

Considerations for Integrating Renewables to Reduce Diesel in the North

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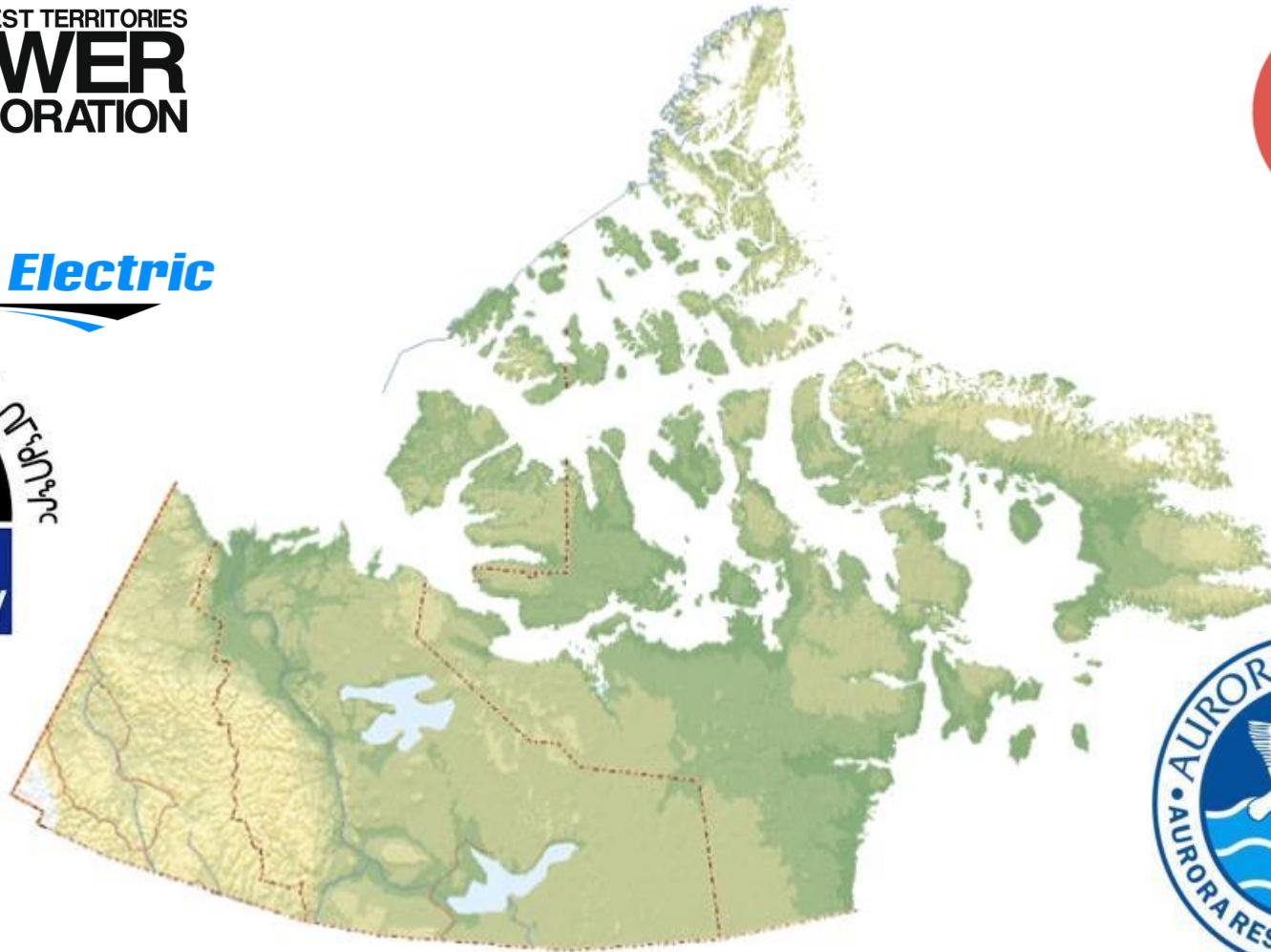
Northern Energy Innovation



ATCO *Electric*



**YUKON
ENERGY**



**Nunavut
Arctic College**

Northern Energy Innovation

- Industry-driven research
- NSERC/ Industry funded
- Pan-territorial



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Northern utilities unite to seek alternatives to diesel power generation

Yukon Energy, ATCO Electric, NTPC, Quilliq will now pool research funds, citing 'economies of scale'

CBC News Posted: Sep 19, 2016 5:43 PM CT | Last Updated: Sep 20, 2016 8:20 AM CT



A diesel power generation plant in Inuvik, N.W.T. Four Northern utilities are pooling their money to research ways to reduce the use of diesel in isolated-grid communities. (Philippe Morin/CBC)

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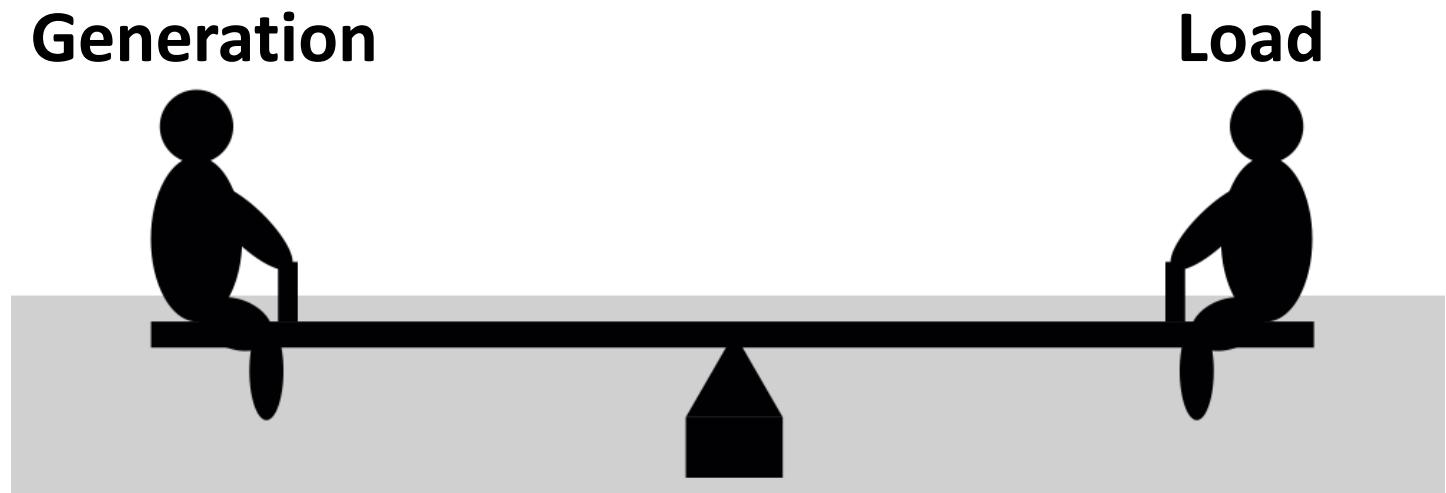
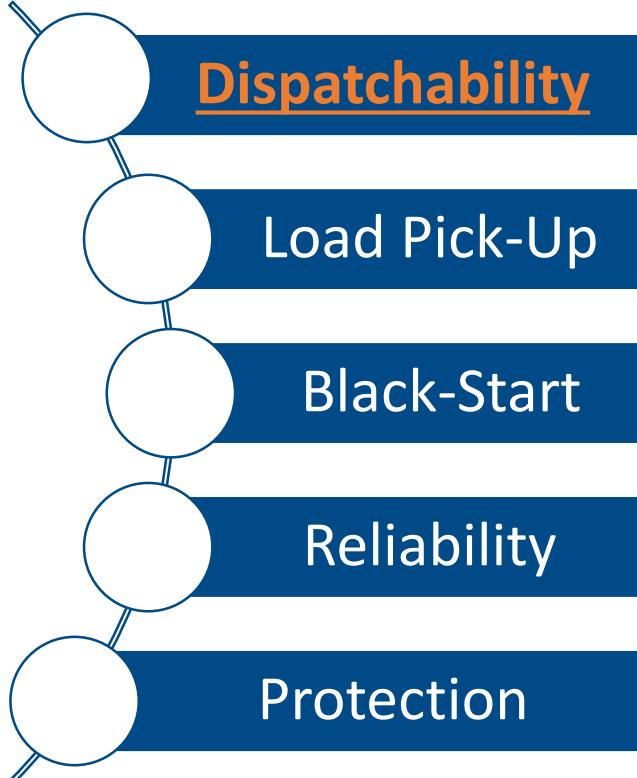
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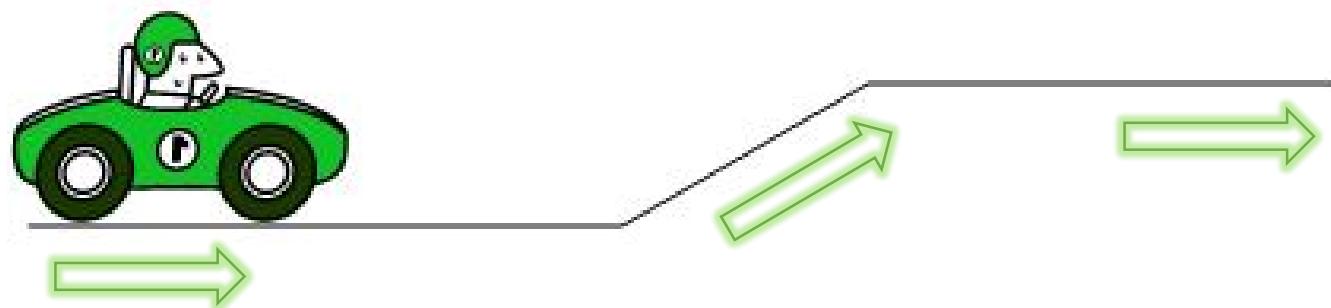
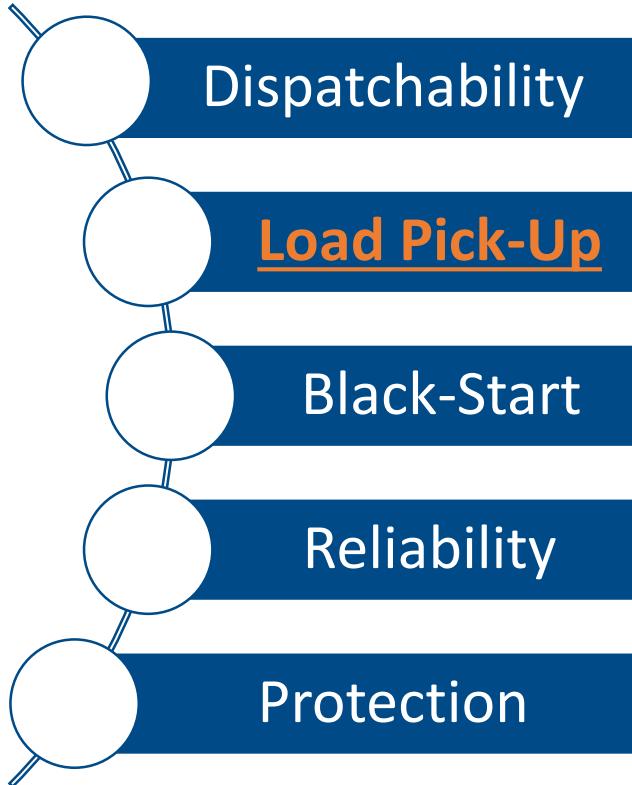


Newsletter

Technical Benefits of Diesel Generation



The Benefits of Diesel Generation



The Benefits of Diesel Generation

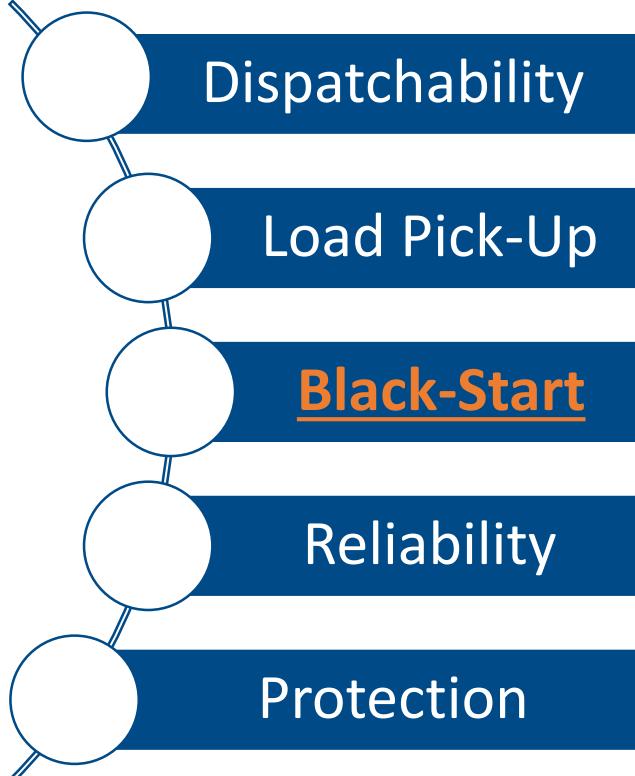


Figure: Image from the 2003 Northeast Blackout

Source: http://www.huffingtonpost.com/2013/08/14/2003-northeast-blackout_n_3751171.html

The Benefits of Diesel Generation

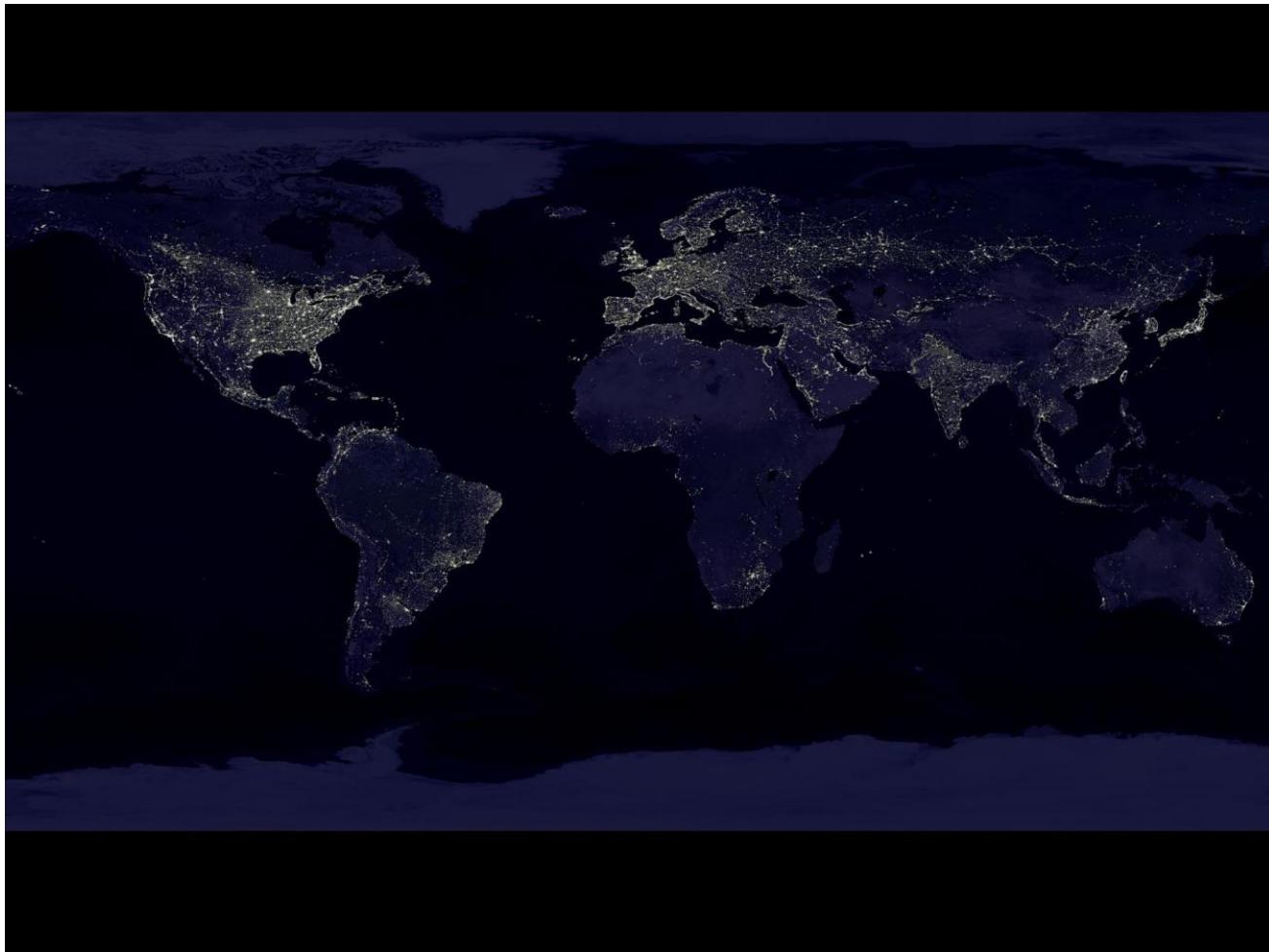
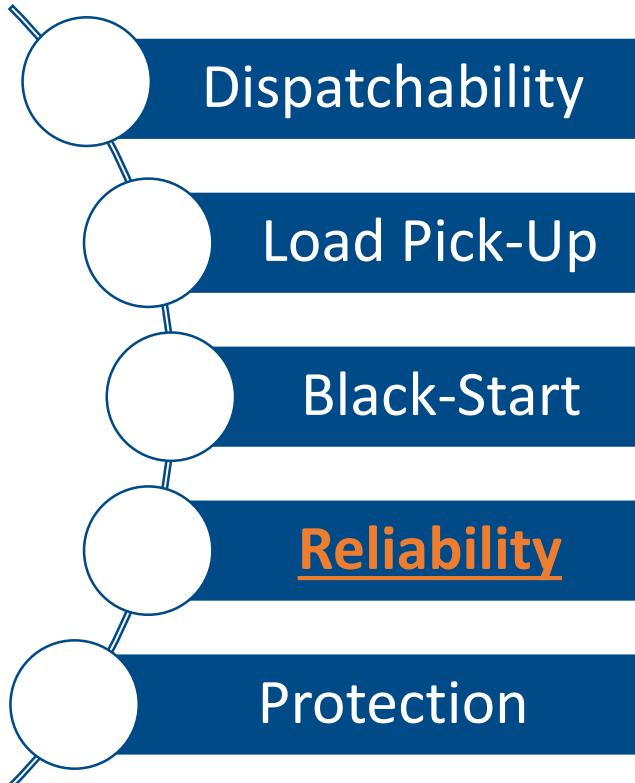
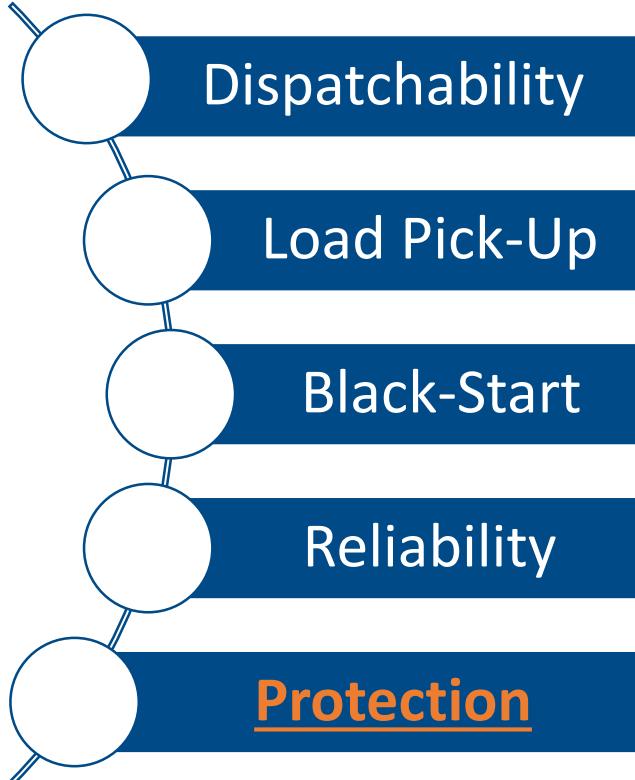


Figure: Earth at Night

Source: https://www.nasa.gov/topics/earth/earthday/gall_earth_night.html

The Benefits of Diesel Generation



<https://nbpower.ca/blog/en/posts/2015/september/outages-how-nb-power-gets-your-lights-back-on/>

The Questions

1. How does our research program fit in to identify and compensate for these benefits?

2. How can our research program help utilities to continue providing power in a safe and reliable manner?

3. How can our research program help communities and renewable projects to meet utility requirements?

Moving Forward

- Modeling remote systems
- Automating the process
- Standardize the studies conducted
- Identify the issues and bottlenecks
- Ensure the results are useful for the energy industry across the territories

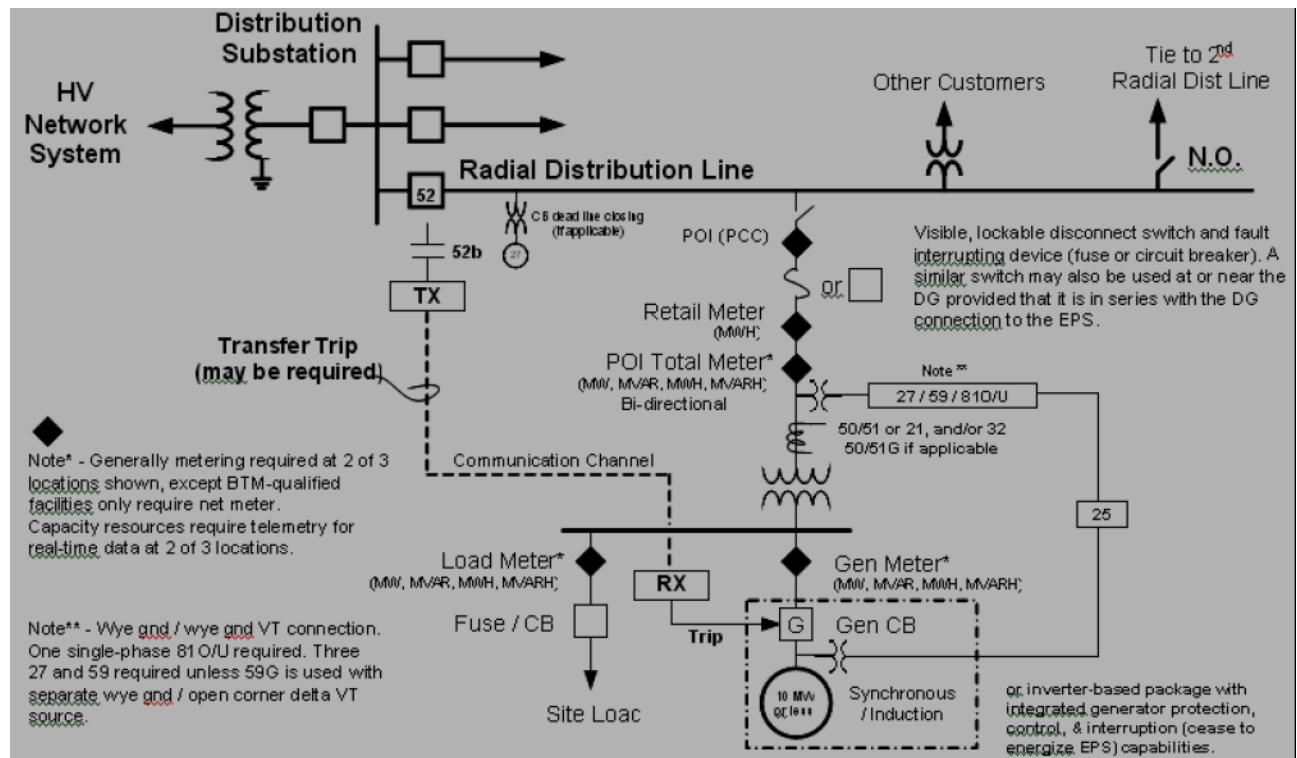


Figure: One-line diagram for an example interconnection with a radial distribution
Source: IEEE Std. 1547.2-2008, Figure A.22, pg. 111

Questions?

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Renewables in Isolated Grids (Sources)

"QEC reconsiders wind power after new money promised in federal budget", CBC News, Mar 2017

<http://www.cbc.ca/news/canada/north/qec-reconsiders-wind-power-after-new-money-promised-in-federal-budget-1.4042335>

"WWF study says renewable energy will work, save money in Arctic communities," CBC News, Jan 2017,

<http://www.cbc.ca/news/canada/north/wwf-renewable-energy-1.3920028>

"Yukon parties lay out plans for renewable energy," CBC News, Oct 2016,

<http://www.cbc.ca/news/canada/north/yukon-election-energy-platforms-renewable-1.3806186>

"Wind, solar energy real options for Canada's remote Arctic communities," CBC News, Sep 2016,

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"Old Crow looks to solar power to cut diesel use," CBC News, Jul 2016

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"Wind, solar wouldn't cost more than diesel power in parts of Nunavut: study," CBC News, Jun 2016,

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<http://www.cbc.ca/news/canada/north/colville-lake-solar-power-1.3604310>

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<http://www.cbc.ca/news/canada/north/yukon-n-w-t-and-nunavut-differ-in-outlooks-for-renewable-energy-1.2804345>

Useful Definitions - Resources

Resource

A source of electricity generation that provides power to the electric power system. A resource may have several defining characteristics associated with it. As examples: diesel can be a dispatchable and a blackstart resource; hydro can be a dispatchable and a renewable resource; solar can be an intermittent, a distributed, and a renewable resource; etc.

Blackstart Resource

A *resource* that is able to be started without support from the electric power system, or is designed to remain in operation without connection to the remainder of the electric power system

Dispatchable Resource

A *resource* that can be dispatched, or have its power output adjusted, on request.

Distributed Resource

A *resource* that is physically distributed throughout the electric power system.

Intermittent Resource:

A *resource* that is not continuously available due to a factor outside direct control, and thus cannot be dispatched; however, they can be predictable. Intermittent energy sources may include solar, wind, tidal, and waves.

Renewable Resource

A *resource* that uses a renewable energy source. Renewable energy sources may include hydro, biomass, solar, wind, tidal, and waves.

Useful Definitions - Penetration

Penetration (Low, Medium, High)

Penetration can refer to both the instantaneous power penetration and the average energy penetration. A commonly spoken of goal of renewable projects is to achieve a high penetration; however, it is often meant as the energy penetration. A high energy penetration of renewables will, out of necessity, require instantaneous power penetrations of greater than 100% of the instantaneous demand. Using solar as an example, if you wanted to produce 100% of your energy with solar, you would need to produce enough energy during the day to meet all of your demands throughout both the day and the night.