

I'm Grateful for the Grid!

Roy Blake, January 8, 2017



Literally, the electrical power grid

Symbolically, all the networks that link us together

Energy

Communications

Laws (Governments)

Commerce

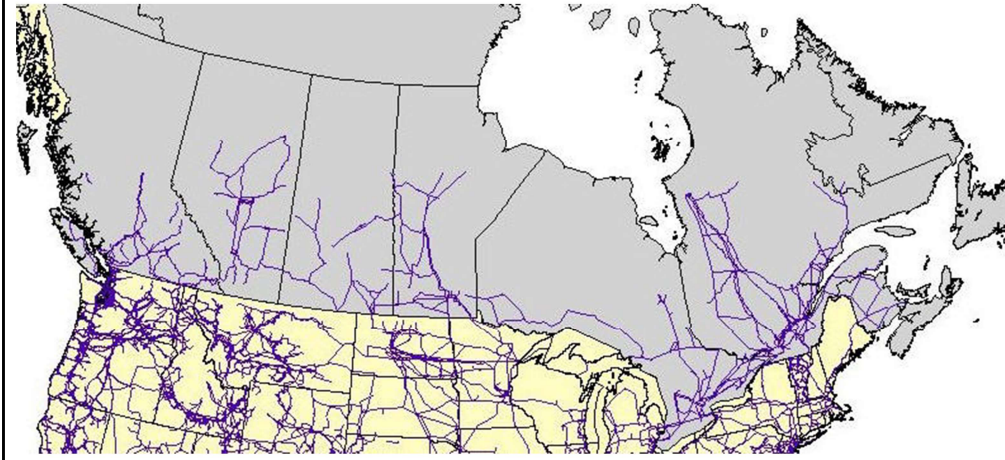
Transportation

“Off the Grid”

- Literally, not requiring power from the electrical grid.
- Symbolically, often a term for independence from society in general.

Seems to hold a lot of attraction for some people, even some Unitarians, in spite of our principles (6 and 7.)

The Canadian Power Grid



Note the long lines into the north, for hydro-electric power.
Also connections to adjacent provinces and states.
Power can travel long distances with low loss (about 5% for 1000 km.)

Power Generation in Ontario



Decew 1 (1898)

First Hydro-electric power stations were built in late 19th century

First at Niagara Falls: 1892

Decew 1: 1898 and still operating, generating 23 MW (enough for about 12,000 houses.)

Now at Niagara

4 power stations plus one pumped storage.

Total capacity 2286 MW.

Too much power for the Niagara Falls area.

Requires distribution to other areas

Hence need for a grid

Ontario's Grid, 1906



Ontario's Grid

Started in 1906, as Hydro-Electric Power Commission of Ontario – world's first publicly owned utility.

First project was a 110 kV line from Niagara Falls to Toronto and 13 other municipalities.

Power from grid was switched on in 1910 by Adam Beck – lit up a sign reading "For the People" in Berlin (now Kitchener.)

Now in process of being 60% privatized.

The Ontario grid now uses voltages up to 500 kV. Higher voltages reduce losses.

Other Types of Power Generation



Darlington Nuclear Station

Nuclear

Pickering 3100 MW
Darlington 3500 MW
Bruce 10,757 MW.

Wind



K2Wind Near Goderich

Tend to be smaller, largest so far is K2 Wind near Goderich at 257 MW from 140 turbines

Solar



Grand Renewable Solar, Haldimand

So far, not a major player in Ontario

Will be in the future – now competitive with wind

Lends itself to smaller installations

Largest station so far is Grand Renewable Solar in Haldimand County (8 MW, eventually 100 MW)

Natural Gas/Landfill Gas



Thorold Cogeneration Station

Used mainly to handle demand peaks as output can be changed quickly. Can also provide steam for industry.

Example: Thorold Cogeneration Station (320 MW)

Actual Power Generation in Ontario

- Generation for past hour

<http://live.gridwatch.ca/home-page.html>

Other Renewable Sources

- Waves
 - Intermittent
- Tides
 - Intermittent
- Geothermal
 - Power from volcanic heat
 - Energy storage in ground
- Biomass

Grid was built to distribute power from a few large stations to large areas.

Uses high voltages to reduce loss (about 5% typical)

Currently being modified to accept power from many smaller stations (wind and solar.)

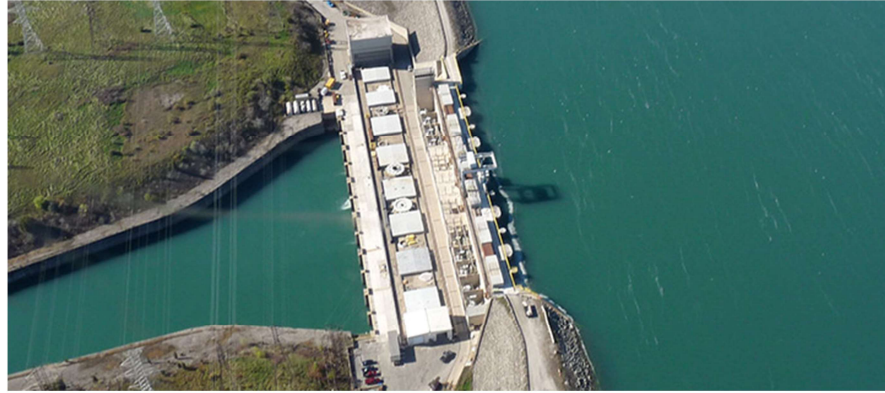
Can accept power from very small installations (rooftop solar)

Needs to accept power from intermittent sources – requires energy storage.

Current and Future Grid

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 - Uses high voltages to reduce loss (about 5% typical)
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 - Can accept power from very small installations (rooftop solar)
- Needs to accept power from intermittent sources
 - requires energy storage.

Pumped Storage



Sir Adam Beck Pumped Generating Station

Storage

Can use pumped water, flywheels, gravity, batteries, compressed air.

Niagara Falls: Sir Adam Beck pumped generating station (174 MW, built 1957)

Flywheel Storage in Minto, ON



For short-term surges

Example: 2 MW for 15 minutes

In Minto, ON (N. Of Kitchener)

Storage Using Molten Salt



Concentrating Solar Plant, California

Batteries



Tesla Powerwall 2
and Solar Roof

Expensive and inefficient

Some use in utilities

Also for homes as backup or load shifting

Can be combined with solar.

Tesla Powerwall 2: 14 kWh, \$7800.

Will power average home for ½ day or less.

Hydrogen Storage



Hydrogen from Water by
Electrolysis

Energy Storage using trains



Proposed System in Nevada

Other Storage Methods

- Dams
- Compressed air (in abandoned mines)
- Electric cars (can supply power to grid and take power from grid when plugged in)

Smart Grid

- <http://www.ieso.ca/smarthomeroadmap/default.htm>

Adjust load to compensate for peaks and valleys of power generation

Power priced according to supply vs demand

Time-of-day metering is a beginning

Smart appliances will adjust power use to supply price automatically

 Dishwashers start when power is cheap

 Heating can be paused or thermostat lowered during power use peaks, etc.

Off-Grid

- Makes sense in isolated locations.
- Often uses diesel generators.
- Solar and wind can work with battery storage.
- Most systems rely on fossil fuels (often propane) for heating.
- Isolated locations result in much use of fuel for transportation.

Many road signs, small cell towers etc are off grid because cheaper than connecting to grid in remote areas. Same with summer cottages. Not an ideological thing.



Right-Wing Version

Expect (hope for?) collapse of civilization

“Bug out” to an isolated location

Expecting SHTF (shit hits the fan)

Have a GOOD kit (get out of Dodge)

Take plenty of canned goods and ammunition

Prepare to live in isolation or with a few like-minded people.

Right-Wing “Preppers” (Formerly Survivalists)

- American Redoubt:
<https://survivalblog.com/redoubt/>
- Prepper Website:
<http://www.prepperwebsite.com/>
- Canadian Preppers Network:
<http://www.canadianpreppersnetwork.com/>

See also: <http://www.survivalretreatconsulting.com/hire-us/>

This site offers a free AR-15 assault rifle if you hire them.

Ecovillages

- Generally try to be self-contained for food, energy, water, etc. Sometimes even medicine and schooling.
- Usually in rural or isolated areas.
- Often involved in mystical spirituality.

Example Ecovillages

- [O.U.R. Ecovillage](#) (B.C)
- [Dancing Rabbit Ecovillage](#) (Missouri)
- [Mother Nature Network](#)

Non-Scalability

- Subsistence agriculture and energy self-sufficiency can work in isolated villages but won't work in society at large.
- Even ecovillages need services like roads and the internet, and goods from shovels to computers.
- Straw-bale construction won't work in cities.
- Widespread adoption would require drastic population reduction.

Off-Grid in Non-Isolated Areas

- Can't use grid for storage.
- Small solar is more expensive than grid electricity.
- Feed-in tariffs make grid connections more economical than stand-alone systems.
- Most of these schemes fail (as they should!)

In Ontario, system will pay more for solar energy than it costs to get from grid.
Currently rooftop solar pays 31.1 cents/kWh.

Price from grid varies, from 8.7 to 18 cents/kWh

A Better Solution

- Apply eco-ideas to larger society.
- Emphasize energy from renewable sources, conservation, and recycling.
- High population density is not the problem: cities use less energy per capita than suburban or rural life.
- Transportation contributes a large share of greenhouse gas and must be more efficient and largely electrical.
- Make better use of the grid to move power from renewable sources to where it's needed, and for storage.

Conclusion

- Energy sustainability works better with large-scale co-operation.
- Climate change is a global problem. Small scale solutions aren't enough.
- Don't feel guilty about using the grid. It can be a large part of the solution.
- Work toward a more sustainable, publicly controlled, grid.

Our Principles are Relevant

- [6th Principle](#): The goal of world community with peace, liberty, and justice for all;
- [7th Principle](#): Respect for the interdependent web of all existence of which we are a part.