

Modernization of the Power System

Stantec at a glance



- Founded in 1954
- Publicly traded on two stock exchanges
 - TSX, NYSE: **STN**
- 60 years of uninterrupted profitability
- Gross Revenue: CDN \$2.5 Billion (2014)
- More than 400 locations
- Approximately 22,000 employees
- Diverse range of services and sectors

The Grid: As it's Always Been

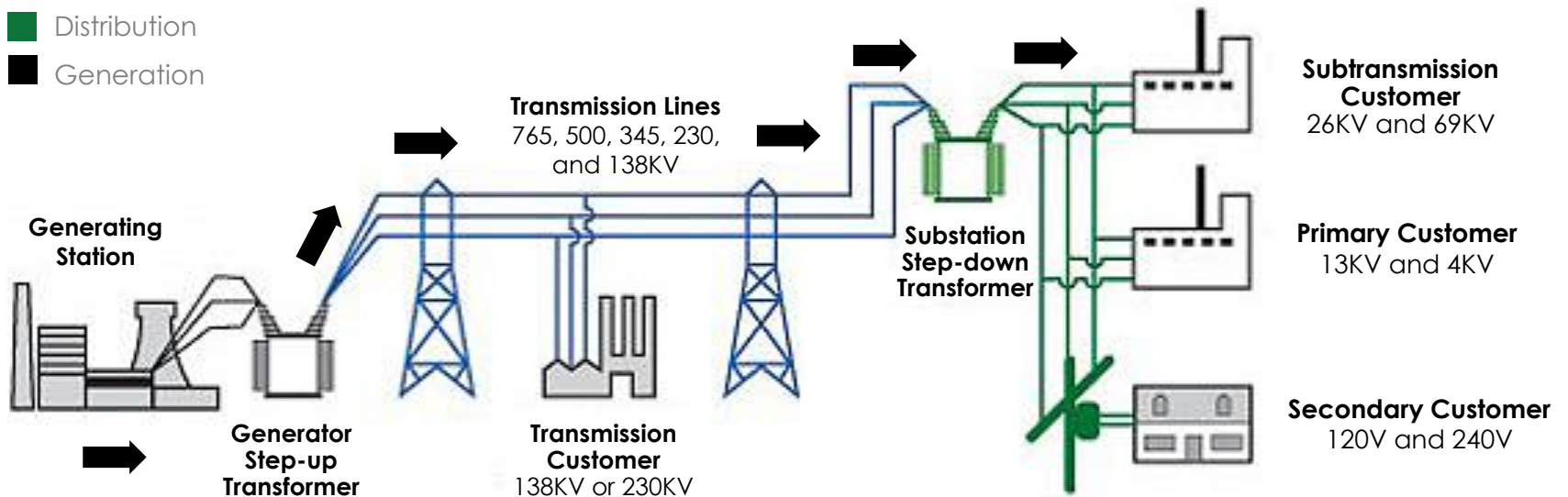
Basic Structure of the Electricity Distribution System

Key:

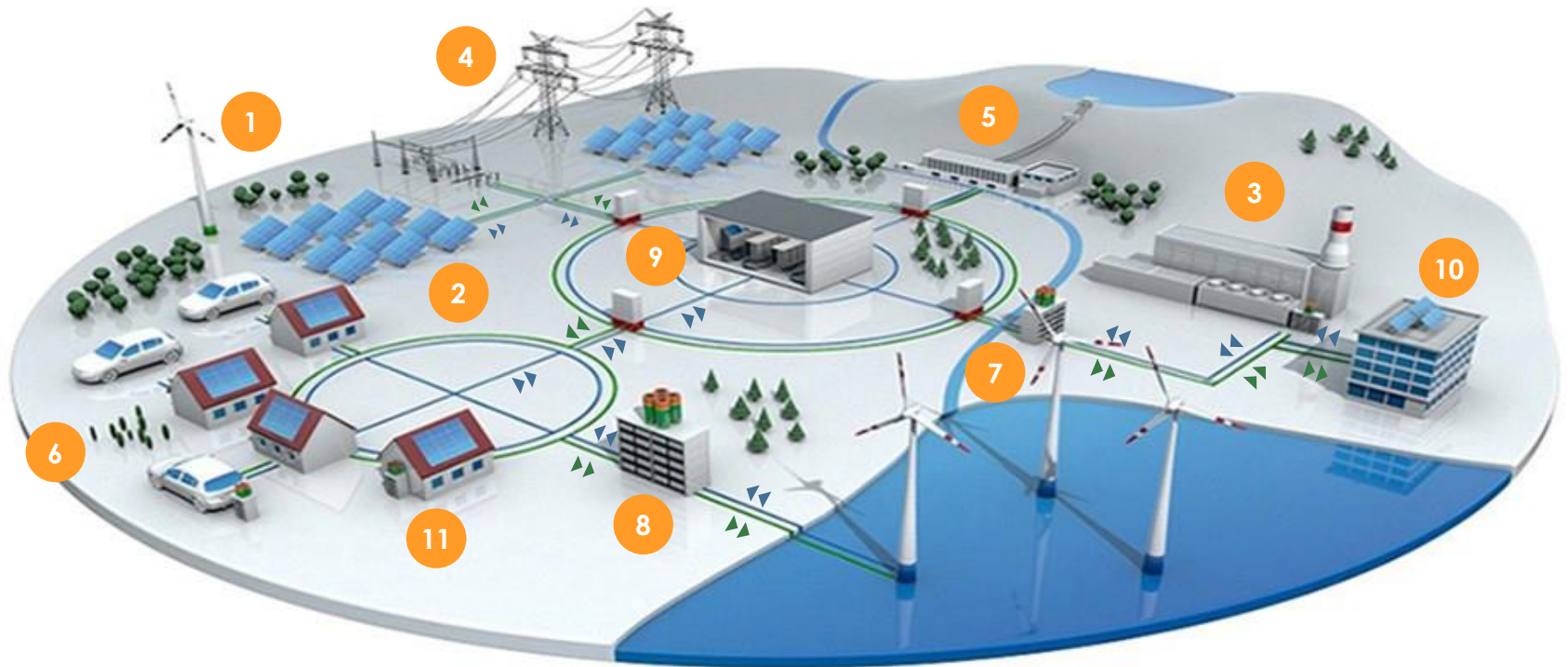
■ Transmission

■ Distribution

■ Generation

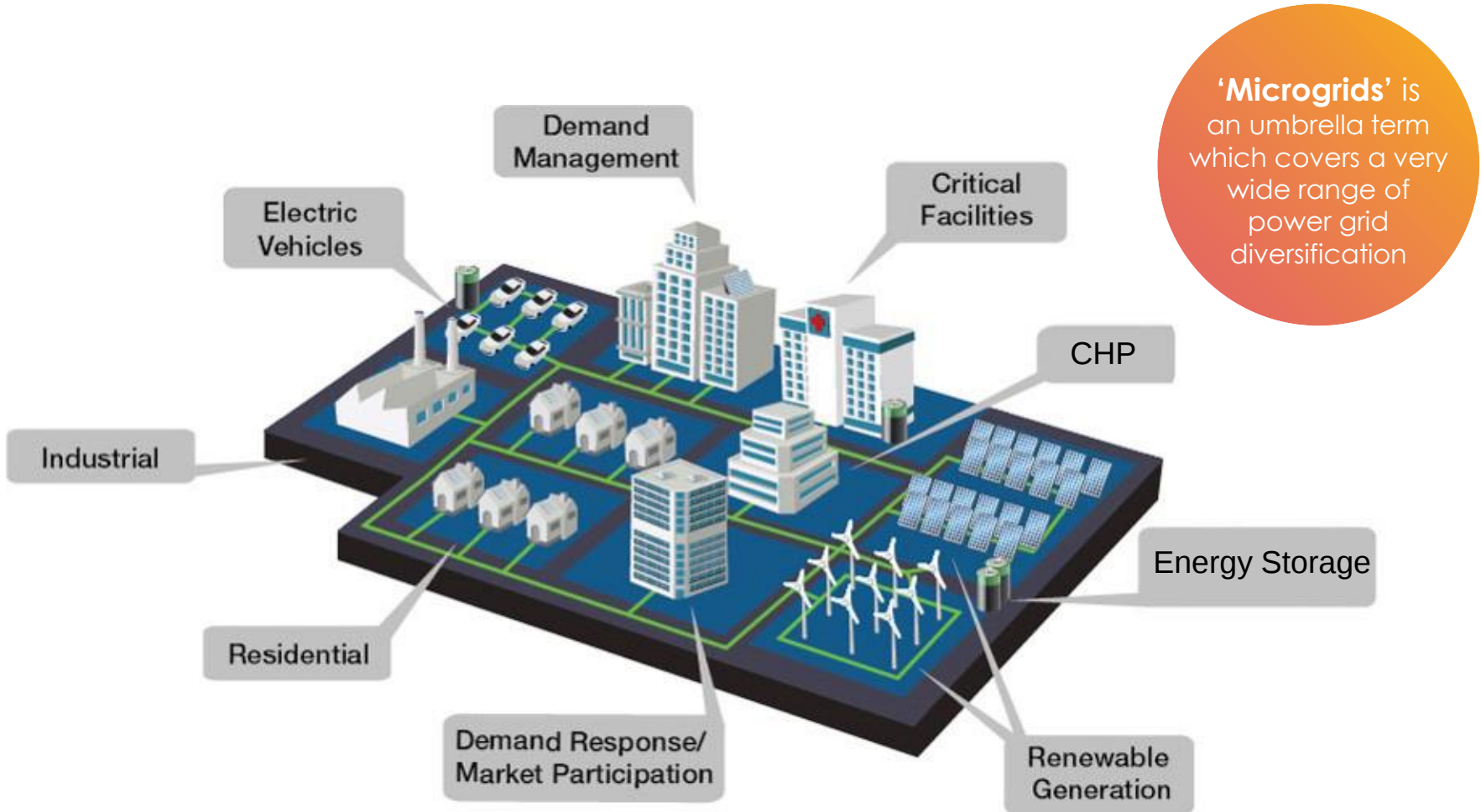


Where the Grid is Going: Distributed Energy



- | | | |
|------------------------------------|----------------------------|-----------------------------|
| 1. WIND | 6. EMBEDDED ENERGY STORAGE | 8. ENERGY STORAGE, FLYWHEEL |
| 2. SOLAR PV | • EV'S | 9. DSM LOAD MANAGEMENT |
| 3. CHP | • REFRIDGERATION | 10. DISTRICT ENERGY |
| 4. T & D | • THERMAL | 11. ROOFTOP SOLAR PV |
| 5. ENERGY STORAGE,
PUMP (HYDRO) | 7. ENERGY STORAGE, BATTERY | |

What's Driving Distributed Energy?: The Emergence of 'Microgrids'



What is a Micro Grid

- A discrete energy system containing DG and storage which can run in parallel with the central grid or can run stand-alone (or islanded) from the central grid
- Generation resources are typically located closer to the load
- A backup diesel generator is an example of a traditional micro grid
- Focus today is on micro grids fueled by lower emitting technologies such as solar, wind, hydro, bio-mass and geothermal

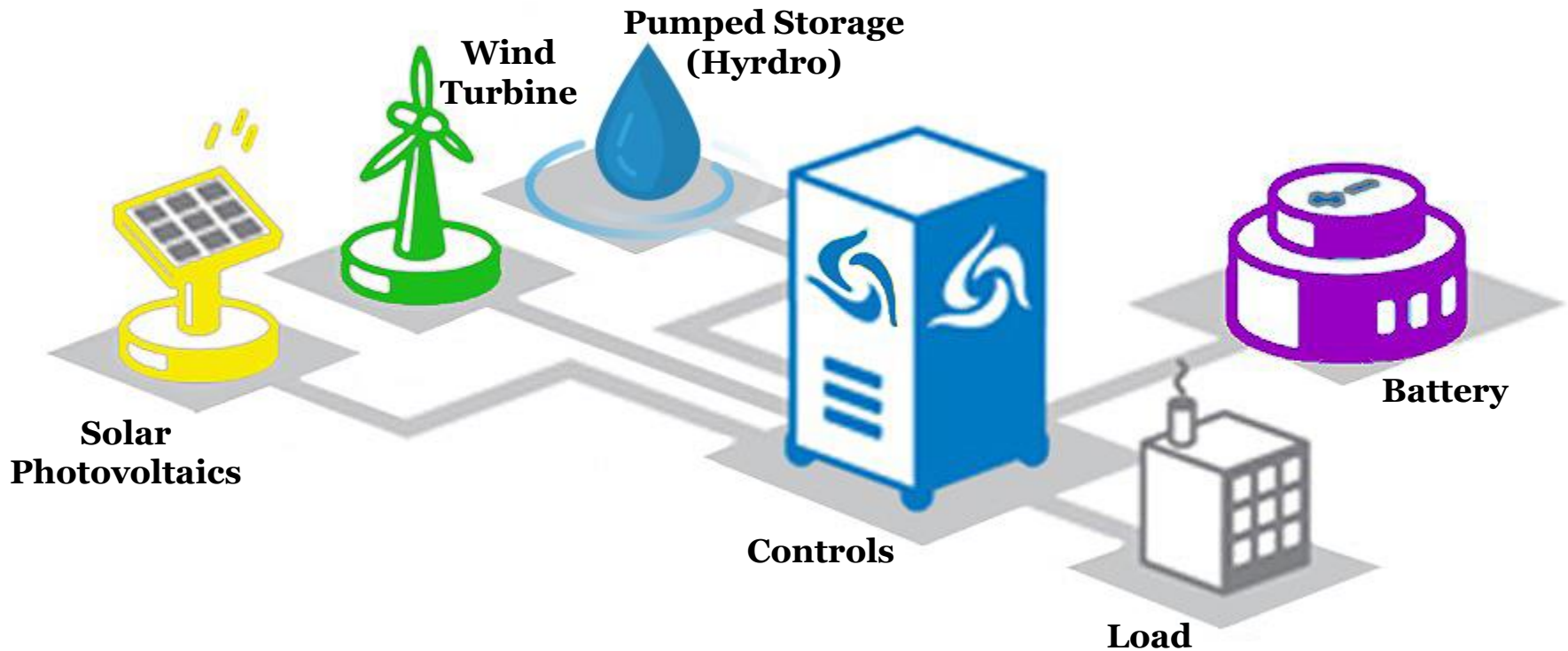
Micro Grid – Uses & Benefits

- Highly efficient, mini versions of the larger power grid
- Contains smaller, localized forms of generation, storage, and distribution in a closed or islanded system
- Helps deliver lower costs, more reliable electric supply, storm resiliency, reduced pollution, greater efficiency, community economic development and jobs, and less forfeiture of open space, habitat and aesthetics to big power plants and transmission lines
- Ensures local, reliable power for communities, campuses and buildings
- Provides resiliency in the event of a storm or grid loss
- Provides the ability to relieve grid congestion or to compensate for weaker parts of the grid

Microgrid Configurations & Components

Some of the most prevalent components to microgrids are:

- Combined Heat & Power (CHP) / Cogeneration systems
- District energy
- **Renewables & energy storage**



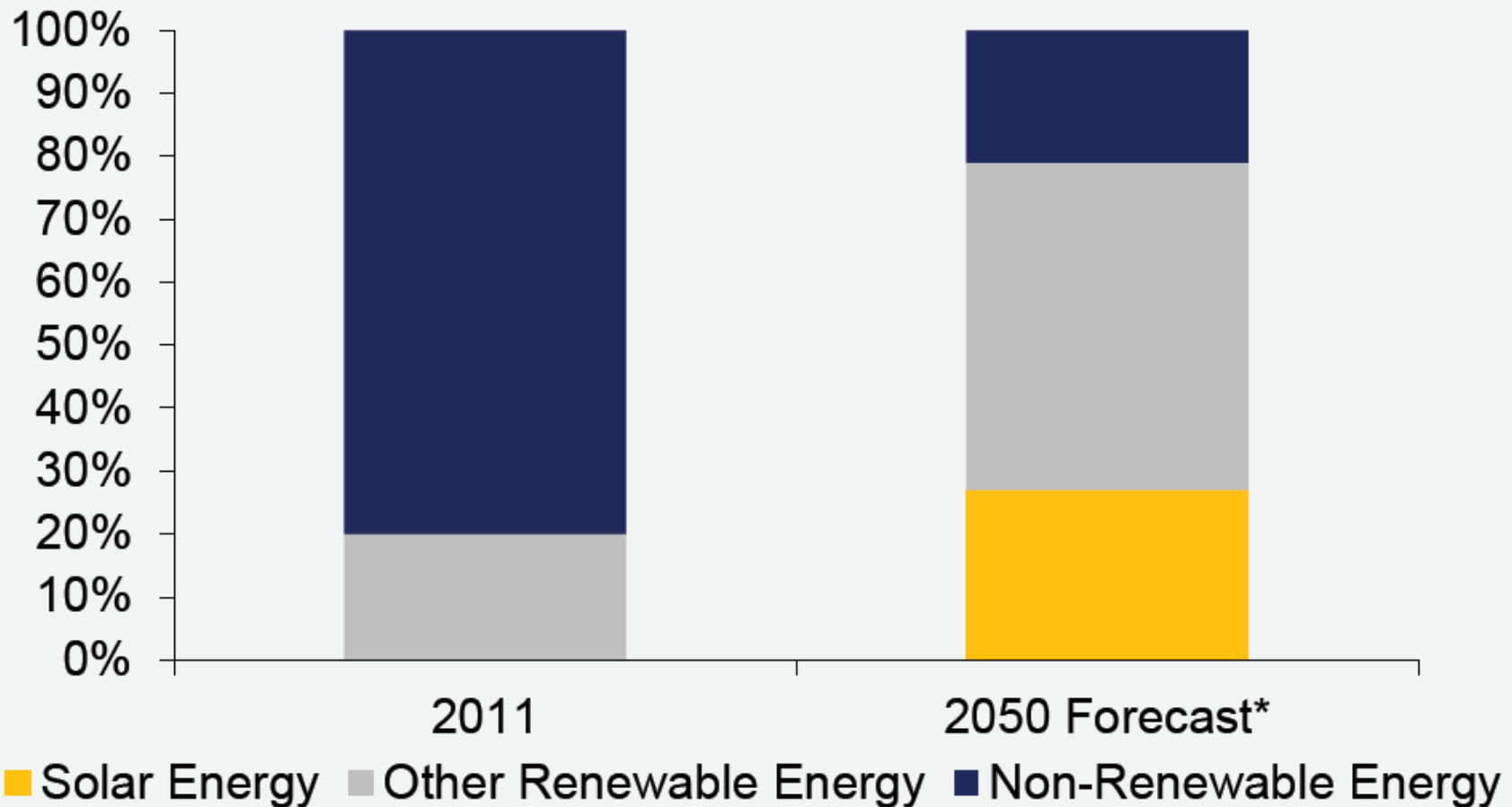


Opportunity

- a. **Abundant energy source**
- b. **Energy security**
- c. **Lower long term energy costs**
- d. **Lower environmental footprint (GHG)**
- e. **Reduces harmful air pollution (clean air)**
- d. **Positive sustainable culture and branding**

Global Solar PV Market

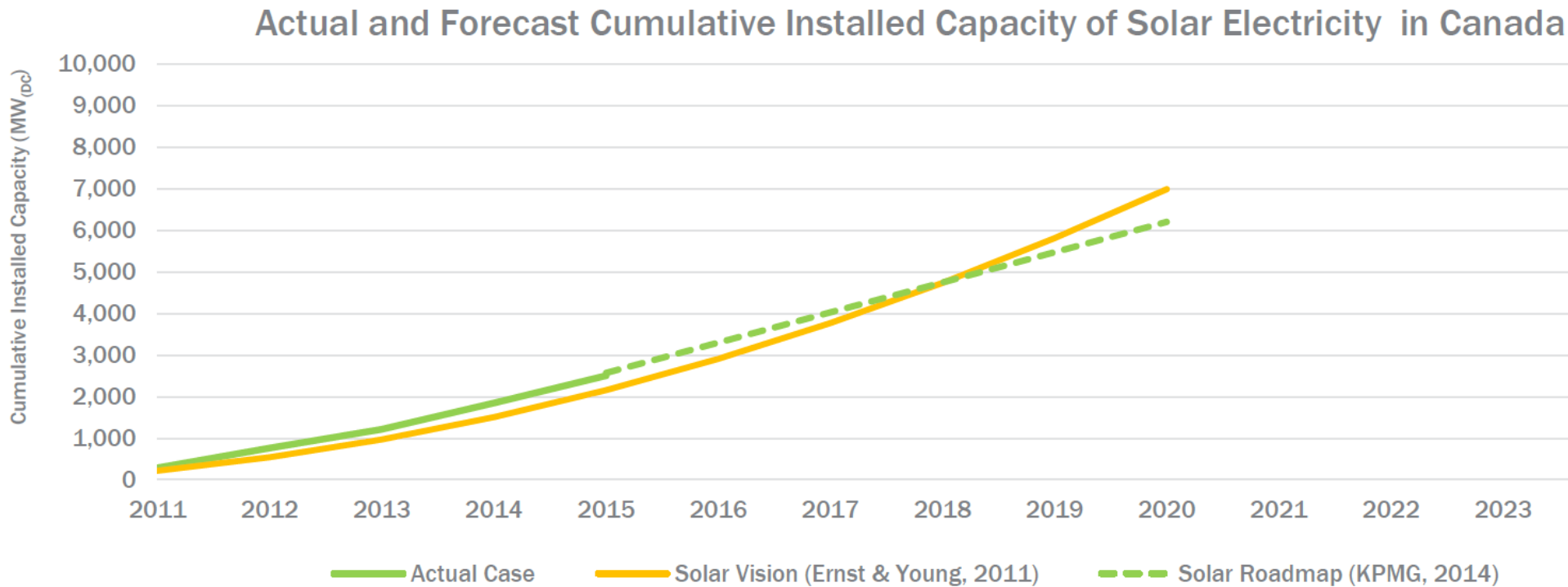
- Fastest growing energy source in the world (~50%/yr).



* High renewables scenario

Source: International Energy Agency

Canadian Solar PV Market



- CanSia 2020 roadmap:
 - PV to produce 1% of Canada generation (~6,300 MW)
 - Creating 65,000 jobs
 - Displacing 1.5 million tCO₂

US PV Pricing Forecast

Historical and Forecasted U.S. PV System Pricing by Market Segment, 2007-2022E (\$/Wdc)



© GTM Research



Ciel & Terre



Solar Roadway

New Applications



Totem



Tesla



Battery Energy Storage

- Saving or storing energy for use at another time
- Can be small-scale (electric vehicles) or large-scale (grid-tied storage system)
- When combined with renewable, can make it appear stable and adjustable (like gas and coal)

Energy Storage - Uses

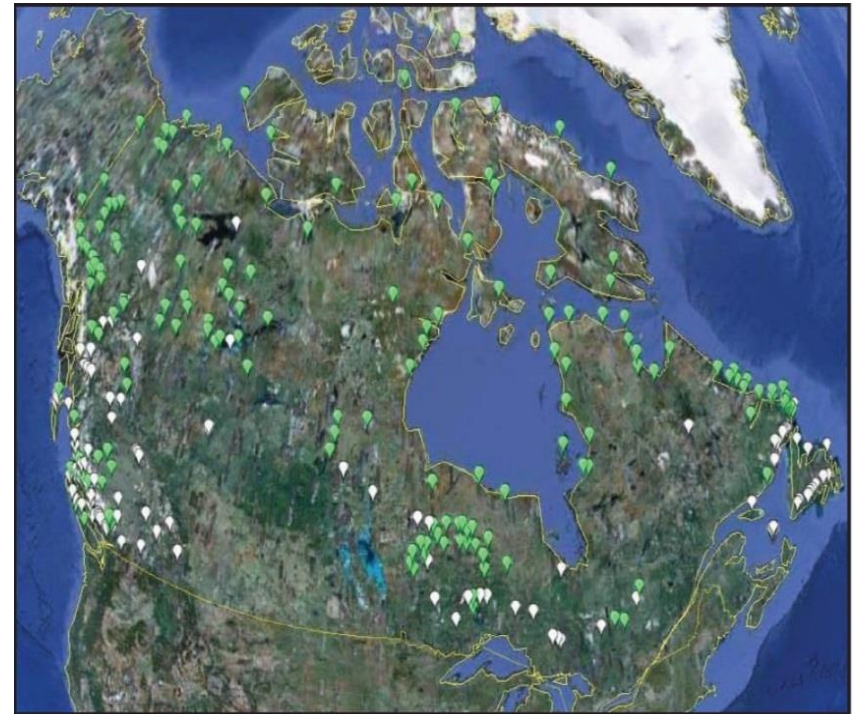
- Balancing load against generation (load leveling)
- Providing ancillary services to grid operator:
 - Providing frequency support / regulation
 - Providing voltage support
- Provide grid support in weak areas to defer asset replacement / investment
- Provide peak shaving to reduce facility load use profile and associated energy costs

Solar PV + Wind + Battery Storage

1. **Peak shaving (load shaving)**
2. **Load balancing**
3. **Grid support: frequency, voltage, reserve...**
4. **Diversity of supply**
5. **Ensures local, reliable power for communities, campuses and buildings**

Benefits of Renewable Energy in Remote Communities

- Increased system resiliency and stability
- Primary source of fuel is diesel which is expensive to transport, has high emissions and fuels noisy, disruptive generators
- High variable fuel costs and therefore high electric prices can deter economic advancement in these communities
- Micro grid could incorporate existing hydro and add solar / wind to reduce / eliminate diesel use



The environmental risks and high costs of diesel generation combined with the continuing cost reductions in solar, wind, and energy storage technologies is providing the opportunity for affordable renewable energy alternatives in remote communities