Advanced Small Modular Reactor Development in New Brunswick

NUPIC Vendor Conference
Daniel Beaulieu
June 14 – 15, 2023

New Brunswick, Canada

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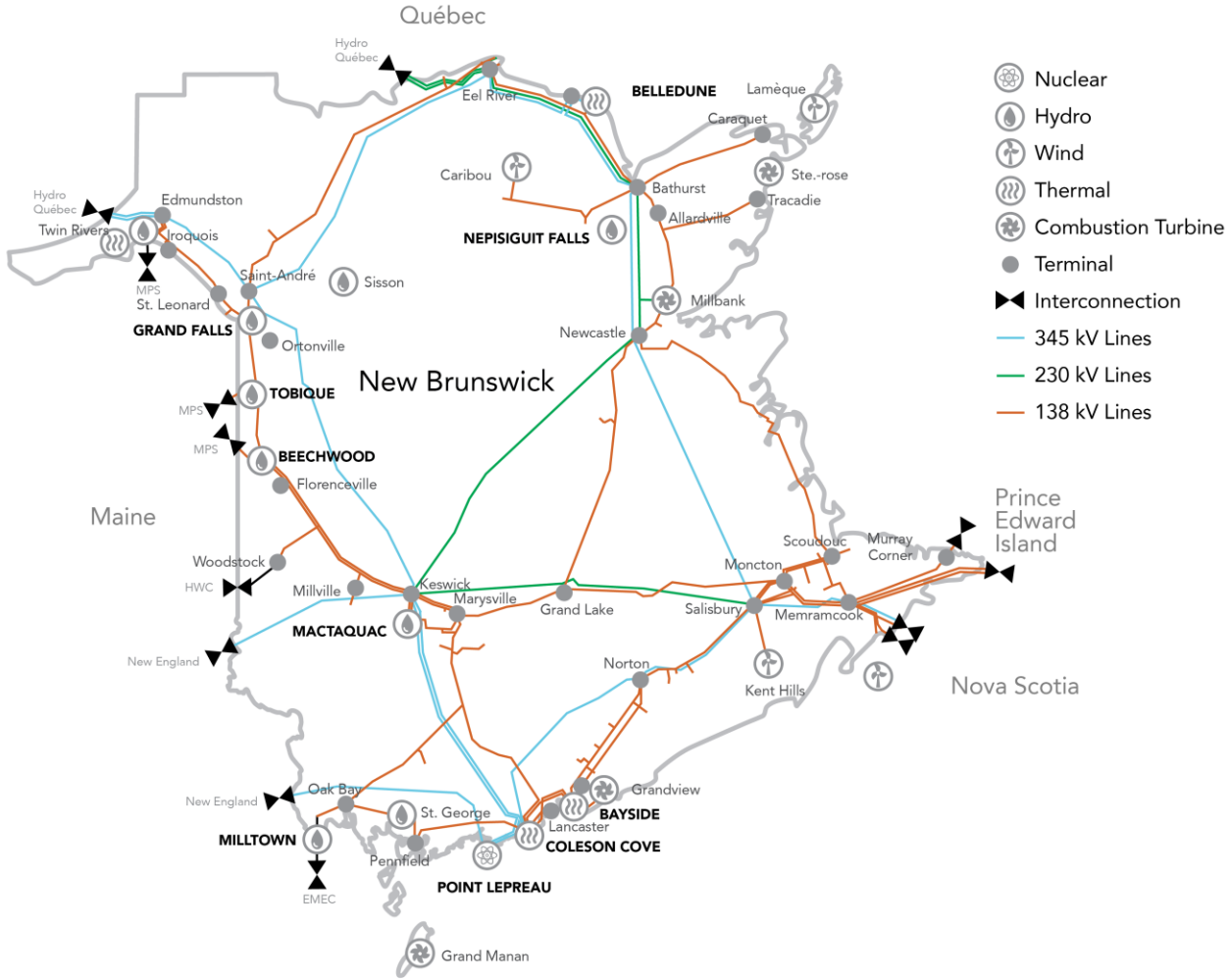
NB Power Overview

- NB Power is the primary electric utility in New Brunswick, Canada – It is a vertically-integrated Crown Corporation
- NB Power has one of the most diverse generation fleets in North America
- Approximately 80-percent non-emitting generation, including **nuclear power** from the Point Lepreau Nuclear Generating Station



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SMR Pan-Canadian Approach

Stream 1

On-Grid “ready deployable” SMRs by late 2020s at Darlington, Ontario

Stream 2

On-Grid next-generation Advanced SMRs being developed in New Brunswick that bring additional benefit for deployment in early to mid 2030s.

Stream 3

Very small SMRs (VSMRs) for resource extraction and remote communities.

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Why Advanced Nuclear?

- **Clean Energy** which is necessary part of climate solution
- **Inherent safety** characteristics and passive safety
- **Simple** design & **Low cost** affordable energy
- Potential to **recycle its own used fuel** thus less waste and less radiological toxicity
- Supports **renewables**
- **High temperature** steam for heavy industry and **hydrogen** generation - synthetic fuels
- **Supply chain**, fleet export market, economic growth

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Vision

Opportunity to grow a new sector

- Demonstrate advanced reactor technologies at Point Lepreau between early to mid 2030s
- Establish supply chain in NB and Canada to support SMRs
- Fleet deployment in New Brunswick / Canada / International markets
- Centralized fleet support Centre in NB

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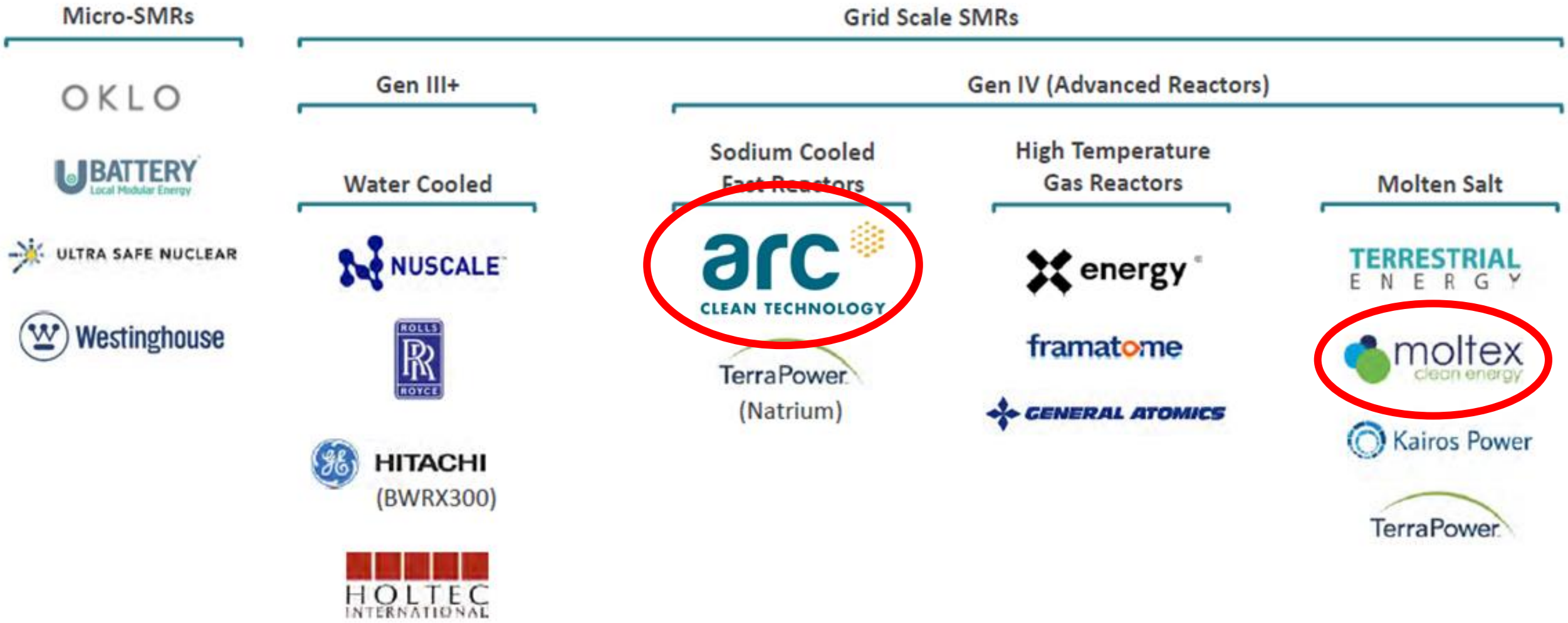
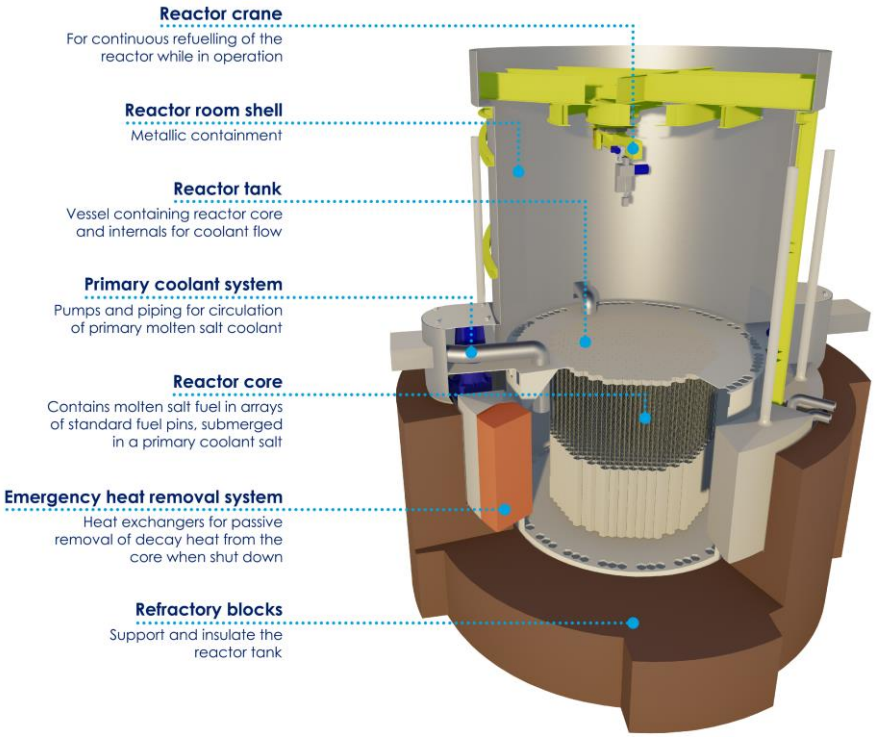
Cross-Section of SMR Technology





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Moltex Energy SSR-W
Molten Salt Fast Reactor

- 300 MWe non-pressurized pool reactor
- Fuelled online
- Fuelled by used CANDU fuel and can recycle its used fuel
- Inherent safety characteristics and passive safety features
- Benefits related to high level radioactive waste disposal
- Grid reserve storage system
- Super heated steam for co-gen / Hydrogen / synthetic fuel production
- Proposed deployment at Point Lepreau site expected in mid 2030s
- Potential subsequent deployment in Ontario and for countries with used fuel stocks

Moltex SSR-W / WaTSS
Current Activities

- Conceptual design and research and development phase
- Completed Phase I of CNSC VDR process, working to move on to Phase II
- Will require a Federal Impact Assessment for fuel recycling

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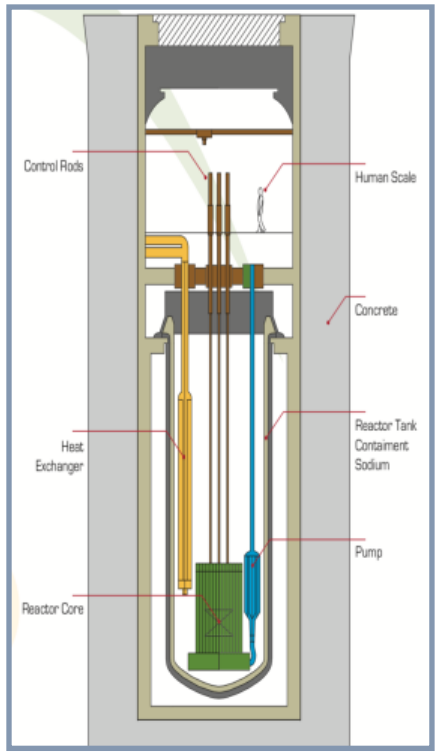

ARC-100
Sodium Cooled Fast Reactor

- 100-150 MWe non-pressurized pool reactor
- Inherent safety characteristics and passive safety features
- Based on 30-year operation at EBR-II
- 20 year fueling cycle and can recycle its used fuel
- Superior load following capability
- Ideally suited for electricity and super heated steam for co-gen / hydrogen / synthetic fuel production
- Good neutron spectrum for isotope production
- Proposed deployment at Point Lepreau site expected early 2030s
- Subsequent units in NB, potentially in western Canada and for export

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ARC-100
Current Activities

- Pre-project phase:
  - Completed Phase I of CNSC VDR process, working through Phase II
  - Site evaluation activities progressing
- LTPS application to be submitted by June 30 2023
- LTPS application submission will officially start the project and environmental assessment

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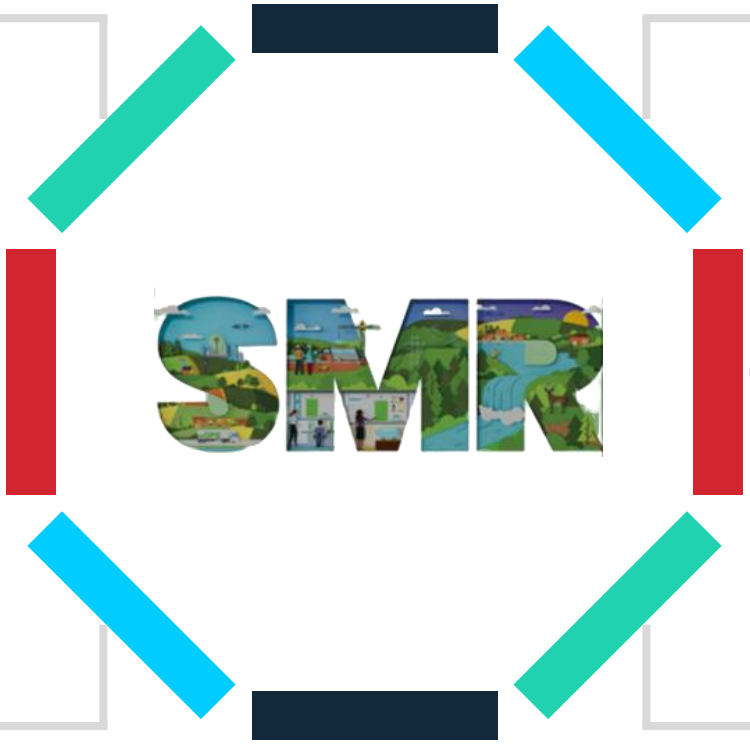
Systems & Major Components – Overview

19 Systems & 116 Components

Assumption is that **80-90%** of the **components** will not change in the detailed design phase

49% of the **NB current capabilities** reside with 1 NB company



7 companies have minimum **1** current capability in Manufacturing and Fabrication (M&F)

15 companies have at least **1** current capability across all Products & Services, i.e., M&F, Installations, Services, Supplier & Other

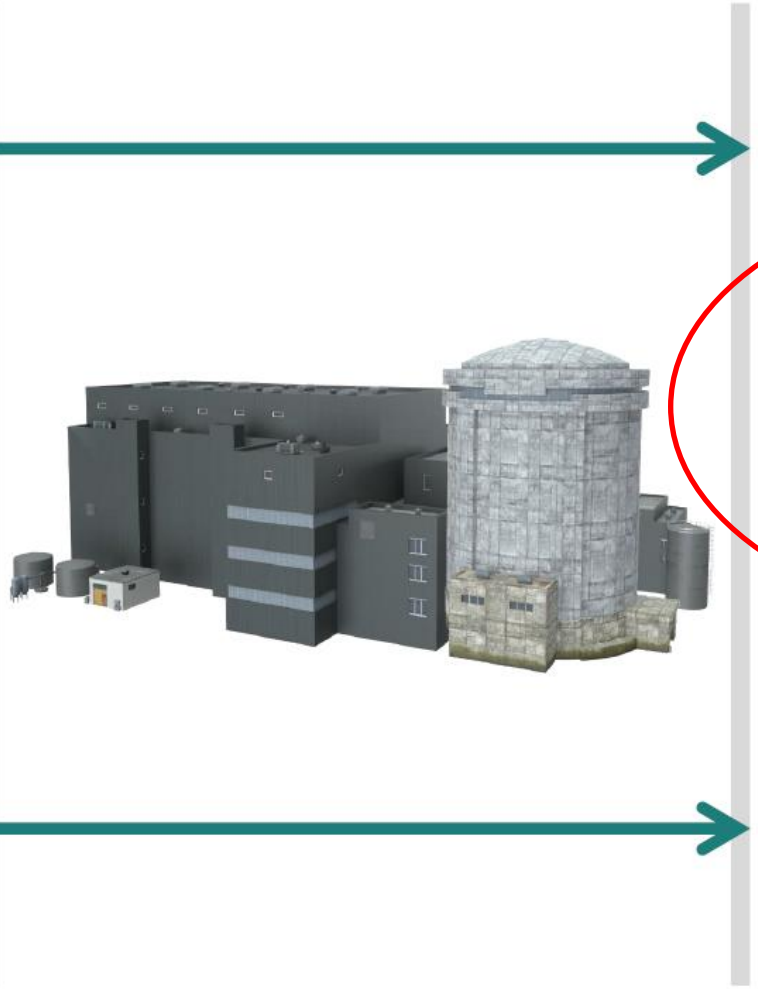
23 companies either have current capabilities or have expressed interest in developing **future capabilities**

Systems & Major Components

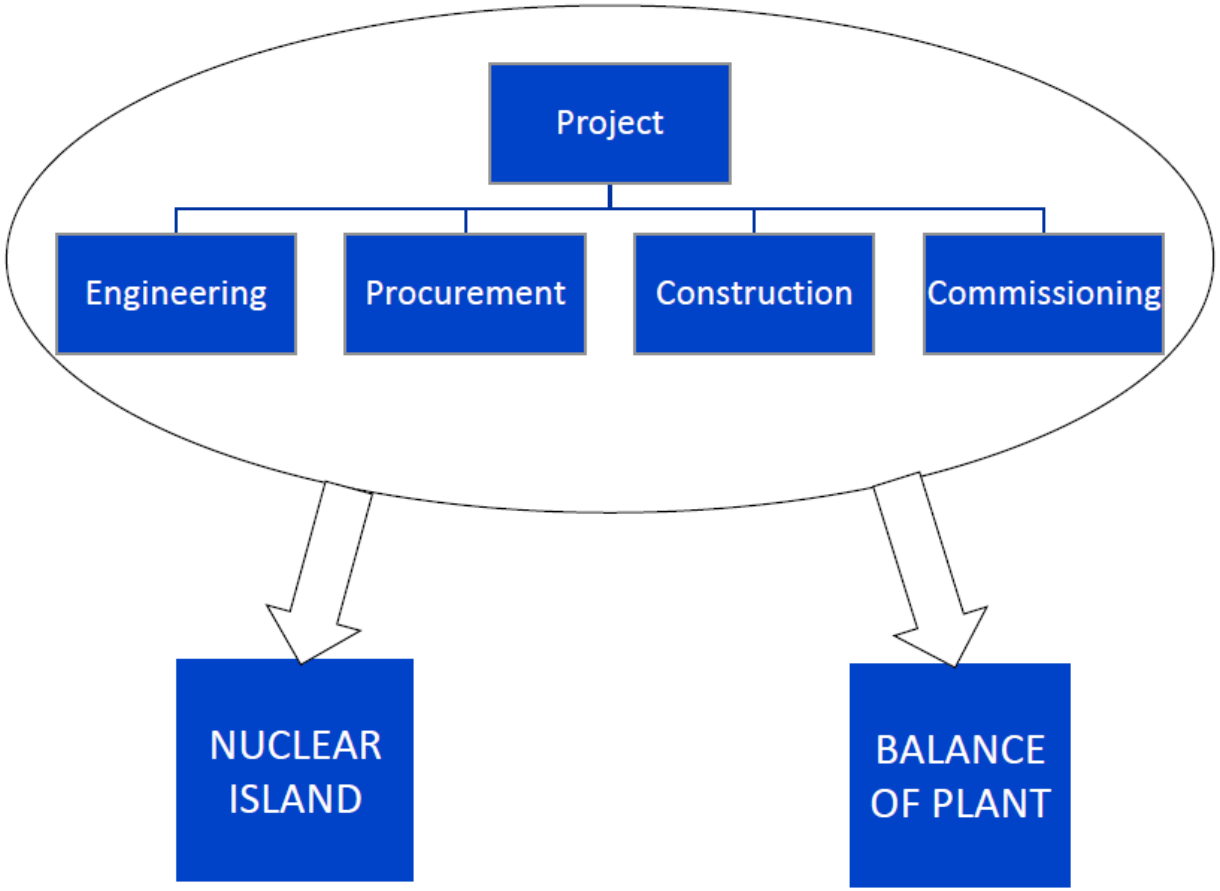
NB companies with current capabilities

Systems & Major Components	# Of Items	NB	GAP	% Coverage
01 - Reactor Vessel	14	6	8	43%
02 - Primary Heat Transport System	4	2	2	50%
03 - Intermediate Heat Transport System	5	0	5	0%
04 - Steam Generator System	5	0	5	0%
05 - I&C System	12	0	12	0%
06 - Primary & Secondary Control Rod System	3	0	3	0%
07 - Security Systems and Programs	3	1	2	33%
08 - Reactor Vessel Auxiliary Cooling	5	5	0	100%
09 - Direct Reactor Vessel Auxiliary Cooling	3	2	1	67%
10 - Refueling & Servicing Equipment	3	2	1	67%
11 - In-Vessel Transfer Machine	1	0	1	0%
12 - Gaseous Waste - Cover Gas	4	2	2	50%
13 - Intermediate Sodium Processing	6	4	2	67%
14 - Primary Sodium Processing	6	3	3	50%
15 - Liquid Metal Systems Heating & Insulating	4	4	0	100%
16 - Condensate & Feedwater	5	4	1	80%
17 - Non-Sodium & Sodium Fire Protection	2	2	0	100%
18 - Plant Electrical Systems	30	30	0	100%
19 - Steam Turbine System	1	0	1	0%
Total	116	67	49	
Total %		58%	42%	

Meeting the Needs of the Future Fleet



- Strategic Goal to separate the nuclear island (NI) from the balance of plant (BOP) or connected facilities (CF)
  - BOP or CF can be engineered, procured, constructed, commissioned, operated, and maintained in the same manner as non-nuclear industrial facilities.
- This separation will lead to regulatory, capital and O&M cost reductions.
- Traditionally, the costs for the balance of plant (BOP) for nuclear plants is 3x what it is for fossil plants with similar equipment.



Source: EPRI Advanced Nuclear Technology Program

SMR Deployment Challenges (FOAK & Fleet)

- Manufacturing and Assembly
- Fuel Supply
- Waste Strategy
- Siting and Regulatory Streamlining
- Financing
- Resources

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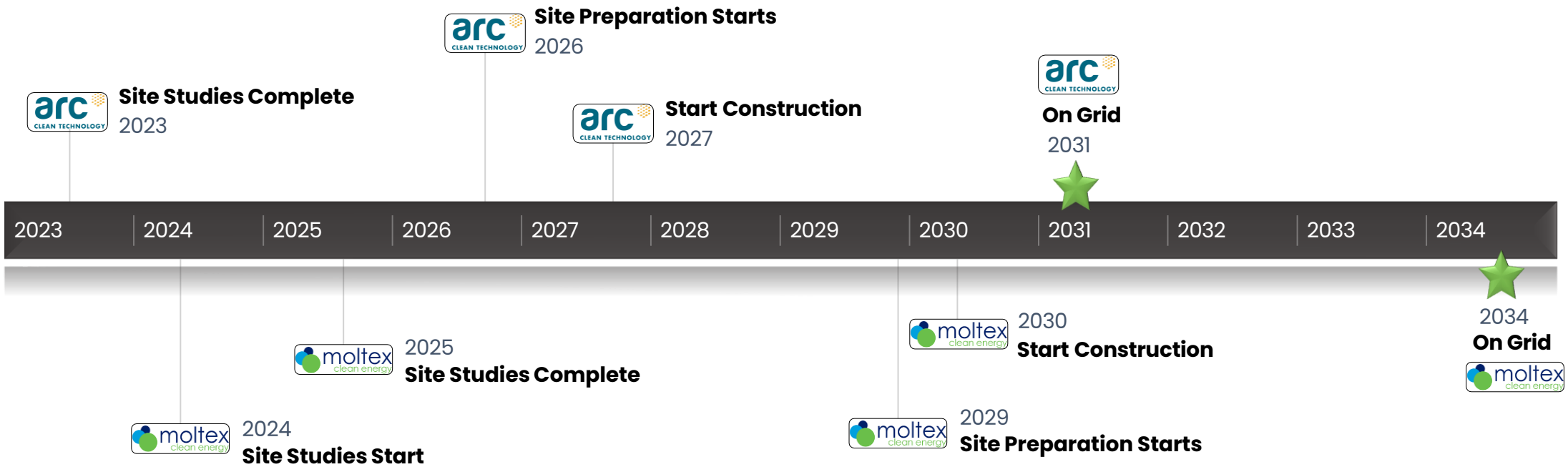
Next Steps

- Submit Application for Licence to Prepare Site for ARC demonstration in June 2023
- Work with industry and finalizing investments and strategic partnerships
- Progress development of supply chain activities
- Working with Atlantic Universities and Colleges to develop programs required to support SMRs
- Progress site characterization and environmental impact assessment

Current Timelines



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RECAP

- LTPS Application and EIA Submittal for ARC-100 – June 30th, 2023 – ***On track***
- LTC Application submittal for ARC-100 – December, 2024
- Develop Supply Chain for FOAK and NOAK
  - In New Brunswick as much as possible
- Demonstrate Technologies in New Brunswick – with Future Fleet Deployment

SMALL MODULAR REACTORS
IN NEW BRUNSWICK

Small reactors.
Big opportunities.

PETITS RÉACTEURS MODULAIRES
AU NOUVEAU-BRUNSWICK

Petits réacteurs.
Grandes possibilités.

Acronyms Utilized in Slide

- CNSC – Canadian Nuclear Safety Commission
- LTPS – Licence to Prepare Site
- LTC – Licence to Construct
- FOAK – First of a Kind
- NOAK – Nth of a Kind
- SSR-W – Stable Salt Reactor – Waste Burner
- WaTTS – Waste to Stable Salt

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