



Small Modular Reactor (SMR) Deployment Prospects

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Framing the picture

What's the need?

Where are we now?

What's the path?

Framing the picture



Ontario?



National?



Canada-UK?

North America may be the best frame for action on SMRs

Compatible systems & institutions; Integrated power system & economy; A (barely) manageable number of jurisdictions



- Record of successes
- River basins & Seaway
- Defence production
- NORAD
- Auto Pact
- Space program
- FTA & NAFTA
- Shared Border Accords
- Carbon markets next?

What's the need?

Replacing fossil fuels **in end-of-life smaller generating units** (priority for Saskatchewan & Alberta, and in many US States under Clean Power Plan)



Ontario's need:

Modest vs. other states/provinces, but presumably knowable

What's the need?

Displacing fossil fuelled power **in edge-of-grid or off-grid communities** (priority for Energy and Mines Ministers)



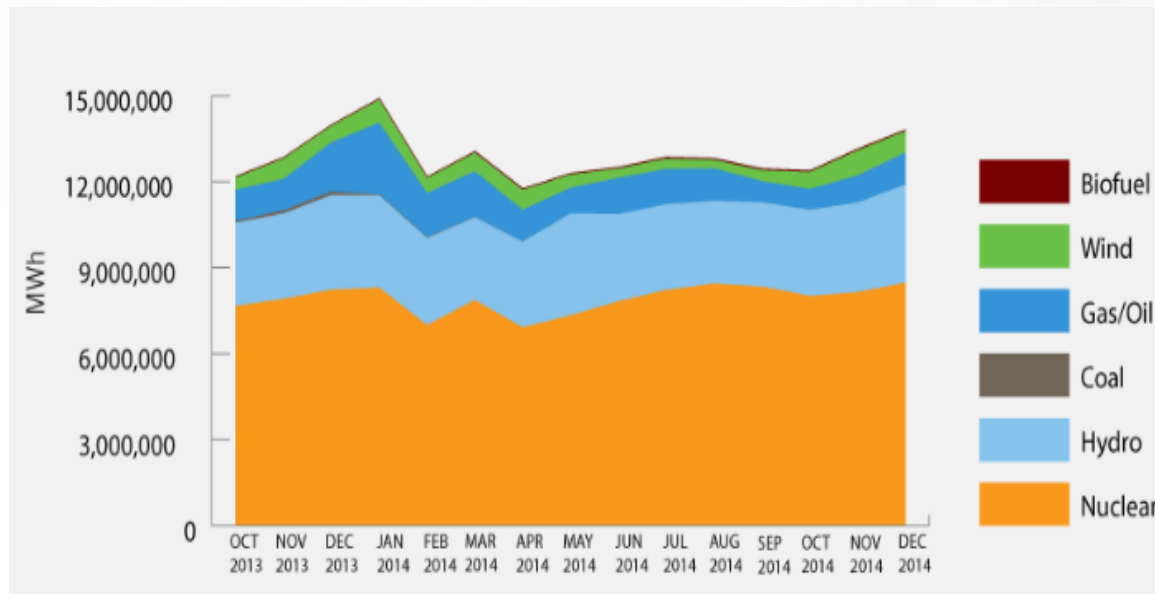
Ontario's need:

21 Hydro One
remote communities

Mostly diesel-fired plus
small hydro and wind

What's the need?

Incremental additions to base load generation
(depends on uncertainties like demand growth, solutions to the intermittency/storage problem, electrification of transport sector, financing mechanisms for SMRs)



Ontario's need:

Unknown

Power system
planning required

What's the need?

Displacing fossil fuels for heat/steam in **natural resource processing** (bitumen separation, wood pulping, minerals)



Ontario need:

Pulp and paper in decline

Minerals is a large sector,
but not much growth

**Future growth depends on
realizing the Ring of Fire
opportunity**

Where are we now? Two examples

Terrestrial Energy

32.5 Mwe integrated molten salt reactor
(radical technology)

Liquid fuel, no coolant, low pressure

Investment from Govt of Canada (SDTC)

Now in CNSC Phase 1 pre-licensing
Vendor Design Review

Site tbd – Canada's main nuclear lab
(CNL) seems to have all assets required

NuScale Power

50 Mwe light water reactor
(scaled-down conventional tech)

Standard LWR fuel, pressurized

Investment from US Govt (DOE)

USNRC Design Certification
Application expected in 2016

Site Use Permit from DOE in Idaho

What's the path? Key questions

ENGINEERING – Will radical designs (like Terrestrial's IMSR or General Atomics' fast gas reactor) compete in the 2020s with small LWRs (like NuScale's)? Or will the familiar and incumbent LWR technology gain an insuperable lead?

REGULATORY & SAFETY – Ditto. And, will regulatory conditions for SMRs improve (or worsen) the economic case for SMRs versus large reactors? Safety may be greater - will security and public acceptance also be advantages?

LOGISTICS – Can a fully fuelled reactor (or core) be transported large distances between a factory/service facility and a licensed site?

ECONOMICS – All things considered, in how many applications can SMR energy compete with low-carbon alternatives? Does this lead to an efficient scale of SMR production? Over how many jurisdictions must the market be integrated?

FINANCING MODEL – Even if the economic model works, is there a financing model that enables it? Must government back a multi-SMR procurement?

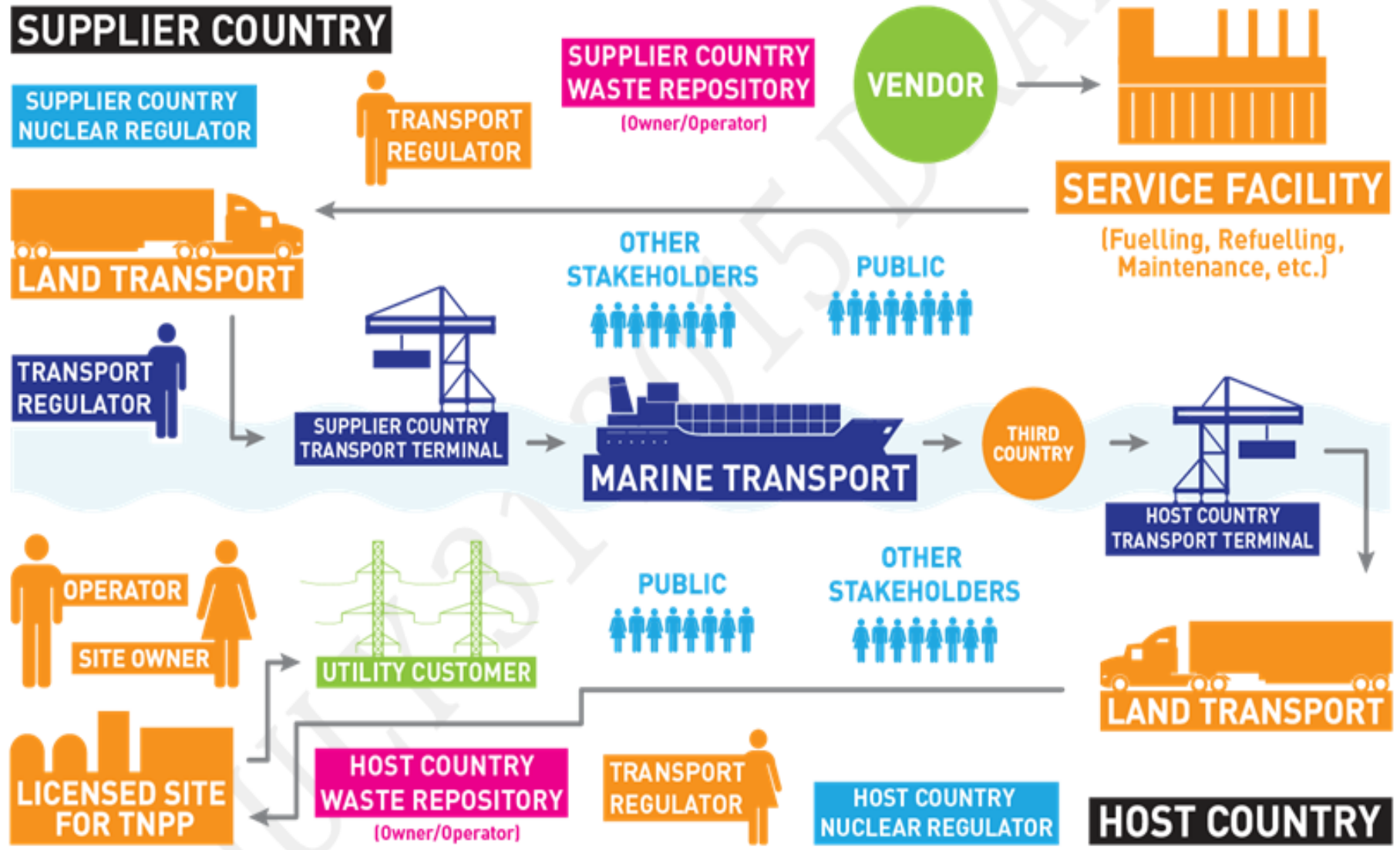
Unpredictability

These questions do NOT appear to stop Ontario from hosting prototype or demonstration SMRs.

These questions DO, however, put great uncertainty around SMRs' deployment in North America in numbers large enough to realize economies of scale in manufacturing, operating, and servicing them.

Odds of success should be improved by transnational thinking and cross-border market integration.

Transnational thinking at INPRO & CNA



Conclusions

SMRs depend on economies of scale in production

Successful SMRs will be a transnational business

Ontario could host prototype/demonstration unit(s)

Ontario can be an SMR market, perhaps an important one

A North American, or Canada-UK, collaboration could expand possibilities for successful deployment.



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