Canadian Electricity Association | Association canadienne de l'électricité

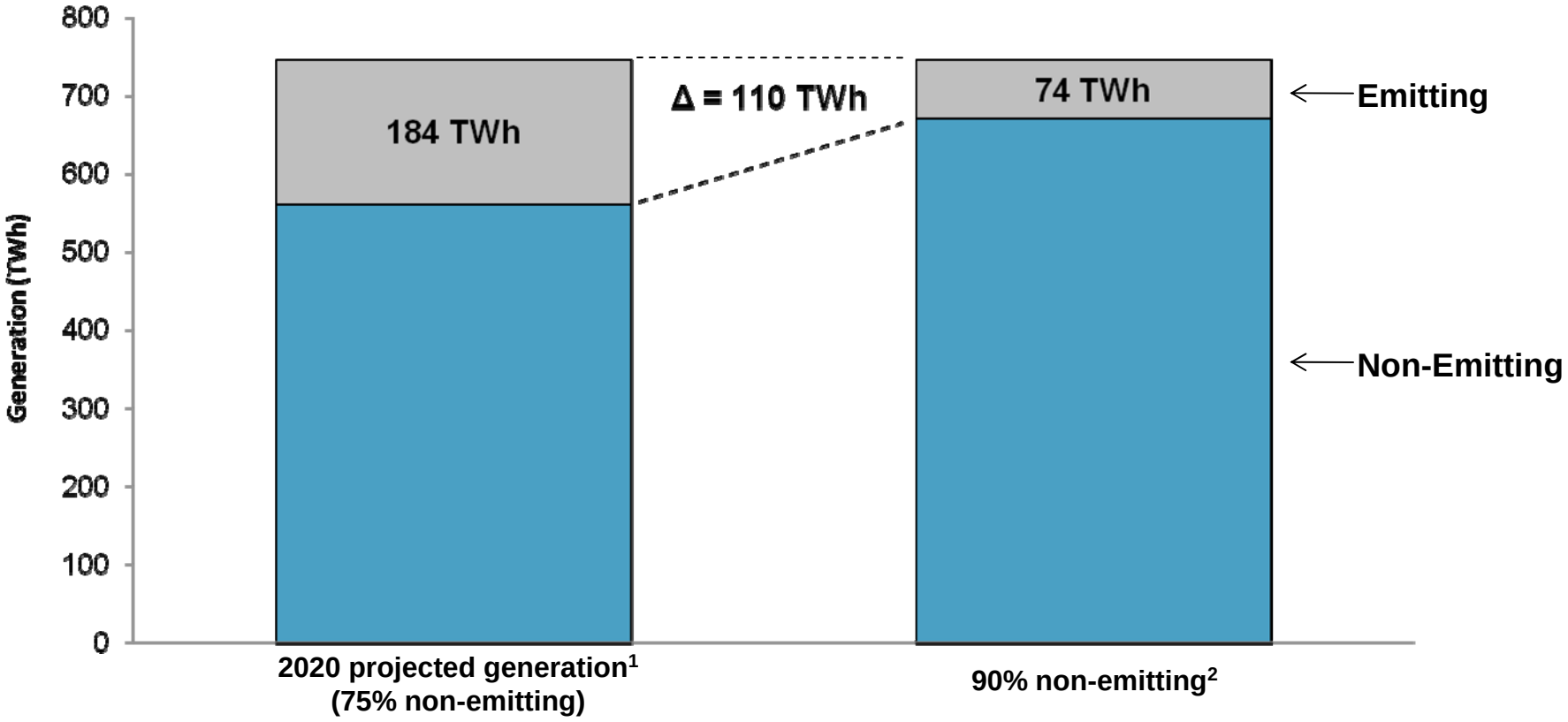
The Clean Electricity Objective: 90 Percent Non-Emitting by 2020

An Analysis by the Canadian Electricity Association

Speech from the Throne, November 19, 2008:

"To meet the challenge posed by climate change, we will also need to make greater use of technologies that do not emit greenhouse gases. Our Government will set an objective that 90 percent of Canada's electricity needs be provided by non-emitting sources such as hydro, nuclear, clean coal or wind power by 2020. In support of this ambitious national goal, our Government will continue to provide support for biofuels, wind and other energy alternatives."

Projected Electricity Generation Mix in 2020



[1] Based on the National Energy Board's forecast *Canada's Energy Future* (2007) and input from CEA member companies.
[2] Generation mix if 90 percent of Canada's generation in 2020 is non-emitting.

Major NEB Projection Assumptions:

Hydro:

- Construction of Lower Churchill (2,260 MW) in Newfoundland
- Construction of Waskwatim (200 MW) in Manitoba
- Other announced hydro projects and expansions constructed

Nuclear:

- Return to service of Bruce A Units in 2009 and 2010
- Construction of a 1,000 MW Advanced CANDU Reactor in 2015
- Refurbishment of Point Lepreau (NB) and Gentilly-2 (QC)

Coal:

- Decrease of 6,600 MW of coal-fired capacity in Ontario
- 300 MW coal plant with CCS online in 2012 (SK)

Current Generation Projections Show Sector is Well Short of 90 Percent Objective

- Today, approximately 75 percent of electricity generation is non-emitting.
- The NEB projects that the electricity generation mix will still be 75 percent non-emitting in 2020.
- Approximately 110 TWh (or 15 percent) of emitting generation must be replaced with non-emitting generation by 2020 in order to meet the 90 percent objective.
- Further analysis shows that if all future load growth were met with a 90 percent non-emitting mix, still only 79 percent of electricity generation will be non-emitting in 2020

Translating the Shortfall into Generation Options

The following options illustrate the magnitude of the non-emitting generation additions (by fuel type) that would be required to replace 110 TWh of emitting generation.

15,000 MW of Nuclear Capacity[1]
21,000 MW of Hydroelectric Capacity[2]
21,000 MW of Clean Coal with CCS[3]
42,000 MW of Wind Capacity[4]

[1] Based on an average capacity factor of 85% for nuclear
[2] Based on an average capacity factor of 60% for hydro
[3] Based on an average capacity factor of 60% for clean coal with CCS (including a 30% energy penalty)
[4] Based on an average capacity factor of 30% for wind

Challenges to Building Electricity Generation: General

There are considerable challenges to building new generation infrastructure that would be amplified in speeding up the process to meet the 2020 objective, including:

- Transmission issues – new generation further from populations
- Not-in-my-backyard (NIMBY) syndrome
- Regulatory approval processes can impede development
- Availability of capital, labour, materials and equipment
- Stranding of assets
- Costs and implications for customers

Challenges to Building Electricity Generation: Nuclear

- 15,000 MW implies 15 new 1,000 MW units
  - Gentilly-2 refurbishment is estimated at $1.9 billion[1]
- Minimum 10 year development period – it is now 2009
- CEAA approvals could slow development
- Managing waste
- Size – may be larger than required in some regions

Examples:

- Pickering refurbishment – cost overruns and project delays
- Transmission for new Bruce Unit

[1] Hydro Quebec, *Refurbishment of Gentilly-2 Nuclear Power Plant*

Challenges to Building Electricity Generation: Large Hydro

- 21,000 MW implies 10 new Lower Churchill Falls Projects (2,260 MW)
  - Churchill Falls Project is estimated at $6.5 billion[1]
- Long development period
- CEAA approvals can slow development
- Resource availability: proximity to water source
- Stakeholder (including aboriginal) engagement/approvals

[1] NALCO, *Environmental Impact Statement for the Lower Churchill Falls Project*

Challenges to Building Electricity Generation: Clean Coal with CCS

- 21,000 MW implies 210 Boundary Dam (SK) Projects (100 MW)
  - IGCC technology (without CCS) could cost up to $6,000/kW[1]
- CCS technology still in development phase
- Resource availability: proximity to coal source and storage capacity
- Parasitic energy loss
  - Retrofit at Boundary Dam results in 40 MW loss or roughly 30 percent
- By 2020, estimated maximum of 2,500 MW online in Saskatchewan and Alberta
  - Pilot online by 2015
  - Construction for commercial deployment initiated by 2018 - 2019

[1] EPCOR, Presentation for Electron Day Gasification Panel, November 20, 2008

Challenges to Building Electricity Generation: Wind

- 42,000 MW implies 14,000 wind turbines (3 MW each)
  - This would require an area of land roughly 2.5 times the size of Prince Edward Island[1]
- Max of 10-20 percent wind on system to maintain reliability[2]
- Grid integration issues
- Power is intermittent and non-dispatchable
- Back-up power (spinning reserves) is required
- Resource availability: proximity to wind resources

[1] Each turbine requires approximately 1 square km: Canadian Wind Association, *Turbines and Land Use: The Win/Win of Wind Energy*
[2] Canadian Electricity Association, *Environmentally Preferable Power Challenges to Development: Wind Technology*.

Future Canadian Projects to Consider Expediting to Meet the 90 Percent

- Transmission enabling the delivery of electricity from Churchill Falls to other provinces (Atlantic Canada Interconnect)
- Transmission enabling the delivery of electricity from Bruce Nuclear Station to population centres
- Other inter-provincial and/or international transmission lines
- Commercial deployment of Carbon Capture and Storage (CCS) technology in Alberta and Saskatchewan

Policies/Regulatory Options to Consider to Expedite Canadian Projects

- Using a multiplier for CO_2 reductions from early implementation
- Expand the definition of “non-emitting”
  - e.g. Including natural gas results in 87 percent non-emitting by 2020
- Pre-certified Projects Fund
- Streamlining regulatory processes
  - SARA
  - CEAA
  - Fisheries Act
- Finance and tax incentives
- Direct government R, D and D funding