Non-Wires Alternatives Study

How Energy Efficiency, Demand Response and Managed Charging Can Cost-Effectively Offset Electric Vehicle Load Growth in Alberta

Electric vehicles (EVs) are seeing increased adoption across Canada – including in Alberta. At-home EV charging can add a significant load to the distribution network at peak times. With the expected growth in EV adoption over the next 10 years, this increased peak load on the electricity system could increase costs to the province's distribution systems – and customers – if left unmanaged.

Energy Efficiency Alberta hired a leading energy consulting firm, Navigant Consulting, to study whether **energy efficiency**, **demand response**, and **smart charging** – collectively, demand-side management (DSM) initiatives – could cost-effectively mitigate the potential distribution impacts of EVs at the transformer level in Alberta.

What were the key findings?

The study found that:

- Demand-side management solutions could reduce peak electricity load caused by EV adoption at a **cost savings of over $7,600 to $10,000 per kilowatt (kW).**
- The non-wires alternatives are **2.5 to 24 times more cost-effective** than traditional wires upgrades.
- **Energy efficiency and demand response cost less than smart charging**, but all three are required to sufficiently reduce impacts at high levels of EV uptake.
- When its wider benefits are considered, energy efficiency provides **more cost savings than imposed costs** – a net benefit of almost $400/kW with energy savings only and a **net benefit of over $1,700/kW** when also considering greenhouse gas emissions (moderate scenario). Implementing energy efficiency programming immediately allows consumers to benefit from the cost savings, even if EV capacity impacts are five to 10 years away.

Benefits of the study

- Provides evidence that non-wires alternatives can meet significant demand and reduce peak impacts from electric vehicles
- Demonstrates the cost-effectiveness of demand-side management when compared to some traditional "wires" investments
- Shows the value of energy efficiency in meeting peak demand, saving consumer costs, and reducing environmental impacts

Demand-Side Management (DSM)

DSM is the planning, implementation, and monitoring of activities designed to modify patterns of energy usage, including timing and level of demand.

ENERGY EFFICIENCY	DEMAND RESPONSE	SMART CHARGING
Management and reduction of energy consumption through technology and behaviour-based changes.	Shifting energy consumption away from high-stress, or peak, periods.	Allows a utility or third party to control, delay or curtail the charging of an EV based on the needs of the grid.

- Can reduce peak demand and distribution costs of EV adoption
- Able to reduce peak load on the transformer
- Cost less than a transformer upgrade: 2.5x to 24x more cost-effective

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What are...

TRADITIONAL WIRES INVESTMENTS?

Investments made in transmission and distribution infrastructure, such as wires and transformers, to meet increases in peak demand.

NON-WIRES ALTERNATIVES?

Solutions such as energy efficiency, demand response and energy storage that avoid or defer transmission and distribution infrastructure developments.

About the study

This study assesses the impact of EV adoption at a 12-customer distribution transformer in a typical neighbourhood in Edmonton over a 10-year period (2020-2030), based on moderate and aggressive EV adoption scenarios. The transformer used in the study is consistent with a median level of peak loading derived from residential transformer data in Edmonton.

The study's **moderate scenario** uses business-as-usual assumptions (e.g. battery pack prices, EV incentives and vehicle model availability) which, by 2030, add two EVs to the representative transformer's load. Under the **aggressive scenario**, more favourable conditions for EV adoption add three EVs to the transformer's load by 2030. Under these scenarios, the transformer's maximum capacity is exceeded between 10 and 349 hours per year.

The study then evaluates the least-cost option (via a cost-benefit analysis) between traditional wires upgrades and the portfolio of DSM solutions (energy efficiency, demand response and smart charging). The study finds that DSM provides significant cost savings over the traditional wires investments (see table below), and when the wider benefits of energy savings and avoided carbon are considered, energy efficiency provides even greater cost savings.

Net Benefits of Non-Wires Alternatives (NWAs)

NWAs provide a net benefit of between $7,600 - $18,000 over traditional wires investments.

	NPV* of NWAs	NPV of NWAs and energy savings	NPV of NWAs, energy savings and avoided carbon
Moderate Scenario	$10,082	$10,921	$12,252
Aggressive Scenario	$7,614	$11,699	$18,379

***Net present value (NPV)** is the value of future cash flows (i.e. benefits and costs) discounted to represent its value today. We discount, or assign less value, to future benefits and costs because a dollar that can be invested today is worth more than one that is invested tomorrow. The net present value of non-wires alternatives represents the cost savings over traditional wires investments.

Read the study: efficiencyalberta.ca/electric-vehicle-study

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