Electrification Sensitivities

PURPOSE

This brief provides background information on the two electrification sensitivities applied to the 2011 Integrated Resource Plan.

OVERVIEW

This brief provides background information on the two electrification sensitivities applied to the 2011 Integrated Resource Plan (IRP).

Provincial climate change objectives will require making deep cuts in greenhouse gas (GHG) emissions in the coming decades. There are many ways to reduce GHG emissions across the economy including energy efficiency and conservation, the increased use of biofuels and other renewable energy sources, the adoption of carbon capture and storage and through switching from fossil fuel use to electricity derived from clean generation sources. This latter approach to reducing GHG emissions is referred to as electrification. BC Hydro's clean electricity supply therefore could have a key role to play in B.C.'s Climate Action Plan by helping our customers reduce their own emissions

Fuel-switching to clean electricity is supported by the Clean Energy Act which includes as an energy objective for B.C. "to encourage the switching from one kind of energy source or use to another that decreases greenhouse gas emissions in British Columbia."

What are the Electrification Sensitivities Used[1]?

BC Hydro uses 2 electrification load sensitivities in the IRP, based on scenario work done by E3 (Energy+Environmental Economics) Consulting. The E3 work covers the major regions in the Western interconnected system (WECC regional market), which include the Western U.S. states, B.C. and Alberta. The key underlying premise of the E3 work is GHG reductions in the WECC.

- Slower Approach: In the WECC, 30% reduction in (energy-related) GHG emissions by 2050, relative to 2008. "Offsets" can account for 10% of emissions reductions; 20% of target achieved through reductions in western states and provinces' fossil-fuel-based GHGs. British Columbia is assumed to surpass the overall regional target, achieving a 50 per cent reduction in GHG emissions relative to 2008 by 2050. For British Columbia, 35% of total 2050 emissions savings come from offsets.
- Faster Approach: 80% reduction in GHG emissions by 2050, relative to 2008. "Offsets" can account for 30% of emissions reductions; 50% achieved through reductions in western states and provinces' fossil-fuel-based GHGs. British Columbia meets the overall GHG target with 35% of 2050 total emissions savings coming from offsets.

In both cases, electrification makes a significant contribution to achieving the stated emission reductions.

[1] These electrification sensitivities are distinct from the market scenarios used for the IRP Risk Assessment and price forecasts (GHGs RECs, gas and electricity prices).

How is it used in the IRP?

The electrification sensitivities are developed and reviewed to provide insight into the potential impacts, over a long term 30 year planning horizon, of electrification loads on the BC Hydro system.

Some electrification takes place naturally as a result of economic growth, energy prices and other drivers. Naturally driven electrification is incorporated into BC Hydro's Load Forecast when it is foreseen with sufficient certainty. For example, the 2010 Load Forecast, which is being used in the IRP, incorporates a component of electric vehicle take-up. It also includes a significant amount of expected switching by industrial customers from fossil-fuel based equipment to electricity driven equipment, particularly in the oil and gas sector. By far the biggest component of load growth in the 2010 Load Forecast is for those new customers in the mining and the oil and gas sectors who are assumed to install new electrically-intensive equipment.

In order to inform the IRP as to the potential long term impacts of electrification, BC Hydro is analyzing the possible impacts of electrification. These are "what if" views of the future that help explore potential impacts of future states of the world. These cases do not necessarily represent what BC Hydro believes what the world will be, but are an exploratory tool to understand the potential impacts if the future unfolded as defined in the cases. The electrification sensitivities run by BC Hydro examine two future states of British Columbia and the interconnected WECC region where GHG emission reduction measures in general, including electrification, have been pursued to differing levels. One case assumes more rapid reductions in GHG reductions than the other.

This analysis is particularly useful for the IRP, because a broad range of outcomes for electricity demand is considered in the planning process. The 2 load sensitivities will determine the extent of new electricity generation and transmission that would be required in the province under these cases, and what the financial, environmental and economic development impacts could be. This helps ensure that the IRP is cost-effective and robust under a range of plausible future outcomes.

How were they developed?

E3 evaluated 5 basic options for achieving reductions in energy-related GHG emissions:

1. Conservation and efficiency - this includes increased efficiency in all uses of energy, including space heating, the transportation sector, industrial processes, etc.
2. Fuel substitution to biofuels and the direct use of renewable energy – such as solar thermal heating and the increased use of energy from biomass. Biomass energy includes ethanol and renewable diesel fuels; biogas captured from agricultural operations and sewage treatment facilities; wood pellets and other forest residues.
3. Low-carbon electricity – E3 assumed that incremental electricity in B.C. will be generated using clean (low or no carbon emissions) generation.
4. Electrification (switching from fossil fuels to electricity generated from low carbon resources)
5. Offsets – reductions in other GHGs (such as methane from landfills), other sectors of the economy (agriculture and forestry, where changed management practices can sequester more GHGs), and other regions (emission reduction projects in both developing and industrialized countries)

In order to determine the electrification in each case, a forecast of baseline energy demand and GHG emissions is prepared. This starts with existing energy demand forecasts by region, sector and fuel type,

extrapolated out to 2050. Next, GHG emissions from non-electricity fuels are calculated. GHG emissions from the electricity sector are determined, assuming all regions in the WECC meet existing Renewable Portfolio Standards. It is assumed that all new B.C. electricity demand is met with low-carbon resources.

As described above, five measures broadly categorize GHG emission reduction options. Using professional judgment, GHG emission reduction targets are achieved by assuming that different levels of effort are applied in each of these five categories to achieve GHG reductions. Each emission reduction category is limited by existing infrastructure and the expected future availability of advanced technologies. For each emission reduction measure, changes to energy use by fuel type and sector are calculated, and then GHG emissions are re-calculated based on these adjusted energy use forecasts.

A central issue in any emission reduction analysis is how quickly reductions can occur. Emissions depend mostly on the existing stock of energy-using capital and equipment, and any reductions require replacing that existing stock with new more efficient technologies or technologies that do not use fossil fuels. In some sectors the stock is replaced fairly frequently; the vehicle fleet will have turned over several times by 2050. In other cases the stock is replaced slowly; most of the 2050 housing stock has already been built.

Reductions will also depend on the rate of commercialization and acceptance of new technologies. Electric vehicles will not likely gain wide acceptance until the purchase costs are more comparable with conventional vehicles, and consumers are satisfied they can recharge when and where they need to.

Government and BC Hydro actions can influence the timing and nature of new investments in energy-using equipment, as well as the commercialization of new technologies, and influence the rate at which electrification occurs.

E3 applied professional judgment to anticipate the timeframe within which emission reduction measures could be deployed. For example, electricity energy efficiency is already being aggressively pursued in many regions, without the need for new technology breakthroughs. As a result, E3 assumed that electric energy efficiency efforts begin in the first year of the study. Likewise, renewable portfolio standards are already in place in many jurisdictions in the United States, and are currently leading to new renewable energy developments. As a result, low carbon electricity generation begins coming online immediately in the analysis.

In contrast, the analysis assumes that electric vehicles will not affect electricity demand prior to 2015, and widespread electrification in the residential, commercial and industrial sectors will not occur until after 2020. Currently, electrification is not being aggressively pursued; in fact, many utility programs encourage fuel switching from electricity to natural gas. In addition, some technology hurdles still exist before plug-in electric cars are likely to see widespread market penetration.

Inputs and Assumptions

Electrification Sensitivity in the IRP	Description	Additional Electricity Requirements	B.C. GHG Reductions
Slower Approach to Meeting Provincial Climate Change Target	Slower ramp up of GHG reductions to meet government reduction targets.	High rate of expansion of clean generation capability. 6,000 GWh of additional B.C. electricity demand by 2030.	23% reduction in B.C. GHG emissions by 2030 relative to 2008 baseline. 6% of this due to electrification.
Faster Approach to Meeting Provincial Climate Change Target	Faster ramp up of GHG reductions to meet government reduction targets.	Higher rate of expansion of clean generation capability. 9,000 GWh of additional B.C. electricity demand by 2030	49% reductions in B.C. GHG emissions by 2030 relative to 2008 baseline. 9% of this due to electrification.