean Technology Introductory Presentation (October 2022).pdf;Backgrounder-SMRs (Jan 2022).docx;Backgrounder - SMR implications for NB - DT613093.docx;
Sent:	1/11/2023 1:20:57 PM

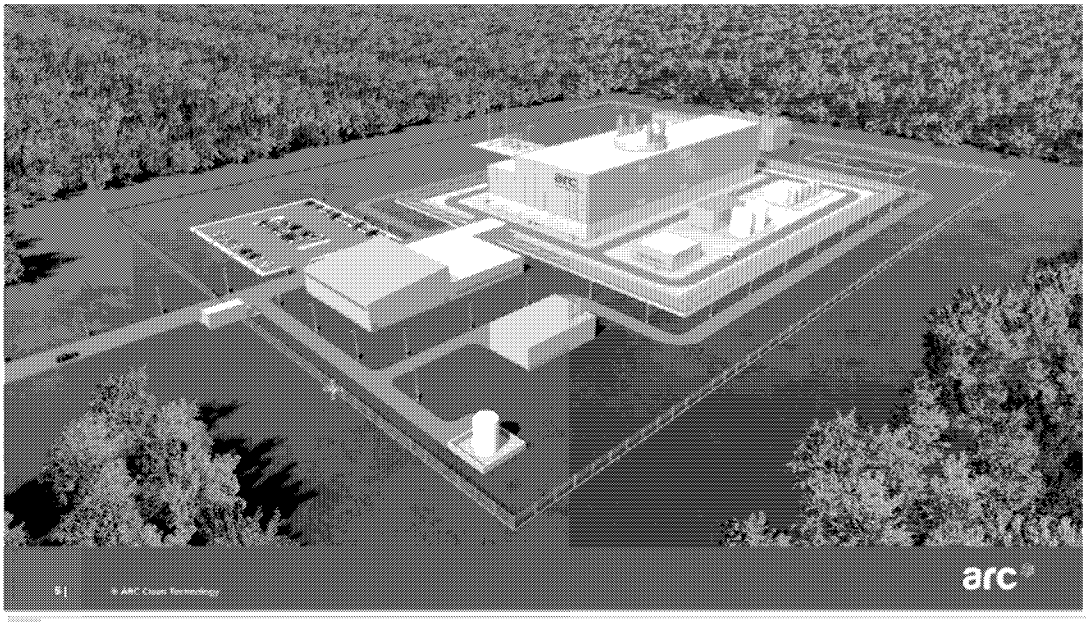
Hi Laura,
In working on this updated version, I thought I'd share a few updates with you from my recent discussions with NBP & ARC:

-
-
-
-
- Last I heard from Lynn Adams is that the tax credit is being led by Finance Canada and no details were yet available. It was announced that it would come into effect just after this coming budget.
-

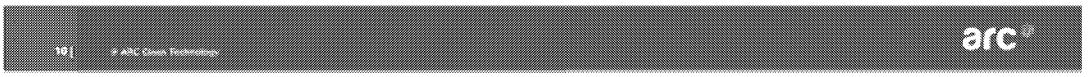
Kalie

s.20(1)(b)

s.21(1)(b)



Technology Development Timeline



From: Nicholas Charney Nicholas.Charney@prosp.apeca.gc.ca
Sent: Wednesday, January 11, 2023 11:33 AM
To: Marc LeBlanc Marc.LeBlanc@ACOA-APECA.GC.CA
Cc: Rose Croteau ; Angele Bastarache ; Kalie Hatt-Kilburn ; Patrick Lacroix ; Andrew Noseworthy ; Lynn Adams ; Christopher Haley
Subject: NEW TASKING: Updating SMR Briefing Note
Hi Marc – back in December Guy requested whatever we had off the shelf for SMRs. I provided him with the two attached notes. He just asked for an updated note on SMRs in Atlantic Canada, indicating that Minister Wilkinson had discussed it at a recent Ec Dev meeting. Ideally it would come by COB Friday as Guy would like to review it prior to the retreat in Ottawa on Jan 16th. Apologies for the short notice, copying those who helped me out previously on this. Thanks!

From: Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>
Sent: Friday, December 2, 2022 4:28 PM
To: Nicholas Charney <Nicholas.Charney@prosp.apeca.gc.ca>
Cc: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>; Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>; Peta Fussell <Peta.Fussell@ACOA-APECA.GC.CA>
Subject: Fwd: SMR latest briefing note
Hi Nick, please find two notes with the attached caveats.
We could update with more time.

Sent from my iPhone

s.20(1)(a)

s.20(1)(b)

s.20(1)(c)

Begin forwarded message:

From: Laura DeLong <Laura.DeLong@acoa-apeca.gc.ca>
Date: December 2, 2022 at 4:08:30 PM AST
To: Patrick Lacroix <Patrick.Lacroix@acoa-apeca.gc.ca>, Peta Fussell <Peta.Fussell@acoa-apeca.gc.ca>
Cc: Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@acoa-apeca.gc.ca>
Subject: RE: SMR latest briefing note

Patrick: If time is of the essence, I have two SMR notes that were previously prepared.

1. Dated October 2022 and speaks to the creation of the Energy Secretariat and forthcoming (at the time) announcement at Darlington
2. Dated January 2022 and is a general SMR backgrounder.

Both are attached. Are you sure they don't want updated bullets? Both of these documents are outdated.
I can pull that together if/as needed to highlight the OCNI and UNB CNER (Phase II) projects, the announcement last week by ONB re: Kinectrics Inc. office in Saint John and other more recent info….?
Laura

From: Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>
Sent: Friday, December 2, 2022 3:43 PM
To: Peta Fussell <Peta.Fussell@ACOA-APECA.GC.CA>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Cc: Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>
Subject: SMR latest briefing note
Hi Peta. Laura,
Nick is looking, for the Chief of Staff, the latest briefing note on SMR, he does not want us to recreate anything new. Timeliness is more important.
What do we have on hand?
Patrick
Patrick Lacroix
Director General
Policy, Planning, Advocacy, Coordination and Communication
New Brunswick Regional Office
Atlantic Canada Opportunities Agency (ACOA) / Government of Canada
Patrick.Lacroix@acoa-apeca.gc.ca Mobile: 506-478-1237 / TTY: 7-1-1
Patrick Lacroix
Directeur général
Politiques, planification, défense des intérêts, coordination et communication
Bureau régional du Nouveau-Brunswick
Agence de promotion économique du Canada atlantique (APECA) / Gouvernement du Canada
Patrick.Lacroix@acoa-apeca.gc.ca Mobile: 506-478-1237 / ATS: 7-1-1

From:	Laura DeLong
To:	Peta Fussell; Patrick Lacroix;
Subject:	FW: Advocacy Issues (draft) and engagement with NRCan / ISED on SMRs
Attachments:	SMRs - March 01 2023 (v2) .docx
Sent:	3/15/2023 3:49:00 PM

Just an FYI as we continue to work with our Ottawa colleagues on this…
L

From: Laura DeLong
Sent: Wednesday, March 15, 2023 3:49 PM
To: Siddhartha Mookerjea ; Carolee Sandell
Cc: Josh Jenkins ; Nathalie Cavanaugh
Subject: Advocacy Issues (draft) and engagement with NRCan / ISED on SMRs
Siddhartha, Carolee:
During our quick touch base today (Josh, Sid and myself), it was agreed that it will be important to reconnect on this issue in early April with a goal of:

- Understanding what the Federal Budget may contain as it relates to SMRs and how that may have an impact, also to review who may be 'leading' on possible response to US IRA, etc.
- Seeking the assistance of the Ottawa ACOA to help ACOA NB strategize about who from ISED and NRCan Kalie would need to connect with to 'ground truth' some of what we are hearing.
- Incorporating feedback from Ottawa office (and other Fed. Departments) to 'round-out' our note

A **draft of this information note highlighting key advocacy items important to advance SMR development and deployment in New Brunswick is attached. Please be advised that it is *a working document*.**
In the meantime, I am happy to discuss anything in the note.
Thanks again for your assistance.
Laura

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Thursday, March 2, 2023 11:20 AM
To: Lucy Falastein <Lucy.Falastein@ACOA-APECA.GC.CA>
Cc: Siddhartha Mookerjea <Siddhartha.Mookerjea@ACOA-APECA.GC.CA>; Carolee Sandell <Carolee.Sandell@ACOA-APECA.GC.CA>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>; Nathalie Cavanaugh <Nathalie.Cavanaugh@ACOA-APECA.GC.CA>
Subject: RE: engagement with NRCan / ISED on SMRs
Excellent – thanks!
Siddhartha / Carolee / Laura – I'll send out a meeting invite shortly
Josh

From: Lucy Falastein <Lucy.Falastein@ACOA-APECA.GC.CA>
Sent: Thursday, March 2, 2023 11:00 AM

To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Subject: RE: engagement with NRCan / ISED on SMRs
Hi Josh!
So great to hear from you, it's been way too long!
Siddhartha and Carolee Sandell on my team will be your best contacts on navigating the file. Sidd knows who to reach out to ISED and Carolee can do the same for NRCan.
Hope you're doing well.
Lucy

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Thursday, March 2, 2023 9:57 AM
To: Lucy Falastein <Lucy.Falastein@ACOA-APECA.GC.CA>
Subject: engagement with NRCan / ISED on SMRs
Hi Lucy,
Long time... hope this finds you well!
Kalie would like to prepare Catherine to engage with her colleagues at NRCan and ISED on SMRs, and we've been preparing some briefing materials to that end. Part of our work has been to solicit input from stakeholders here in NB (e.g. ARC, Moltex, NB Power, etc), and it's been helpful to get their perspectives on the issues at play.
Before sharing with Catherine, Kalie wants to validate (or maybe "ground truth" is a better word) some of these points with ISED and NRCan, in order to properly represent their perspective in our briefing.
I'd really like to work with your team to put together a plan – who to meet with, when, what do we know about their thinking/priorities, etc? Wondering who you'd like us to work with? Have worked with Siddhartha in the past on nuclear issues – just fyi.
Let me know what you think – thanks! Would like to set up a call next week if that works...

Josh Jenkins
Director, Innovation, Trade & Business Growth
Atlantic Canada Opportunities Agency / Government of Canada
Josh.Jenkins@canada.ca / Tel: 506-851-3626/ Cell: 506-227-9520 / TTY:1-877-456-6500
Directeur, Innovation, commerce et croissance des entreprises
Agence de promotion économique du Canada atlantique / Gouvernement du Canada
Josh.Jenkins@canada.ca / Tél: 506-851-3626/ Cell: 506-227-9520 / ATS:1-877-456-6500

From:

To: Laura DeLong

Subject: Re: SMR briefing paper for Catherine

Attachments:

Sent: 2/9/2023 10:32:01 PM

---

s.19(1)

s.20(1)(b)

s.21(1)(b)

Laura,
Great speaking with you today, thank you for the call and I hope you'll rest up at least for the next few days and not get into the attached until you're feeling all better.
When you feel like taking a look, the 2 attached files provide a bit more depth on some of the topics we spoke about.
If you're still under the weather on Monday, feel free to reschedule our next call.
Regards,

Vice President, Corporate Development

moltexenergy.com
Connect with me on Linkedin

moltex
clean energy

Moltex Energy
75 Prince William Street • Unit 102 • Saint John • New Brunswick • Canada • E2L 2B2
+1 506 214 8551 • info@moltexenergy.com • **www.moltexenergy.com**

From: Laura DeLong
Date: Thursday, February 9, 2023 at 4:51 PM
To:
Subject: Accepted: SMR briefing paper for Catherine

s.19(1)

moltex
clean energy

Pages 845 to / à 846

are withheld pursuant to sections

sont retenues en vertu des articles

20(1)(a), 20(1)(b), 20(1)(c), 20(1)(d)

of the Access to Information Act

de la Loi sur l'accès à l'information

Page 847

is withheld pursuant to sections

est retenue en vertu des articles

19(1), 20(1)(a), 20(1)(b), 20(1)(c), 20(1)(d)

of the Access to Information Act

de la Loi sur l'accès à l'information

moltex
clean energy

Pages 849 to / à 850

are withheld pursuant to sections

sont retenues en vertu des articles

20(1)(a), 20(1)(b), 20(1)(c), 20(1)(d)

of the Access to Information Act

de la Loi sur l'accès à l'information

Page 851

is withheld pursuant to sections

est retenue en vertu des articles

19(1), 20(1)(a), 20(1)(b), 20(1)(c), 20(1)(d)

of the Access to Information Act

de la Loi sur l'accès à l'information

From:	Laura DeLong
To:	Patrick Lacroix; Peta Fussell;
Cc:	Laura DeLong
Subject:	Updated Information Note on SMR Advocay for your Review/Approval
Attachments:	FW: NEW TASKING: Updating SMR Briefing Note
Sent:	2/10/2023 10:39:54 AM

Patrick/Peta:
An updated information note which now includes new information and context following my conversation with Moltex yesterday can be found here for your review and approval.
Information Note SMR advocacy
Can I assume that once approved, one of you will route this to Kalie for her review? My hope was to have it to her by COB today.
Two things to note:

Happy to discuss if/as required. I have another call with the VP at Moltex on Monday to discuss a number of documents he sent me following our chat yesterday. Happy to have either one of you (or both!) join that if you'd like.
Laura

s.19(1)

s.21(1)(b)

INFORMATION NOTE

Security classification N/A
Reference No. DT
Prepared by Laura DeLong
Date submitted February 10, 2023

Subject: New Brunswick (NB) Small Modular Reactors (SMR) Items for Advocacy

Purpose: The purpose of this information note is to highlight key advocacy items important to New Brunswick SMR development and deployment.

Overview:

- SMR projects will support Canada's goals of phasing out coal by 2030, becoming carbon net zero by 2050 and providing affordable clean energy to remote communities.
- SMR projects will create a new sub-category of nuclear industrial activity that would see Canada well placed to be a major player in the global deployment of SMR technologies.
- There are three different streams of SMR, each serving a different purpose: stream 1 for on grid electricity, stream 2 for on grid electricity and industrial decarbonization, and stream 3 for very small off grid application like remote communities
- Without **regulatory clarity and certainty**, the process for SMR development and deployment becomes more time-consuming and expensive, even though new reactor designs are simpler and inherently safer.
- Government partnership and **funding** is essential. The cost associated with being the first of a kind (FOAK) is large and private investment in advanced SMR technology is not enough.
- The federal government, given its jurisdiction over nuclear energy and issues deemed to be in the national interest, can play a leadership role in enabling SMRs in Canada.
    - It can help de-risk demonstration and first-commercial projects by providing clear signals of support, or through policy levers and programs.
    - It can ensure that the federal legislative, regulatory, and policy framework is sound and ready for SMR deployment, while working with bilateral and multilateral partners to align international engagement and cooperation with Canadian priorities on SMRs.
    - The federal government can also support and enable SMR research and development work to help advance designs through demonstration to commercial deployment stages.
    - Help set the stage for Canada to compete in international energy markets

New Brunswick Snapshot:

- New Brunswick is currently home to the development of two stream 2 reactor designs undertaken by ARC and Moltex.
- Both are considered "Generation IV" reactors (See Appendix A) which are attractive to the market because they have more inherent safety features than earlier versions, effectively mitigating the risk of a thermal nuclear incident and produce high temperature heat which is favorable for industrial decarbonization
  - **ARC Clean Energy** is developing an advanced Generation IV SMR, the ARC-100, a 100 MW liquid sodium-cooled fast reactor which is expected to be operational by 2029. The reactor is based on the technology of the EBR-II fast-reactor at the Argonne National Laboratory in Lemont, Illinois, which operated for 30 years.
  - **Moltex Energy** is developing a 300 MW Stable Salt Reactor-Wasteburner. It is also developing technology to recycle used CANDU fuel at the Point Lepreau Nuclear Generating Station, lowering the amount of nuclear waste that will need long-term storage. Both the reactor and spent fuel recovery system are expected to be operational by the early 2030s.

Key Advocacy Issue: Importance of Regulatory Clarity and Certainty

NB Specific Issues for Advocacy:

- Timely progress toward key milestones and regulatory decisions is important to keep SMR development and deployment on track.
- Timely, evidence-based regulatory decisions are required. SMRs are smaller and simpler than traditional nuclear, with enhanced safety features, so it is important not to overwhelm the process with disproportionate legislative or regulatory requirements.
- In order to stay competitive with other countries, NBP has expressed a general concern regarding the length of time the current Impact Assessment requires. NBP will attend a session in Ottawa surrounding the events of CNA 2023 this Feb. 22-24 to voice their concerns as part of an industry lobby effort stressing timelines for review are an important issue.
- The nuclear sector in Canada has voiced its opinion that the Impact Assessment (IA) must be restructured to ≤ 3 years.
  - Moltex has reiterated that it is their view that the current IA process is not compatible with the current decarbonization timelines for Canada.
  - ARC has also indicated that in order to meet market demands and stay competitive with international competition timelines for fleet deployment need to be optimized

Background

- In 2020 the Government of Canada released a document entitled *A Call to Action: A Canadian Roadmap for Small Modular Reactors* where the importance of regulatory clarity and certainty is highlighted as a key issue.
- An interprovincial MOU between Ontario, New Brunswick, Saskatchewan and Alberta was signed to promote the development and deployment of SMR technology and included a feasibility report and strategic deployment plan.
- A *Regulatory Readiness Working Group* made up of experts from across Canada was tasked with a mandate of identifying barriers and challenges to the deployment of SMRs under

current regulatory regime. Key activities of this working group included a comprehensive review of federal, provincial, and territorial legislation and regulations for SMR readiness; an analysis of the current Canadian regulatory regime for SMR deployment, and the identification of gaps in regulatory regime, and proposed way forward.

The Regulatory Readiness Working Group, released the following key findings:

- Canada's enabling framework is sound. Existing regulatory and legislative processes are ready for SMR deployment in Canada, although some refinements would improve efficiencies.
- On Canada's nuclear liability framework, the existing legislation is sound and current regulations assign liability limits to existing Canadian nuclear facilities based on the concepts of a graded approach, commensurate with risk. It is anticipated that some revisions to the regulations under the *Nuclear Liability and Compensation Act* will be required in order to apply these same concepts to small power reactors, thereby acknowledging the small size and low inherent risk of many SMR designs.
- On nuclear security, the current regulations would require SMRs to incorporate security infrastructure comparable to today's operating full scale nuclear power plants. Industry stakeholders and the Canadian Nuclear Safety Commission (CNSC) are engaged in discussions about potential changes to these regulations to take a graded approach, commensurate with size and risk, while continuing to ensure appropriate security coverage is maintained. (See Appendix B)
- Some additional refinements have been identified which would improve efficiencies in some existing regulatory control areas such as staff training and emergency response. Due to the consultation already undertaken to date by CNSC on the regulatory framework for SMRs, both industry and the CNSC are aware of and understand these refinement opportunities and are confident they can be resolved. This confidence is based on past experience whereby similar technical regulatory issues have been satisfactorily resolved in the past.

NB Specific Issues for Advocacy:

- Timely progress toward key milestones and regulatory decisions is important to keep SMR development and deployment on track.
- Timely, evidence-based regulatory decisions are required. SMRs are smaller and simpler than traditional nuclear, with enhanced safety features, so it is important not to overwhelm the process with disproportionate legislative or regulatory requirements.
- In order to stay competitive with other countries, NBP has expressed a general concern regarding the length of time the current Impact Assessment requires. NBP will attend a session in Ottawa surrounding the events of CNA 2023 this Feb. 22-24 to voice their concerns as part of an industry lobby effort stressing timelines for review are an important issue.
- The nuclear sector in Canada has voiced its opinion that the Impact Assessment (IA) must be restructured to ≤ 3 years.
    - Moltex has reiterated that it is their view that the current IA process is not compatible with the current decarbonization timelines for Canada.
    - ARC has also indicated that in order to meet market demands and stay competitive with international competition timelines for fleet deployment need to be optimized

Key Advocacy Issue: Funding

NB Specific Issues for Advocacy

Targeted advocacy strategies and focus in the short-term:

- Clean Electricity Fund (NRCan) 1

- Access to the CIB's Accelerator Fund

- A better understanding of how NBP can leverage the Canada Growth Fund (CGF).
- Clarity around the 30% investment tax credit as it could impact the work underway to establish an owner/operator consortium for the FOAK reactor.
- Ongoing support for First Nations capacity-building in New Brunswick.

New Brunswick Power (NBP)

- NBP has identified the need for assistance with advocacy on funding with respect to access to:
  1. Low interest loans
  2. Tax Credits, including access to equivalent to tax credits for crown corporations
  3. Federal grants to offset the extra cost and financial risk of initial deployments, similar to the programs in other countries (like the Inflation Reduction Act in the US)

ARC

-
  - ○

- ARC has also expressed an interested in better understanding the recent budget announcement of a 30% investment tax credit and are eager to understand how this will be applied as it may impact the success of their series B round.
- Given the interest coming from utilities in a number of jurisdictions for the development of ARC's reactor technology,

Moltex

s.20(1)(b)
s.21(1)(a)
s.21(1)(b)
s.21(1)(c)

-

- As currently drafted, Moltex has advised that the proposed Investment Tax Credit for Clean Technologies are insufficient to provide the needed stimulus to the sector, create strong investor confidence, and competitively attract private sector investment dollars and talent to meet Canada's decarbonization timelines.
  - In a recent conversation with an ACOA official, Moltex indicated that they consider the following amendment essential:
    -

Context

- An important part of SMR project feasibility is cost and risk-sharing. Securing support from the federal government in a timely manner is essential to continue progress on the SMR file.
- The release of the SMR Action Plan heightened expectations for federal funding to support SMR development among provincial and territorial governments, Indigenous people, organized labour, utilities, industry, innovators, academia and civil society.

Position of ACOA

- ACOA plays an important role bringing Atlantic Canada perspective to decision making.
- The Agency continues to advocate that investment in new clean energy technologies is essential to achieving decarbonization—which is essential for our country and region's climate goals. SMR development and deployment is a strategic advocacy priority for New Brunswick and the Atlantic Region – of which regulatory clarity and certainty, alongside funding are key issues.
- The magnitude of the investments required necessitates coordination with and funding from other federal departments to achieve the development and deployment of SMRs across Canada.

s.20(1)(b)
s.20(1)(d)
s.21(1)(a)
s.21(1)(b)
s.21(1)(c)

Appendix A: Context within New Brunswick

- New Brunswick is part of the pan-Canadian SMR Action Plan initiative, under the leadership of Natural Resources Canada
- Launched in 2020, Canada's SMR Action Plan seeks to advance the safe and responsible development and deployment of SMRs through a pan-Canadian approach in partnership with provincial and territorial governments, Indigenous Peoples, organized labour, utilities, industry, innovators, academia and civil society.
- The focus for New Brunswick is on Stream 2 - *which* involves two 4th generation, advanced small modular reactor designs that will be developed in New Brunswick through the construction of demonstration units at the Point Lepreau nuclear site in NB.
- By fostering a strong collaboration among the various research, manufacturing, federal and provincial agencies, New Brunswick will see the completion of an initial ARC Clean Energy demonstration unit by 2030, and Moltex Energy's waste recycling facility and reactor, operational by the early 2030s.
- With these timelines, New Brunswick will be supporting the additional clean energy needs within Atlantic Canada and with partnering jurisdictions starting in 2030.
- New Brunswick is positioned to become the leader in the development and deployment of these 4th generation technologies through its efforts, its partnerships and its support.
- These designs represent a significant opportunity for advancing domestically produced energy within Canada and around the world that is both clean and safe.
- Through ongoing support and collaborations, these advanced technologies can start being deployed as early as 2030 in support of the industrial needs in areas like Saskatchewan and Alberta, and indeed, around the globe.
- The made in New Brunswick designs represent significant economic diversification opportunities for the province and will place New Brunswick as a world leader in the deployment of 4th generation advanced SMR technologies.
- With funding from the provincial government, two developers (Moltex Energy and ARC Nuclear Canada Inc.) have opened offices in New Brunswick. Companies are developing delivery capability in New Brunswick with the promise of local economic development.
- These two designs are expected to result in new lower-cost units that recycle nuclear waste, have more inherent safety attributes and are attractive for global deployment.
- Stream 2 can create economic benefits for Canada for demonstration units in New Brunswick (2020 – 2035) of:
    - 21,870 person-years of direct and indirect employment
    - a positive impact on GDP (direct and indirect) of $2.15 billion
    - an increase of government revenue of $198 million

  with the opportunity to expand this through a fleet of both Canadian and export units to 2060 of:
    - 537,000 person-years of direct and indirect employment
    - a positive impact on GDP (direct and indirect) of $59 billion
    - an increase of government revenue of $5.2 billion

Appendix B: Role of the Canadian Nuclear Safety Commission (CNSC)

The Canadian Nuclear Safety Commission (CNSC) regulates the use of nuclear energy and materials to protect health, safety, security and the environment; to implement Canada's international commitments on the peaceful use of nuclear energy; and to disseminate objective scientific, technical and regulatory information to the public. Any proposed project to build and operate an SMR would require licensing from the CNSC.

Nuclear reactors of varying sizes and power outputs are used in Canada for a range of applications, such as research, materials testing, medical uses, and electrical power generation. The CNSC regulates activities associated with all of these applications.

The Canadian nuclear regulatory framework is comprehensive and in large part technology neutral, which means that that it allows for all types of technologies to be safely regulated. All reactor facilities, including SMRs, are classified as Class IA nuclear facilities under the Class I Nuclear Facilities Regulations. Reactor facilities include:

- nuclear power plants or small reactors for the generation of power or heat for industrial processes
- small reactors for non-power generation uses (e.g., isotope production, and research and development activities)

This means that in regulating SMRs, the CNSC can apply the same criteria used to regulate traditional reactor facilities. This will be done through a risk-informed approach, by applying resources and regulatory oversight commensurate with the risk associated with the regulated activity.

As the CNSC continues to prepare for the regulation of SMRs, it is committed to informing Canadians and potential licensees about any changes, applications, and notable updates. A vendor design review (VDR) is an optional service provided by the CNSC at the vendor's request. A VDR does not result in any decision by the Commission under the *Nuclear Safety and Control Act*. However, it allows a reactor vendor to receive preliminary CNSC staff feedback on a reactor technology.

This includes:

- whether the applicant is addressing Canadian regulatory requirements in its design and safety analysis activities
- whether the applicant is developing the necessary evidence to support the adequacy of the proposed design.

The CNSC is currently engaged in many pre-licensing vendor design reviews for SMRs.

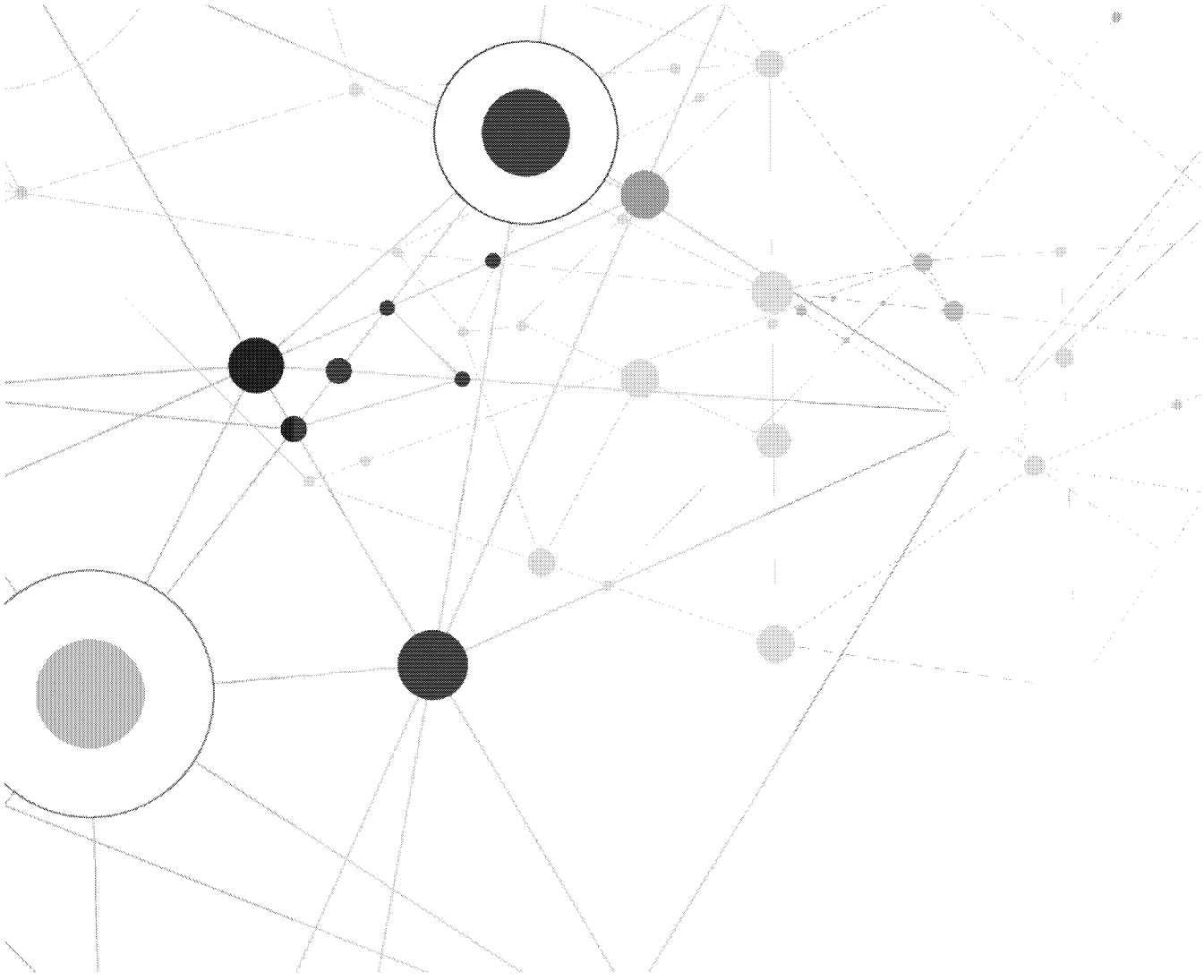
From:	Laura DeLong
To:	Kafa El Zamer; Krista Hicks;
Cc:	Josh Jenkins; Patrick Lacroix; Luke Bulmer; Peta Fussell;
Bcc:	Laura DeLong
Subject:	Deep Dive Nuclear Investment Presentation for May 1
Attachments:	Nuclear Investments May 1 2023 FINAL.pptx
Sent:	4/28/2023 10:35:00 AM

Hi Kafa/Krista:
Please find attached the presentation we intent to use for the Nuclear Investment 'deep dive' taking place on Monday, May 1st at 11am.
Looking forward to it! I hope you all have a lovely weekend!
Laura

NUCLEAR ENERGY INVESTMENTS: ADVANCED SMALL MODULAR REACTORS (SMR)

Deep Dive

May 1, 2023



NUCLEAR ENERGY INVESTMENTS AND ADVANCED SMALL MODULAR REACTORS

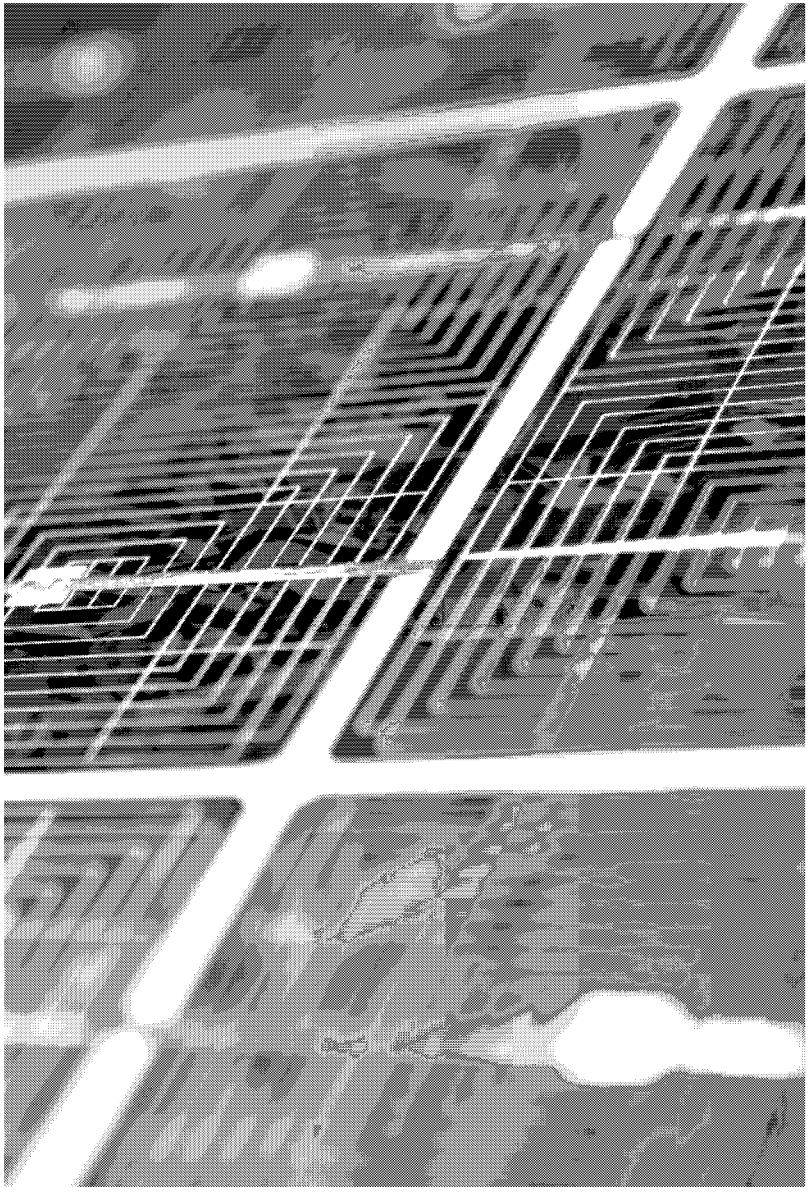
- Overview
- What are SMRs?
- Canada's SMR Action Plan
- SMR Technology in NB
- Economic Benefits
- ACOA NB Investments
- Recent Announcements
- Budget 2023
- Advocacy
- What's Next?

OVERVIEW

There is growing interest in advanced Small Modular Reactors (SMR) because of their potential to generate non-emitting, safe, reliable, and cost-effective baseload energy.

SMRs offer great flexibility for a number of uses within New Brunswick's energy mix.

New Brunswick is one of two provinces with nuclear power generation, the other province being Ontario.



WHAT ARE ADVANCED SMALL MODULAR REACTORS?

SMALL

In both size and power output compared to conventional power reactors. **They produce 1 to 300 megawatts** (MW) of electricity, compared to 600-1500 MW produced by traditional reactors.

MODULAR

Means that they are **manufactured in factories** and transported to site, capitalizing on efficiencies, lowering production related emissions, reducing assembly complexities and time, and **achieving economies of scale**.

REACTORS

Advanced SMRs (aSMR) are a **non-emitting and efficient way to generate energy;** in the form of industrial heat and electricity. aSMRs are also designed for simplified and inherent safety and proliferation resistance.

CANADA'S SMR ACTION PLAN

SMR TECHNOLOGY DEVELOPMENT IN NEW BRUNSWICK

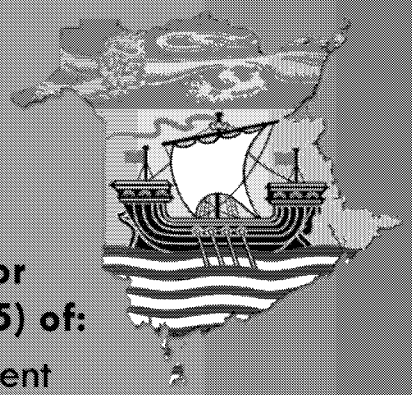
arc CLEAN TECHNOLOGY

ARC Clean Technology is developing an advanced Generation IV SMR, the ARC-100, a 100 MW liquid sodium-cooled fast reactor. The reactor is based on the technology of the EBR-II fast-reactor at the Argonne National Laboratory in Lemont, Illinois, which operated for 30 years.

moltex clean energy

Moltex Clean Energy is developing a 300 MW Stable Salt Reactor-Wasteburner. It is also developing technology to recycle used CANDU fuel at the Point Lepreau Nuclear Generating Station, lowering the amount of nuclear waste that will need long-term storage.

ECONOMIC BENEFITS



Stream 2 can create economic benefits for Canada for demonstration units in New Brunswick (2020 – 2035) of:

21,870 person-years of direct and indirect employment

a positive impact on GDP (direct and indirect) of $2.15 billion

an increase of government revenue of $198 million

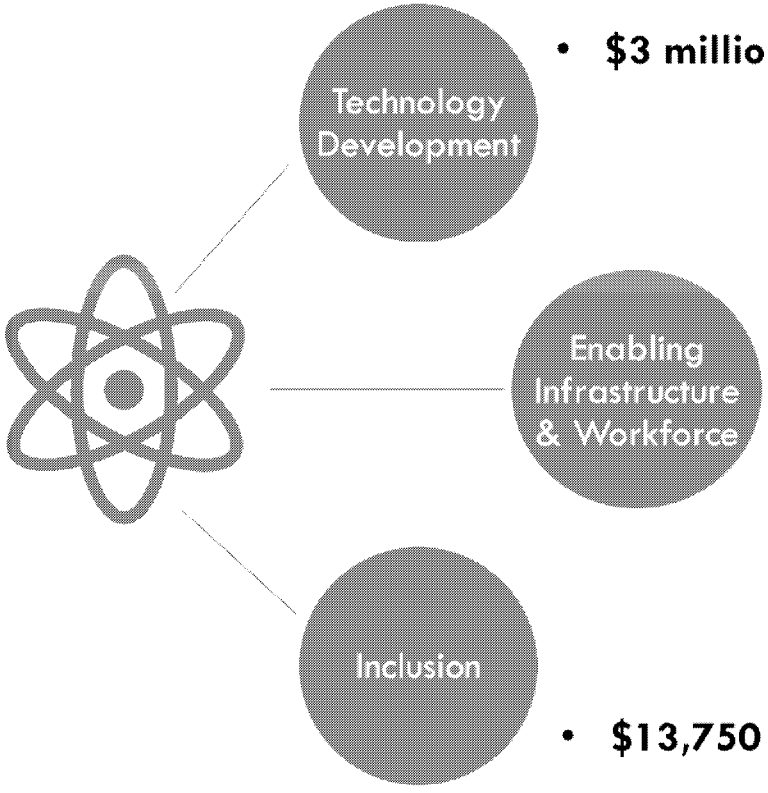
With the opportunity to expand this through a fleet, of both Canadian and export units, to 2060 of:

537,000 person-years of direct and indirect employment

a positive impact on GDP (direct and indirect) of $59 billion

an increase of government revenue of $5.2 billion

ACOA NB INVESTMENTS IN THE SMR CLUSTER



- **$3 million** – Moltex Clean Energy
- **$5 million** – NB Power
- **$2.48 million** – UNB's Centre for Nuclear Energy Research
- **$786,250** – Organization of Canadian Nuclear Industries
- **$38,225** – Atlantica Centre for Energy
- **$13,750** – North Shore Micmac District Council (NSMDC)

RECENT ANNOUCEMENTS

April 18, 2023	ARC was named as potential technology solution to advance industrial decarbonization in Saskatchewan in an interprovincial MOU between the Province of Saskatchewan and the Province of New Brunswick.
March 28, 2023	Moltex Energy announced SNC-Lavalin will take a minority ownership position to continue the development of Moltex's aSMR, SSR-W, and the WATSS waste recycling technology.
March 27, 2023	President Biden and PM Trudeau affirmed their intent to promote enhanced collaboration on nuclear energy and technology between their two countries, working together to develop a secure and reliable nuclear fuel supply of Low Enriched Uranium (LEU) for existing reactors and High Assay Low Enriched Uranium (HALEU) for advanced reactors, and to explore enabling frameworks with like-minded allies and partners.
March 23, 2023	ARC Clean Technology and Invest Alberta agreed to pursue activities to support commercialization of ARC's aSMR ARC-100 technology in Alberta.
Nov. 28, 2022	The Port of Belledune and Cross River Infrastructure Partners in New Brunswick announced that they will pursue ARC technology as an energy source for expanded hydrogen production and other industries based at the Port.

BUDGET 2023: A MADE-IN-CANADA PLAN: STRONG MIDDLE CLASS, AFFORDABLE ECONOMY, HEALTHY FUTURE

Clean Electricity Investment

a **refundable 15% tax credit** on the capital costs of investments made by non-taxable entities, such as Indigenous communities, municipally owned utilities and Crown corporations that make investments in renewable energy, energy storage

Clean Tech Manufacturing Investment

a **refundable tax credit equal to 30% of investments in machinery and equipment used to manufacture or process key clean technologies,** and extract, process, or recycle critical minerals (including nuclear energy equipment and processing or recycling of nuclear fuels).

Clean Technology Investment

a **refundable 30% tax credit** on capital cost of investments made by taxable entities in SMR, wind, solar PV and energy-storage technologies.

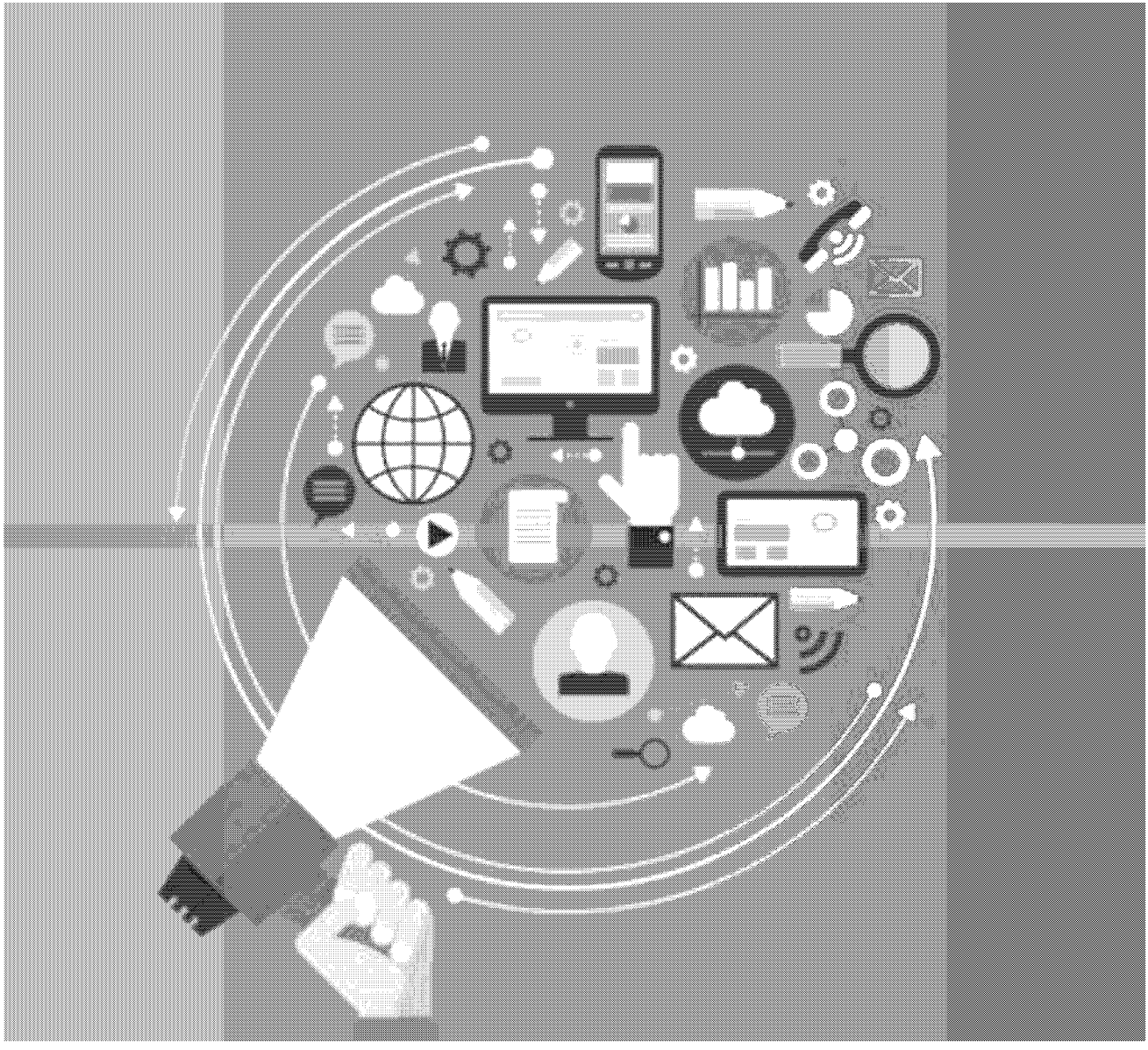
- An additional $20 billion being granted to Canada Infrastructure Bank for accelerating the energy transition, including up to $10 billion in clean power, and a further $10 billion in green infrastructure.
- Increased budget of $1.3 billion to increase efficiencies with regulatory reviews and approvals, including for the Canadian Nuclear Safety Commission, Impact Assessment Agency, and others.
- The Canada Growth Fund will partner with the Public Sector Pension Investment Board, enabling it to attract private capital to Canada's clean economy.
- Providing $500 million over ten years to the Strategic Innovation Fund, which has supported SMR projects in the past, including Moltex, Westinghouse, and Terrestrial Energy
- NR Can's Enabling Small Modular Reactors program to fund projects researching radioactive waste management and the supply chain of SMRs. NB stakeholders are preparing multiple applications to this fund as we speak.

ADVOCACY

- Importance of regulatory clarity and certainty
- Clarifying funding pathways to support SMR technology development

Other issues of importance are:

- A fuel security and waste policy that is financially viable.
- Incentives to match or surpass international competitors to counteract 'brain drain' and remain competitive.



WHAT'S NEXT FOR THE SMR CLUSTER IN NB?

- **UNB is working towards the launch of a Nuclear Engineering Degree,** spurred through ACOA NB's recent investment in CNER.

- **OCNI's Ready4SMR Supply Chain project is really ramping up,** ACOA NB can expect to assist 10-15+ SMEs with their entrance into, or expansion within, the nuclear supply chain, with activities such as QA programs & certifications, upskilling, AM adoption, etc.

- **The Canadian Nuclear Society (CNS) will be hosting it's annual conference *"Shifting the Paradigm of Thought"* in Saint John,** from June 4-7. There will be a Japanese nuclear delegation attending, and will be meeting with stakeholders, touring PLNGS, etc.

QUESTIONS?

From:	Laura DeLong
To:	Nadine Cormier
Cc:	Lynn Adams; Roger Miranda; Josh Jenkins; Luke Bulmer; Patrick Lacroix;
Subject:	RE: Moltex
Sent:	11/12/2024 9:49:50 AM

Nadine: I hope that these are helpful – happy to discuss in more detail if you'd like. Also, over the week when time permits, I will be pulling together all my notes from the trip and am happy to share those too.
Laura

**

-
-
-
-
-

- The Agency will be monitoring both the scientific outcomes, as well as the commercialization path of the company going forward (in partnership with our federal funding partners).

Timeframe

Event	Timeframe
Testing at CNL continues	Mid December
Report provided to NB Power	By December 31st
Results available publicly	Second week of January

From: Nadine Cormier
Sent: Tuesday, November 12, 2024 8:59 AM
To: Josh Jenkins
Cc: Lynn Adams ; Laura DeLong ; Roger Miranda
Subject: RE: Moltex
Thank you! Nadine
Nadine Cormier (her/elle)
Senior Policy Analyst | Analyste principal des politiques
Green Economy Policy | Politiques Economie Verte
Atlantic Canada Opportunities Agency (ACOA) | Agence de promotion économique du Canada atlantique (APECA)
506-227-3076 | nadine.cormier@acoa-apeca.gc.ca

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Thursday, November 7, 2024 4:25 PM
To: Nadine Cormier <Nadine.Cormier@ACOA-APECA.GC.CA>
Cc: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>; Roger Miranda <Roger.Miranda@acoa-apeca.gc.ca>
Subject: Re: Moltex
Great timing; Laura and I are attending the company's test of their technology at CNL tomorrow, along with colleagues from NRCan and SIF.
Should be able to get you a few bullets on the 12th
Josh

s.20(1)(b)

s.20(1)(c)

s.20(1)(d)

s.21(1)(b)

Sent from my iPhone

On Nov 7, 2024, at 1:43 PM, Nadine Cormier <Nadine.Cormier@acoa-apeca.gc.ca> wrote:

Hi Josh
Hope you are well.
I have been tasked with preparing a meeting note for our President for her monthly meeting with NRCan.
Do you have a few bullets you could share with me on the current status of this project and any involvement we have that may interest NRCan?
My note is due November 13. If I could get something by **noonish on November 12**, this would provide sufficient time for me to complete the note.
Thanks,
Nadine

s.21(1)(b)

From:	Josh Jenkins
To:	Lynn Adams
Subject:	Follow-up re: RERT meeting
Sent:	6/6/2023 9:57:00 AM

Hi Lynn,

I've been thinking about our conversation with Cori (spelling?) and her team at NRCan two weeks ago on the RERTs, and I'd like to follow up with her to elaborate on a couple points that I don't feel like I communicated effectively at the time. Would appreciate your thoughts on the below, as well as her email address if you have it. Thanks

---

Hi Cori,

It was nice meeting you and your team in-person a couple of weeks ago; I appreciated your openness in updating us on the various issues surrounding the RERTs in NL and NB.

I've been reflecting on your comments regarding the SMR issue in NB, particularly the points around multiple technologies being developed in NB and concerns around the regulatory review process.

There's a piece of context that I'm not sure I communicated effectively at the time, but would be important for you to understand as it explains many of the decisions and priorities that you'll hear about from NB stakeholders: the SMR Roadmap and subsequent SMR Action Plan.

As you know, the Federal government has worked with stakeholders in NB and other provinces/partners across the country, investing a considerable amount of time and effort at all levels (including discussions and approvals at the DM/Minister, Utility CEO level) into developing a SMR roadmap and later releasing a pan-Canadian approach to SMR development.

NB stakeholders view Canada's SMR Action Plan as Canada's plan for the development, demonstration and deployment of SMRs; they see it as the plan that has been vetted and approved at all levels and provides the "marching orders" for how we move forward with the prioritization of technologies.

The focus – per Canada's SMR Action Plan – is for New Brunswick to lead on Stream 2 which involves **two 4th generation, advanced small modular reactor designs** that will be developed in New Brunswick through the construction of demonstration units at the Point Lepreau nuclear site. Both are attractive to the market because they have better safety features than earlier versions, mitigating the risk of a thermal nuclear incident and producing high temperature heat which is favorable for industrial decarbonization.

- ARC Clean Energy is developing an advanced Generation IV SMR, the ARC-100, a 100 MW liquid sodium-cooled fast reactor which is expected to be operational by 2029. The reactor is based on the technology of the EBR-II fast-reactor at the Argonne National Laboratory in Lemont, Illinois, which operated for 30 years.
- Moltex Energy is developing a 300 MW Stable Salt Reactor-Wasteburner. It is also developing technology to recycle used CANDU fuel at the Point Lepreau Nuclear Generating Station, lowering the amount of nuclear waste that will

need long-term storage. Both the reactor and spent fuel recovery system are expected to be operational by the early 2030s.

The government of New Brunswick supports both ARC and Moltex Small Modular Reactor (SMR) *technologies as they offer distinct reactor types and fill different sectors of the nuclear energy market*. There is also enough space at the Point Lepreau site for both reactors. These two technologies also support the work undertaken in the development of the Roadmap (2018) and SMR Action Plan (2020).

- The ARC-100 is well-suited for combined use in heavy industry or desalination, and coupled with its proliferation resistance, it is also a strong fit for both existing and emerging nuclear nations while the Moltex technology is significant from a waste re-use perspective.

Thanks again for your update and I hope you find the above helpful - please let me know if you have any additional questions or concerns,

Josh Jenkins
Director, Innovation, Trade & Business Growth
Atlantic Canada Opportunities Agency / Government of Canada
Josh.Jenkins@canada.ca / Tel: 506-851-3626/ Cell: 506-227-9520 / TTY:1-877-456-6500

Directeur, Innovation, commerce et croissance des entreprises
Agence de promotion économique du Canada atlantique / Gouvernement du Canada
Josh.Jenkins@canada.ca / Tél: 506-851-3626/ Cell: 506-227-9520 / ATS:1-877-456-6500

s.21(1)(b)

From: Josh Jenkins
To: Jeanetta Hill
Subject: FW: **URGENT FOR ACTION*** MOLTEX PAF Approval
Sent: 1/9/2024 12:00:00 PM

Kalie's comments have been addressed - fyi

From: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Sent: Monday, January 8, 2024 7:16 PM
To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Subject: RE: **URGENT FOR ACTION*** MOLTEX PAF Approval

This has been addressed. Project has been validated and is now for next steps.

Please let me know if any other changes are required,

Thank you!
-Luke

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Monday, January 8, 2024 5:16 PM
To: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Subject: FW: **URGENT FOR ACTION*** MOLTEX PAF Approval

Hi Luke – see Kalie's comments below on the PAF.

I've written her back to say we wouldn't normally write in the lump-sum repayment option into the CA, so you can action comments # 1 and # 3

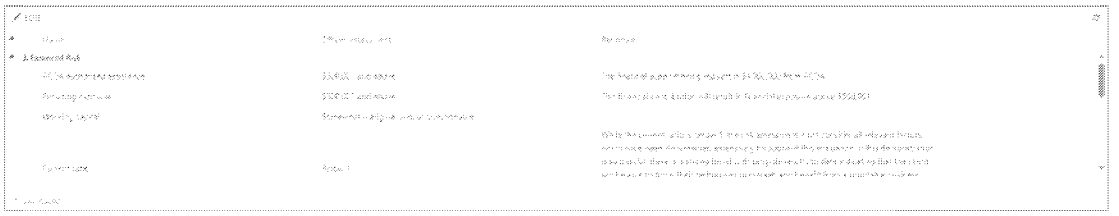
Thanks

Josh

From: Kalie Hart-Kilburn <Kalie.Hart-Kilburn@ACOA-APECA.GC.CA>
Sent: Monday, January 8, 2024 3:49 PM
To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>; Jeanetta Hill <Jeanetta.Hill@ACOA-APECA.GC.CA>
Cc: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>; Crystal Hawkes <Crystal.Hawkes@ACOA-APECA.GC.CA>; Janelle Landry <Janelle.Landry@acoa-apeca.gc.ca>
Subject: RE: **URGENT FOR ACTION*** MOLTEX PAF Approval

Thanks Josh. Jeanetta may have some additional comments, but here are a few that I noted while reviewing the PAF (see comments in red).

Kalie



PLEASE UPDATE THE RATIONALE FOR THE AUTHORIZED ASSISTANCE WITH THE CURRENT FUNDING REQUEST OF $2.66M

Conditionally Repayable Reporting Requirements

Success Factors

Repayment will be triggered based on revenue generation from resulting products and technologies. A repayment scheme based on 3% of all revenues to a maximum of $500,000/year may be considered.

ARE WE ANTICIPATING THE POSSIBILITY THAT THE IP COULD BE SOLD? IF SO, DO WE ALSO INCLUDE THE POSSIBILITY OF A ONE-TIME WINDFALL PAYMENT IN OUR REPAYMENT SCHEME?

Project Overview

Short Description	Demonstrate the WATSS technology using spent CANDU fuel
Project Full Description (EN)	Demonstrate the Waste To Stable Salt (WATSS) technology at an industrial scale, clarifying the commercial viability of Moltex's proprietary technology, which converts used CANDU fuel (spent fuel) into recycled fuel usable in Moltex's advanced Small Modular Reactor (SMR) technology, the Stable Salt Reactor – Wasteburner (SSR-W), thereby reducing the cost, volume and toxicity of spent nuclear waste while producing low-to-zero carbon electricity at low cost in collaboration with Canadian Nuclear Labs (CNL), Natural Resources Canada (NRCan), Innovation, Science and Economic Development (ISED), and other federal and provincial partners. This project's activities will be primarily completed at the Chalk River Laboratory in Deep River, Ontario
Program	Regional Economic Growth through Innovation (REGI)
Sub-Program	REGI - Business Scale-up and Productivity (BSP)
Assistance Type	Conditionally Repayable Contribution | Contribution remboursable sous condition
Project Type (Commerciality)	Commercial
Project Location - City	DEEP RIVER
Total Project Costs	
ACOA Assistance	$2,660,667.00
Average Rate of Assistance	50.00
Total Federal Financing	...
Total Provincial Financing	...

NOT SURE WHAT THE CURRENT GUIDANCE OF PROJECT LOCATION IS. BUT WONDERING IF WE WANT THIS TO BE LISTED AS DEEP RIVER (WHERE THE SUBCONTRACTOR IS) OR THE CLIENT'S LOCATION OF SAINT JOHN?

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Monday, January 8, 2024 3:22 PM
To: Jeanetta Hill <Jeanetta.Hill@ACOA-APECA.GC.CA>, Kalie Hart-Kilburn <Kalie.Hart-Kilburn@ACOA-APECA.GC.CA>
Cc: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>; Crystal Hawkes <Crystal.Hawkes@ACOA-APECA.GC.CA>; Janelle Landry <Janelle.Landry@acoa-apeca.gc.ca>
Subject: FW: **URGENT FOR ACTION*** MOLTEX PAF Approval
Importance: High

FYI: I've reviewed the PAF and it's ready for your review… just working with Luke to set the transitions up properly in CAPRI and will notify once that is ready. Didn't want to hold up your review waiting for that step,

Josh

From: Crystal Hawkes <Crystal.Hawkes@ACOA-APECA.GC.CA>
Sent: Monday, January 8, 2024 1:24 PM
To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Cc: Jeanetta Hill <Jeanetta.Hill@ACOA-APECA.GC.CA>; Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>; Kalie Hart-Kilburn <Kalie.Hart-Kilburn@ACOA-APECA.GC.CA>
Subject: **URGENT FOR ACTION*** MOLTEX PAF Approval
Importance: High

Hi Josh,

Are you able to take some time before 3 today to review the MOLTEX paf Project: Project Assessment: Demonstrate the WATSS technology using spent CANDU fuel - Dynamic.pdf and transition it up to Jeanetta and then Kalie. This has approved by Michel via email but nothing was done in CAPRI and We want to have kalie review today.

Thanks,

Crystal Hawkes

Executive Assistant to the Director General of Regional Operations, NB Region

Atlantic Canada Opportunities Agency / Government of Canada
crystal.hanhart@acoa-apeca.gc.ca / Tel 506-349-7340/TTY: 1-877-456-6500

Adjointe exécutive de la Directrice Générale des opérations régionales du N-B
Agence de promotion économique du Canada atlantique / Gouvernement du Canada
crystal.hanhart@acoa-apeca.gc.ca / Tél: 506-349-7340/ATS 1-877-456-6500

From:	Luke Bulmer on behalf of Luke Bulmer
To:	Laura DeLong; Josh Jenkins;
Cc:	Faruk Ener
Subject:	FW: Dassault Systemes solutions for SMR
Sent:	12/9/2024 11:19:29 AM

I see they refer to Modularization as the path forward to commercialization of SMRs – which is very much aligned with the work in NB on the modular approach to SMR development with GNB & UNB's OCRC.

Happy to discuss further,
-Luke

From: @3ds.com>
Sent: Friday, December 6, 2024 5:13 PM
To: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Subject: Dassault Systemes solutions for SMR

Hi Luke

it was really nice meeting with you earlier this week in Moncton
To follow up on our side discussions on SMR, please find some links on Dassault Systemes solutions on this topic
https://www.3ds.com/sustainability/energy-use/clean-energy-technologies/small-modular-reactors
press release on NAAREA (French startup pioneer in fourth-generation micro-nuclear power and the inventor of XAMR) and Dassault Systemes collaboration
https://www.3ds.com/insights/customer-stories/naarea-micro-modular-reactor
https://www.youtube.com/watch?v=mugLLWzinsg

Let me know if you have questions or if you would appreciate more information on a particular topic.

Regards

s.19(1)
s.21(1)(b)

Best Regards,

Office:
Mobile:
Dassault Systèmes Canada Inc. | 393, Rue St-Jacques Ouest - suite 300 | H2Y 1N9 Montreal | Canada

s.19(1)

From:	Josh Jenkins
To:	Kalie Hatt-Kilburn
Cc:	Patrick Lacroix; Laura DeLong; Jeanetta Hill;
Subject:	FW: Follow up re: RERT meeting
Sent:	6/7/2023 7:44:00 AM

FYI – below is the correspondence with Cori Anderson, my colleague at NRCan leading the RERTs in Atlantic Canada, following up on the meeting Lynn Adams and I took with her in Ottawa.

I've highlighted a piece of info that we'll be following up on to see what an appropriate next step would be – engagement by ACOA vs technical briefing from NB Power, ARC, Moltex, etc.

Josh

From: Anderson, Cori <Cori.Anderson@nrcan-rncan.gc.ca>
Sent: Tuesday, June 6, 2023 12:30 PM
To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Cc: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>
Subject: RE: Follow up re: RERT meeting

Josh – thanks for this explanation, very helpful.

You make an important point though that if this is what was agreed to in the SMR Action Plan, then that does carry some weight. We'll follow up with our SMR team to better understand their thinking on that point.

Thanks,
Cori

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Tuesday, June 6, 2023 10:59 AM
To: Anderson, Cori <Cori.Anderson@nrcan-rncan.gc.ca>
Cc: Lynn Adams <Lynn.Adams@ACOA-APECA.GC.CA>
Subject: Follow up re: RERT meeting

s.21(1)(b)

Hi Cori,

It was nice meeting you and your team in-person a couple of weeks ago; I appreciated your openness in updating us on the various issues surrounding the RERTs in NL and NB.

I've been reflecting on your comments regarding the SMR issue in NB, particularly the points around multiple technologies being developed in NB and concerns around the regulatory review process.

There's a piece of context that I'm not sure I communicated effectively at the time, but would be important for you to understand as it explains many of the decisions and priorities that you'll hear about from NB stakeholders: the SMR Roadmap and subsequent SMR Action Plan. My hope is that this context would help advance your work on the RERTs, in helping to better understand some of what you're hearing from the province as well as a potential source for solutions on how to move forward.

As you know, the Federal government has worked with stakeholders in NB and other provinces/partners across the country, investing a considerable amount of time and effort at all levels (including discussions and approvals at the DM/Minister, Utility CEO level) into developing a SMR roadmap and later releasing a pan-Canadian approach to SMR development.

NB stakeholders view Canada's SMR Action Plan as Canada's plan for the development, demonstration and deployment of SMRs; they see it as the plan that has been vetted and approved at all levels and provides the "marching orders" for how we move forward with the prioritization of technologies.

The focus – per Canada's SMR Action Plan – is for New Brunswick to lead on Stream 2 which involves **two 4th generation, advanced small modular reactor designs** that will be developed in New Brunswick through the construction of demonstration units at the Point Lepreau nuclear site. Both are attractive to the market because they have better safety features than earlier versions, mitigating the risk of a thermal nuclear incident and producing high temperature heat which is favorable for industrial decarbonization.

- ARC Clean Energy is developing an advanced Generation IV SMR, the ARC-100, a 100 MW liquid sodium-cooled fast reactor which is expected to be operational by 2029. The reactor is based on the technology of the EBR-II fast-reactor at the Argonne National Laboratory in Lemont, Illinois, which operated for 30 years.
- Moltex Energy is developing a 300 MW Stable Salt Reactor-Wasteburner. It is also developing technology to recycle used CANDU fuel at the Point Lepreau Nuclear Generating Station, lowering the amount of nuclear waste that will need long-term storage. Both the reactor and spent fuel recovery system are expected to be operational by the early 2030s.

The government of New Brunswick supports both ARC and Moltex Small Modular Reactor (SMR) *technologies as they offer distinct reactor types and fill different sectors of the nuclear energy market*. There is also enough space at the Point Lepreau site for both reactors. These two technologies also support the work undertaken in the development of the Roadmap (2018) and SMR Action Plan (2020).

- The ARC-100 is well-suited for combined use in heavy industry or desalination, and coupled with its proliferation resistance, it is also a strong fit for both existing and emerging nuclear nations while the Moltex technology is significant from a waste re-use perspective.

Thanks again for your update and I hope you find the above helpful - please let me know if you have any additional questions or concerns,

Josh Jenkins
Director, Innovation, Trade & Business Growth
Atlantic Canada Opportunities Agency / Government of Canada
Josh.Jenkins@canada.ca / Tel: 506-851-3626/ Cell: 506-227-9520 / TTY:1-877-456-6500

Directeur, Innovation, commerce et croissance des entreprises
Agence de promotion économique du Canada atlantique / Gouvernement du Canada
Josh.Jenkins@canada.ca / Tél: 506-851-3626/ Cell: 506-227-9520 / ATS:1-877-456-6500

s.21(1)(b)

From:	Josh Jenkins
To:	Rima Thomeh
Cc:	Kafa El Zamer; Jeanetta Hill;
Subject:	FW: FOR ACTION: Update on ARC and Moltex - MINO request
Sent:	7/4/2023 5:16:00 PM

Hi Rima,

See below for bullets for ARC and Moltex... You'll note we've removed any info we haven't been able to validate, and I've highlighted two lines that are a little "iffy". We got confirmation from NRCan that

Josh

ARC:

- In 2018, ARC committed $5M towards the establishment of an Advanced SMR Research Cluster in New Brunswick, which received $10M from the New Brunswick Energy Solutions Corporation, a provincial Crown corporation.
- ARC has secured $20M in financial assistance form the Province of New Brunswick in February, 2021,
- ,
- ,
- In November 2022, Belledune Port Authority announced it is working with Cross River Infrastructure Partners to pursue the use of ARC's technology as part of a future expansion at the northern New Brunswick port, realizing their Green Energy Hub vision, due to the ARC-100's ability to produce both clean power and high heat.
- The Canadian Nuclear Isotope Council (CNIC) announced a partnership with ARC in December, 2022. ARC joins 76+ organizations in Canada's isotope community that work together to advance Canada's role in the global supply chain for nuclear isotopes. ARC is the first advanced small modular reactor (aSMR) company to join the CNIC.
- Progress is continuing steadily regarding site preparation at Point Lepreau Nuclear Generating Site (PLNGS) and implementation of the first aSMR (ARC-100) in New Brunswick is expected early in the 2030s.
- The CIB's largest ever investment in clean technologies occurred in October, 2022, with the announcement of $970M in support of OPG's development of GE Hitachi's GE Hitachi BWRX-300, a generation 3 SMR technology.
    -

s.20(1)(b)

s.20(1)(c)

s.21(1)(b)

s.21(1)(c)

- On June 30th, 2023, NB Power, in partnership with ARC Clean Technology Canada, Inc. (ARC), is pleased to announce the submission of an Environmental Impact Assessment registration document to the Department of Environment and Local Government (DELG) and a Licence to Prepare Site Application to the Canadian Nuclear Safety Commission (CNSC) on the advanced Small Modular Reactor (SMR) project. These submissions mark an important milestone in the plans to construct and operate an advanced small modular reactor on the site of the existing Point Lepreau Nuclear Generating Station (PLNGS).

Moltex:

- In 2018, Moltex committed $5M towards the establishment of an Advanced SMR Research Cluster in New Brunswick, which received $10M from the New Brunswick Energy Solutions Corporation, a provincial Crown corporation.
- In March, 2021, Moltex announced the receipt of financial support through SIF of $47.5M which will be matched by Moltex dollar for dollar, and complimentary support of $3M from ACOA.
- In early 2023, Moltex's project with ACOA was completed, demonstrating the technical viability of the core chemical extraction process to be used for recycling waste nuclear fuel (WATSS)

s.20(1)(b)

s.20(1)(c)

s.21(1)(b)

s.21(1)(c)

From: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Sent: Tuesday, July 4, 2023 3:45 PM
To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Cc: Josh Waite <Josh.Waite@ACOA-APECA.GC.CA>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Josh,

Please see below:

- On June 30th, 2023, NB Power, in partnership with ARC Clean Technology Canada, Inc. (ARC), is pleased to announce the submission of an Environmental Impact Assessment registration document to the Department of Environment and Local Government (DELG) and a Licence to Prepare Site Application to the Canadian Nuclear Safety Commission (CNSC) on the advanced Small Modular Reactor (SMR) project. These submissions mark an important milestone in the plans to construct and operate an advanced small modular reactor on the site of the existing Point Lepreau Nuclear Generating Station (PLNGS).

https://www.nbpower.com/en/about-us/news-media-centre/news/2023/nb-power-submits-environmental-impact-assessment-registration-and-licence-to-prepare-site-application-for-advanced-small-modular-reactor-project/

-Luke

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Tuesday, July 4, 2023 1:08 PM
To: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Cc: Josh Waite <Josh.Waite@ACOA-APECA.GC.CA>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Thanks Luke – can I ask you to please add one more bullet addressing last week's announcement by NB Power re: site certification at Lepreau for the ARC unit?

I'd like to get this to Rima by cob if possible – thanks,

JOsh

From: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Sent: Thursday, June 29, 2023 1:13 PM
To: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Cc: Josh Waite <Josh.Waite@ACOA-APECA.GC.CA>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Following-up on this with one additional Moltex bullet, regarding their MOUs, and an announcement from today, below:

- In June, 2021 Moltex Energy, Pabineau First Nation and Belledune Port Authority (BPA) have signed a Memorandum of Understanding (MOU) to work collaboratively on mutually beneficial initiatives at the Port of Belledune and surrounding areas in Northern New Brunswick, specifically related to Small Modular Reactor (SMR) Canadian domestic use and exports.

- On June 28, 2023, Moltex Energy USA LLC, a subsidiary of Moltex Energy Canada Inc., is pleased to be a recipient of a Gateway for Accelerated Innovation in Nuclear (GAIN) Nuclear Energy Voucher, which provides advanced nuclear technology developers with capacity and expertise at U.S. Department of Energy (DOE) national laboratories. The work will focus on heat-transfer testing.
    - The energy voucher is not the first time the DOE has supported Moltex. In 2020, Moltex received $4.5M in funding through the Advanced Research Projects Agency – Energy (ARPA-E), an agency within the DOE, to advance the development of its reactor. In 2019, ARPA-E awarded Moltex $2.55M to develop technologies to shorten reactor construction time.

-Luke

From: Luke Bulmer
Sent: Thursday, June 29, 2023 11:02 AM
To: Josh Jenkins <Josh.Jenkins@ACOA-APECA.GC.CA>
Cc: Josh Waite <Josh.Waite@ACOA-APECA.GC.CA>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Good morning Josh & Josh,

Please find below the updated bullets that Kalie had outlined – there remain a number of gaps that I simply do not have the answers to..happy to dig in further, wondering if our Ottawa colleagues may have some insight to share. As Danika had mentioned previously, Lynn Adams has no further information to share regarding the status of SMR development, regarding either the technology itself or the regulatory aspects.

ARC:

- In 2018, ARC committed $5M towards the establishment of an Advanced SMR Research Cluster in New Brunswick, which received $10M from the New Brunswick Energy Solutions Corporation, a provincial Crown corporation.
- ARC has secured $20M in financial assistance form the Province of New Brunswick in February, 2021,
-
- **Current Series B funding round** – *Bill Labbe was quoted in a 2022 news article stating that Series B funding was likely to be launched in June or July 2022.*
- In November 2022, Belledune Port Authority announced it is working with Cross River Infrastructure Partners to pursue the use of ARC's technology as part of a future expansion at the northern New Brunswick port, realizing their Green Energy Hub vision due to the ARC-100's ability to produce both clean power and high heat. I
- The Canadian Nuclear Isotope Council (CNIC) announced a partnership with ARC in December, 2022. ARC joins 76+ organizations in Canada's isotope community that work together to advance Canada's role in the global supply chain for nuclear isotopes. ARC is the first advanced small modular reactor (aSMR) company to join the CNIC.
- Progress is continuing steadily regarding site preparation at Point Lepreau Nuclear Generating Site (PLNGS) and implementation of the first aSMR (ARC-100) in New Brunswick is expected early in the 2030s.

s.20(1)(b)
s.20(1)(c)
s.21(1)(b)
s.21(1)(c)

-

- The CIB's largest ever investment in clean technologies occurred in October, 2022, with the announcement of $970M in support of OPG's development of GE Hitachi's GE Hitachi BWRX-300, a generation 3 SMR technology.
    -

Moltex:

- In 2018, Moltex committed $5M towards the establishment of an Advanced SMR Research Cluster in New Brunswick, which received $10M from the New Brunswick Energy Solutions Corporation, a provincial Crown corporation.
- In March, 2021, Moltex announced the receipt of financial support through SIF of $47.5M which will be matched by Moltex dollar for dollar, and complimentary support of $3M from ACOA.
- In early 2023, Moltex's project with ACOA was completed, demonstrating the technical viability of the core chemical extraction process to be used for recycling waste nuclear fuel (WATSS)

-Luke

From: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Sent: Wednesday, June 28, 2023 4:00 PM
To: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>

s.20(1)(b)
s.20(1)(c)
s.21(1)(b)
s.21(1)(c)

Cc: Josh Waite <Josh.Waite@ACOA-APECA.GC.CA>
Subject: FW: FOR ACTION: Update on ARC and Moltex - MINO request

Please let me know where you've got gaps in being able to respond to Kalie's suggestions, and we can come up with a plan to fill those.

Would appreciate know by tomorrow morning, thanks

Josh

From: Danika LeBlanc <Danika.LeBlanc@ACOA-APECA.GC.CA>
Sent: Wednesday, June 28, 2023 1:37 PM
To: Josh Waite <Josh.Waite@ACOA-APECA.GC.CA>; Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Cc: Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Subject: FW: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Josh W/Luke,

Forwarding to you for your action.

Luke and I worked on this last Friday and we've now received feedback from Kalie. Timeline was tight so we weren't able to get any intel on ARC (not an ACOA client, reached out to Lynn Adams but she didn't have anything to add). We'll need to make phone calls to get the info on them. Not sure who would be the contact for this.

Josh J, any leads on this?

Danika LeBlanc, CPA

From: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>
Sent: Wednesday, June 28, 2023 1:31 PM
To: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>; Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Cc: Jeanetta Hill <Jeanetta.Hill@ACOA-APECA.GC.CA>; Danika LeBlanc <Danika.LeBlanc@ACOA-APECA.GC.CA>
Subject: FW: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Rima and Josh,
See below comments from Kalie on the ARC and Moltex information for MINO. We can remove the first part that is overall/general info on SMRs and have more focused bullets on just ARC and Moltex with the info Kalie shared below for each. Some was included in the document and some was missing.

Cc'ing Danika as she was acting for Josh when the document was drafted.

Let me know if you have any questions.
Thanks
Kafa

From: Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>
Sent: Wednesday, June 28, 2023 12:05 PM
To: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Thanks Kafa. As mentioned, I think we should shorten it to key bullets and should include the following:

ARC:
Funding received from PNB to date

Moltex:
Funding received from ACOA and PNB

From: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>
Sent: Wednesday, June 28, 2023 9:07 AM
To: Kalie Hatt-Kilburn <Kalie.Hatt-Kilburn@ACOA-APECA.GC.CA>
Subject: FW: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Kalie,
I thought you might want to have a look at the attached information on ARC and Moltex before it goes to MINO.
Kafa

From: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>
Sent: Friday, June 23, 2023 3:25 PM
To: Danika LeBlanc <Danika.LeBlanc@ACOA-APECA.GC.CA>
Cc: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>; Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>; Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>; Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>; Jeanetta Hill <Jeanetta.Hill@ACOA-APECA.GC.CA>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Thank you, Danika et. al. ! Going above and beyond as usual

s.20(1)(b) I put the bullets into a Word document and formatted it to share with MINO. See attached.

s.20(1)(c)
s.20(1)(d) Kafa/Jeanetta – please confirm who provides final approval.

s.21(1)(b) Thank you,

Rima

From: Danika LeBlanc <Danika.LeBlanc@ACOA-APECA.GC.CA>
Sent: Friday, June 23, 2023 1:07 PM
To: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>
Cc: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>; Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>; Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>; Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>; Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Rima,

Here is what I propose in terms of an "informal (i.e., a few bullets) update on ARC and Moltex (e.g., any new developments)":

- The government of New Brunswick supports both ARC and Moltex Small Modular Reactor (SMR) technologies as they offer distinct reactor types and fill different sectors of the nuclear energy market. There is also enough space at the Point Lepreau site for both reactors.
    - The ARC-100 is well-suited for combined use in heavy industry or desalination, and coupled with its proliferation resistance, it is also a strong fit for both existing and emerging nuclear nations while the Moltex technology is significant from a waste re-use perspective.

- NB Power sees the potential for deployment of ARC units in northern New Brunswick to help transition away from coal and allow a reliable source of clean, base-load energy to fuel current needs and future industrial development in that region, such as hydrogen/ammonia production. Deployment in northern New Brunswick is considered achievable by the mid-2030s.

- Funding has been provided through ISED's Strategic Innovation Fund (SIF) to Moltex to assist the company in developing its technology. ARC received a CAD20 million investment by the Government of New Brunswick (unlocking private sector investment in matching funds).

- In addition to funding support for SMR technology development, the importance of regulatory clarity and certainty remain key areas for advocacy as NB moves toward SMR development and deployment.
    - Keeping legislative and regulatory requirements streamlined (and within a *reasonable* timeframe) is key to advancing SMR technology.
    - NB Power, Moltex and ARC (and most other nuclear industry proponents across Canada) have expressed a concern regarding the length of time the current Impact Assessment (IA) requires for the technology. It is understood that the Canadian Nuclear Association is calling for an expedited process (<3years) so that Canada can remain competitive with other jurisdictions (current timeframes are estimated at 6-8years for the IA).

- Ongoing Indigenous engagement by ARC, Moltex and NBP has resulted no significant opposition from NB FNs to date.

- On March 23, 2023, ARC Clean Technology and Invest Alberta agreed to pursue activities to support commercialization of ARC's aSMR ARC-100 technology in Alberta.

- On April 18, 2023, ARC was named as potential technology solution to advance industrial decarbonization in Saskatchewan in an interprovincial MOU between the Province of Saskatchewan and the Province of New Brunswick.

- The Coalition for Responsible Energy Development in New Brunswick (CRED-NB) is lobbying (and has lobbied the Minister responsible for ACOA) for a nuclear-free renewable energy future. CRED-NB strongly believes NB can meet its future energy needs with renewable energy and storage technologies and that nuclear energy is a "dirty, dangerous distraction from the work we all need to be doing to address the climate crisis".

- ACOA's $3M funding for Moltex's early-stage technical validation work (Phase 1) on its waste fuel recycling technology is now complete. Through this project, Moltex has demonstrated technical viability of the core chemical extraction process to be used for recycling waste nuclear fuel.

- The CIB's largest ever investment in clean technologies occurred in October, 2022, with the announcement of $970M in support of OPG's development of GE Hitachi's GE Hitachi BWRX-300, a generation 3 SMR technology.
    - [redacted]

s.20(1)(b)

s.20(1)(c)

s.21(1)(b)

s.21(1)(c)

Danika LeBlanc, CPA

From: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>
Sent: Thursday, June 22, 2023 3:02 PM
To: Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Cc: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>; Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>; Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>; Danika LeBlanc <Danika.LeBlanc@ACOA-APECA.GC.CA>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Laura,

Yes, very helpful! Thank you so much.

Danika is acting for Josh who is on leave today and tomorrow, so I have copied her in to share any feedback.

Danika – a request from MINO came in asking for an informal (i.e., a few bullets) update on ARC and Moltex (e.g., any new developments). Laura has initiated by pulling together bullets from her previous briefing on the subject. Can you please review and provide your feedback or concurrence?

Please let me know if there are any questions.

Thank you,

Rima

From: Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Sent: Thursday, June 22, 2023 2:52 PM
To: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>
Cc: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>; Patrick Lacroix <Patrick.Lacroix@ACOA-APECA.GC.CA>; Josh Jenkins <Josh.Jenkins@acoa-apeca.gc.ca>
Subject: RE: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Rima:

This isn't pretty – sorry, I'm running low on time - but below are bullets from my most recent update on SMR as at May 11 2023 (which incorporated Kalie's input at the time). I'm copying Patrick and Josh in case they have additional intel and encourage you to reach out – per your note below – to Danika/Luke for their concurrence.

I hope this is helpful.

Laura

**

GENERAL CONTEXT

- To meet the goal of reaching net-zero by 2050, Canada will need to act boldly, including a transition towards non-emitting energy throughout the country. Canada is well positioned to become a clean electricity superpower and build a net-zero economy of tomorrow that is more sustainable, more secure, and more affordable.
- SMRs are a new class of nuclear reactors that are considerably smaller in size and power output than conventional nuclear power reactors, with enhanced safety features. This technology has the potential for a range of applications. From grid-scale units that can provide non-emitting reliable electricity, to smaller units suitable for heavy industry, and powering remote communities. Several provinces, including New Brunswick (NB) are actively pursuing SMRs, and Canada's first SMR could be in operation as early as the mid-to-late 2020s.
- In 2020, the Government launched its SMR Action Plan, which illustrates Canada's plan for the development, demonstration, and deployment of SMRs for multiple applications at home and abroad. The Plan built on the momentum of Canada's SMR Roadmap, released in 2018.

-

NEW BRUNSWICK CONSIDERATIONS

- New Brunswick is positioned to advance small modular reactor technology because of its rich academic and scientific community, an existing nuclear site that can accommodate multiple SMRs and the nuclear expertise of the professionals at the Point Lepreau Nuclear Generating Station.
- New Brunswick is part of the pan-Canadian SMR Action Plan initiative led by NRCan.
- The focus for New Brunswick is on Stream 2 which involves two 4th generation, advanced small modular reactor designs that will be developed in New Brunswick through the construction of demonstration units at the Point Lepreau nuclear site in NB.
- The two companies developing SMRs in New Brunswick are ARC and Moltex. Both are attractive to the market because they have better safety features than earlier versions, mitigating the risk of a thermal nuclear incident and producing high temperature heat which is favorable for industrial decarbonization.
    - ARC Clean Energy is developing an advanced Generation IV SMR, the ARC-100, a 100 MW liquid sodium-cooled fast reactor which is expected to be operational by 2029. The reactor is based on the technology of the EBR-II fast-reactor at the Argonne National Laboratory in Lemont, Illinois, which operated for 30 years.
    - Moltex Energy is developing a 300 MW Stable Salt Reactor-Wasteburner. It is also developing technology to recycle used CANDU fuel at the Point Lepreau Nuclear Generating Station, lowering the amount of nuclear waste that will need long-term storage. Both the reactor and spent fuel recovery system are expected to be operational by the early 2030s.
- The government of New Brunswick supports both ARC and Moltex Small Modular Reactor (SMR) technologies as they offer distinct reactor types and fill different sectors of the nuclear energy market. There is also enough space at the Point Lepreau site for both reactors.
    - The ARC-100 is well-suited for combined use in heavy industry or desalination, and coupled with its proliferation resistance, it is also a strong fit for both existing and emerging nuclear nations while the Moltex technology is significant from a waste re-use perspective.
- NB Power sees the potential for deployment of ARC units in northern New Brunswick to help transition away from coal and allow a reliable source of clean, base-load energy to fuel current needs and future industrial development in that region, such as hydrogen/ammonia

production. Deployment in northern New Brunswick is considered achievable by the mid-2030s.

- NB Power is also looking to SMRs as replacements for the Point Lepreau nuclear facility, which is scheduled to reach its end-of-life in the early 2040s. The facility currently supplies approximately 39 percent of the province's energy needs as well as baseload power supply to Prince Edward Island. The development and deployment of SMR technology will help the broader Atlantic region maintain its critical energy supply while providing mitigation from the intermittence of other renewable energy sources.
- ACOA NB has invested in a number of projects to assist with the SMR technology development cluster, given the importance of increasing non-emitting power generating sources to support the NB economy.
    - These include projects with the University of New Brunswick's Centre for Nuclear Energy Research (CNER) expanding capacity, support for strategic planning for Indigenous involvement in SMR development in NB and, with the goal to activate an underutilized supply chain to participate in a worldwide SMR market various supply chain initiatives including events for SMEs interested in entering, or expanding their role in the SMR supply chain
- Funding has been provided through ISED's Strategic Innovation Fund (SIF) to Moltex to assist the company in developing its technology. ARC received a CAD20 million investment by the Government of New Brunswick (unlocking private sector investment in matching funds).
- The release of the SMR Action Plan heightened expectations for federal funding to support SMR development among provincial and territorial governments, Indigenous people, organized labour, utilities, industry, innovators, academia and civil society. Budget 2023 announced a number of initiatives that could be of benefit to the SMR industry, including the Clean Electricity Investment Tax Credit, the Clean Technology Manufacturing Investment Tax Credit, and expanding the eligibility for the Clean Technology Investment Tax Credit.
- In addition to funding support for SMR technology development, the importance of regulatory clarity and certainty remain key areas for advocacy as NB moves toward SMR development and deployment.
    - Keeping legislative and regulatory requirements streamlined (and within a *reasonable* timeframe) is key to advancing SMR technology.
    - NB Power, Moltex and ARC (and most other nuclear industry proponents across Canada) have expressed a concern regarding the length of time the current Impact Assessment (IA) requires for the technology. It is understood that the Canadian Nuclear Association is calling for an expedited process (<3years) so that Canada can remain competitive with other jurisdictions (current timeframes are estimated at 6-8years for the IA).
- Ongoing Indigenous engagement by ARC, Moltex and NBP has resulted no significant opposition from NB FNs to date.
- On March 23, 2023, ARC Clean Technology and Invest Alberta agreed to pursue activities to support commercialization of ARC's aSMR ARC-100 technology in Alberta.
- On April 18, 2023, ARC was named as potential technology solution to advance industrial decarbonization in Saskatchewan in an interprovincial MOU between the Province of Saskatchewan and the Province of New Brunswick.
- The Coalition for Responsible Energy Development in New Brunswick (CRED-NB) is lobbying (and has lobbied the Minister responsible for ACOA) for a nuclear-free renewable energy future. CRED-NB strongly believes NB can meet its future energy needs with renewable energy and storage technologies and that nuclear energy is a "dirty, dangerous distraction from the work we all need to be doing to address the climate crisis".

From: Rima Thomeh <Rima.Thomeh@acoa-apeca.gc.ca>
Sent: Thursday, June 22, 2023 1:07 PM
To: Laura DeLong <Laura.DeLong@ACOA-APECA.GC.CA>
Cc: Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>
Subject: FOR ACTION: Update on ARC and Moltex - MINO request

Hi Laura,

During the Minister's call this week, we were asked to provide an update on ARC and Moltex. Kalie mentioned that you recently worked on an SMR briefing, and I wondered if you could provide me with some general bullets that outline their status or any new developments.

I can share the bullets with Danika/Luke for their concurrence.

If it's any help, here is the briefing from February 2023 - http://portal.acoa-apeca.gc.ca/sites/NB/Policy/abu/MinPres%20Repository/2023/BACKGROUNDERS,%20INFO%20REQUESTS%20AND%20STATUS%20UPDATES/SMR%20Update%20Janurary%202023/Briefing%20-%20SMRs%20-%20February%202023.docx

There was also a backgrounder completed in 2022 on ARC and Moltex as well - Moltex and ARC - All Documents (acoa-apeca.gc.ca)

Due date: Friday, June 23 at noon.

Let me know if you wish to chat further.

Thank you,

Rima

From:	Josh Jenkins
To:	Kalie Hatt-Kilburn; Jeanetta Hill;
Cc:	Kafa El Zamer; Crystal Hawkes; Krista Hicks;
Subject:	FW: Moltex Energy Canada - PAF ready for review
Sent:	11/30/2023 12:01:00 PM

Hi Kalie / Jeanetta,

You'll see below that we've now shared the Moltex PAF with HO for a QA review in advance of moving the project up to MINO on a special list for their direction.

Our intent is to share the one-pager used for Directors/DGs concurrence as supporting context/briefing material for MINO direction.

Would appreciate your review and comments on the PAF. You'll note that input you've both provided on the one-pager has been included in the assessment document.

We're awaiting HO's input before formally transitioning the PAF in CAPRI for MINO direction (and so it may come to you as part of that process depending on timing/your return), but we'd like to incorporate any feedback you might have now, concurrent with HO review, in case it's ready to go up while folks are still acting this week.

Please let me know if you have any questions or concerns with the document or our proposed approach – thanks,

Josh

From: Josh Jenkins
Sent: Thursday, November 30, 2023 11:50 AM
To: Jennifer Cormier <Jennifer.Cormier@ACOA-APECA.GC.CA>
Cc: Luke Bulmer <Luke.Bulmer@acoa-apeca.gc.ca>; Mélanie LeBlanc <Melanie.LeBlanc@ACOA-APECA.GC.CA>; Tristan Hovey <Tristan.Hovey@ACOA-APECA.GC.CA>; Kafa El Zamer <Kafa.ElZamer@ACOA-APECA.GC.CA>
Subject: Moltex Energy Canada - PAF ready for review
Importance: High

Hi Jennifer,

Here's the link to the Moltex PAF, for your team's review and comments:

Project: Project Assessment: Demonstrate the WATSS technology using spent CANDU fuel - Dynamics 365

Please let us know if you have any questions or concerns – thanks,

Josh Jenkins
Director, Innovation, Trade & Business Growth
Atlantic Canada Opportunities Agency / Government of Canada
Josh.Jenkins@canada.ca / Tel: 506-851-3626/ Cell: 506-227-9520 / TTY:1-877-456-6500

Directeur, Innovation, commerce et croissance des entreprises
Agence de promotion économique du Canada atlantique / Gouvernement du Canada
Josh.Jenkins@canada.ca / Tél: 506-851-3626/ Cell: 506-227-9520 / ATS:1-877-456-6500