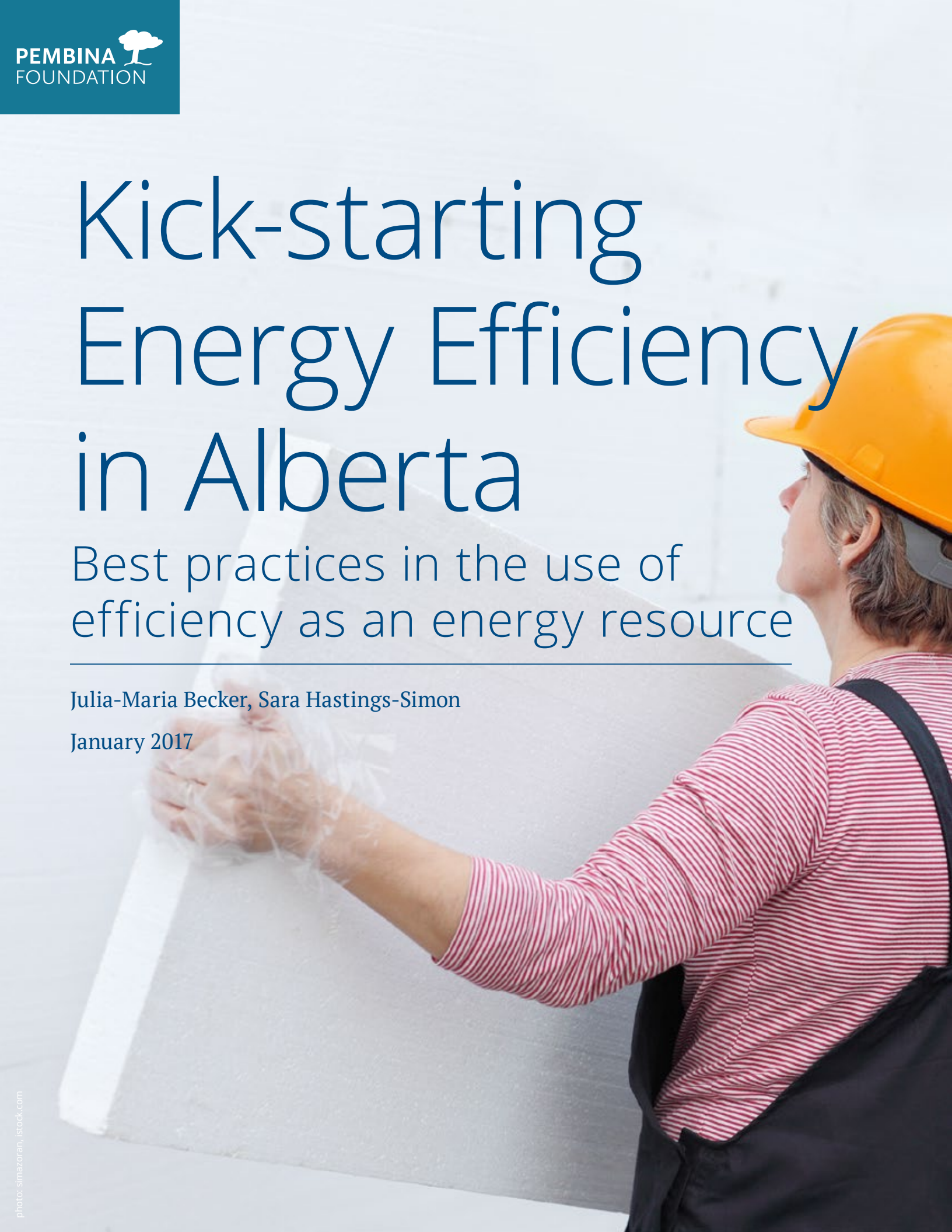
PEMBINA FOUNDATION

Kick-starting Energy Efficiency in Alberta

Best practices in the use of efficiency as an energy resource

Julia-Maria Becker, Sara Hastings-Simon

January 2017



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Executive summary

Energy efficiency promotes economic prosperity, reduces environmental pollution and strengthens local independence. It is one of the lowest cost energy resources and the cheapest option to reduce greenhouse gas (GHG) emissions.

In recent decades, the global community has seen the benefits of deploying energy efficiency and experienced the challenges and barriers that must be overcome in its successful development. Alberta has the chance to start with a clean slate and take advantage of all the lessons learned from around the world on how to best leverage its newest resource and develop it to Albertans' advantage.

This report starts with an overview of energy efficiency around the world and in Alberta and provides an outline of best practices, organized by policy approaches. These approaches are: direct programs; codes and standards; innovative financing; integration of energy efficiency into the utility system; and the government leading by example.

We give particular focus to why it makes sense to consider energy efficiency as a resource and to integrate it into the utility system. Thinking of energy efficiency as a resource means including it in the decisions on investments in electricity generation, transmission and distribution. This can lower overall system costs by avoiding the need to build costly power plants and transmission lines. As standard with other energy resources, all benefits of energy efficiency should be recognized and a long-term view in investment decisions applied.

Later we explore potential leverage points for the success of the newly established agency, Energy Efficiency Alberta (EEA), and give recommendations on how to realize the full potential of energy efficiency programs in Alberta. These recommendations are based on the analysis of best practices and on conversations with thought leaders. Specifically, apart from measuring and communicating the results of the programs, EEA should be ambitious in setting its goals, using a variety of indicators that reflect the needs of the environment and Albertans. Additionally, a stakeholder group should be established to ensure that new programs are developed to address the needs of different stakeholders while at the same time being at the frontline of innovation.

The first step to integrate energy efficiency into the utility system in Alberta is to establish a mandate for the regulator, system operator and utility consumer advocate to pursue energy efficiency whenever it is the most cost-effective investment decision.

Another opportunity is to allow energy efficiency to bid into the newly established capacity market which will be put in place to help ensure that the electricity grid can meet the required demand.

To reach the full potential of energy efficiency in Alberta, it is essential to understand the value of energy efficiency, realize the related opportunities, and aim for long-term sustainable development of this resource. For this, it is crucial to recognize energy efficiency as a resource and to integrate energy efficiency into the utility system. Issues around data access, reporting on program impacts, and funding should also be considered. Considering these leverage points for success in the upcoming decisive time will ensure that the potential of Alberta's newest resource will be fully realized.

1. Introduction

"Energy efficiency is the one energy resource that every country possesses in abundance."

Dr. Fatih Birol
International Energy Agency

Energy efficiency is one of the most valuable energy resources. It promotes economic prosperity, reduces environmental pollution and strengthens local independence. It is one of the lowest cost energy resources and the cheapest option to reduce greenhouse gas (GHG) emissions. When properly implemented, energy efficiency is also the only option that actually saves money for every dollar invested.

In recent decades, the global community has experienced the challenges and opportunities of deploying energy efficiency. Alberta has the chance to start with a clean slate and take advantage of all the lessons learned from around the world on how to best take advantage of its newest resource.

This report provides an overview of high-impact strategies and best practices that should be adopted in Alberta. We give particular focus to why it makes sense to consider energy efficiency as a resource and integrate it into the utility system. Finally, we flag leverage points to lead the newly established Energy Efficiency Agency of Alberta to success.

This report is based on research and feedback from thought leaders in the field.

Defining energy efficiency: "Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input. For example, a light-emitting diode (LED) bulb uses less energy than an incandescent bulb to produce the same amount of light, therefore the LED is considered to be more energy efficient."[1]

[1] International Energy Agency (IEA), "Energy Efficiency," 2017. http://www.iea.org/about/faqs/energyefficiency/

2. Overview of energy efficiency

2.1 Potential and progress on energy efficiency in the world

"Experience around the world and evidence from many independent international agencies confirms that energy efficiency is the most cost-effective energy investment that any jurisdiction can make."

Dr. David Wheeler
Energy Efficiency Advisory Panel

In 2015, savings through energy efficiency measures achieved a global improvement in energy intensity — the amount of energy to produce one unit of gross domestic product (GDP) — of 1.8%.[2] In 2015 alone, International Energy Agency member countries[3] saved US$540 billion on end-use fuels through energy efficiency, as shown in Figure 1.

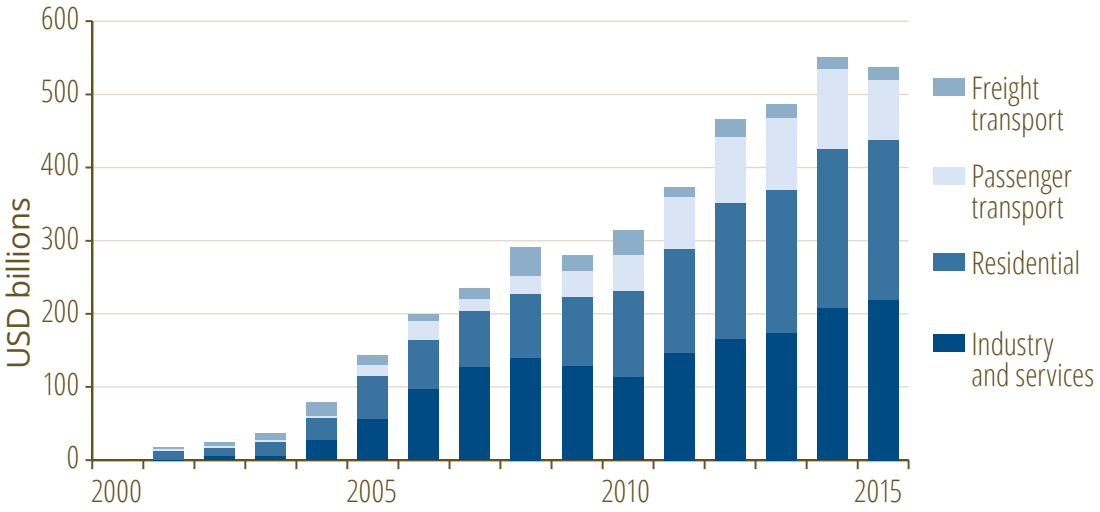

Figure 1. Avoided expenditure on end-use fuels in IEA countries by sector

Adapted from International Energy Agency [4]

[2] IEA, *Energy Efficiency Market Report 2016*. https://www.iea.org/eemr16/files/medium-term-energy-efficiency-2016_WEB.PDF

[3] Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Republic of Korea, Luxembourg, The Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States.

[4] *Energy Efficiency Market Report 2016*, 31.

Since 2000, these savings equate to a reduction in greenhouse gas emissions of 13 Gt CO_2 and additional local pollution reduction in IEA countries. The impact is significant on the scale of a single year – IEA countries avoided a total of 1.5 $GtCO_2$ of emissions through energy efficiency measures in 2015. This amount exceeds Japan's total emissions for that year. The avoided emissions over time through energy efficiency improvements are shown in Figure 2.

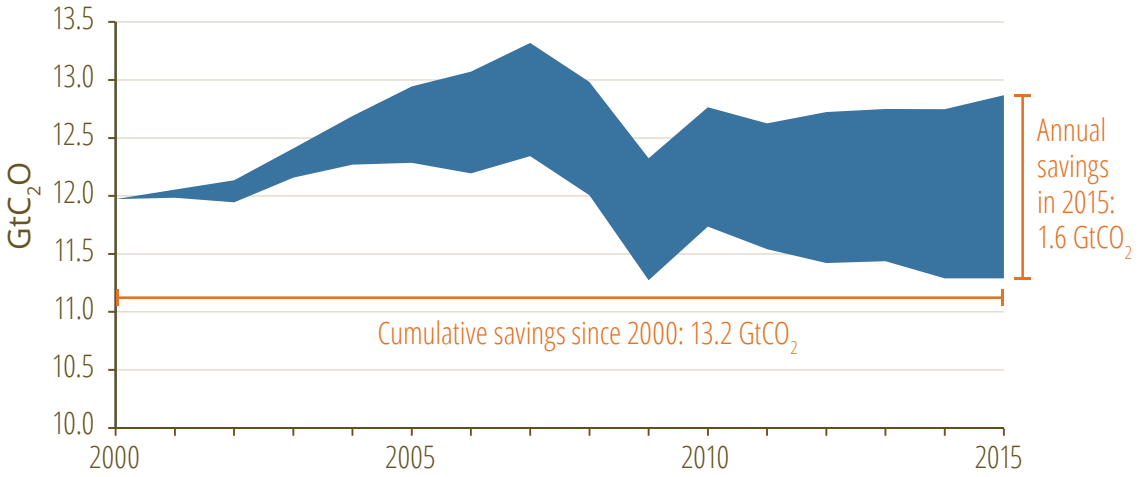

Figure 2. Avoided GHG emissions from energy efficiency improvements in IES countries

Adapted from International Energy Agency[5]

Avoided costs for the utility system as a whole, including government, utilities and consumers, and avoided GHG emissions are typical benefits considered by jurisdictions to value energy efficiency, but in general energy reductions from energy efficiency don't show up in typical accounting and are therefore often overlooked. To understand the magnitude of the reduction it is necessary to calculate full avoided costs and emissions.[6]

Energy efficiency has the potential to reduce global greenhouse gas emissions by 40%.[7]

[5] *Energy Efficiency Market Report 2016,* 33.

[6] A comprehensive analysis of the full value of energy efficiency can be found here: Jim Lazar and Ken Colburn, *Recognizing the Full Value of Energy Efficiency (What's Under the Feel-Good Frosting of the World's Most Valuable Layer Cake of Benefits).* (The Regulatory Assistance Project, 2013.

[7] McKinsey&Company, *Energy efficiency: A compelling global resource* (2010). http://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/sustainability/pdfs/a_compelling_global_resource.ashx

In light of the 2015 Paris Agreement and the urgent need to reduce carbon pollution, Canada committed to a GHG reduction of 30% below 2005 levels by 2030. In November 2016, Canada submitted its Mid-Century Long-Term Low-Greenhouse Gas Development Strategy[8] to the United Nations Framework Convention on Climate Change (UNFCCC), committing to reduce emissions by 80% from 2005 levels by 2050. One of the core components of Canada's decarbonization pathway is to max out energy efficiency.

This strategy is in line with other jurisdictions around the world that have emphasized investing in energy efficiency to create and protect jobs, and to reduce energy import dependence while reducing GHG emissions.

> Every dollar spent on energy efficiency programs in Canada generates between $4 and $8 of GDP.[9]

2.2 Status of energy efficiency in Alberta

"Energy efficiency is an important way for all Albertans to contribute to reduced greenhouse gas emissions. Energy efficiency is essentially a low-cost, underdeveloped energy resource."

Climate Change Advisory Panel

Alberta is starting from behind on energy efficiency. Until recently, Alberta was the only jurisdiction in all of Canada and the U.S. without energy efficiency programs. In addition, Alberta is one of the few Canadian and U.S. jurisdictions that does not have policy and regulatory structures to consider of the role of energy efficiency in long-term energy planning. This dubious distinction has lead to missed opportunities to generate savings in both direct energy costs as well as reduced transmission and other infrastructure; to protect energy consumers against price volatility; to make the energy system more reliable; and to reduce emissions. The Climate Change Advisory Panel[10] highlighted the importance of energy efficiency as a complementary policy tool for the

[8] Environment and Climate Change Canada, *Mid-Century Long-Term Low-Greenhouse Gas Development Strategy* (2016). http://unfccc.int/files/focus/long-term_strategies/application/pdf/can_low-ghg_strategy_red.pdf

[9] Environment Northeast (Acadia Centre), *Energy Efficiency: Engine of Economic Growth in Canada* (2014), 3. http://acadiacenter.org/document/energy-efficiency-engine-of-economic-growth-in-canada/

[10] This panel provided recommendations in November 2015 that informed the Alberta government's Climate Leadership Plan. Climate Change Advisory Panel, *Climate Leadership Report to Minister* (2015). http://www.alberta.ca/documents/climate/climate-leadership-report-to-minister.pdf

carbon levy, and the Alberta government has signaled a commitment to energy efficiency in its Climate Leadership Plan.

2.2.1 Potential benefits

Research from Dunsky Energy Consulting, a leading firm in energy efficiency issues in Canada, and the Acadia Center, a non-profit organization, finds investing heavily in energy efficiency in Alberta can create 15,000 new jobs locally and increase Alberta's annual GDP by $3 billion.[11] Additionally, this investment would raise nearly $200 million per year in extra personal income tax and corporate income tax revenues. These results assume annual efficiency savings targets for electricity of 1.75%, for natural gas 1.25% and for liquid fossil fuels 1.75%. This level of effort would place Alberta among current leaders; in comparison, Nova Scotia, a leader in Canada in energy efficiency, was able to reduce its demand for electricity in 2012 by 1.52%.

These numbers assume very ambitious spending in energy efficiency programs. The Alberta Energy Efficiency Alliance (AEEA) claims that energy efficiency programs funded at a level comparable to the average of other Canadian provinces ($34 per capita annually) could deliver $510 million in annual energy savings, trigger a $550 million annual GDP increase,[12] create 3,000 jobs and reduce emissions equivalent to taking 900,000 cars off the road.[13] Average annual funding for energy efficiency programs in other Canadian provinces is $34 per capita.

In summary, studies confirm that in Alberta, as in the rest of the world, investing in energy efficiency increases GDP, creates jobs and reduces emissions.

[11] *Energy Efficiency: Engine of Economic Growth in Canada.51.*

[12] Alberta's GDP in 2015 was 310,640 millions of chained (2007) dollars. Statistics Canada, "Real gross domestic product, expenditure-based, by province and territory," CANSIM table 384-0038. http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/econ50-eng.htm).

[13] Alberta Energy Efficiency Alliance, *Jurisdictional Review of Funding for Energy Efficiency Programs in Canada and the United States* (2016). http://www.aeea.ca/pdf/jurisdictional-review-of-funding-for-ee-jan-2016.pdf

In 2015, energy efficiency employed 1,000 Nova Scotians, helping residents save $110 million in 2016 alone and preventing the release of 590,000 tonnes of GHG emissions.[14] The more than 30,000 energy efficiency projects reduced electricity use by 1.2% in that year.[15]

2.2.2 Commencing energy efficiency in Alberta

> *"Alberta will need to... [e]ncourage demand-side management and energy efficiency to be larger contributors to the market (both demand response and energy efficiency tend to be more cost effective capacity than building simple cycle peaking plants, thus reducing carbon emissions at relatively low cost)"*
>
> Terry Boston
> Coal phase-out facilitator

Typical barriers to investments in energy efficiency in Alberta cited by the AEEA are the same as those faced around the world: a lack of information and awareness, split or disconnected incentives, limited availability of products and services, perceived risks and rewards, and institutional or regulatory barriers.

To overcome barriers for individuals and businesses to invest in energy efficiency, the Climate Change Advisory Panel recommended energy efficiency programs as a complementary policy to an economy-wide price on carbon.[16] As a first step, the Government of Alberta established an independent agency, Energy Efficiency Alberta (EEA) with the mandate to raise awareness, promote, design and deliver programs and to promote the development of an energy efficiency services industry.[17]

The Government of Alberta also convened the Energy Efficiency Advisory Panel[18] in June 2016. The panel was mandated to provide recommendations to EEA on energy saving programs to enable the launch of programs by early 2017, as well as supporting

[14] Efficiency Nova Scotia, "About Efficiency Nova Scotia." https://www.efficiencyns.ca/about-us/

[15] EfficiencyOne Services, "Who we are"(2014-2015). https://www.efficiencyone.ca/who-we-are/

[16] *Climate Leadership Report to Minister,* 8.

[17] Province of Alberta, Energy Efficiency Alberta Act, SA 2016 c E-9.7 s 2(2). http://www.qp.alberta.ca/documents/Acts/e09p7.pdf

[18] Government of Alberta, "Alberta establishes panel to advance energy efficiency programs," media release, June 9, 2016. http://www.alberta.ca/release.cfm?xID=418961BE1C8AE-E550-A5BB-7A6020BF0FC462A1

with the creation of a long-term vision. The government has committed an investment of $645 million over five years with funding from the economy-wide carbon levy.[19]

In October 2016, the Chair and Board of Directors of EEA were named and Requests for Proposals for the first three programs were announced targeting a launch in early 2017.[20] These include a direct install residential program, a residential consumer products program and a business non-profit and institutional rebate program.

[19] Government of Alberta, "Energy Efficiency Advisory Panel." http://www.alberta.ca/energy-efficiency.aspx

[20] Government of Alberta, "Energy Efficiency Alberta helps people save money," media release, October 27, 2016. http://www.alberta.ca/release.cfm?xID=4370646A37239-E955-7D4E-646CB8636D0063B3

3. Best practices in energy efficiency

> *"Time and time again, we repeat that the cheapest, cleanest and most reliable energy resource is the energy we save through energy efficiency."*
>
> Kate Zerrenner
> Environmental Defense Fund

In addition to reducing greenhouse gas emissions, energy efficiency initiatives create jobs and offer significant cost savings while protecting energy consumers from future volatile energy prices and costly investments for additional unnecessary capacity. At the same time, the barriers to adopting energy efficiency are increasingly understood. Globally, jurisdictions have been working to take advantage of these benefits and reducing the barriers that prevent activities on energy efficiency.

A review of the recommendations of the International Efficiency Agency (IEA), the American Council for Energy-Efficient Economy (ACEEE), and Regulatory Assistance Project (RAP), as well as experts allowed us to identify a set of best practices that should be followed in Alberta. The best practices are organized by government approaches to address energy efficiency. Different approaches will work for different sectors depending on the types of barriers and potential. Ideally, a mix of approaches is applied to make sure energy efficiency is widely spread throughout the different sectors within an economy.

3.1 Direct programs

Programs are a mainstay of energy efficiency policy and can be delivered by utilities, government agencies or third parties. These programs normally consist of a combination of four elements

- educational campaigns: raising awareness about the benefits of energy efficiency and programs available
- financial incentives (loans and rebates): direct financial support to offset cost and to reduce the burden of an initial investment, which allows savings over time to pay for energy efficiency
- technical services (audits and retrofits): making services available to help find energy savings opportunities and deliver retrofits

- behavioural strategies (data and access to data): using big data and behavioural psychology to influence consumer behaviour around energy use.

3.1.1 Information and big data as program enablers

Data is a key both to identifying opportunities and to measuring program success. With the rise of internet-based communication and the capability to store and manipulate large data sets, the use of data in energy efficiency is increasing.

Much like the emergence of targeted advertising, increased information about individual households and buildings can be used to match customers with products[21] and services that meet their needs and are specific to their activities; for example, targeting pool owners with efficient pool pumps. This allows programs to bring information to customers at a lower cost, allowing better use of program funds.

In addition, data can be used to provide consumers with information (e.g. home energy reports) to target behavioural opportunities such as turning off lights in unoccupied rooms in a home and switching off central air conditioning systems when no one is at home. These changes can represent savings of 1-3% across a jurisdiction.[22]

3.2 Codes and standards

Codes and standards are an important part of the mix of approaches to take advantage of the opportunities in energy efficiency. Codes and standards can generally be applied within the building sector, to appliances and equipment, and to the transport sector. They are an important complementary tool to energy efficiency programs.

3.2.1 Buildings

It is universally recognized that properly implemented standards within the construction industry are the easiest way to support consumers in saving money and energy, increasing house affordability and improving air quality.[23] Energy efficiency

[21] Marisa Uchin and Cristina Coltro, "Engaging Customers to Adopt Distributed Energy Resources," *ACEEE Summer Study on Energy Efficiency in Buildings* (2016). http://aceee.org/files/proceedings/2016/data/papers/6_1092.pdf

[22] State and Local Energy Efficiency Action Network, "Behaviour-Based Energy Efficiency." https://www4.eere.energy.gov/seeaction/topic-category/behavior-based-energy-efficiency

[23] American Council for Energy-Efficient Economy (ACEEE), "Building Codes." http://aceee.org/topics/building-codes

standards for the construction industry ensure that these benefits are captured at the moment of the construction of buildings. The goal should be to ensure that new buildings are as energy efficient as economically justified as it is more expensive to retrofit these buildings afterwards to achieve the same energy savings.[24]

Standards and codes have, together with policies, led to improved energy performances of buildings within the last 30 years. Raising the bar for energy efficiency over time allowed industrialization of technologies and economies of scale to develop in this industry. Apart from mandatory standards, additional voluntary building standards have emerged for organizations interested in achieving sustainability goals.

Alberta still has a long way to go to catch up to other jurisdictions in this area.[25] While the recently announced code updates are a first step,[26] additional, more ambitious codes and standards should be adopted in the future.

3.2.2 Appliances and equipment

Appliance and equipment standards are a relatively low-cost way to achieve savings. They have a market-wide impact and have been shown to be a very successful tool to save energy and money while benefitting the environment.[27]

Such standards require energy-intensive appliances and equipment like refrigerators, air conditioners, and electric motors to meet certain efficiency levels. Better efficiency saves consumers, businesses and industry money and energy, while the cost-effective improvements become the new norm within the market. The drive for improvements fosters innovation within the manufacturing sector, making the sector more competitive while providing consumers and businesses with lower cost alternatives. Efficient products become more accessible and affordable.[28]

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[24] ACEEE, *Advanced Building Energy Codes* (2016). http://aceee.org/policy-brief/advanced-building-energy-codes

[25] More on the current state of Alberta's building sector: http://calgaryherald.com/opinion/columnists/row-alberta-needs-to-do-more-to-ensure-homes-and-businesses-use-less-energy

[26] Alberta Municipal Affairs, "Information on Energy Codes." http://www.municipalaffairs.alberta.ca/CP_Energy_Codes_Information

[27] ACEEE, *Advanced Appliance and Equipment Efficiency Standards* (2016). http://aceee.org/policy-brief/advanced-appliance-and-equipment-efficiency-standards

[28] Ibid.

3.2.3 Transport

Transport is the sector that consumes most final energy.[29] The U.S., for example, devotes 28% of its total energy use to transporting people and goods.[30] In Alberta, personal and freight transport account for 38% of domestic energy use.[31] To achieve a more energy efficient transportation sector, jurisdictions can implement policies that improve the efficiency of purchased or operated vehicles, that promote more efficient transportation modes, and that decrease the need in general to drive. The ACEEE recommends to set quantitative targets for reducing vehicle miles traveled and integrate land use and transportation planning.[32]

3.3 Innovative financing

One of the key barriers to energy efficiency is the availability of capital. However, its higher upfront capital cost and reliable revenue stream makes energy efficiency well suited to private investment looking for secure returns. Innovative financing mechanisms can be used to leverage private capital and lower upfront costs for energy efficiency measures. Financial institutions in other jurisdictions, such as credit unions in Saskatchewan, have provided long-term low-interest loans that can be repaid by energy savings that result from capital investments in efficiency.

Financing can also stretch the amount of funding available from the government. Programs can take the form of green finance such as bonds or new institutions such as green banks or ESCOs (Energy Service Companies). Innovative financing programs can

[29] Kazunori Kojima and Lisa Ryan, *Transport Energy Efficiency: Implementation of IEA recommendations since 2009 and next steps* (IEA, 2010). https://www.iea.org/publications/freepublications/publication/transport_energy_efficiency.pdf

[30] The National Academies of Sciences, Engineering, Medicine, "Transportation." http://needtoknow.nas.edu/energy/energy-use/transportation/

[31] Personal and freight transport consumed 471.4 PJ of energy in 2013 in Alberta; a total of 1253.5 PJ of energy (useful energy plus end-use losses) was used domestically. Canadian Energy Systems Analysis Research, "Sankey diagrams of Canada's energy system." http://www.cesarnet.ca/visualization/sankey-diagrams-canadas-energy-systems?scope=Alberta&year=2013&modifier=none&hide=all&scalevalue=0.01728654356185329#chart-form

[32] Weston Berg et al., *The 2016 State Energy Efficiency Scorecard* (ACEEE, 2016) Research Report U1606. http://aceee.org/research-report/u1606

also address other barriers such as transfer of ownership when properties are sold. Property-tied finance programs such as PACE[33] have been successful in this regard.

3.4 Integration into the utility system

The value of energy efficiency goes far beyond the direct energy savings to the consumer. As energy efficiency is almost always the cheapest source of new generation or transmission (the "negawatt" [34]), it can lower overall system costs by avoiding the need to build costly power plants and transmission lines. Realizing the full value of energy efficiency comes from thinking of it as a resource whenever you think about investment options in electricity generation.

Utilities may already have a mandate to pursue demand-side management, or such a mandate can be directly provided. One mechanism is a white certificate program for "negawatts" rather than watts. Italy was the leading jurisdiction to use these, and this mechanism is now employed in many other market-oriented electricity sectors.[35] Other leading regions like New York City are reforming the utility system as a whole to make better use of low-cost energy efficiency resources. The integration must be done with care to avoid situations where utilities could over-report or double count savings.

Energy efficiency has been integrated into the deregulated capacity markets in PJM and ISO-NE[36] by ensuring that market rules allow for its participation.[37] Experience in these jurisdictions shows that energy efficiency can make significant contributions to system needs, lowering prices. However the revenues from the capacity market alone are not enough to support energy efficiency investments, so capacity markets can't be the only tool to develop energy efficiency.

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[33] PACENation, "What is PACE?". http://pacenation.us/what-is-pace/

[34] "A megawatt of power saved by increasing efficiency or reducing consumption": Margaret Rouse, "negawatt", *TechTarget*. http://whatis.techtarget.com/definition/negawatt

[35] Gestore Servizi Energetici, "White Certificates." December 28, 2012, http://www.gse.it/en/White%20Certificates/Pages/default.aspx

[36] The States covered by PJM are the following: all or most of Delaware, District of Columbia, Maryland, New Jersey, Ohio, Pennsylvania, Virginia and West Virginia. Parts of Indiana, Illinois, Kentucky, Michigan, North Carolina and Tennessee. ISO-New England covers the following States: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

[37] Chris Neme and Richard Cowart, *Energy Efficiency Participation in Electricity Capacity Markets – The U.S. Experience* (Regulatory Assistance Project, 2014). http://www.raponline.org/document/download/id/7303

To work in a deregulated electricity market such as Alberta, government can establish a mandate for the regulator, system operator and utility consumer advocate to pursue energy efficiency with a fixed target for efficiency and to consider energy efficiency as an option in cost-based investment decision. Energy efficiency can also be included directly in the market by ensuring market rules allow it to bid into the capacity market.

This was identified as a critical opportunity for Alberta to act on to improving energy efficiency within the province. For that reason, this report will go into more detail on this opportunity in Chapter 4.

3.5 Government leading by example

Another complementary approach to increase energy efficiency is when the government leads by example. A jurisdiction commits itself to expand and highlight its efforts, such as adding financial incentive programs, retrofitting government-owned buildings, enacting policies that require transparency about energy use from building owners and managers, and investing in energy efficiency-related R&D centres.

4. Integration of energy efficiency into the utility system

"Integrating energy efficiency, or demand side management, into the utility system has been by far the most successful approach to creating long-term success for energy efficiency programs."

Jesse Row
Alberta Energy Efficiency Alliance

While energy efficiency is generally understood as a way to save money and reduce emissions by using less energy, it has a multitude of other less-recognized benefits. Acknowledging all of its benefits is essential to realizing opportunities and implementing energy efficiency in a way that benefits Albertans and the environment the most, including through long-term investment decisions.

The business case to avoid costly transmission and distributions investments through energy efficiency is clear, but based on observations from other jurisdictions, government needs to mandate the consideration of energy efficiency and selection of the least-cost approach.[38]

4.1 Energy efficiency as a resource

The role for energy efficiency in the utility system can be understood by thinking of energy efficiency as a resource. The practice of incorporating energy efficiency into infrastructure investment decisions originated in the U.S. after the energy crisis of the 1970s.[39] Until then, regulatory and business models were based on the assumption that demand would continue to grow and prices would decrease. After the energy crisis, utilities began to provide energy efficiency programs as one of the tools to manage the demand for electricity in order to make them less vulnerable to supply changes. Later,

[38] Chris Neme and Rich Sedano, *US Experience with Efficiency As a Transmission and Distribution System Resource* (Regulatory Assistance Project, 2012), 12. http://www.raponline.org/knowledge-center/us-experience-with-efficiency-as-a-transmission-and-distribution-system-resource/

[39] Dan York et al., *Three Decades and Counting*: *A Historical Review and Current Assessment of Electric Utility Energy Efficiency Activity in the States* (ACEEE, 2012) Research Report U123. http://aceee.org/research-report/u123

many utilities started integrating energy efficiency into their resource planning. Other benefits, like increased savings for customers and reduced emissions, were nice side effects.

By using customer participation to reduce the demand for electricity, utility companies saved money on further infrastructure and production investments and developed stronger relationships with their customers, while those customers saved on their electricity costs. Energy efficiency programs expanded rapidly and U.S. utilities invested $7.7 billion in energy efficiency in 2015[40] leading to significant energy and economic benefits within the utility system and to ratepayers.[41]

Nowadays, the value in thinking of energy efficiency as a tangible resource in itself is increasingly understood around the world. Driven by both policy and economics, utility companies in the U.S. and Europe generally factor energy efficiency investments into their resource decision-making when they evaluate investing in new resources and the operation of the existing systems. Efficiency presents a clear cost advantage in electricity production, as shown in Figure 3, which shows the range of the levelized costs of pursuing energy efficiency compared to other resources of electric generation. Energy efficiency programs for utility customers typically cost one-third as much as building new generation capacity. There is a clear cost advantage to pursuing energy efficiency investments instead of simply building another power plant.

[40] *The 2016 State Energy Efficiency Scorecard.*

[41] American Council for Energy-Efficient Economy (ACEEE), "Energy Efficiency Programs." http://aceee.org/portal/programs

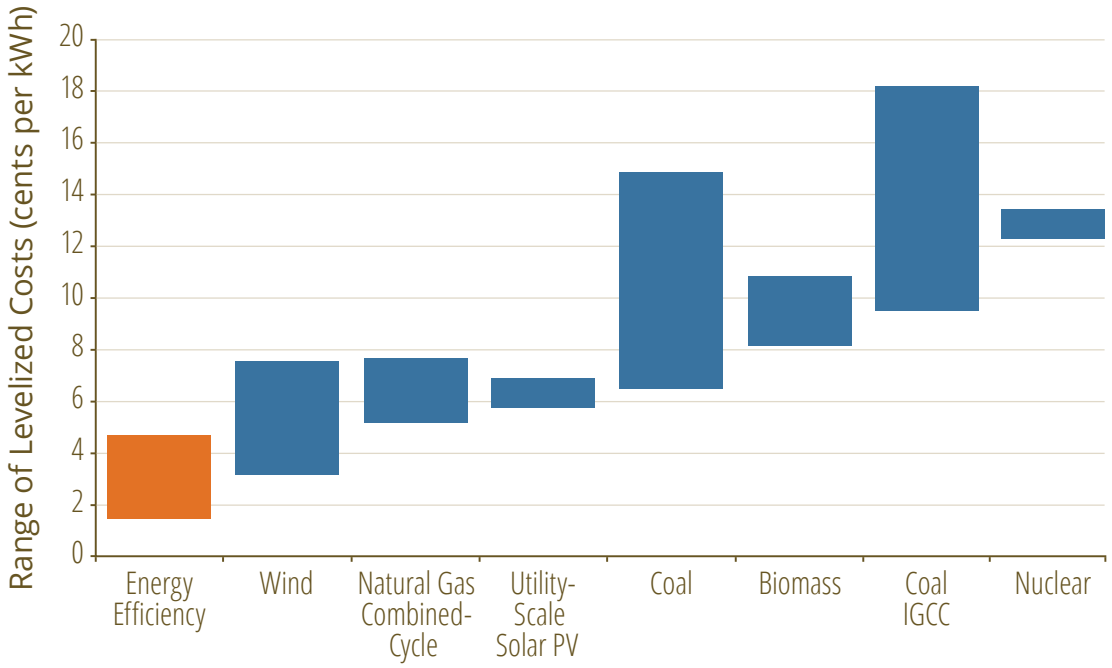

Figure 3. Cost of energy efficiency versus electricity generation

Adapted from Neme and Grevatt[42]

Equally important to the reduced need for new generation, efficiency programs through their impact on demand also reduce the need for new or upgraded transmission and distribution equipment.

Utilities and retailers typically see a benefit in the positive direct relationship with the energy users that utilities and retailers gain by engaging individuals and companies in energy efficiency.

The jurisdictions that are most successful in achieving large electricity savings (such as Massachusetts, Maine, Hawaii, and Rhode Island)[43] are the ones that treat energy efficiency as a resource that should be used whenever it is cost-effective.[44] And many jurisdictions are successfully pursuing efficiency programs to avoid costly transmission and distribution upgrades.

[42] *The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years,* 4.

[43] *The 2016 State Energy Efficiency Scorecard.*

[44] Chris Neme and Jim Grevatt, *The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years.* (Regulatory Assistance Project, 2016). http://www.raponline.org/knowledge-center/the-next-quantum-leap-in-efficiency-30-percent-electric-savings-in-ten-years/

Consolidation Edison, the electric utility serving New York City and Westchester Country, saved $223 million in capital investments between 2003 and 2010 due to efficiency programs that deferred transmission and distribution updates. This added up to $300 million savings for ratepayers.[45]

4.2 Realizing the full potential of energy efficiency in the utility system

Recognizing the full value of energy efficiency as a resource that responds to system needs is crucial to make optimal decisions on cost-effective investments. But without direct integration into the utility system, it is difficult for decision makers and market participants to purse energy efficiency due to misaligned incentives and lack of clear mandate.

4.2.1 Recognizing additional benefits

The study *Recognizing the Full Value of Energy Efficiency* describes how regulators that evaluate the adoption of energy efficiency programs almost exclusively consider only energy-related benefits.[46] This approach excludes the benefits of efficiency programs on decreasing negative "externalities"[47] caused by electricity production and usage that impact the broader wellbeing of society and the environment and should be considered.

4.2.2 A long-term view

In all development of energy efficiency resources, it is necessary to consider energy efficiency investment decisions in the long term. While it is common to use a long timeframe when considering investment decisions in the electricity system — weighing economic objectives, environmental impacts and reliability issues — the same doesn't often apply to energy efficiency. Energy efficiency programs and initiatives often have one- or two-year timelines instead of long-term plans of at least 10 years, as there is a tendency to focus on low-hanging fruit. By applying long-term objectives, deeper

[45] *US Experience with Efficiency As a Transmission and Distribution System Resource*, 12.

[46] *Recognizing the Full Value of Energy Efficiency (What's Under the Feel-Good Frosting of the World's Most Valuable Layer Cake of Benefits).*

[47] Externalities are consequences of an economic activity experienced by unrelated third parties but which are not reflected in the costs to the producer.

investments will occur that often have a bigger impact than accumulated short-term savings.

Program and initiative administrators also require long-term goals. However, the success of a program administrator is typically measured against an annual performance goal. As a result, there is a disincentive toward investing in technologies or strategies that take longer to pay off but might have a larger overall impact. Having savings goals of more than a year or two may also shift the investment focus to longer but deeper investments. Ideally, a combination of annual savings targets and lifetime savings goals should be considered.

5. Energy efficiency in Alberta

> *"Alberta is late to this game, but know that offering energy efficiency programs will reduce energy costs for consumers."*
>
> Honourable Shannon Phillips
> Alberta Environment and Parks

Alberta may be late to the game of energy efficiency programs, but it is determined to catch up. This chapter discusses Alberta's current approach on energy efficiency and provides an overview of leverage points for the success of the approach based on best practices from other jurisdictions and conversations with thought leaders in the field. Key leverage points to obtain a successful and sustainable use of this resource in the Albertan context were identified as setting the newly established agency up for success, as well as integrating energy efficiency into the utility system.

5.1 Alberta's first steps

When jurisdictions initiate energy efficiency programs, they typically start with the most cost-effective and easily accessible programs, like energy-efficient lighting and appliances.[48] After years of inactivity, Alberta has applied this approach with the announcement of similar programs intended to start in early 2017. Over time, while program providers gain experience and customers become aware of the benefits, the variety of approaches should increase and a shift to comprehensive, deep-savings approaches should be the end goal.

5.1.1 Energy Efficiency Alberta

Energy Efficiency Alberta (EEA) was established in October 2016, a government agency that will "deliver programs and services to help Albertans save energy, reduce emissions and save money."[49]

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[48] *The 2016 State Energy Efficiency Scorecard.*

[49] Government of Alberta, "Energy Efficiency Alberta." http://www.alberta.ca/energy-efficiency-alberta.aspx

It will operate as an independent agency, reporting to its board and the Minister of Environment and Parks. Its mandate is to raise awareness, promote, design and deliver programs and to promote the development of an energy efficiency services industry.[50]

Having the programs delivered by an independent organization that can outsource the services to third parties or deliver them themselves has certain advantages. These include being able to have energy efficiency programs for both electricity and natural gas; economies of scale; flexibility; performance accountability; and unified branding that increases awareness for energy efficiency activities. Being an arm's-length agency also helps the organization to stay focused on its mandate and remain politically independent.[51]

Jurisdictions that have been successful with this approach include Nova Scotia, Oregon, Vermont, New York and Norway.

The establishment of the independent agency is a good first step to ensure that taxpayers' money is invested cost effectively. To reach excellence, however, further considerations must be given to ensure that the agency is as ambitious as possible, that the broader public can benefit from the programs, and that programs are run cost effectively while reaching their greenhouse gas emissions reduction goals.

5.1.2 Success and performance accountability

Apart from measuring and communicating the results of the programs, EEA should be ambitious in setting its goals over a variety of indicators that reflect the needs of the environment and Albertans.

As an independent agency, EEA has the advantage of not only being focused on "system benefits" like reducing investments in transmission and distribution as would be the case with utility administered programs, but also of considering societal and customer benefits. Jurisdictions that are successful with an independent administration of efficiency programs have a variety of goals by which they define success. Nova Scotia's EfficiencyOne, for example, has the following targets by which it tracks its performance:

- financial and energy savings
- customer satisfaction
- process efficiency

[50] Energy Efficiency Alberta Act, s.2.2.

[51] Brendan Haley, personal communication, 21.10.2016.

- people (capacity building, safety, on time hiring etc)[52]

The Energy Trust of Oregon measures its performance across nine categories: [53]

- electric energy efficiency
- natural gas energy efficiency
- renewable energy
- financial integrity
- program delivery efficiency
- staffing
- customer satisfaction
- benefit/cost ratios
- Northwest Energy Efficiency Alliance and market transformation

It is important that EEA sets a broad set of targets that reflects the needs of the environment and Albertans. While it might be tempting for the agency to set itself up for "success" by setting modest targets, instead the bar should be set as high as possible. Its definition of success must reflect the needs of Albertans and the environment as whole.

5.1.3 Integrating a stakeholder group

To ensure new programs address the needs of different stakeholders while at the same time being at the frontline of innovation, jurisdictions often establish stakeholder groups consisting of people with expertise in certain topics such as service providers, ratepayers, environmental groups, non-profits, and small businesses. The stakeholder group makes sure programs proposed by third parties or utilities are beneficial and make sense within the mission of the agency.

Examples for this are the conservation advisory council of Energy Trust of Oregon;[54] the stakeholder advisory group for Illinois Energy Efficiency[55] (the whole state of Illinois); and the energy efficiency advisory group for Idaho Power (one utility).[56]

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[52] Efficiency One, *Annual Report 2015*, 8. http://efficiencyone.ca/2015/assets/files/EfficiencyOne Annual Report 2015.pdf

[53] Energy Trust of Oregon, *2016 OPUC Performance Measures*, 2. http://www.energytrust.org/wp-content/uploads/2016/11/2016_opuc_performance_measures.pdf

[54] Energy Trust of Oregon, "Leadership: Conservation Advisory Council." http://www.energytrust.org/about/leadership/

[55] Illinois Energy Efficiency, "Stakeholder Advisory Group." http://www.ilsag.info/background.html

The structure of this group depends on the jurisdiction. In the case of Energy Trust of Oregon, a third party administrator like Energy Efficiency Alberta, the conservation advisory council "is a key sounding board for decisions affecting program design, incentive levels, special projects and policies, offering feedback and guidance drawn from members' wide-ranging expertise and knowledge of conservation and energy efficiency."[57] EEA should consider setting up its own stakeholder group similar to Energy Trust of Oregon's advisory council to support its decision-making.

5.2 Realizing the full potential of energy efficiency in Alberta

Alberta has the chance to start with a clean slate and take advantage of all the lessons learned from around the world on how to best take advantage of its newest resource, energy efficiency. Establishing energy efficiency over the long term and recognizing all benefits in Alberta is essential to ensure that Albertans and the environment can profit most of this undeveloped resource. But to realize the full potential of energy efficiency in Alberta, it is essential to go beyond the ambitious and effective agency and integrate energy efficiency into the utility system.

As discussed in chapter 4, to realize the untapped potential of energy efficiency jurisdictions have to recognize all the benefits of energy efficiency, take full advantage of this undeveloped resource, and at the same time apply a long-term objective on investment decisions related to energy efficiency.

There are also considerations around data access, reporting on program impacts, and funding. Considering these leverage points for success in the upcoming decisive time will ensure that the potential of Alberta's newest resource will be fully realized.

5.2.1 Integrating energy efficiency into the utility system

Integrating energy efficiency into the utility system is critical, as it allows benefits of energy efficiency to be realized across the system; brings targeted programs to the

[56] Idaho Power, "Energy Efficiency Advisory Group." https://www.idahopower.com/EnergyEfficiency/Residential/Programs/EnergyEffFunds/advisoryGroupMinutes.cfm

[57] Energy Trust of Oregon, "Conservation Advisory Council." , http://energytrust.devel.pollinate.com/events/event-detail.aspx?eventid=621&eventdateid=7294

broadest group for greater impact; and assures long-term sustainability of energy efficiency initiatives.

Involving the utility system in providing energy efficiency programs is now standard over most of North America and offers a huge opportunity for Alberta to guarantee the sustainability of its energy efficiency efforts.

The first step to integrate energy efficiency into the utility system in Alberta is to establish a mandate for the regulator, system operator and utility consumer advocate to pursue energy efficiency whenever it is the most cost-effective investment decision. This can include both a mandate for a specific energy efficiency target as well as inclusion of energy efficiency in evaluating least-cost transmission and distribution.

Another opportunity to integrate energy efficiency into Alberta's utility system is to allow energy efficiency to bid into the newly established capacity market which will be put in place to help ensure that the electricity grid can meet the required demand. In this way, energy efficiency can be a direct alternative to developing new generation facilities. This would complement a mandate for the electric system operator to pursue investments in energy efficiency as an alternative to transmission and distribution system investments, as well as a mandate for a energy efficiency target. This approach has been sucessful in other jurisdictions where it leads to additional development of energy efficiency and reduced electricity costs for consumers.

Consolidated Edison (New York City) started a program in 2003 to defer system upgrades. Cumulative savings are more than $300 million in net benefits to ratepayers.[58]

5.2.2 Working with big data

Data is key both to identifying opportunities and to measuring program success. With the rise of internet-based communication and the capability to store and manipulate large data sets, the use of data in energy efficiency is increasing. As noted in section 3.1.1, increased information about individual households and buildings can be used to match customers with products and services that meet their needs and are specific to their activities.

At the moment in Alberta the relevant data is held by the utilities and energy retailers, and is not accesible by the government or third parties. This prevents third parties and

[58] *US Experience with Efficiency As a Transmission and Distribution System Resource,* III.

entrepreneurs from coming up with innovations to encourage additional investment. This barrier can be overcome as the Energy Efficiency Alberta Act[59] includes a provision for the agency to access this data, but EEA will have to determine who should receive, analyze and deliver/use the data. This could in theory include the agency, utilities, energy retailors, and/or third party service providers.

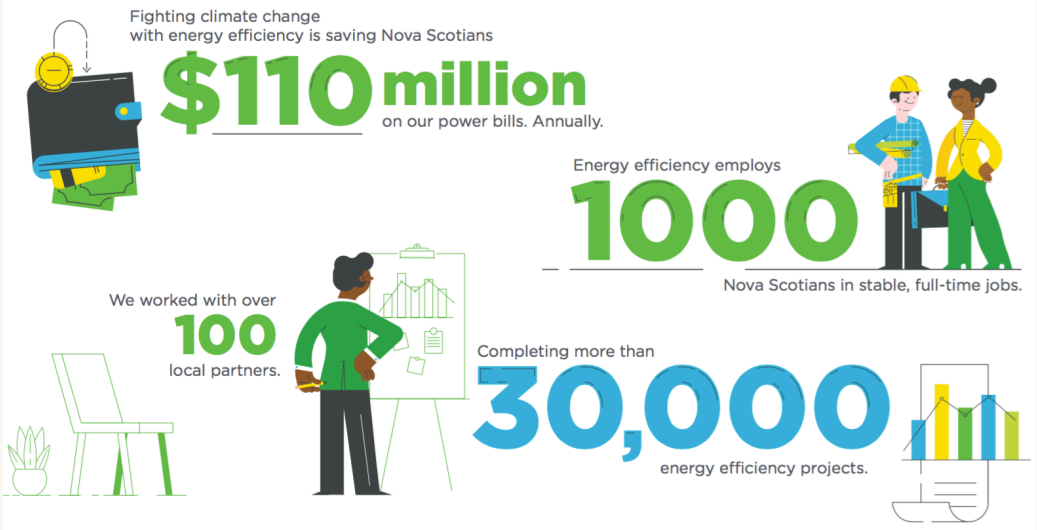
5.2.3 Evaluating programs and sharing results

Understanding the successes and failures of programs by tracking progress is critical to identify what is working and to fix issues that may arise. In addition, information on the overall performance and savings generated from energy efficiency programs can help support the continuation of programs and the development of new programs and make the case for energy efficiency as a valuable resource. Sharing the results of program evaluations will ensure that Albertans are aware of the benefits of energy efficiency programs; this could contribute to behavioural shift towards a more resource-efficient society. An institution that is transparent in its reporting will welcome external evaluation and will communicate the results with the public and stakeholders.

Because many of energy efficiency's benefits come as avoided costs and/or are distributed, Albertans will remain unaware of how energy efficiency is benefiting them unless there is a clear effort to communicate these benefits. Apart from the typical energy and monetary savings, communication should also include the number of jobs that have been created due to energy efficiency programs and the emissions reduced. Case studies from local projects should also be highlighted. Public support for energy efficiency programs that continue to benefit Albertans will make the programs more resilient against changing government priorities.

[59] Energy Efficiency Alberta Act, s14(d).

EfficiencyOne's annual report includes emissions reductions, cost savings and jobs.[60]



5.2.4 Funding considerations

Some of the benefits of energy efficiency accrue to the utility system in the form of lower energy bills and infrastructure investments, and these savings can be used as a source of funding for energy efficiency programs. In fact, this is the most common way to fund programs as it has historically been more stable than funding allocated in a government budget.

Stable long-term funding is essential to give the right market signals to incentivize investments in energy efficiency throughout the different sectors. In the majority of jurisdictions, energy efficiency programs are funded by a system benefit charge or through electric system revenues. In Alberta, EEA will be funded through the carbon levy with $645 million budgeted to EEA over the next five years.

The jurisdictions that are most successful in saving electricity and natural gas are the ones that don't artificially cap spending on energy efficiency. Instead, they treat it as a resource that should be used whenever it is cost-effective.[61]

To increase the effectiveness of efficiency programs, additional income sources should be considered. Building a diversified income structure provides more security and

[60] EfficiencyOne, 2015 Annual Report. https://www.efficiencyone.ca/2015/

[61] *The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years.*

additional programs funding in the long term. Apart from the revenue from the carbon levy, efficiency programs and initiatives could be financed by the federal government or by allocating a small portion of utility revenues to energy efficiency programs as a way to reduce costs for consumers.

From 2001 to 2015, Energy Trust of Oregon invested $1.3 billion into energy efficiency programs that helped save participants $5.6 billion on utility bills.[62]

5.3 Possible complementary approaches

The following models are new approaches that have worked in some jurisdictions but are not common yet in established and standardized energy efficiency programs. As the approach to energy efficiency continues to evolve these new models should be tracked and could be taken into account for future application.

- Models similar to energy service companies (ESCOs),[63] such as pay-for-performance,[64] seek to address well-known barriers in energy efficiency deployment while encouraging innovation
- Upstream product rebates aimed at distributors instead of end consumers
- Strategic energy management to improve operational efficiency in industrial, commercial and institutional settings in a systematic and sustained manner
- Market-specific "deeper dives" sustain engagement with large customers through knowledge about the business needs of different sectors

"The climate partnership has been an effective lever to Novo Nordisk's Triple Bottom Line by implementing energy-saving projects that are turned into renewable energy investments. The results created by the partnership model are unique but the model in itself can easily be replicated to other businesses and industries."[65]

[62] Energy Trust of Oregon, *2015 Annual Report,* 2. http://assets.energytrust.org/api/assets/reports/PublicAnnualReport_2015_Final.pdf

[63] Companies that offer energy services and are often not directly connected to utilities.

[64] Matt Golden, "PG&E's Newly Proposed Efficiency Program Is Simple. But It's Based on a Revolutionary Concept," *Greentechmedia,* April 7, 2016. http://www.greentechmedia.com/articles/read/PGEs-Newly-Proposed-Efficiency-Program-Is-Simple.-But-Its-Based-on-a-Rev

[65] Monday Morning, *A Business Partnership Driving Sustainability: How to save energy and increase profit while investing in renewable energy,* 2. https://www.novonordisk.com/content/dam/Denmark/HQ/sustainability/commons/documents/Partnership-Sustainability.pdf

6. Conclusion

Alberta is in the exciting position of being able to start with a clean slate and take advantage of all the lessons learned from around the world on how to best take advantage of its newest resource, energy efficiency.

The government of Alberta is on the right track with the recently established arm's-length organization, Energy Efficiency Alberta. Apart from measuring and communicating the results of the programs, EEA should be ambitious in its goal setting over a variety of indicators that reflect the needs of the environment and Albertans. Additionally, the establishment of a stakeholder group should be considered.

To realize the full potential of energy efficiency in Alberta, it is essential to understand the full value of energy efficiency, realize the related opportunities, and aim for long-term sustainable development of this resource. For this, it is important to recognize energy efficiency as a resource and to integrate energy efficiency into the utility system. Issues around data access, reporting on program impacts, and funding should also be considered. Considering these leverage points for success in the upcoming decisive time will ensure that the potential of Alberta's newest resource will be fully realized.