Expanding Natural Gas Service in Ontario Using Liquefied Natural Gas (LNG)

Joshua Samuel, President and CEO of the General Partner
Northeast Midstream LP

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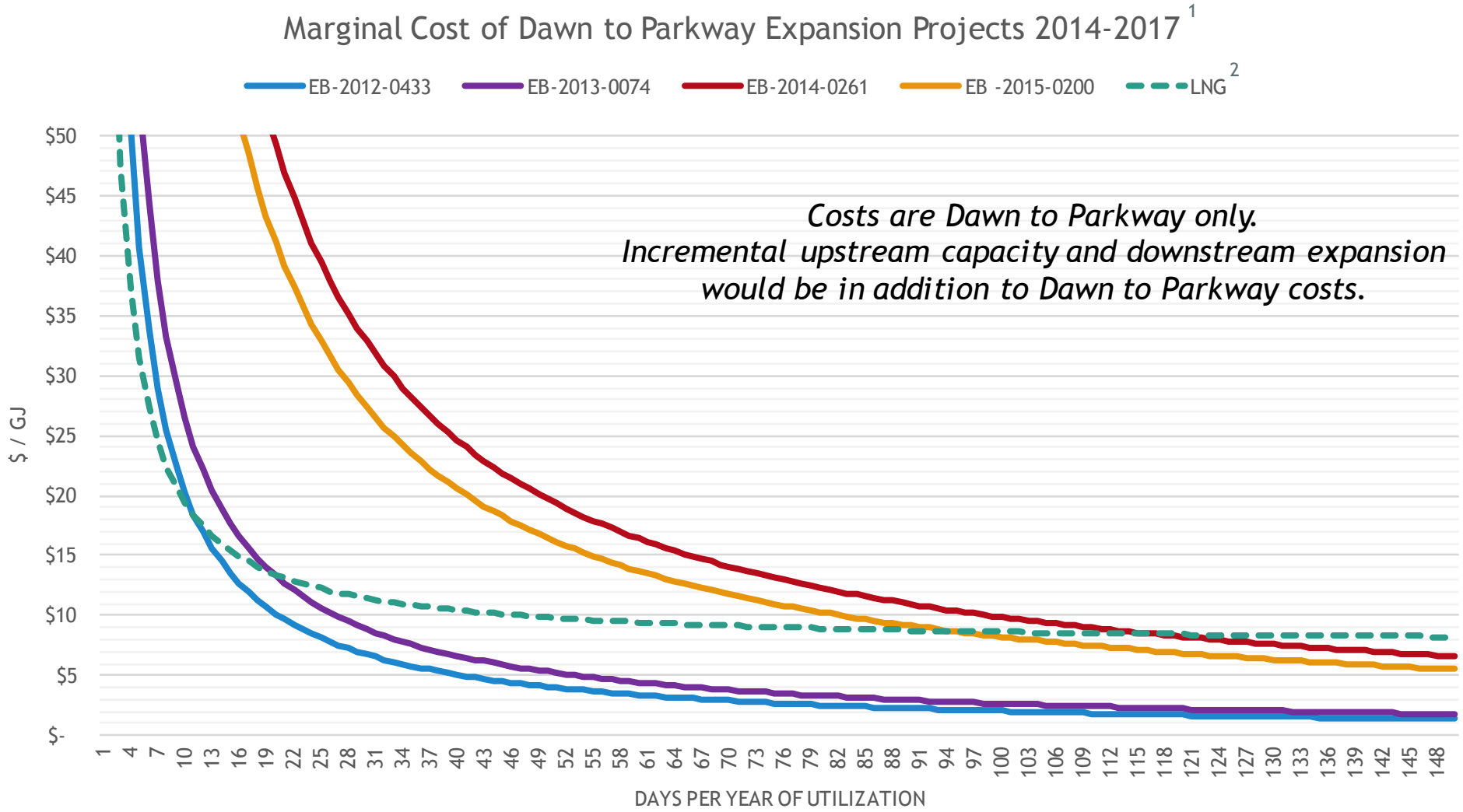
Introduction

- Northeast Midstream LP (Northeast) is an Ontario-based limited partnership engaged in the development of liquefied natural gas (LNG) infrastructure.
  - Northeast has permitted an LNG production facility in Thorold, Ontario, with an in-service date of 2017, and is developing a facility near Nipigon to serve Northwestern Ontario.
  - North Shore communities of Manitouwadge, Marathon, Schreiber, Terrace Bay and Wawa have signed Franchise Precedent Agreements with Northeast for local distribution service where the gas supply will be LNG, subject to Ontario Energy Board approval.
- Northeast believes that LNG has a strategic role to play in expanding access to natural gas in Ontario, and the purpose of this presentation is to present two applications for review and discussion as part of the NGMR:
  1. LNG to meet the needle peaking requirements using storage facilities situated in close proximity to the market rather than developing remote underground gas storage and constructing expensive incremental pipeline capacity to meet such needs; and
  2. LNG to deliver gas to rural and Northern communities that are located long distances from existing pipeline infrastructure and that otherwise would not have economic access to natural gas.

Marginal cost of system expansions is escalating rapidly to accommodate peak day loads, driving up customer rates without regard to long-term demand risk



Ontario needs to look beyond the traditional "pipeline" expansion model, which is becoming cost prohibitive and locks customers into an obsolete energy outlook.

1. Source: Union Gas. Capital cost for EB-2015-0200 excludes Dawn H compressor.
2. LNG economics is based on a 1.5 PJ tank; capex of C$180 million; vaporization capacity of 150,000/GJ/day; $7.43/GJ for liquefaction, trucking and vaporization (EB-2015-0179, Exhibit JT1.2); a capital recovery factor of 0.10.

LNG meets the gas supply planning principles of Ontario's gas distributors

Reliability	•LNG has traditionally been used for peak shaving in winter and to help maintain system pressures at different points of regional natural gas systems. •In New England LNG provides from 20% to over 40% of design day supply in the winter for several LDCs.
Capital Efficiency	•LNG significantly reduces upfront capital requirements, lowers fixed costs and increases flexibility for utility assets to meet peak day/hour loads. •Facilities eliminate fully loaded upstream tolls and long-term rate uncertainty associated with potential de-contracting of capacity in the future.
Flexibility	•Production and storage are scalable, hedging risk around future demand loads, impact of efficiency programs, and climate change initiatives. •Modular, small-scale assets can grow or shrink with attachments and usage, and can be re-deployed when the load supports the building of a lateral pipeline or when existing pipeline capacity becomes available.
Diversity	•LNG can be a lower cost alternative to lateral pipelines for both system expansions and "greenfield" utility assets in rural and northern communities. •LNG mitigates supply risk by providing an additional procurement and delivery path.
Safety	•LNG is natural gas that has been cooled to about -160°C, converting it into liquid for easy transportation and storage, with an excellent safety record in all its facets. •Stringent safety standards and regulations govern all aspects of the LNG supply/delivery system.

LNG is a safe, effective, and widely adopted means of supplying natural gas to regions of Ontario where pipeline service is constrained or not available

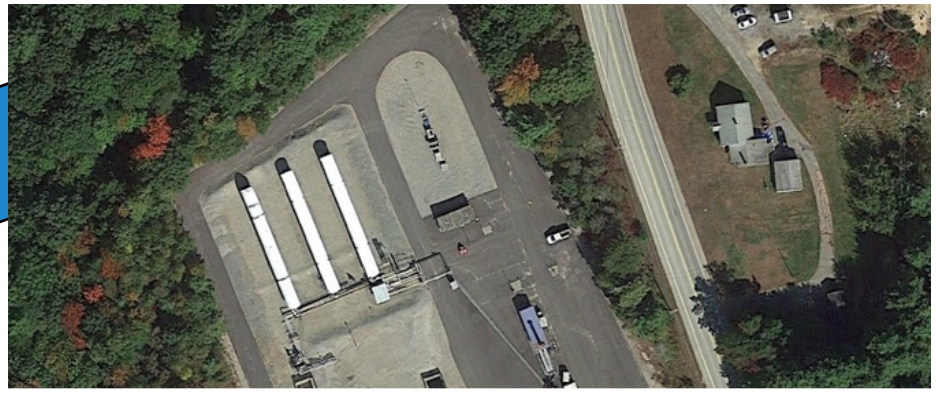
LNG is 1/600th the volume of natural gas at atmospheric pressure and 3X-5X more gas can be delivered by truck compared to CNG.

- LNG is a competitive market in Ontario, with multiple sources of supply including Northeast (Thorold, 2017), Union Gas (Hagar), Gaz Metro (Montreal), Distrigas (Mass.), and UGI (Penn.).

LNG is trucked in cryogenic trailers, and ISO containers provide for intermodal transport as well as flexible "swap & drop" storage.

- More than 10 PJ/year of LNG is trucked from terminals to utility-owned satellite facilities in North America, with an excellent safety record.

LNG is stored locally in insulated tanks, heated using a vaporizer, returning the liquid to gas, and injected into a distribution system.



- Satellite facilities replace new lateral pipelines to deliver gas to local distribution systems.

Natural gas is delivered to local homes and businesses using underground plastic pipe, just like communities with gas today.

- LNG is back-up fuel across North America, and is (or will be) the primary fuel for Fairbanks, Alaska; Keene and Hanover, New Hampshire; Revelstoke, BC; and Hawaii.

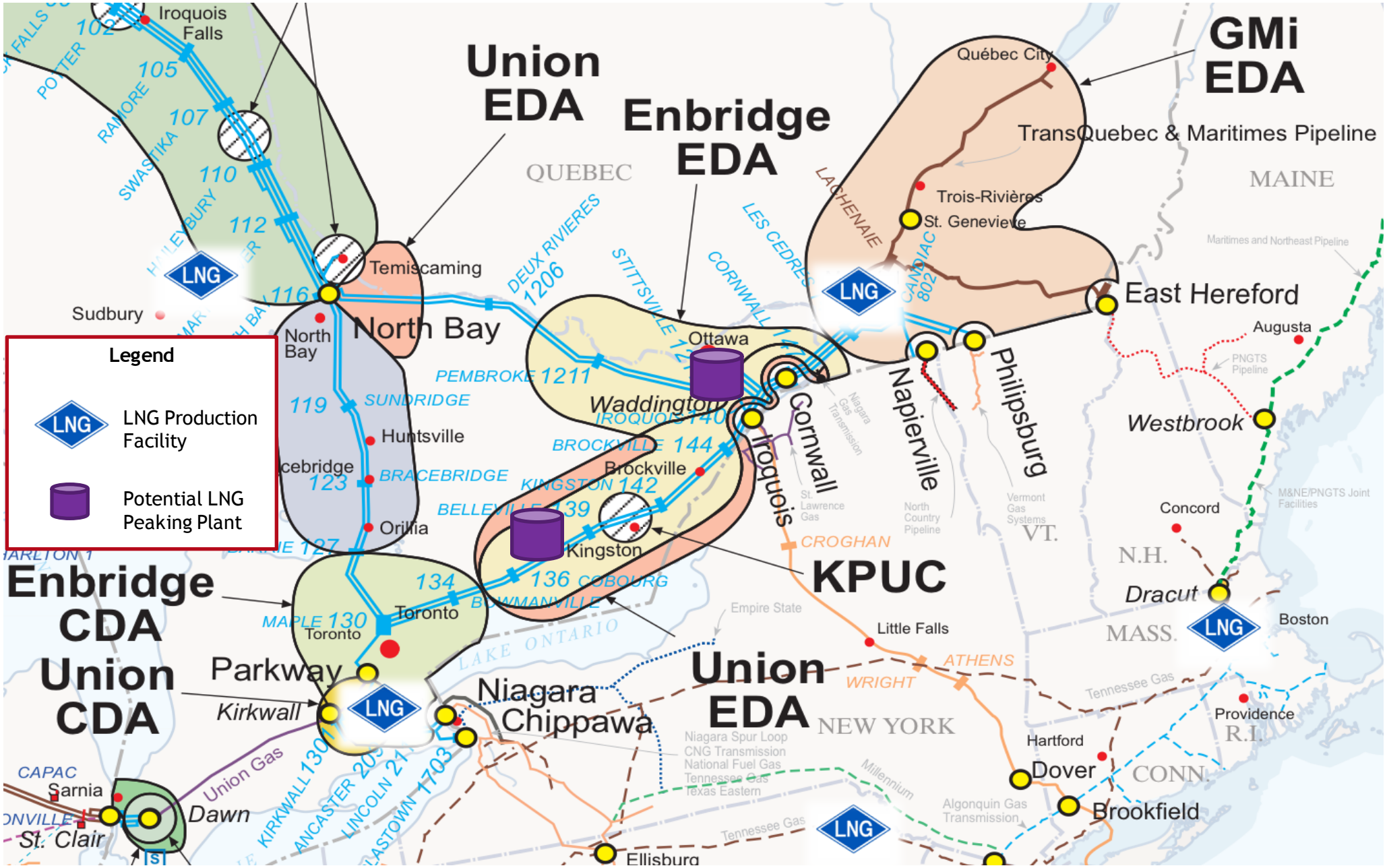
New England LDCs hold ~17 MM TBTU of LNG capacity for peak shaving and system reliability, about 6% of New England's total annual gas supply

New England Utility LNG Facility Statistics as of 2012

	Company	*Plant Location*	*Storage Capacity (MMBTU)*	*Vaporization (MMBTU/d)*	*Est. Annual Liquefaction (MMBTU)*
1	Berkshire Gas	Whatley, MA	11,680	5,000	-
2	City of Holyoke	Holyoke, MA	18,000	21,000	-
3	Columbia Gas	Easton, MA	780,750	52,000	-
4	Columbia Gas	Ludlow, MA	1,006,300	50,000	1,800,000
5	Columbia Gas	Marshfield, MA	9,088	9,000	-
6	Columbia Gas	Lawrence, MA	13,866	18,000	-
7	Liberty Utilities	Concord, NH	4,200	6,270	-
8	Liberty Utilities	Tilton, NH	4,200	6,270	-
9	Liberty Utilities	Manchester, NH	4,200	6,270	-
10	Liberty Utilities	Fall River, MA	150,000	20,000	-
11	Middleborough G&E	Middleborough, MA	2,350	1,440	-
12	National Grid	Lynn, MA	1,045,000	91,542	-
13	National Grid	Salem, MA	1,045,000	31,768	-
14	National Grid	Haverhill, MA	418,000	41,069	-
15	National Grid	Tewksbury, MA	1,045,000	68,343	-
16	National Grid	S. Yarmouth, MA	179,740	27,600	-
17	National Grid	Dorchester, MA	1,192,345	198,968	-
18	National Grid	Wareham, MA	8,400	4,494	-
19	National Grid	Westford, MA	4,200	6,270	-
20	National Grid	Exeter, RI	220,000	19,000	-
21	National Grid	Cumberland, RI	80,000	32,000	-
22	National Grid LNG*	Providence, RI	2,259,664	150,000	-
23	Northern Utilities	Lewiston, ME	13,335	13,000	-
24	Norwich DPU	Norwich, CT	4,700	2,400	-
25	NStar/NU	Acushnet, MA	520,000	31,000	-
26	NStar/NU	Waterbury, CT	1,200,000	105,000	1,080,000
27	NStar/NU	Hopkinton, MA	3,120,000	240,000	3,240,000
28	United Illuminating	Rocky Hill, CT	1,200,000	90,000	1,080,000
29	United Illuminating*	Milford, CT	1,142,100	82,000	900,000
30	Unitil	Fitchburg, MA	4,170	7,200	-
31	Westfield G&E	Westfield, MA	8,300	4,500	-
	Total		***16,714,588***	***1,441,404***	***8,100,000***

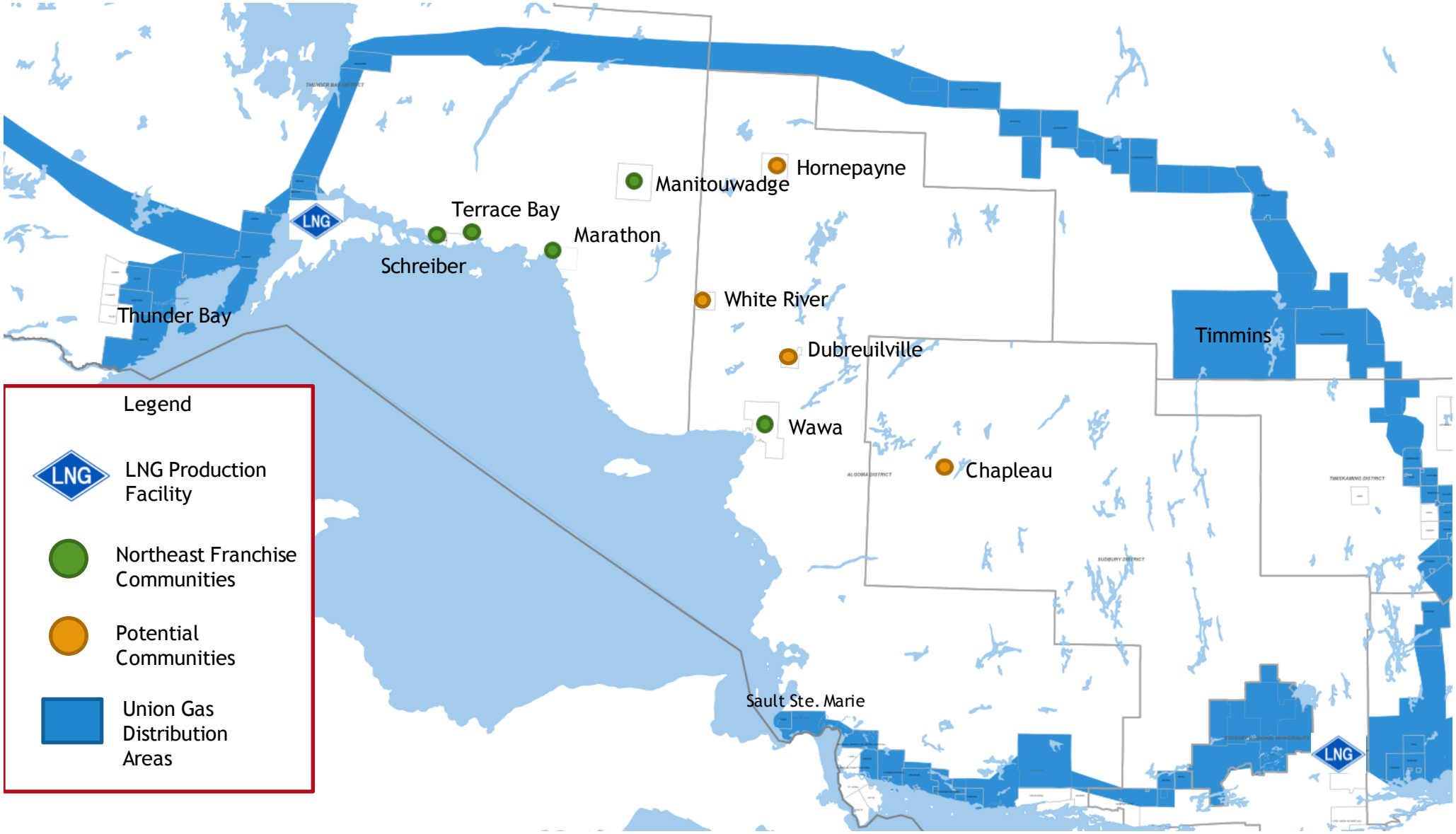
*FERC regulated facility

Peak shaving facilities in eastern Ontario could eliminate the need for certain LDC reinforcement projects and reduce build out of transmission infrastructure



Northeast Midstream

North Shore communities are ideal candidates for LNG, as it is too expensive to build pipelines from existing service areas (in blue along Highway 11)



Connections to natural gas in Ontario can be maximized through a phased approach using LNG infrastructure at one-third the capital cost of building pipelines to serve certain off-system communities.

Economic and environmental benefits of LNG facilities will increase business competitiveness and help Ontario meets its climate change objectives

Mining, Manufacturing, and Processing

- Access to natural gas will cut operating costs and emissions for large end-users of energy, improving their long-term competitiveness and economic viability.
- LNG facilitates on-site power generation where grid capacity is unavailable and/or new service is not feasible.

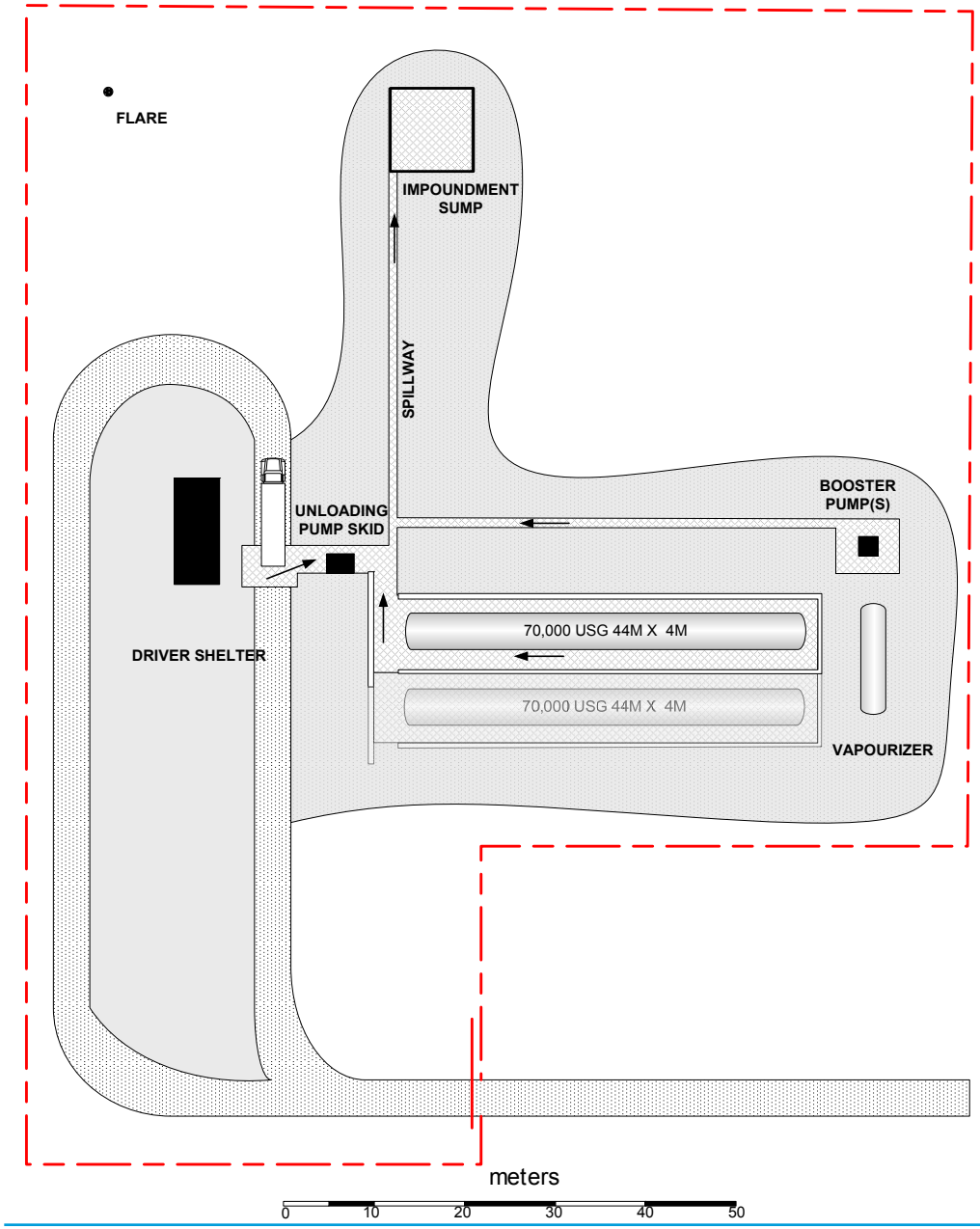
Power Generation

- LNG can be the most economical and reliable gas delivery option during peak demand periods.
- Pipeline tolls to transport gas have significant impact peak generation costs, and there is no storage in Northwestern Ontario.

On-Highway, Marine, and Railroad

- While the province's transportation sector is a huge consumer of energy, virtually none of the energy comes from natural gas.
- Stringent emissions regulations for the Great Lakes came into effect in January 2015.
- Major industry players in rail and marine are looking for LNG supply and delivery solutions in the region.

Indicative site plan is based on CSA code requirements and resembles 100+ satellite LNG facilities in service for more than 40 years across North America



- LNG is delivered by a cryogenic truck trailer capable of holding about 1,000 GJ.
- Specially designed tank hold LNG at low pressure.
- LNG is pumped to pressure, heated, returning the liquid to gas, and injected into the fuel gas feed line.
- Operation is automated, with remote control and monitoring by operations staff.
- Excess boil-off gas is fed at low pressure to a local distribution line (boil-off rate is approximately 0.17% per day).
- The site is equipped with gas and fire detection, spillways, LNG impoundment.

The facility is designed and government approved so that potential impacts are contained within the property boundaries.

LNG cannot burn or explode in its liquid state. In the unlikely event of a spill, the liquid vaporizes into the atmosphere and dissipates rapidly. Therefore, there is no cleanup required and there are no detrimental impacts to soil or water.

Siting and operation fall under local zoning, provincial regulations, and federal safety codes, and are influenced by infrastructure and public attitudes

- Primary and secondary loads
  - Primary: Peak shaving where there are pipeline constraints or primary fuel delivery in remote communities.
  - Secondary: Possible source of supply for transportation and industrial fuels markets.
- Infrastructure
  - Proximal location to one or more sources of LNG supply or liquefaction onsite.
  - Highway to facilitate trucking (3 to 6 deliveries per day for summer refill, 1 to 5 deliveries per week in winter for remote communities).
  - Access to local gas distribution system for injecting boil-off gas from the LNG tank.
  - Electric interconnections.
- Site characteristics
  - Relatively flat land with minimal abutters, ideally zoned industrial.
  - While the actual footprint can range from one to five acres, the facility is designed and government approved so that potential impacts of any leaks are contained within the property boundaries.
- Public safety and environmental impacts
  - Studies include thermal radiation, vapor dispersion, seismic, flooding, soil, wind, severe weather, adjacent activity, setbacks, wetlands, airports, all-weather accessibility.
- Regulations, permits
  - The governing code is CSA Z276-15 (Liquefied Natural Gas Production, Storage, and Handling) which is enforced by TSSA.
  - Siting, construction, and operation of the facility will require site plan approval from the local authority and air and noise permit from the provincial ministry of energy (emissions are mostly fugitive in nature).
  - Sale of LNG in Ontario is competitive and unregulated.
- Training.
  - The Northeast Gas Association (NGA) runs an LNG program with the Massachusetts Firefighting Academy. The school has been in operation over 25 years, training personnel from utilities, pipelines, and fire departments.

LNG is a strategic infrastructure investment that requires closer consideration by LDCs and understanding by the Board as an alternative gas supply option

- LNG corresponds to the guiding principles of Ontario's gas distributors.

- The policy issue that Northeast is asking the Board to consider relates to the requirement of a natural gas distributor to present a comprehensive and transparent long-term economic comparison of the alternative approaches to gas supply as part of a system expansion or community expansion application.

- Northeast believes that it is important, as a matter of policy, that such a comparison of gas supply alternatives be prepared and presented to the Board in accordance with criteria established by the Board.

- The issue of comprehensive and transparent economic comparison of alternatives is entirely consistent with the issue that triggered the current Board consultation to review the gas supply and transportation planning process undertaken by the gas distributors in Ontario (EB-2015-0238).

For more information, please contact:

Joshua Samuel
President and CEO of the General Partner
Northeast Midstream LP
150 Connie Crescent, Unit 4
Concord, Ontario L4K 1L9
+1 (416) 848-1165
jsamuel@northeastmidstream.com
http://northeastmidstream.com