

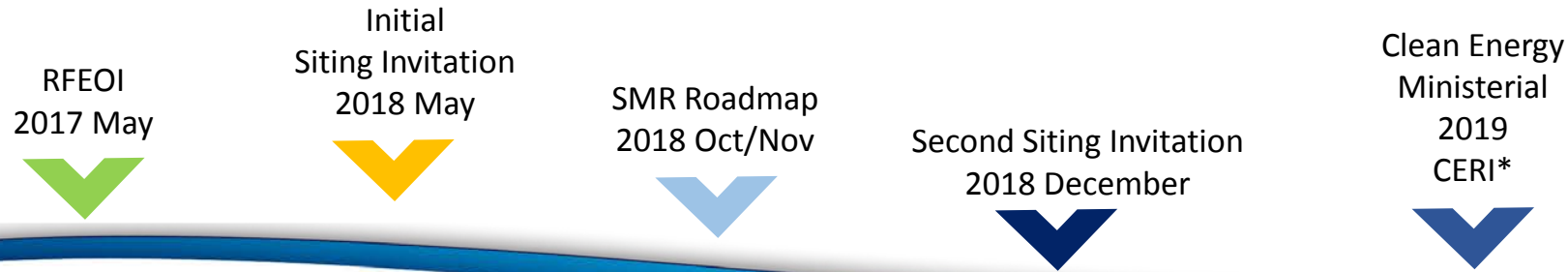
Canada's Industrial User Needs

GAIN Micro-Reactor Workshop
Idaho National Laboratory

June, 18, 2019

Corey McDaniel, Ph.D.
Chief Commercial Officer, Science & Technology
Canadian Nuclear Laboratories

Communicating SMR Momentum in Canada



SMR Roadmap (NRCAN)

Issued by GoC in October

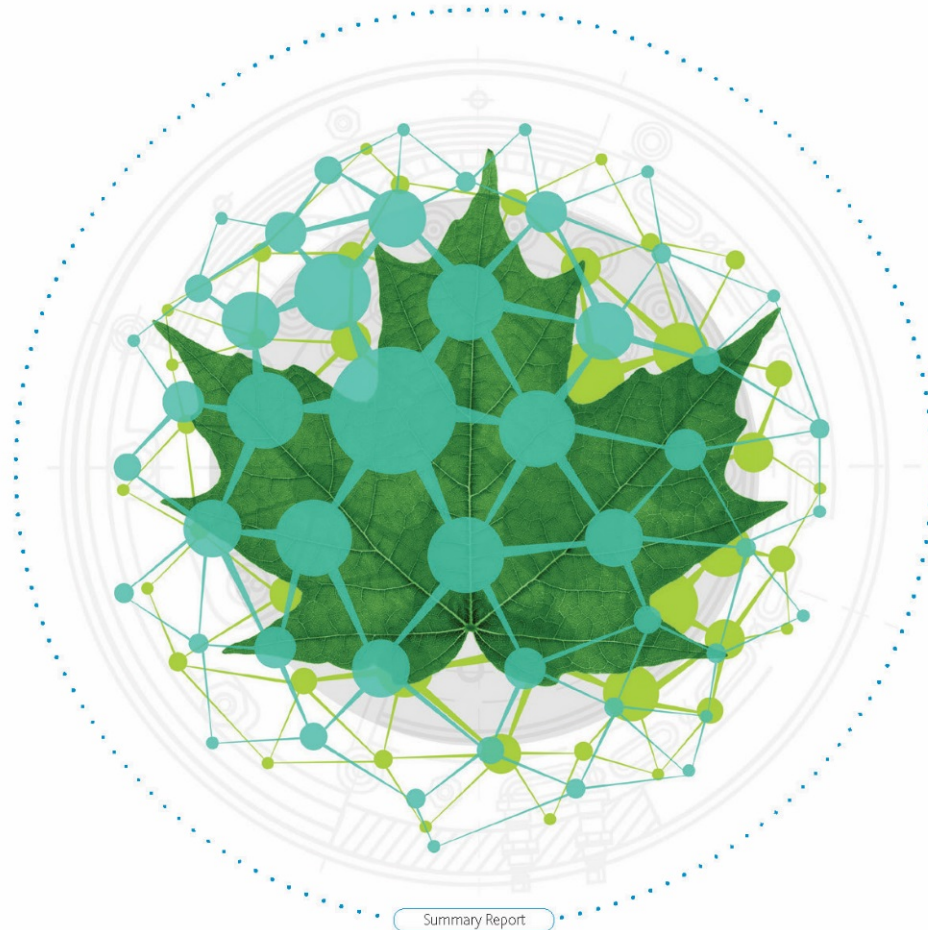
You can read the details at www.smrroadmap.ca

11 SMR Applicants to CNSC Vendor Design Process

- SMR Public Workshop (Nov. 24, 2017) - results report available online

8 Site applicants in Canada

- 6 at CNL (USNC/GF advanced to Stage 3 negotiations with government)
- 2 in New Brunswick (ARC, Moltex)



PERSPECTIVES ON CANADA'S SMR OPPORTUNITY

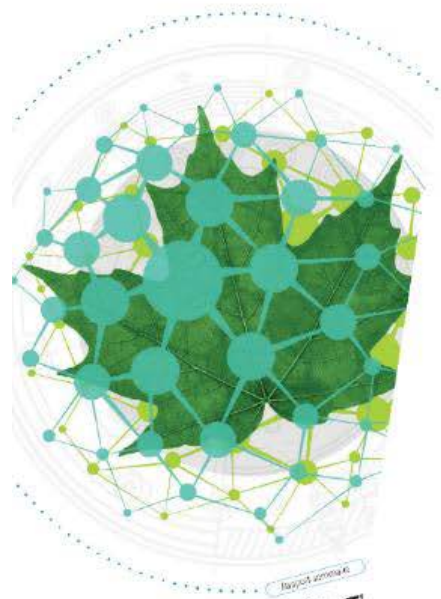
Summary Report: Request for Expressions of Interest—
CNL's Small Modular Reactor Strategy



UNRESTRICTED / ILLIMITÉ

CNL began the conversation in Canada...

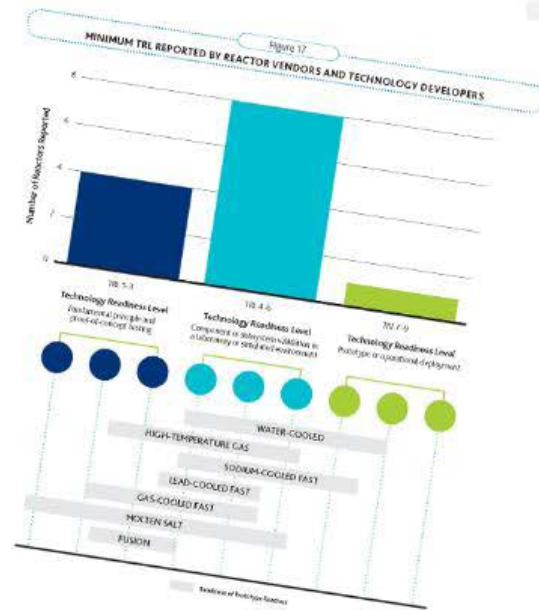
Launched RFEOI in 2017 - to get in a better understanding from all perspectives.



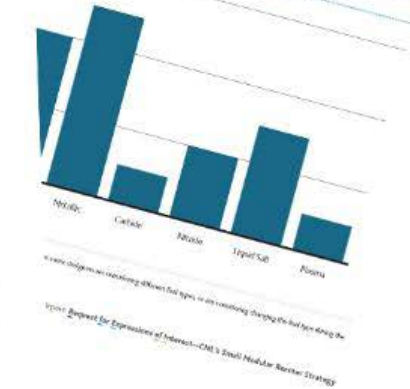
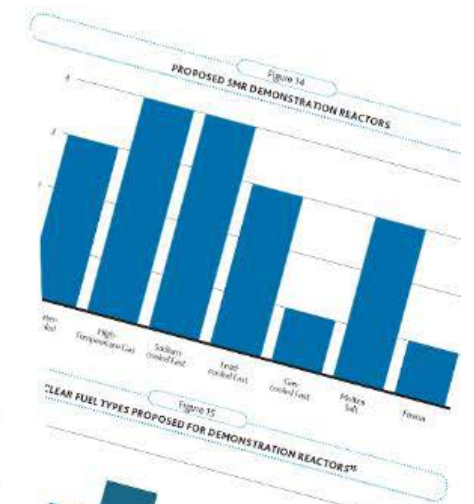
PERSPECTIVES DES RÉACTEURS DE PETITE TAILLE
 Rapport sommaire : Appel à manifester en ce qui concerne les réacteurs



35



Summary Report: Request for Expressions of Interest



Path to Demonstration

Market Survey (2017):

- 80 responses
- 19 potential demonstrations
- Gathered input from vendors, end users and industry

Invitation to Site a Demonstration SMR (2019):

- 6 applications received, more anticipated
- Technology and project developers serious and progressed to site the first demonstration unit



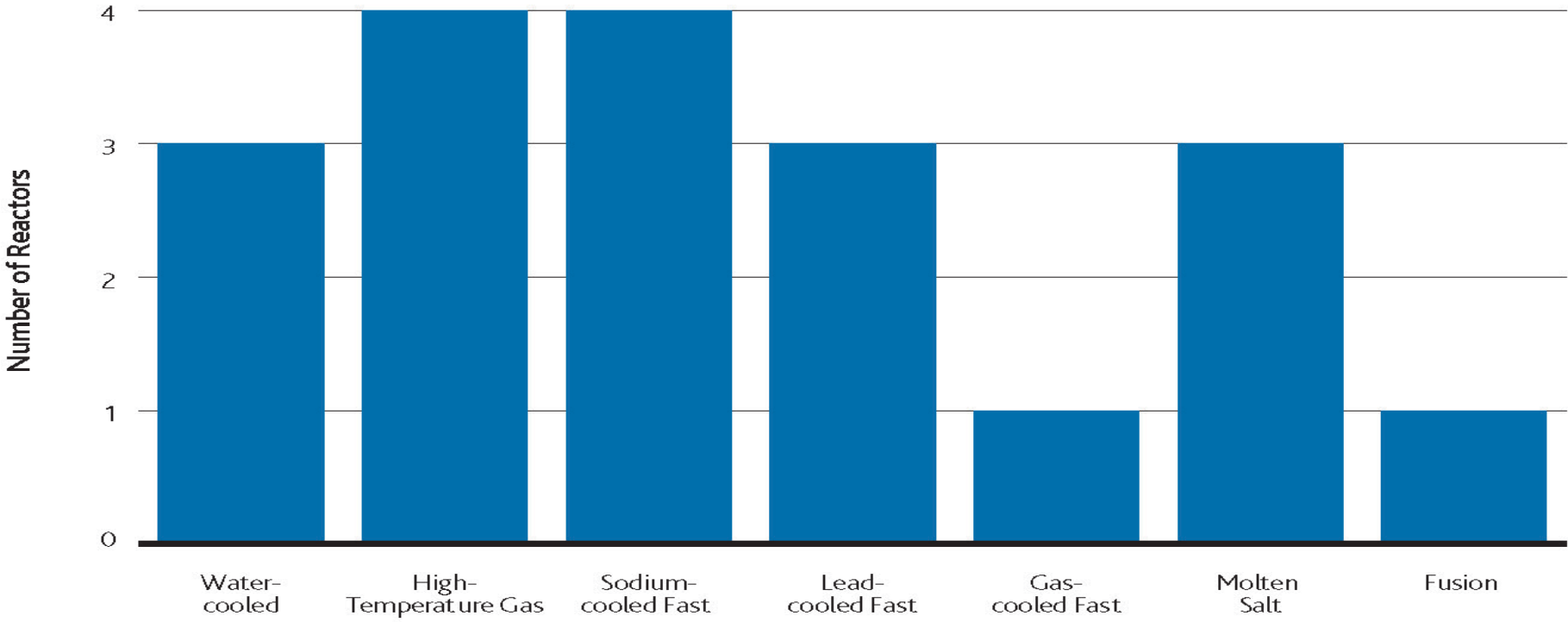
Parallel Activities

- Public Engagement
- Building R&D Capabilities
- Environmental Assessment/ Impact Assessment
- Licence Applications
- Developing partnerships
- Assess waste management approaches and nuclear liabilities

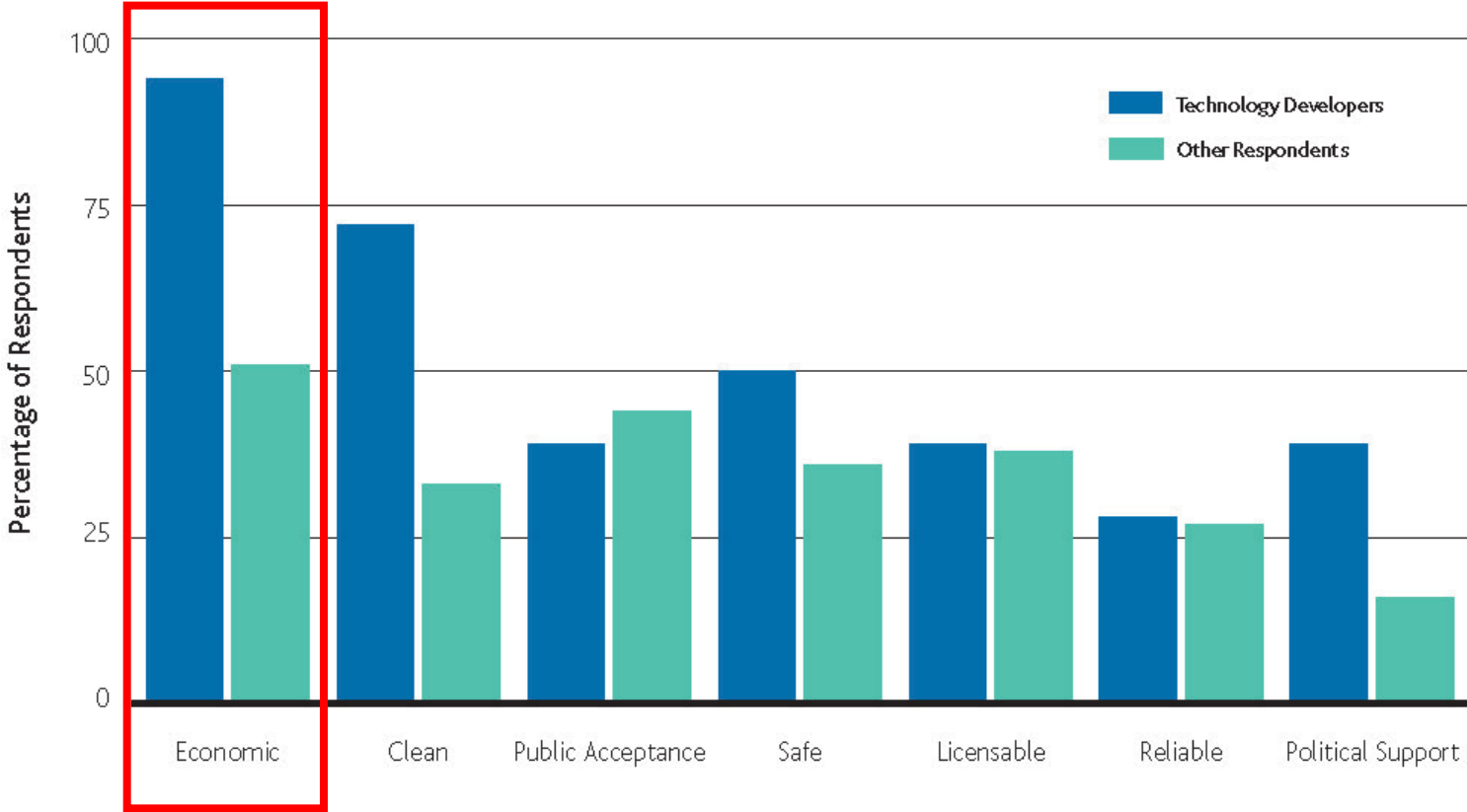
Canadian Responses



Proposed SMR Demonstration Reactors



Requirements for SMR Deployment



Generic Siting Activities at CNL

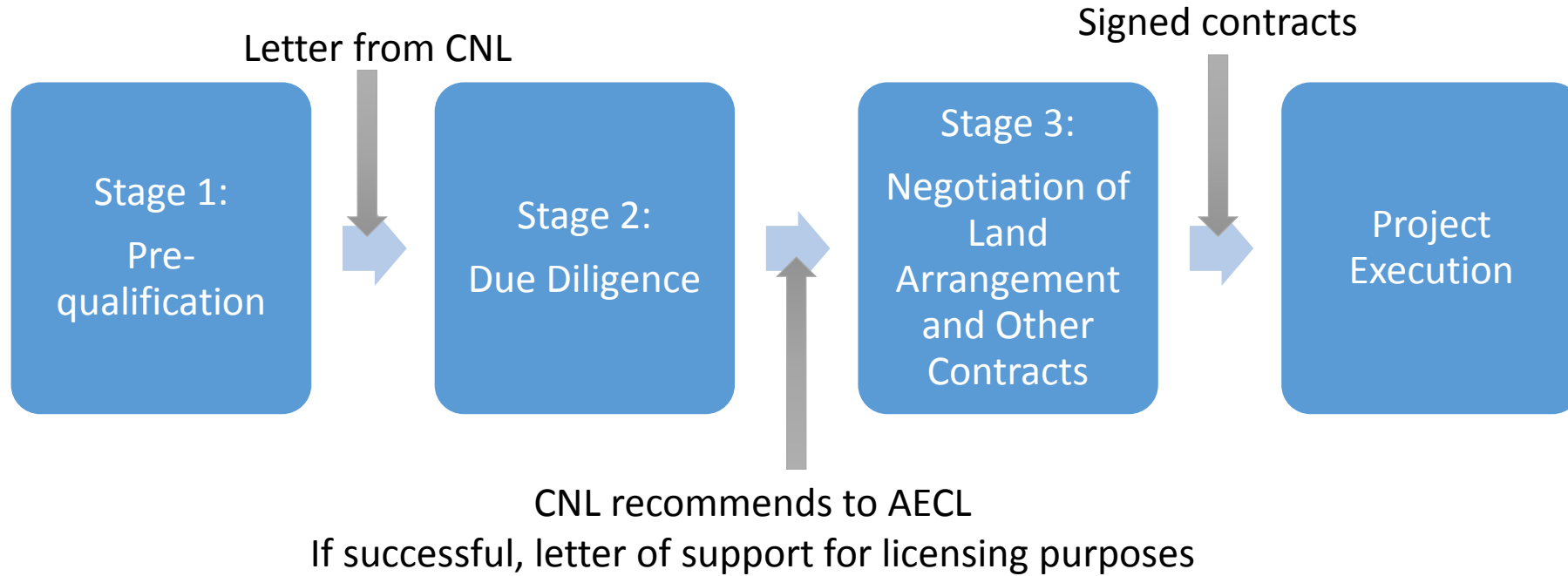
- Technology neutral undertaking, CRL and WL
- Generic SMR siting study using broad vendor feedback
- Sites for at least 10 SMR demonstrations have been identified
 - Some will be more suitable than others
 - Some will be more suitable than others for different technologies
 - Some of these areas could handle more than one SMR

The number of SMRs at CNL will not be limited by the number of sites...

... and CNL manages more than one site.

SMR Siting at CNL

- Process



6 Applicants (3 vSMRs – “Micro-Reactors”)
One Stage 2 Applicant Approved to Stage 3
Two Stage 1 Applicants Approved to Stage 2
One new Stage 1 Applicant

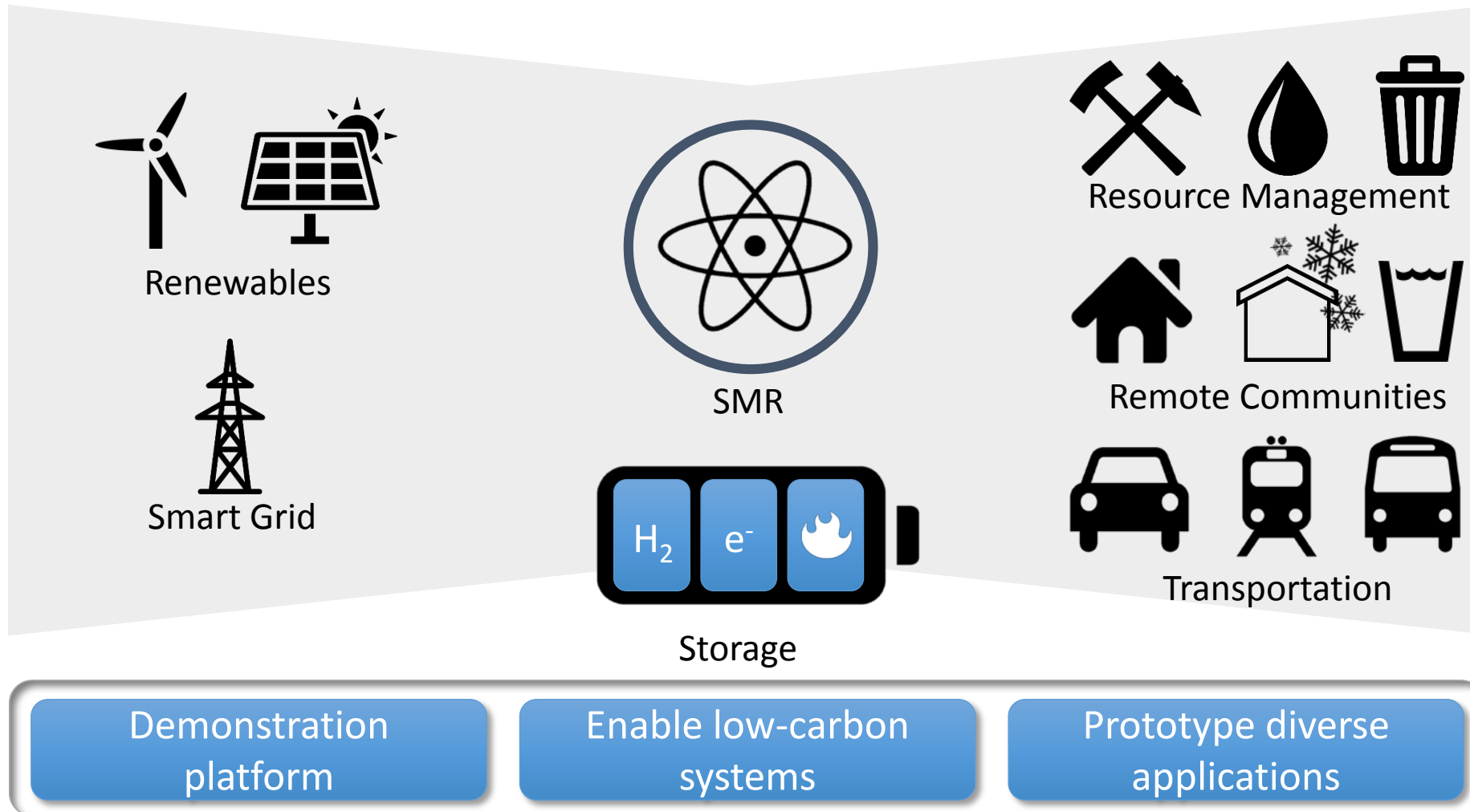
Clean Energy Research Initiative:

1. **Launch / Guidelines – as early as July**
2. **Applications – as early as August**
3. **Awards – as early October**
4. **Size of work – TBD by applicants**
5. **Scope – collaborative clean energy R&D (e.g., economics, fuel, renewable system integration, materials, chemistry, thermalhydraulics, modeling & simulation, etc.)**



Clean Energy Research Park (CERP)

- Advancing the readiness of low-carbon hybrid energy systems with SMRs



SMR Work at CNL

- Work Across the Company

RESEARCH

- Construction
- Remote inspection and monitoring
- Human Performance
- Modelling & Simulation
- Computational tools
- Waste management
- Hybrid energy systems
- Passive safety systems
- Severe accidents
- Fission Product Release

BUILDING CAPABILITY

Continue to invest into the facilities and capabilities needed to support SMR development, including molten salts and fuel fabrication of HA LEU fuels.

COMMERCIAL

- 18 NDA
- 7 MOUs
- 8 MTA
- 12 contracts

35 additional in discussion.

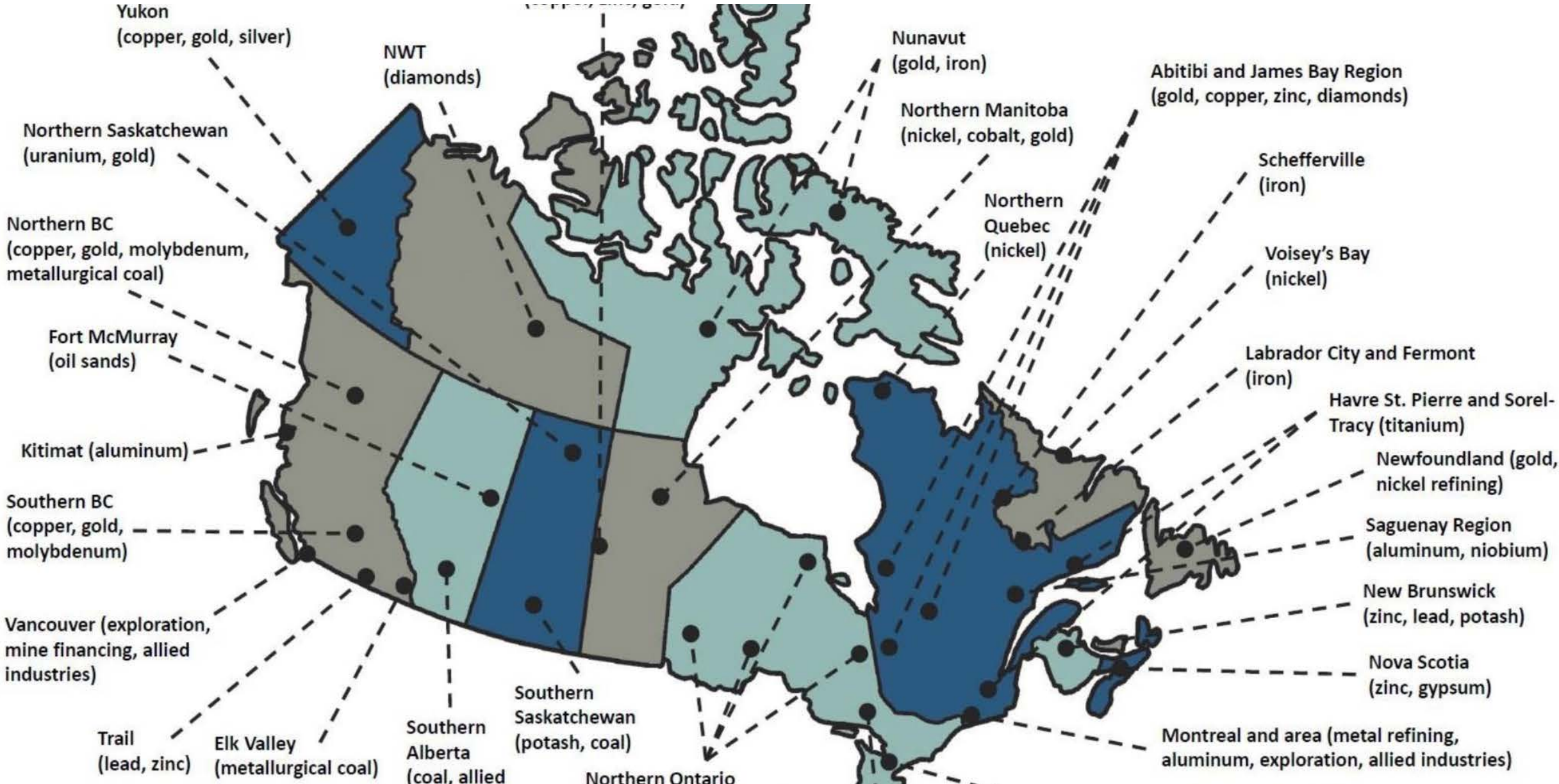
SITING

Generic siting studies completed.

Vendor-specific siting studies underway.

6 site applications received

Canada has >200 Remote Mining Sites (Alaska has 31)



Mining in Canada

- **60% of global mining revenue is traded on TXE**
- **PDAC (Prospectors) conference attracts >30,000**
 - Large nuclear timeline is 60 years
 - Mining timeline is 5-15 years
- Mining Business Case
 - Demonstration within 5-10 years to take advantage of current “up-swing” (cyclical)

Advantages to vSMR Deployment in Canada

- Government Climate Policy (applies to mining)
- Robust market for mining and remote communities
 - >125 remote communities >500 inhabitants
- Progressive, Risk-Informed Regulator (CNSC)
 - 11 applicants to Vendor Design Review (VDR)
- Mature Supply Chain (\$26 Billion refurbishments)
- Canadian National Laboratories
 - Siting, R&D support, fuel fabrication/HALEU
- Federal Government SMR Roadmap (no funding, yet)



**MOMENTUM IS
BUILDING FOR
SMALL MODULAR
REACTOR
DEPLOYMENT IN
CANADA**

- 6 APPLICANTS TO CNL'S SITING INVITATION
- 9 APPLICANTS TO CNSC VENDOR DESIGN REVIEW
- 35+ REACTORS REPRESENTED AT 4 CNL ROUNDTABLES

Canadian Momentum

6 SMR Roundtables w/ 38 Different Vendor Designs

- 1st - Winnipeg, October 2017 (12 Vendors)
- 2nd - Atlanta, March 2018 (18 Vendors)
 - Launch: **CNL Siting Application Process**
- 3rd - San Francisco, PBNC - October 2018 (26 vendors, 6 countries) Launch: **CERP**
- 4th - Ottawa, G4SR, 6 November 2018 (23 Vendors - 500 attendees - **SOLD OUT**)
 - Launch: **Canada's SMR Roadmap**
- 5th - Atlanta, April 2019 (19 Vendors)
- 6th - Vancouver, May 2019 (18 Vendors) Launch: **CERI**

7th SMR Roundtable - Washington, DC

- ANS Winter Meeting, November 20, 2019
- Focus: **North America Collaboration**
- Regulatory Harmonization, HALEU, Joint R&D

8th SMR Roundtable - Toronto - G4SR 2020 (TBD)

<https://www.youtube.com/watch?v=wsfrYpfmpWI>



The place is Canada.
The time is now.
Your partner is CNL.

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