Canadian Nuclear Laboratories | Laboratoires Nucléaires Canadiens

Enabling Small Nuclear: A Pan-Canadian Approach to SMRs

Energiforsk SMR Conference

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A national lab focused on national priorities.

- Canada’s national nuclear laboratory
- Over 50 unique laboratories
- Diverse team of ~3,300
- Laboratory and Project Sites:
  - Chalk River Laboratories, Ontario
  - Whiteshell Laboratories, Manitoba
  - Historic Waste Program / PHAI, Ontario
  - National Innovation Centre for Cybersecurity, New Brunswick
  - Prototype reactors and legacy facilities

Restore and protect the environment

Clean energy for today and tomorrow

Improve the health of Canadians

Canadian Context: “Team Canada Approach”

- Federal recognition of role of nuclear in achieving GHG emission targets
- National SMR Roadmap developed and actioned
- Provinces and Utilities commit to the development & deployment of new nuclear in Canada

- CNL builds SMR research programs and prepares for potential demonstration project
- Academia focused on next generation of nuclear workers and researchers
- Supply chain assesses SMR industry and readies itself

Pan-Canadian SMR Roadmap (2018) and Action Plan (2020)

SMRs as a source of safe, clean, affordable low carbon energy

SMR Roadmap

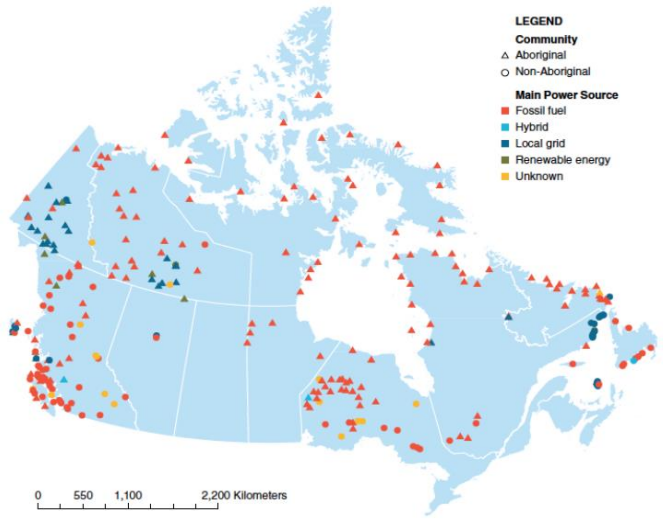
- 4 Provinces, 2 Territories and 5 power utilities
- 50+ recommendations for Government, Industry, Academia, Research Organizations and others

SMR Action Plan

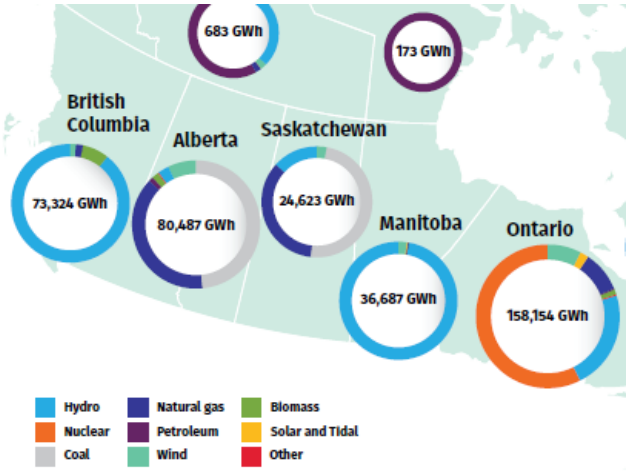
- a path forward for SMRs
- 109 Participating Organizations
- 450 Actions being tracked

"Team Canada" Approach

Canadian Market Potential



Sources: The Conference Board of Canada; Arriaga, *Sector Profile*.



Northern Canada

- Over 200 communities, largely Indigenous, reliant on diesel generation
- Health & well being, climate, and financial advantages from energy independence and energy empowerment

Resource extraction

- Hydrogen production for oil sands bitumen upgrading
- Power for in-situ and surface extraction sites
- SMR for mineral mining sites

Low Carbon Energy

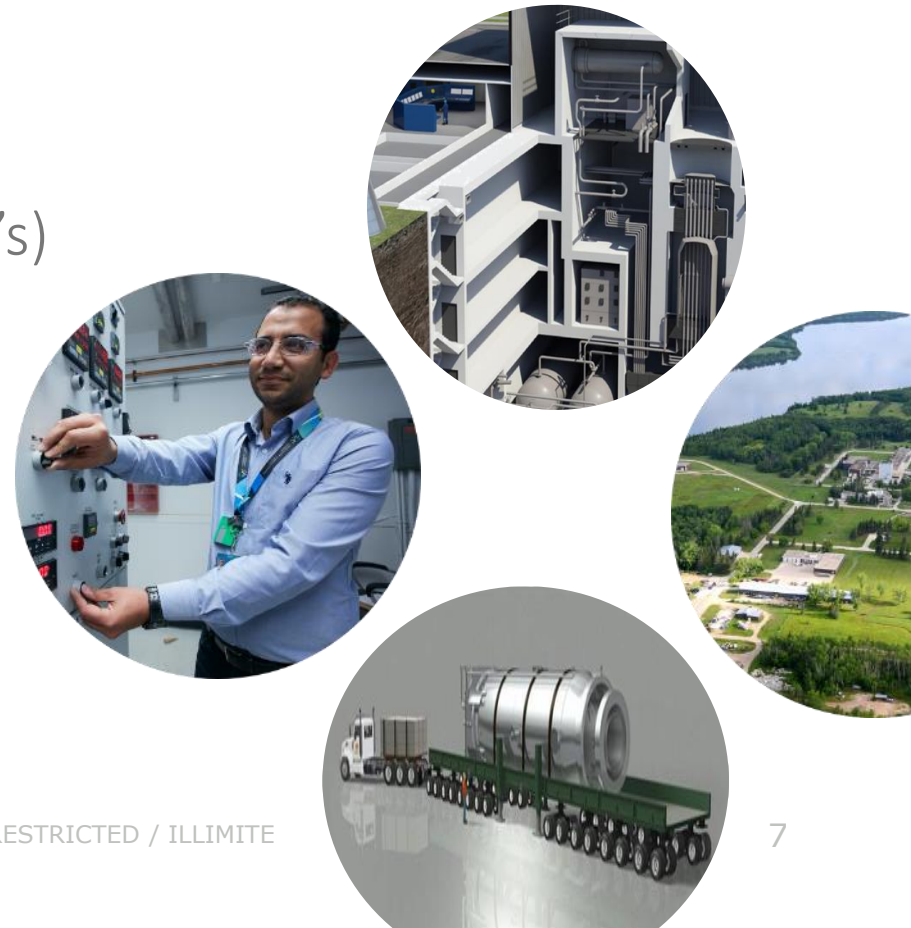
- Larger, grid-sized SMR designs could enable a significant shift away from coal-fired generation, as demonstrated in Ontario

Time Frames to Deployment in Canada

Nuclear Industry defines 3 distinct and equally important streams for SMR deployment

- **Stream 1**: On-Grid Replacement (2020's)
- **Stream 2**: On-Grid Replacement AR (Early to mid 2030's)
- **Stream 3**: Off—Grid Micro Reactor (2020's)

CNL has a goal to site an SMR Demonstration project by 2026 through an open invitation process



Canadian Industry Actively Supporting SMR Development

- NB Power supporting Moltex and Arc, creating an SMR Research Initiative involving UNB
- OPG supporting Terrestrial Energy, GE/Hitachi and X-Energy
- Bruce Power pursues applications of Westinghouse eVinci reactor
- Provincial MOU between New Brunswick, Ontario and Saskatchewan
- GFP project at CRL first project in Canada to submit a licence application

CNL Demonstration Timeline

GLOBAL FIRST POWER

Launch CNL Invitation Process and First Intake 2018

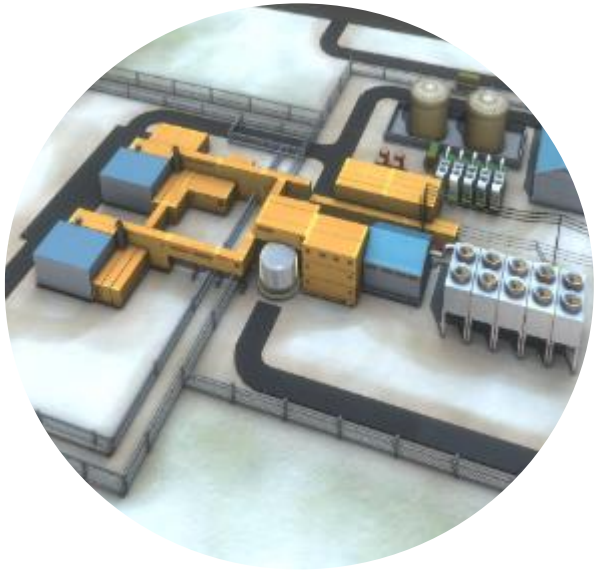
1st Licence Application in Canada 2019

Licence to Prepare Site 2022*

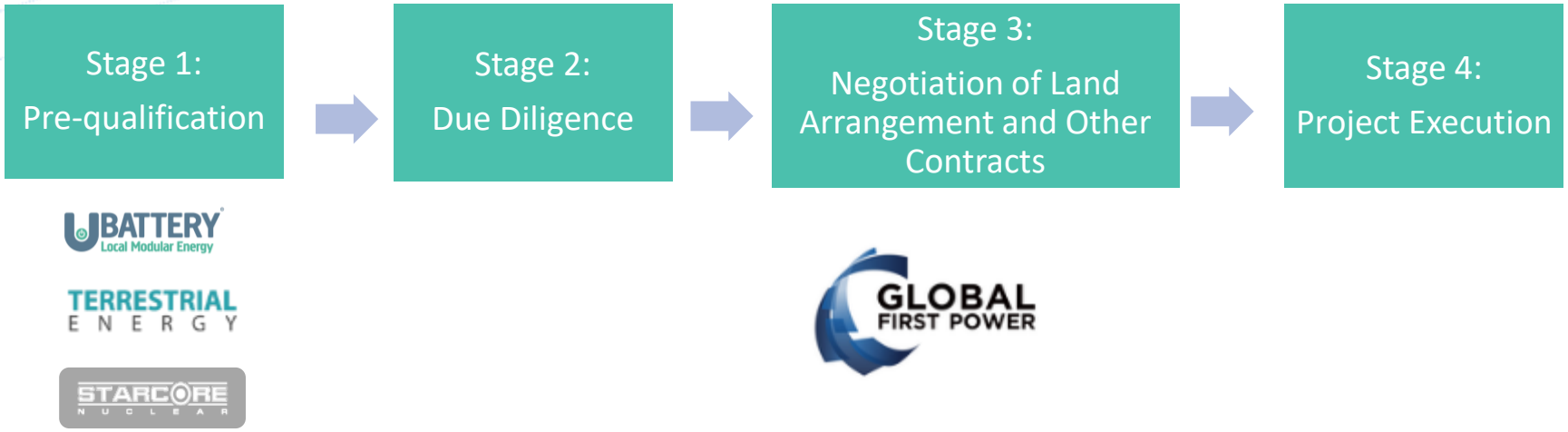
Licence to Construct and Licence to Operate 2023*

SMR First Power 2026

Energy Offtake ~2027-2028



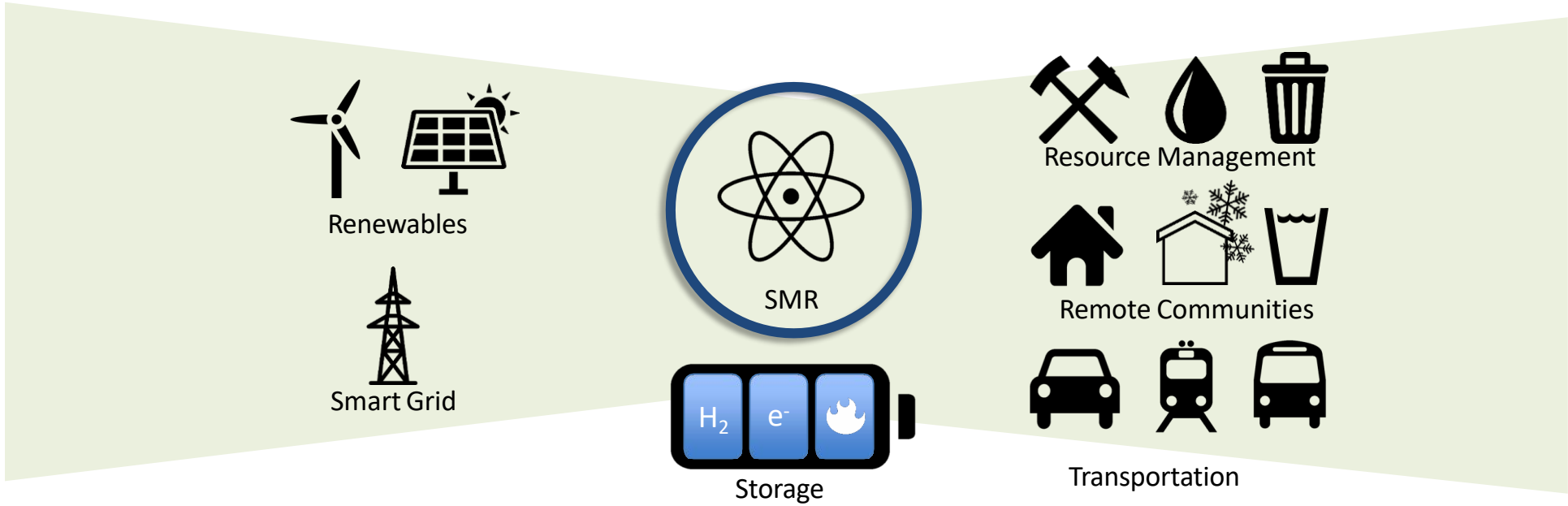
Siting Invitation Process Update



- GFP jointly owned by OPG and USNC
- Submitted application to CNSC for a licence to prepare site at CRL in March 2019
- CNSC Record of Decision related to Environmental Assessment scope – July 2020
- GFP Environmental Impact Statement work commenced
- Completed geophysical site evaluations for deployment of GFP's MMR reactor in Chalk River

Clean Energy Development Innovation and Research (CEDIR) Park

Demonstrate Nuclear Co-Generation (future project at CNL)



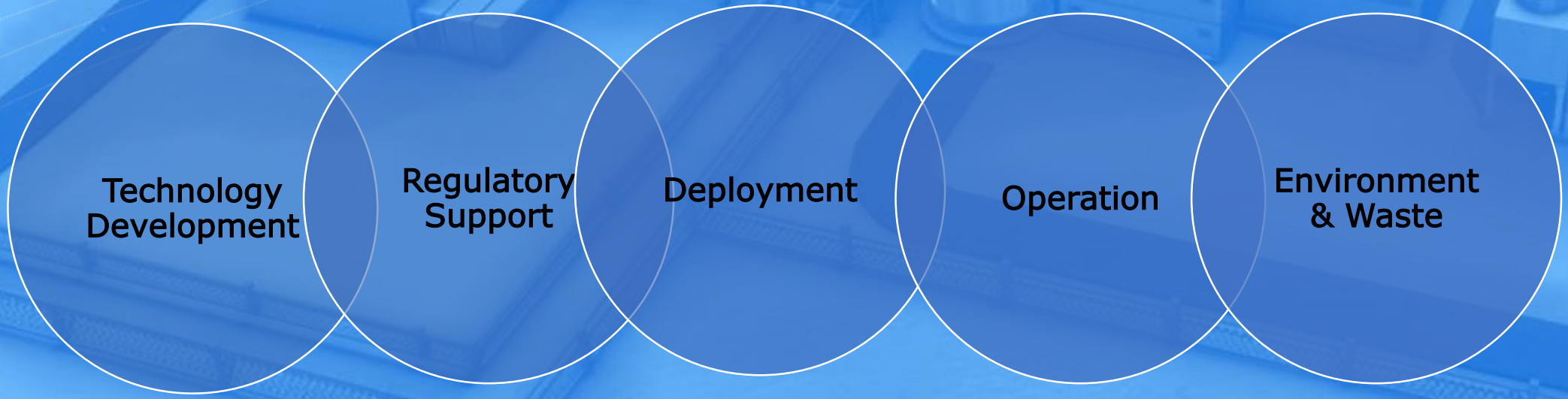
Demonstration platform

Enable low-carbon systems

Prototype diverse applications

Advanced Reactor Research at CNL

De-Risking Development & Deployment



Canadian Nuclear Research Initiative (CNRI)

- **Feasibility Studies, Co-generation & Economics**
- **Reactor Physics & Fuel**
- **SMR Component Degradation**
- **Safety, Security and Licensing**
- **Tritium Management**
- **Thermalhydraulics**

A cost sharing program with SMR Developers

Thank You

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DELIVERING THE
SCIENCE OF TOMORROW,
TODAY.