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Key Findings from Electricity Customer Market Research

Attitudes Regarding Grid Modernization
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Public Final Report

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I. Executive Summary

Executive Summary

The requirements of a modern electricity grid are changing rapidly due to the introduction of distributed energy resources, increasing electrification and new technologies. It is more important than ever that Alberta Distribution Facility Owners (DFOs) ensure that grid modernization efforts are in alignment with changing customer behaviours/preferences in addition to government initiatives, in order to continue to maintain safe, affordable and reliable service. Despite the need for deep customer insights in this area, traditional customer satisfaction surveys were not designed to provide DFOs with deeper insights into customer awareness and understanding of the impacts of new technologies and services including renewable energy resources, distributed energy resources and increased electrification on the distribution grid. Customer data and insights are critical to inform the transformational approach that is required to address the technological, environmental and socioeconomic impacts of modernizing the grid.

To fill the critical gap in customer research and ensure that utilities are operating with robust data, The Strategic Counsel (TSC), on behalf of the Alberta Smart Grid Consortium (Consortium), conducted comprehensive customer research across the province of Alberta. The research assessed customer awareness and knowledge of grid modernization and its related concepts, as well as the motivators and barriers to grid modernization.

A four-phased approach was taken that encompassed both qualitative and quantitative methodologies. This research spanned three key customer segments that collectively represent the largest share of electricity consumers in the province: residential (including urban, suburban, rural and remote), commercial (including retail, hospitality, professional services and not-for-profits, etc.) and farm (including crop, livestock and others).

The research determined that residential, commercial, and farm customers in Alberta hold varying perspectives regarding grid modernization, specifically regarding perceived motivators and barriers. Nevertheless, customers' views did align in several areas:

1. Customers were generally supportive of modernizing the province's electricity grid and believe there are a wide range of associated benefits.
2. There was a modest willingness to pay an additional amount on the electricity bill, assuming electricity providers can deliver on the benefits of grid modernization.
3. Some benefits of grid modernization were seen as more important and relevant than others, particularly the opportunity to save money by using energy more efficiently, in addition to the potential to drive economic activity in the province.
4. Many customers were either unaware of existing energy efficiency programs for homes, communities and businesses, or believed that any energy efficiency activities they might undertake would have minimal impact, if any, on their overall electricity costs.
5. Concerns over the current cost of electricity in the province, particularly the transmission and delivery charges, were a consistent theme.

Detailed findings from the research will contribute to a better understanding amongst Alberta DFOs of customer awareness and knowledge of grid modernization and aid in deeper alignment of grid modernization work with customer preferences. Moving forward, the Consortium recommends continued engagement with the customer segments identified in the research, along with a range of additional stakeholders. These engagement efforts should focus on continuing to increase the overall understanding of grid modernization barriers in Alberta and enhancing customer literacy. In addition, the Consortium has identified further research questions that can be explored to complement the findings of this report.

II. Introduction

Introduction

In July of 2017, The Alberta Smart Grid Consortium (Consortium) was formed collaboratively with Alberta Innovates (AI), Alberta Energy and the Alberta Distribution Facility Owners (DFOs) from across the province. Representatives from these organizations make up the Consortium members. As a collective, the Consortium is tasked to look for ways to explore and implement grid modernization solutions, while continuing to ensure a safe, affordable and reliable system for all Albertans.

The electricity grid has traditionally been a one-way power flow from generation to transmission and distribution to the end user. Today the demands on the grid are changing rapidly due to the introduction of distributed energy resources (DER), increasing electrification and new technologies. The grid is evolving into a complex network with bi-directional power flows to support the integration of renewable generation sources and a back-up for intermittent power supplies. The electricity distribution system is the backbone of social and economic prosperity in Alberta. The investments made in grid modernization will enable and allow a transition towards a lower-carbon economy, ensure global investment in Alberta products and services, and provide customers with greater flexibility over their energy usage and costs.

Alberta's electric utilities are proactively planning to implement new technologies to address system issues as well as changing customer behaviours and the ways in which customers want to interact with the grid. Technologies including behind-the-meter devices, electric vehicles, communications infrastructure such as 5G, distributed generation, micro-generation, and micro-grids are challenging utilities to respond from both technical and regulatory perspectives.

As the electricity sector in Alberta strives to move itself forward, a significant missing link to the customer context has been observed. Traditionally, utilities and regulators have based the customer focus on a standard set of performance-based satisfaction metrics focused on pricing, reliability, service, and issue resolution. Most Alberta utilities measure customer satisfaction based on these foundational elements. However, energy transformation and the technologies outlined above have brought about a new set of customer challenges that include access to information, digitization, service offerings, and participation. The traditional customer satisfaction surveys that utilities perform voluntarily, and to satisfy requirements in the Alberta Utilities Commission (AUC) Rule 002, are pillars to ensuring safe and reliable service, however as energy transition occurs additional information, such as evolving customer expectations of service providers to support their future electricity needs, will be required. While there is abundant literature that discusses utility customer needs and expectations in a general sense, there is a need for research to determine what is important to Alberta electricity customers now and in the future.

The ability for utilities to continue to include customer market research, amongst other drivers, into utility business models will help to inform a more efficient and cost-effective transition. The customer research undertaken and reported on here is intended to build an understanding among Consortium members about the state of the Alberta consumer/prosumer by delving into questions such as "what do Albertans really want from electricity providers", "what kind of alternative rates or pricing models are important to customers," and "what are the trends in terms of technology adoption," among others.

One of the key aspects of conducting research that is valuable and will help the DFOs to gauge general attitudes and understanding of grid modernization is to include specific customer segments. The DFOs have unique customer portfolios and it was essential that the research provide perspectives from

consumers all across the province in order to ensure the voice of the customer was well-represented. The focus for this research study was on three customer segments which, combined, represent the largest share of electricity consumers in the province, including: residential (urban, suburban, rural and remote), commercial (retail, hospitality, professional services and not-for-profits) and farm customers (crop, livestock and other types of farm operations). Feedback from these diverse customer groups provided a baseline of knowledge indicative of their understanding and awareness of the challenges and opportunities grid modernization brings to Alberta residents and businesses. This study was designed to give a voice to the consumers that are not as engaged with the utilities as the larger industrial customers. The Consortium was excited to lead this type of engagement, addressing a fundamental research knowledge gap among electricity customers in the province.

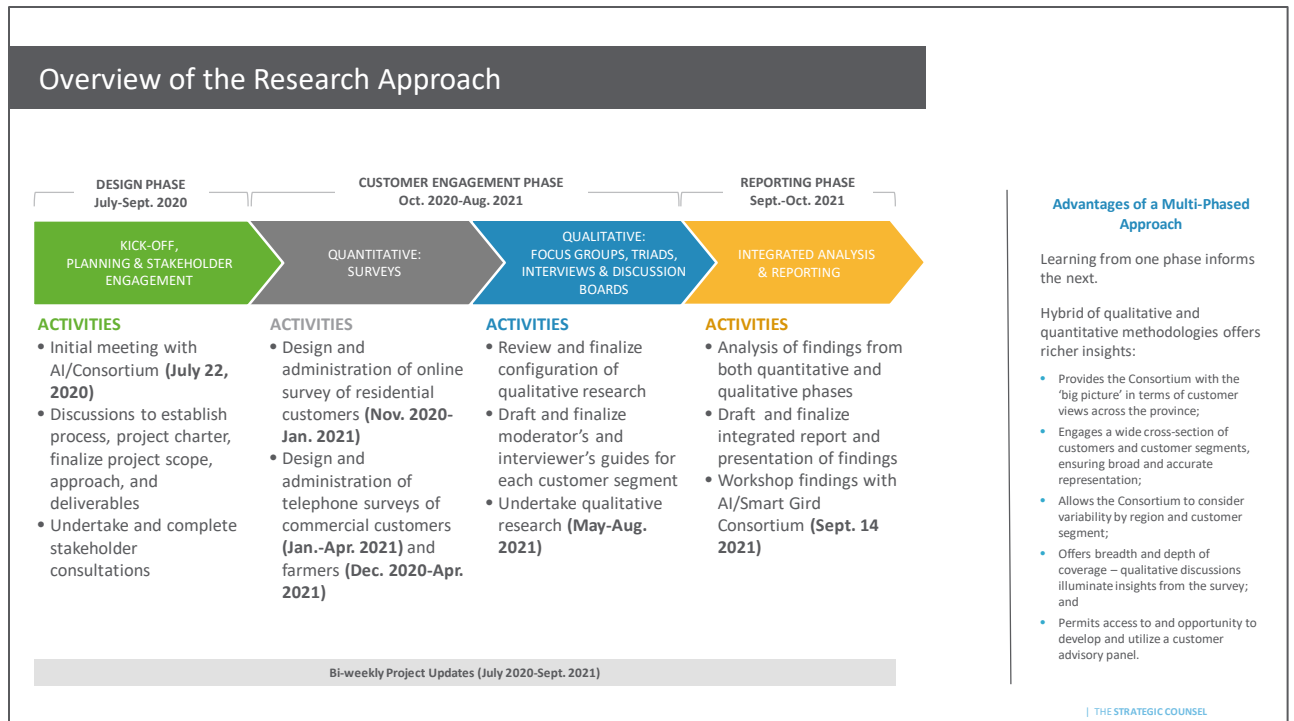
The Consortium understood that there would be some challenges to engaging customers in meaningful research in the midst of a global pandemic. However, research has shown that in difficult times it is more important than ever to reach out to customers and stakeholders to listen, understand and address changing perceptions and needs to help determine a path to move forward. This report highlights the key findings from this research which was undertaken in a phased approach over a 12-month period.

The Consortium would like to acknowledge and thank all the stakeholders and participants who provided their thoughts, perspectives and ideas on grid modernization. Response rates and engagement were exceptionally strong and helped define the actions and outcomes the Consortium will employ as the opportunities and challenges that grid modernization presents to all Albertans are considered.

A. Approach and Methodology

A four-phased approach was undertaken, encompassing both qualitative and quantitative methodologies. This approach permitted a large number of customers to share their views across multiple platforms. The iterative process also ensured that the learning from one phase informed the next.

Regular bi-weekly meetings were held with Consortium members over the duration of the study. This provided an opportunity for members to review and comment on both the design as well as the output from each phase.



The first phase focused on design of the research program and included outreach to a range of stakeholders including regulators, policy-makers in the Alberta Government, consumer advocacy groups, city councillors, industry associations and businesses interests, including Indigenous-owned businesses and Indigenous communities, among others. In total, 18 different organizations were engaged in in-depth one-on-one interviews. These conversations yielded helpful advice and direction regarding proposed lines of inquiry for subsequent phases of the research program and highlighted some challenges as well as possible solutions with respect to the overall process of engaging customers.

In the second phase of the study three surveys were administered targeting each of the three customer segments:

- Residential customers – A total of 2,004 residential customers were surveyed via an online panel of Alberta residents which was conducted between November, 2020 and January, 2021.
- Small commercial customers – 550 respondents representing owner/operators, general managers and those overseeing commercial operations completed a survey which was administered by telephone from January through April, 2021. The sample for this survey was largely drawn from a list procured through Dun and Bradstreet, a reliable, comprehensive and up-to-date company directory. This was supplemented by customer lists provided by members of the Consortium where such lists were available and customers had consented to being contacted.
- Farmers – 350 farmers completed a survey by telephone conducted between December, 2020 and April, 2021. As with the survey of commercial customers, the sample of farmers was procured from Dun and Bradstreet.

The longer timeframe for fielding the surveys of farmers and commercial customers was a factor of scheduling challenges, specifically identifying and connecting with the appropriate individual who would have sufficient knowledge of the operation, energy use and management. Some delays were also attributable to the evolving situation related to COVID-19 in the province.

A core set of questions, with some adaptations, was included in each survey to allow for comparisons across the three customer segments. Residential customers were asked some additional questions as the online methodology lent itself to a slightly lengthier survey. The surveys ranged in length from 16 to 20 minutes.

The final sample for each of the three surveys reflected a cross-section of customers by region within the province, including customers residing or based in the North, Central and Southern regions of Alberta and in urban, suburban, rural and remote communities. Best efforts were also made to ensure representation by gender and age among residential customers, as well as by business sector and type of operation among commercial customers and farmers, respectively. Respondents to the residential survey included panellists 18 years of age and older who reside in Alberta. No other restrictions were imposed in terms of their rate payer status or knowledge of the electricity sector in Alberta. For the other two customer segments – farmers and commercial customers – a short series of questions were included to ensure that the individual responding to the survey had some knowledge of electricity usage and energy management within the operation. A majority of respondents were owner/operators or, in the case of commercial enterprises, working in an operational or executive capacity.

The quantitative phase was then followed by extensive qualitative research utilizing focus groups (discussions involving about five to six participants) among residential customers, triads (discussions including up to three participants) and one-on-one in-depth interviews with commercial customers and farmers, and online discussion boards (which took place over a two-day period with up to 25 participants in each) with residential and commercial customers. These different approaches were employed in order to offer participants greater flexibility in terms of scheduling and to provide an opportunity to explore certain issues and aspects of grid modernization in more depth with each customer segment. The configuration of discussions during the qualitative phase of the research also promoted greater interaction and discussion among and between customers with similar or different circumstances.


In keeping with COVID-19 safety protocols, all discussions were conducted online or by telephone, in the case of some of the interviews. In total, 108 customers were engaged in the qualitative phase, a number of whom had also completed the survey and had volunteered to participate in a follow-up discussion. Additional customers were recruited by The Strategic Counsel with a view to obtaining input from a broad range of electricity customers with varying needs, experiences and expectations. All participants within this phase of the research were paid a nominal cash honorarium in recognition of their time, effort and input.

The qualitative research was conducted from May through July, 2021. More details on this phase of the research program are shown in the chart below.

Qualitative Research Phase


108 customers were engaged via four different approaches, as shown in the table to the right:

Research Method	Customer Segment	Classification	Number	Number of Participants
Focus Groups	Residential	Urban	1	13
		Rural	1	
Triads	Commercial	Urban	2	17
		Rural	2	
	Farmers	-	4	14
One-on-One Interviews	Commercial	-	10	10
	Farmers	-	10	10
Discussion Boards	Residential	-	1	25
	Commercial	-	1	19
Total Number of Participants				108




Focus Groups

- Participants were recruited based on their agreement during the quantitative phase to participate in further phases of research.
- Focus groups were 2 hours in length, conducted online via Zoom and were completed on May 5 and May 6, 2021.




Triads

- Participants were recruited based on their agreement during the quantitative phase to participate in further phases of research and from sample lists.
- Triads were 2 hours in length, conducted online via Zoom and were completed between May 26 and June 22, 2021.



One-on-One Interviews

- Interviewees were identified through lists provided by the SAC and through the Alberta Chamber of Commerce (ACC).
- One-on-one interviews were 45-60 minutes in length, conducted online via Zoom, and were completed between July 13 and August 4, 2021.



Discussion Boards

- Participants were recruited based on their agreement during the quantitative phase to participate in further phases of research and additional outreach.
- Discussion boards took place online over a two-day period using the iTracks platform. They were completed July 21/22 and July 29/30, 2021.

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The last phase of the study culminated in an information session which was held with members of the Consortium in September, 2021 the purpose of which was to share the results from all previous phases of the research program, detailing similarities and differences across the three customer segments, as input for a discussion regarding next steps.

In keeping with the standards of conduct for the market research industry and privacy legislation in Canada, respondents to the surveys and those who participated in interviews, triads, focus groups or discussion boards were informed of the voluntary nature of their participation and of security and confidentiality provisions in place to protect any personal information which was collected for research purposes only. No personally identifying information has been provided to the Consortium without the express permission of participants. Moreover, any data or commentary gathered as part of this research study cannot be linked back to any individual respondent or participant.

Note to the Reader: The percentages shown in charts may not add up to 100% in cases where respondents were permitted to provide more than one response to a question and/or due to rounding.

III. What We Heard

What We Heard

Residential and commercial electricity customers and farmers in Alberta hold varying views and perspectives regarding grid modernization, specifically in terms of the perceived motivators and barriers. Nevertheless, customers' views did align in several areas:

- They are generally supportive of modernizing the province's electricity grid and believe there are a wide range of associated benefits;
- Some benefits of grid modernization are seen as more important and relevant than others, particularly the opportunity to save money by using energy more efficiently, in addition to the potential to drive economic activity in the province;
- Cost, however, is a major issue. Concerns about the current cost of electricity in the province, particularly the transmission and delivery (T&D) charges, were a consistent theme both in responses to the survey and in subsequent in-depth conversations with customers.
- While some customers appear to be leading the way in adopting energy efficient (EE) behaviours, many were unaware of existing EE programs for homes, communities and businesses;
- The consensus view among customers was that any EE activities they might undertake would have minimal impact, if any, on their overall electricity costs and this perspective was linked to the two previous points; and
- There was a modest willingness to pay an additional amount on the electricity bill, assuming electricity providers can deliver on the benefits of grid modernization. At the same time, customers stressed that addressing reliability issues and access to high-speed Internet across the province (primarily in rural and remote areas) was foundational to advancing public support for grid modernization and to setting the stage for customers to become more active energy managers.

A. Grid Modernization

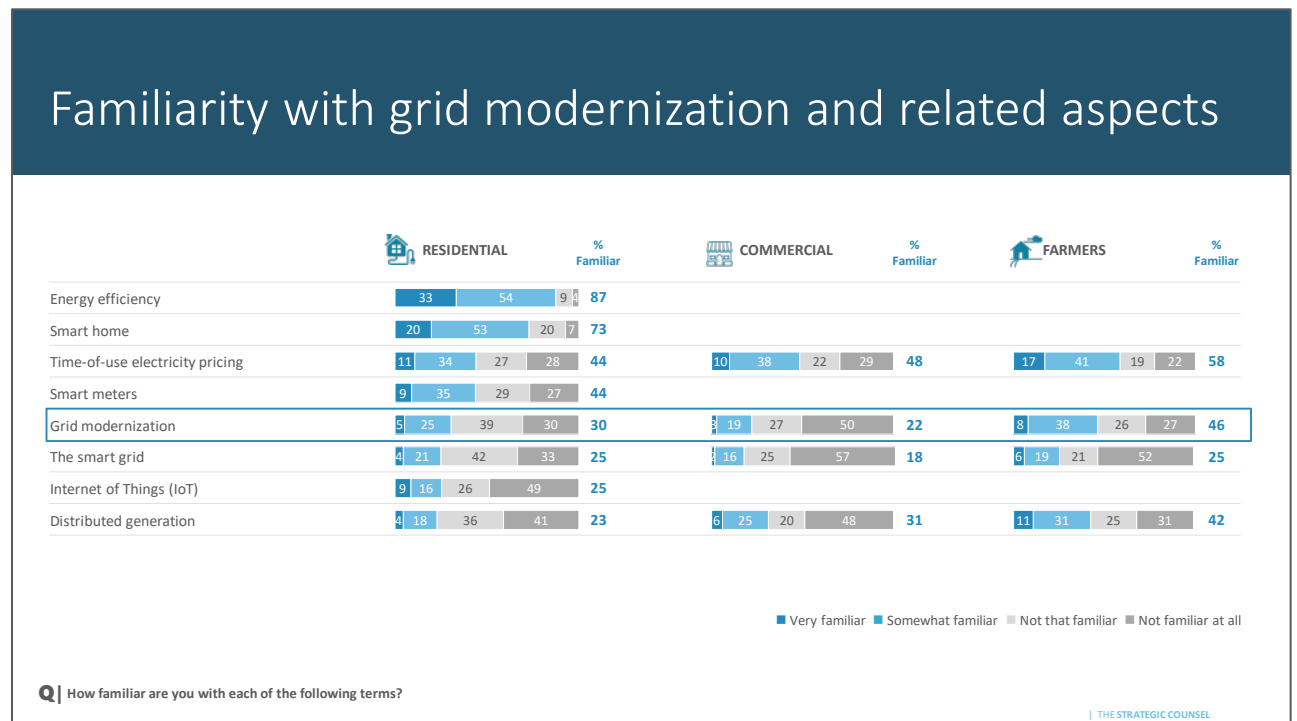
Discussions on the topic of smart renewable energy systems and grid modernization are taking on more importance and urgency in many jurisdictions around the world. Although policy makers and energy sector insiders are intimately familiar with this issue, and some jurisdictions are more advanced than others, many electricity consumers are only now beginning to consider the implications of rapid technological change for the generation, transmission and distribution of electric power as evidenced by the results of this customer research program.

In the surveys as well as in focus groups, one-on-one interviews and discussion boards, customers were asked about their familiarity with grid modernization as well as a number of the key terms relevant to modernizing the electricity distribution system. While there was a reasonable level of self-reported familiarity with some terms and concepts specific to a modernized grid, awareness of the term 'grid modernization' itself was modest. Not surprisingly, responses suggest that on the journey toward awareness and understanding of this topic, consumers are presently at a very early stage.

Of the three customer groups surveyed, farmers did appear to be somewhat more familiar with the idea of grid modernization. While just under half (46%) of farmers were familiar with the term ‘grid modernization,’ less than a third (30%) of residential customers were. Across the three customer segments, commercial customers (22%) were the least familiar with this term.

Residential customers were most familiar with terms such as ‘energy efficiency’ and ‘smart home,’ but less so with concepts such as ‘time-of-use pricing,’ ‘smart meters,’ ‘grid modernization’ or ‘the smart grid,’ the ‘Internet of Things,’ and ‘distributed generation.’

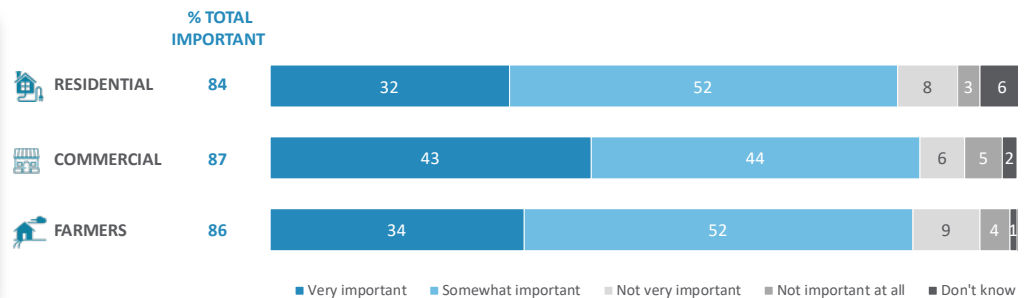
Notably, almost three-in-five farmers (58%) expressed familiarity with ‘time-of-use pricing,’ compared to slightly less than half of commercial customers (48%) and just over two-in-five residential customers (44%).



However, once the concept of grid modernization was briefly explained to customers, over four-in-five in each customer segment viewed modernization of Alberta’s electricity distribution system as important – 87% of commercial customers, 86% of farmers and 84% of residential customers said it is either somewhat or very important to modernize the grid in Alberta.

Perceived importance of grid modernization

Grid modernization means making the electricity distribution system (the grid) 'smarter' by incorporating technologies that provide more detailed information to consumers and electricity providers about when and how electricity is being used. It would also allow people, communities and businesses to become more actively involved in controlling their energy usage or producing energy to sell back to the grid.



Q | Based on this explanation, how important do you feel it is to modernize the grid in Alberta?

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While customers acknowledged the importance of grid modernization, they were more circumspect about time-of-use (TOU) pricing. After being told that a smart grid would allow consumers to be billed different rates depending on the time of day or the day of the week, and that they could then choose to use electricity when rates are lower, a slim majority (51%) of residential customers favoured this type of electricity pricing system. Fewer than half of farmers (46%) and just under two-in-five commercial customers (37%) favoured TOU pricing.

During more in-depth conversations which were conducted as part of the qualitative phase of the research program, commercial customers and farmers, in particular, offered mixed to more negative views of TOU pricing, depending on the nature of their business or operation. Many felt they would be unable to take advantage of a variable rate structure given their electricity usage patterns. Moreover, they questioned the advantages associated with TOU pricing noting that usage charges typically comprise a small portion of their bill relative to transmission and distribution (T&D) charges.

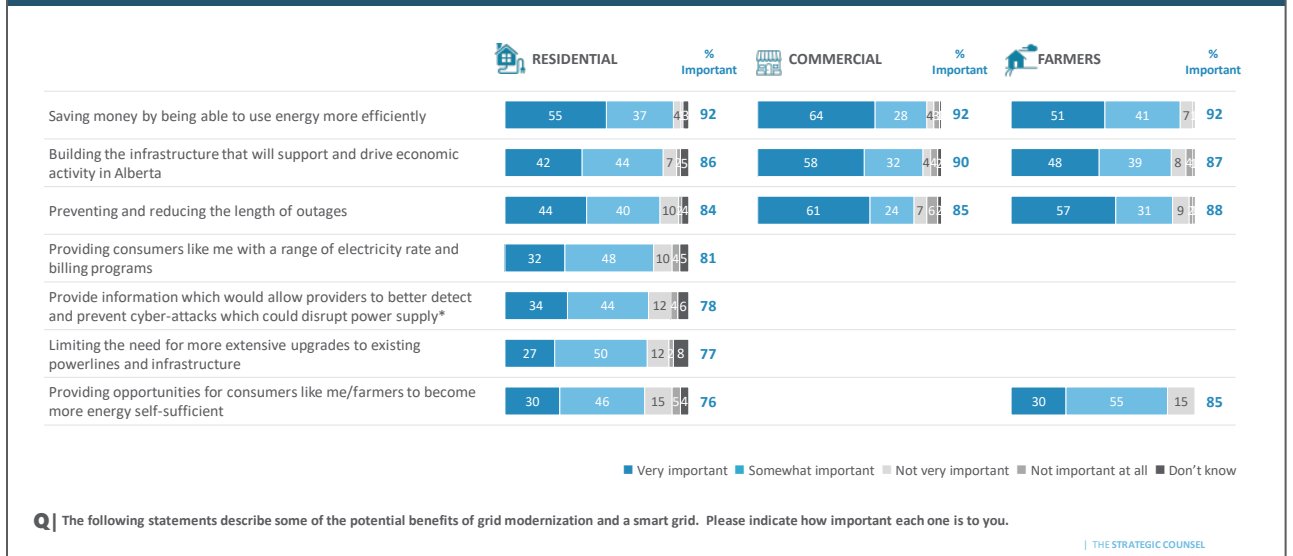
1. Perceived Benefits and Barriers

Customers were asked to evaluate the importance of a range of potential benefits associated with grid modernization. Across all three customer segments, about nine-in-ten rated being able to use energy more efficiently and save money as important (either somewhat or very important). Building the infrastructure to support and drive economic activity in Alberta and increasing system reliability (i.e., fewer/shorter outages) were seen as important by at least four-in-five customers.

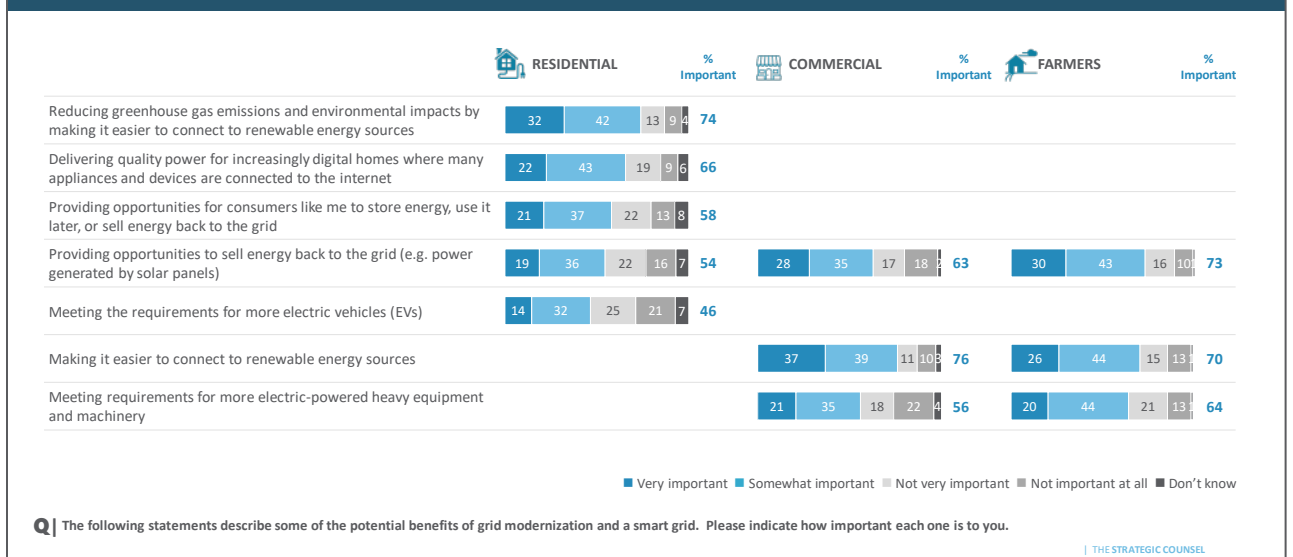
Other benefits, such as opportunities for customers to become more self-sufficient and making it easier to connect to renewables, store energy and sell it back to the grid were rated as important by a majority of

customers, although the balance of respondents assessed them as somewhat important rather than very important.

Benefits associated with grid modernization



Benefits associated with grid modernization



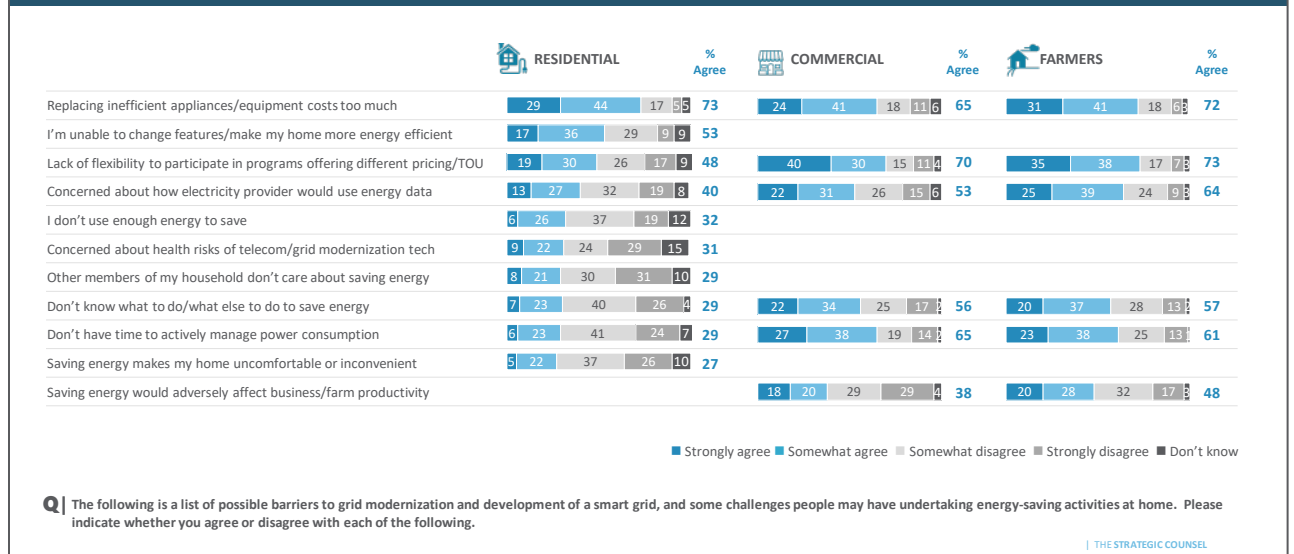
Notably, while customers saw the opportunity to save money as an important benefit of grid modernization, the cost outlay associated with replacing outdated and inefficient appliances and equipment was also identified as one of the primary barriers by two-thirds or more customers across the three segments.

Among residential customers, costs were the key barrier – almost three-quarters (73%) agreed that ‘replacing inefficient appliances costs too much.’ Other issues for this customer segment included an inability to make any changes to features in their home which would improve home energy efficiency (53% agreed this posed a challenge to consumers) and a lack of flexibility to participate in programs offering different pricing (48% agreed). The remaining barriers examined in the survey were viewed as less problematic – half or more residential customers disagreed that each posed a barrier to grid modernization.

Farmers were equally concerned about the cost of replacing inefficient equipment as they were with their ability to participate in flexible electricity pricing programs – 72% and 73%, respectively, agreed that these were key challenges that could prevent people from undertaking energy efficiency activities. A majority also agreed that concerns about how electricity providers would use customer energy data (64%), not having the time to actively manage their power consumption (61%) and a lack of understanding of what else they could do to save energy (57%) were also potential barriers to implementing on-farm energy-saving activities.

The perceived inability to take advantage of TOU pricing was among the more significant barriers identified by commercial customers (70%), followed by the cost of purchasing or replacing equipment (65%) and the time and effort required to more actively manage their business’ energy consumption (65%). A majority also agreed that they lacked an understanding of what more they could do to save energy (56%) and were concerned about the use of their energy data (53%).

Barriers to grid modernization



Concerns that grid modernization would adversely impact business or farm productivity were less of a barrier, relative to other issues. Nevertheless, this was seen as an impediment to grid modernization by almost half of farmers (48%) and about two-in-five commercial customers (38%).

In further discussions during the qualitative phase of the research program customers spoke in more depth about their questions and concerns regarding grid modernization. Some rural residential customers were keenly interested in any improvements to the grid which would lead to greater reliability and a more stable and predictable electricity system.

Comments from commercial customers linked grid modernization to better access to more data and information which would help business owners and operators gain insights into potential opportunities for electricity cost savings. This customer segment also raised questions about grid-scale technologies designed to store surplus energy, specifically around whether such systems would have the capacity to meet their current and future electricity needs, and the environmental impact associated with the materials used in the manufacture of the storage devices as well as their disposal. Concerns were also expressed about micro-generation, with several commercial customers viewing this as an opportunity for electricity providers to download some of the costs associated with building and maintaining the province's energy infrastructure to utility payers.

Similarly, farmers flagged concerns about the cost of the batteries which would be required to store energy in order to use it later or sell it back to the grid, and the environmental footprint associated with large scale lithium-ion batteries. They also raised the issue of stranded system assets, including existing generation facilities as well as the poles and wires that comprise Alberta's electricity distribution system, and how these would be amortized or paid for. Several felt that the absence of reliable Internet and cellphone

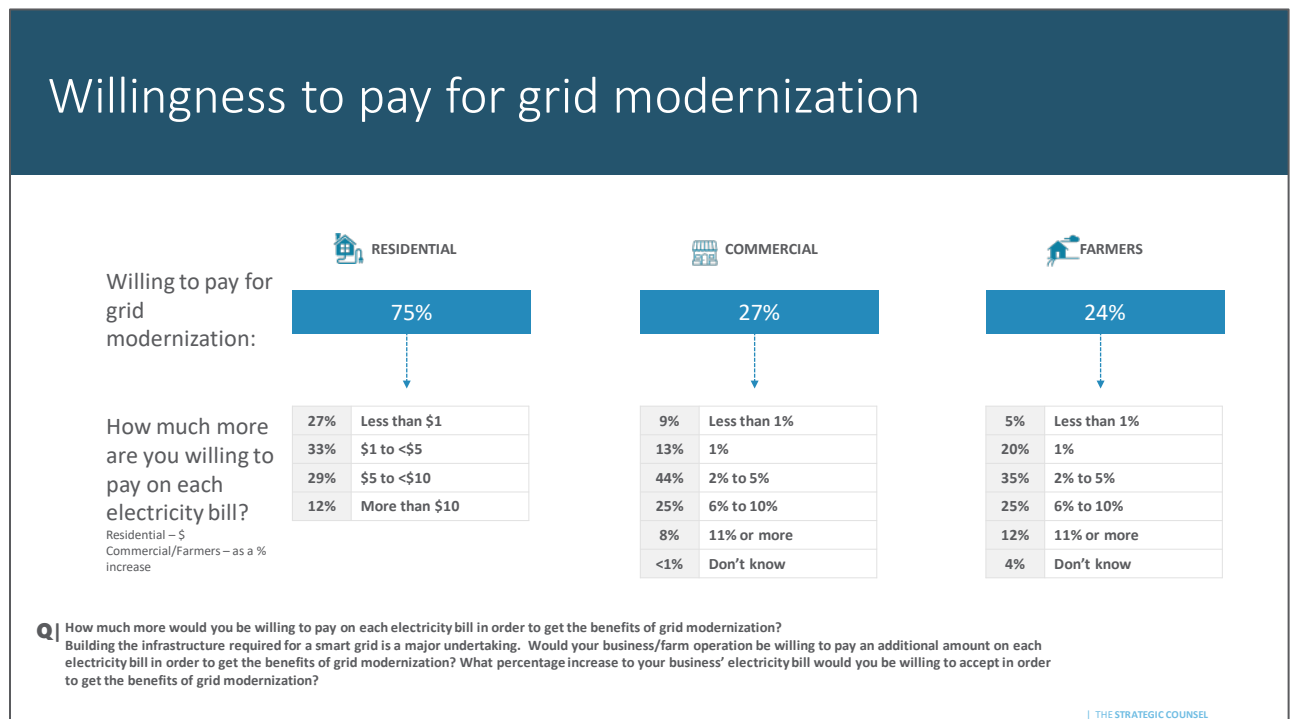
service in various parts of the province would also pose a significant impediment to successful implementation of smart systems. At the same time, the conversation prompted some farmers to consider opportunities for additional revenue streams, including:

- The ability to generate emission reduction credits (i.e., carbon credits) by leveraging the various low carbon technologies which could be supported by an environmentally-friendly smart grid; and
- Leasing the land rights to site renewable power generation installations on their farm property, such as photovoltaic power stations or solar farms, in a manner similar to existing lease agreements with oil and gas companies in the province.

2. Willingness to Pay

After customers had considered both the merits and potential challenges of grid modernization, they were asked if they would be willing to pay an incremental amount on their monthly electricity bill in order to obtain the benefits of a smart grid. Relative to commercial customers and farmers, residential customers were more inclined to indicate a willingness to pay – 75% of residential customers expressed some support for an increase to the bill compared to 27% of commercial customers and 24% of farmers.

As shown below, those customers in all three segments who were willing to pay for grid modernization improvements favoured a relatively modest increase on their electricity bill.



Regardless of their willingness to pay, most customers confirmed that fulfilling on the benefits of grid modernization would serve to enhance their perception of the value for money they receive from their

electricity provider – 51% of farmers held this view, increasing to 54% among commercial customers and 57% among residential customers.

3. Other Thoughts and Questions about Grid Modernization

In general, findings from the qualitative research phase underscored that customers are most interested in those aspects of grid modernization that will reduce the cost of electricity to consumers, accelerate economic activity in the province, increase system reliability and create efficiencies. While a certain segment of customers focused more so on the environmental benefits this was not necessarily the primary driver of interest in grid modernization.

Comments from commercial customers, in particular, suggested that the perceived benefits from grid modernization varied greatly depending on the nature, size, scope and energy intensity of the business, and on the extent to which the company prioritized sustainability as a stated corporate value. For many of the farmers and ranchers who participated in the survey or in the subsequent qualitative discussions, while electricity costs overall were not deemed to be a large factor in terms of their overall operating expenses, the cost of outages was frequently described as significant in terms of disruption to operations and damage to equipment. Increased reliability and improved outage management underpinned their interest in grid modernization.

In addition to the information gathered through the survey, qualitative discussions revealed other positive associations with grid modernization, including: greater empowerment of consumers vis a vis their electricity providers and ability to manage their energy use in general, a more competitive electricity market, and the opportunity to generate power at the local or community level (closer to where people live and work), resulting in reduced line loss and need for additional infrastructure.

Other customers were less convinced of the benefits of grid modernization or were of the view that it was not a particularly high priority for Alberta at this time. Some were concerned about who would bear the costs of any new infrastructure and felt there was no real or compelling need to modernize the electricity system in Alberta. Arguments were put forward by several customers that renewables could be integrated effectively within the current system without the requirement for significant investment in additional distribution infrastructure. Importantly, for those customers who had experienced service issues or disruptions, grid modernization was not seen as directly addressing these concerns and some were skeptical about the claims of improved system reliability.

In general, customers expressed some cynicism about modernizing the grid especially around the notion that it would create opportunities for customers to become more active energy managers – they worried about what they viewed as unproven technologies, issues of accountability and fairness, downloading of costs to consumers, and whether or not consumers would in fact ultimately reap the stated benefits (i.e., revenues or offsets from selling power back to the grid).

Throughout the discussions, participants raised a number of questions about grid modernization and development of a smart grid, including:

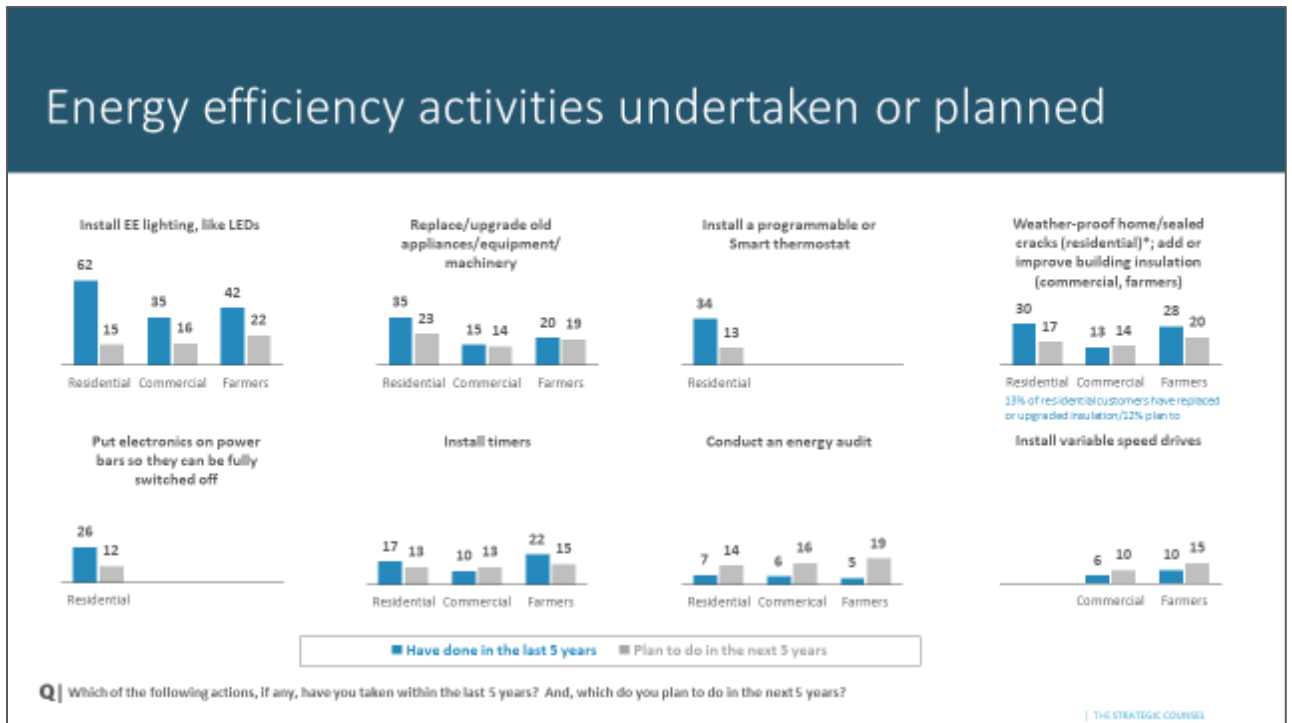
- What exactly is it?
- What is the timeframe for grid modernization? And, how will it be phased in across the province? Can we expect service interruptions as this is occurring?

- Who will pay for it? How will grid modernization impact customers' electricity bills?
- What's in it for customers? What will change for electricity customers? And, what do customers need to do to get ready for these changes?
- How will issues of Internet connectivity be addressed so that rural customers can participate effectively in the smart grid?
- Will there be rebates or incentives to offset capital investments which are made by customers?
- What are the potential privacy and security risks, and the associated mitigation strategies?
- How can customers stay informed and engaged on this issue?

B. Energy Efficiency

In addition to improving system resiliency by creating a distribution system that is better prepared to address unanticipated events like severe storms or flooding, grid modernization is also a way to address aging infrastructure that needs to be upgraded or replaced while at the same time incorporating energy efficiency measures. It allows for better integration of customer-owner power generation systems and distributed energy resources (DERs), including renewable energy systems, and for wider integration of large-scale renewable energy systems to support electrification on a broader scale. The digital technology that permits two-way communications between utilities and customers as well as the sensing along transmission lines will lead to the development of a 'smart grid,' shifting the energy industry into a new era of a more efficient and reliable electrical grid allowing for quicker restoration after power disturbances and improved security.

A key area of focus for this electricity customer research program was to gauge customers' views on the environmental benefits associated with grid modernization and explore the extent to which they are currently engaged in energy efficiency activities. Customers were asked about the kinds of EE activities they have undertaken within the last five years and those they plan to undertake within the next five years. Responses show that customers have engaged in a range of EE activities, most notably the installation of LED lighting. However, there has been less uptake on other EE activities, including replacing or upgrading appliances, equipment, insulation and weather-proofing. A small proportion of customers plan to undertake these activities in the near term. Customers' self-reported actions, both past and anticipated, aligned with their expressed concerns about the cost of replacing devices and equipment as a key barrier to grid modernization and the development of a smart grid.



Of note, a slightly higher proportion of customers said they plan to conduct an energy audit or install variable speed drives (VSDs) as compared to those who have already undertaken these activities within the last five years, although the forecast numbers for these types of activities remains relatively modest – in the range of 10%-20% of customers. Nevertheless, customer interest and activity in these areas represents and opportunity for Consortium members, working in collaboration with vendors, contractors and energy consultants/auditors, to further engage and inform customers about the evolving electricity sector in the province, energy management and the possibilities created by grid modernization for energy efficiency gains.

During the qualitative phase of the research program customers expanded on their thoughts regarding energy efficiency and their experiences in this area. While their comments generally supported the findings from the survey, they offered additional insights into reasons for their hesitancy in adopting a wider range of EE behaviours:

- As noted earlier, customers did not feel strongly motivated to undertake EE activities given the prevailing view that their actions would have little impact on the bill. Nevertheless, it was clear that customers supported incentives, grants and rebates which would help to offset the initial capital outlay required to purchase energy efficient appliances and equipment, and promote wider adoption. However, many were unaware of any EE initiatives at the provincial or federal levels of government that would benefit electricity consumers.

I put things in place that are energy efficient, but the actual usage on the bill is such a small fraction of the bill ... so, I don't pay much attention, or see much incentive in doing so. (Residential Customer)

- The experience some customers have had with new technologies in general, and specifically with EE technologies and programs, has not necessarily been overly positive. Several customers had been told by their energy auditor that there was little else they could do to reduce their energy consumption in a way which would be impactful in terms of enhancing overall business efficiencies and reducing operating expenses. Others found that the equipment or devices they required, or

Having a payback structure outside of five years is something I won't work with because my business plan is only five years. (Commercial Customer)

which had been recommended to them, were expensive to purchase and not always reliable. They anticipated a low return on their investment (ROI)

given the initial capital outlay, estimated maintenance fees, and concerns about premature ageing of technological devices.

- Smart devices were generally less appealing for those customers who had poor or intermittent Internet connectivity – typically an issue for customers residing in rural and remote areas as well as some Indigenous communities.

During discussions with commercial customers and farm operators the linkages between grid modernization and the Government of Canada's stated commitment to achieve net-zero emissions by 2050 were briefly explored. Awareness of the net-zero emissions goal was limited. Many were challenged to understand exactly how it would directly impact their business or farm operation. Some assumed that reaching net-zero emissions by 2050 would require customers to drastically cut their energy use and believed this would not only be difficult to accomplish, but would also have a significant adverse effect on the overall quality of life for residents of the province.

There were also concerns expressed about the stress on the current electricity distribution infrastructure and questions as to whether the system could handle a significantly increased electricity demand resulting from further and widespread electrification across key sectors in the province.

Most discussions tended to revert back to the issue of cost. Business owners, farmers and ranchers expected they would ultimately be asked to bear most of the expense, including the cost associated with replacing equipment deemed to be 'non-energy efficient,' which

They [electricity providers] are in the business of selling power, so why would they care if we become more energy efficient? (Farmer)

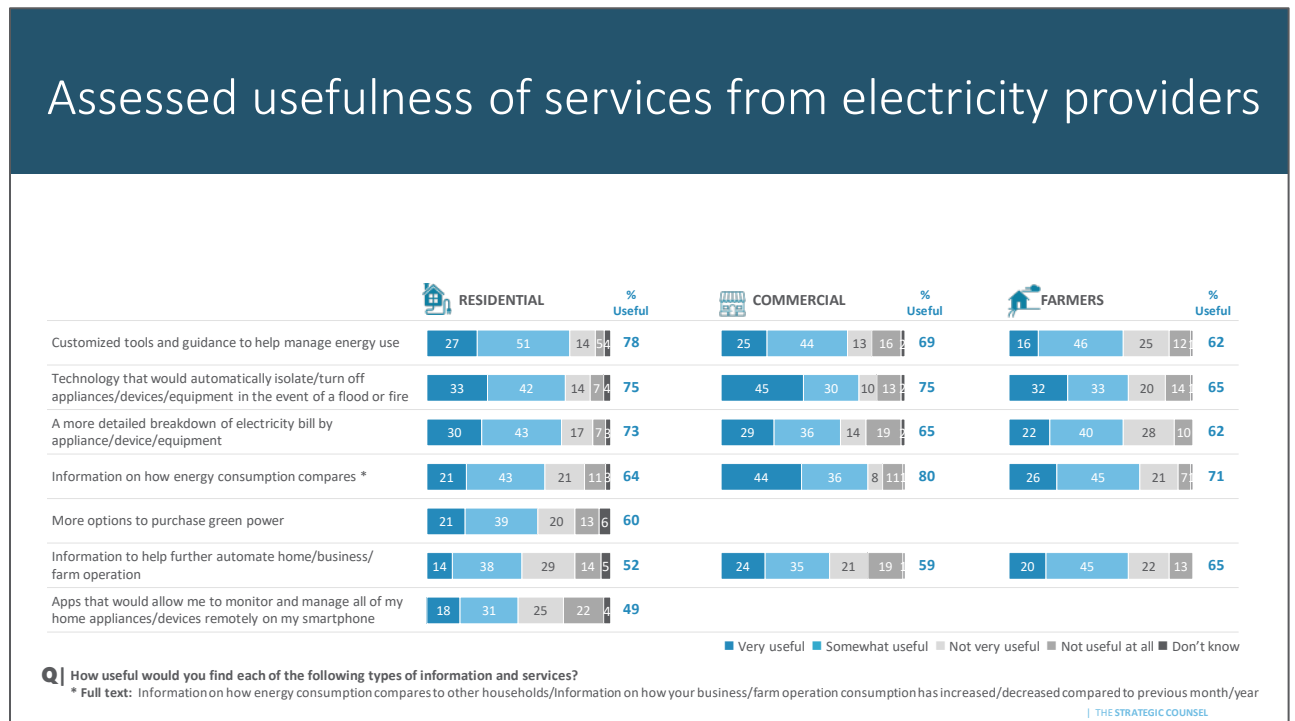
they predicted government officials would mandate as needing to be replaced at the owner's expense. They anticipated that consumers would also have to bear responsibility for the system-wide capital costs of upgrading and enhancing distribution networks across the province. They were cynical about the motives of electricity providers, viewing energy efficiency as in direct opposition to their companies' mission and not in the interests of shareholders.

C. Electricity-Related Products and Services

While further uptake of energy efficient activities would require addressing a number of barriers as identified by customers, the research underscored that there are opportunities to assist customers in becoming more active energy managers through information and tools that would empower them to make informed decisions and choices regarding their energy use. As highlighted in the chart below, customers

would value a range of additional information, products and services from their electricity provider, although the perceived utility of each varies to some degree across the three customer segments.

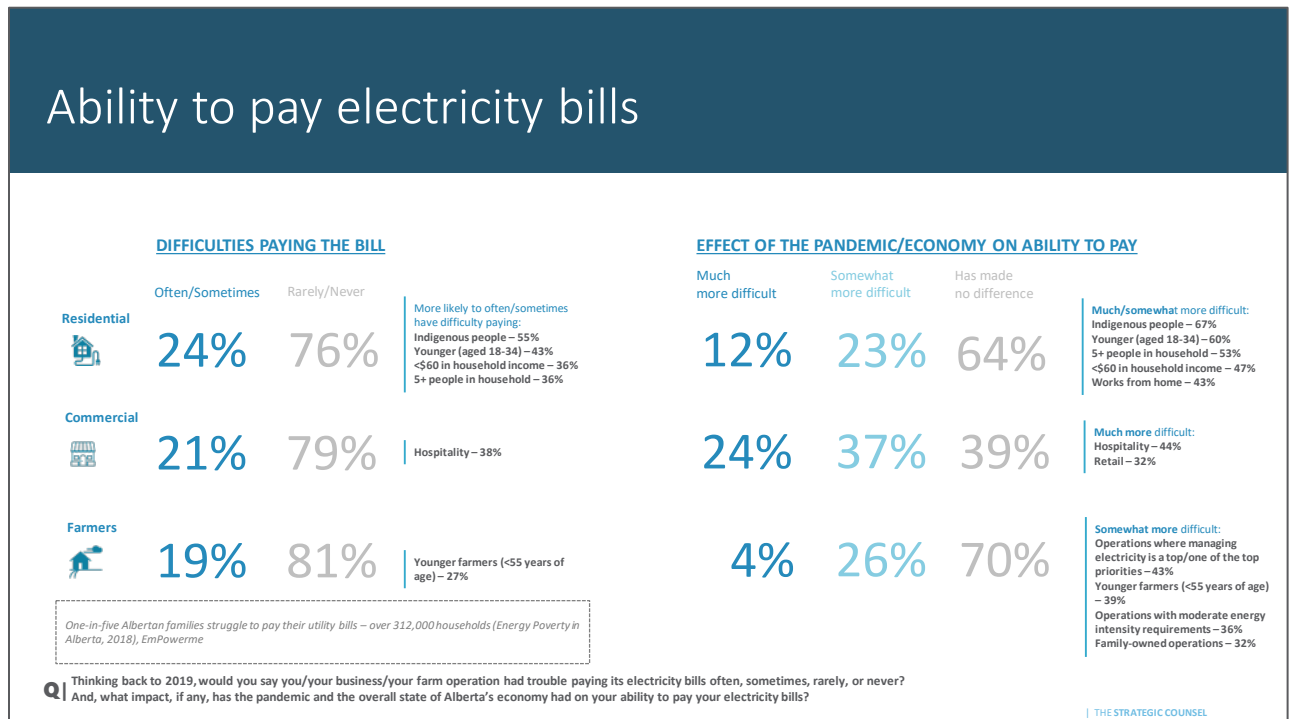
Across the board, customers said they would find it useful to have access to customized energy management tools and guidance, technology that would isolate and shut down appliances, devices and equipment in the event of a flood or fire, and a more detailed breakdown of their bill by appliance or device. Most customers would also value receiving information that shows how their energy consumption compares against other households, in the case of residential customers, or relative to the previous month or year, in the case of commercial customers and farm operators. A majority of customers also said that information to assist in further automating their home or operation would be useful. Farmers, in particular, expressed interest in this type of information.



D. Electricity Costs

There is no formal definition of ‘energy poverty’ in Canada, although it is typically qualitatively defined as the experience and extent to which households and communities encounter difficulties in meeting their home energy needs. The research afforded an opportunity to assess customers’ struggles paying their electricity bills, which is one indicator of vulnerability. Other indicators which were not explored in any particular depth as part of this research program could include lack of access to the grid, experience with disconnections, a lack of thermal comfort, and financial or other limitations which would prevent customers from improving the energy performance of their home, business or farm operation.

One-in-five or more customers, depending on the customer segment, reported having difficulty paying their electricity bills, either sometimes or often (note that the question was posed in terms of respondents' pre-pandemic situation). Specific sub-groups within the residential customer segment were more likely to experience difficulties, including: younger customers, those residing in larger households, those with annual household incomes of less than \$60,000 and customers who self-identified as Indigenous. This was also true of younger farmers (under 55 years of age) and businesses operating in the hospitality sector.



When asked if the pandemic and the overall state of the Alberta economy had any impact on their ability to pay electricity bills, a significant share of customers responded affirmatively. About one-quarter (24%) of commercial customers who responded to the survey said it had become much more difficult and this was higher among businesses in the hospitality and retail sector. Another two-in-five (37%) indicated it was somewhat more difficult (61% in total said it was more difficult). Just over one-in-ten (12%) residential customers reported finding it much more difficult while another one-quarter (23%) said it was somewhat more difficult (35% in total).

Those sub-groups which had reported challenges paying their bills under 'normal' circumstances were also more likely to indicate that the combination of the pandemic and economic conditions in the province had exacerbated the issue. Of the three customer segments surveyed, farm operators were the least likely to say that paying their electricity bills had become more difficult, although almost one-third (30% in total) indicated this was the case (4% said it was much more difficult; 26% said it was somewhat more difficult). Again, younger farm operators, under the age of 55, were among those most likely to feel this pressure.

E. Customer Personas

This report has outlined some of the similarities and differences in the attitudes, behaviours and experiences relevant to grid modernization for the three customer segments, which were the focus of this research program. However, each of these customer segments are not necessarily themselves homogenous. Further analysis, utilizing advanced statistical techniques, was undertaken to create customer personas for each of the residential, commercial and farmer segments.

Customer personas are frequently used in the development of branding, marketing and communication strategies permitting a more targeted and effective approach to connecting with various audiences. Distinct customer profiles are produced which provide deeper insights and a more detailed portrait of sub-groups of customers, in this case electricity consumers within the residential, commercial and farmer segments.

In this study, a series of customer personas were developed based on respondents' answers to attitudinal and behavioural questions posed in the surveys, including those pertaining to:

- Support for grid modernization and time-of-use pricing
- The perceived benefits and barriers of grid modernization
- Prioritization of energy use/management
- Respondents' energy use patterns and energy efficiency behaviours
- Perceptions regarding the cost of electricity and ease/difficulty of paying electricity bills
- Attitudes towards technology in general

The residential and commercial survey data yielded four distinct customer personas for each customer segment. Results from the survey of farmers yielded three distinct customer personas. These are included in the Appendix to this report.

While there is some overlap, each of the personas represents a distinct or unique subset within the three customer segments in terms of their attitudinal, behavioural and demographic/firmographic characteristics. The profiling information highlighted in each persona illustrates the range of perspectives within each customer segment with respect to grid modernization (i.e., those who are more and less supportive) and underscores the opportunities for more customized and targeted approaches to inform, educate and engage customers on the benefits of smart grid systems and grid modernization.

IV. Outcomes and Next Steps

Outcomes and Next Steps

This customer engagement study provided new insights into customer opinions and confirmed to members of the Consortium that public awareness of grid modernization is limited. The study highlighted the need for further customer engagement to increase the public understanding of why grid modernization is imperative to secure Alberta's future with low-cost, reliable electricity. Engagement is needed to clearly articulate how grid modernization enables energy efficient usage of electricity in homes and businesses and integration of distributed energy resources, as well as provides energy access, equity and independence to all members of society. It also highlighted the need for better identification of the key resources available to customers for assistance and to answer their questions about electricity usage, production, energy efficiency programs and the energy transition, including the integration of electric vehicles and electric vehicle infrastructure.

The Consortium members identified several questions that need to be answered:

- How can a responsible and proactive approach to enabling the achievement of the climate change goals and changing customer behaviors be deployed, while ensuring safe and reliable electricity service today and in a modern grid?
- What are the impacts of decentralized energy resources, electric vehicles and other energy transition initiatives to Alberta's distribution system?
- What policy and regulatory barriers need to be addressed in order for all customers to be able to participate in the energy transition facilitated through a modernized grid?
- How can the DFOs make sure that they are focusing on the various customer groups and their different needs, such as supporting the connectivity required for grid modernization?
- How can the Consortium enhance customer literacy around the energy used?
- What opportunities exist for energy efficiency for customers, and what is available to incent customers to make changes?
- What programs exist or should be developed to enable energy equity so that everyone has access to low cost, reliable electricity?
- How can the Consortium further collaboration efforts with all interested stakeholders to develop a pathway to a modern grid?

The first step in answering these questions is continued engagement. The Consortium members will create opportunities to engage with customers, electricity generators, electricity retailers, government and government agencies, academic experts and other interested stakeholders to increase the overall understanding of grid modernization and to find solutions to the barriers of grid modernization in Alberta.

Future stakeholder engagement will take many forms, likely including customer surveys to validate efforts in improved communication with customers regarding the opportunities and challenges of grid modernization in Alberta.

The Alberta Smart Grid Consortium thanks all who participated in this study and looks forward to engaging with more customers in the near future. The Consortium further thanks the participants in this customer engagement study who indicated that they were interested in providing further insights and have given permission to The Strategic Counsel to share their contact information with the Consortium for follow up discussions.


V. Appendix: Customer Personas

Customer Personas


Residential Customer Personas

Champions (RESIDENTIAL)


See value in grid modernization, empowering consumers with more options and opportunities to reduce their electricity costs. They view time-of-use pricing as an effective mechanism for shifting consumer behaviours in a more environmentally positive direction.




26%




Skews female




Slight skew younger




Slight skew to lower income




Slight skew to three-person household



Slight skew to apt dweller/urban/work from home



96% Say it's important to modernize the grid (65% very important)



64% Favour time-of-use pricing (28% strongly favour)

Top 2 Box' score on each component (based on the index created) : Compared to Total

PRO SELF-SUFFICIENCY/ GREEN ENERGY	52	73%	100%
PRO TECH/AUTOMATION	12	65%	72%
TECH COMFORT (GENERAL)	10	62%	68%
INFRASTRUCTURE/ RELIABILITY IMPROVEMENTS	37	91%	94%
ENERGY HEALTH/ COMFORT CONCERNS	4	30%	31%
BARRIERS TO ENERGY EFFICIENCY	5	53%	51%
COST SENSITIVITY	29	78%	73%
NEED INFORMATION/ HELP TO SAVE ENERGY	5	31%	34%

One-quarter (26%) report household electricity use is **HIGHER (8% say a lot higher)** relative to the average (slightly higher percentage say home is heated by radiators, electric baseboards or don't know)

Largest share who report having had difficulty paying their electricity bill **OFTEN or SOMETIMES (28%)**

More likely to rank **building a more environmentally friendly system and giving consumers the ability to generate their own power/store/sell back to the grid** among their 'top 2' important features of the electricity distribution system

NO. OF UPGRADES MADE (PAST 5 YEARS) **3.3** vs. 3.3 Total

NO. OF UPGRADES PLAN TO MAKE (NEXT 5 YEARS) **2.8** vs. 2.3 Total

MEAN SCORES

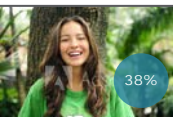
" I feel [TOU pricing] helps people consider their effect on the system and better understand the limits of the system, and ultimately reduce power consumption and demand... and hopefully encourage people to think before putting "convenience" at the top of their priorities, ahead of environmental considerations.

Hopefully companies will not charge the consumer for upgrading their system. Also, I'm hoping they will do it [grid modernization] well ... this will help the environment and the reliability of the system.


| THE STRATEGIC COUNSEL

Concerned Enthusiasts (RESIDENTIAL)


Strong environmental leaning and generally convinced of benefits of grid modernization. But, somewhat more skeptical regarding impact on consumers, specifically with respect to removing flexibility, inconveniencing customers and the potential for cost increases.




38%




Skews female




Slight skew younger




Slight skew to lower income




Slight skew to one-person household



No differences



86% Say it's important to modernize the grid



50% Favour time-of-use pricing

Top 2 Box' score on each component (based on the index created) : Compared to Total

PRO SELF-SUFFICIENCY/ GREEN ENERGY	95	73%	97%
PRO TECH/AUTOMATION	6	65%	75%
TECH COMFORT (GENERAL)	2	62%	64%
INFRASTRUCTURE/ RELIABILITY IMPROVEMENTS	18	91%	94%
ENERGY HEALTH/ COMFORT CONCERNS	27	30%	28%
BARRIERS TO ENERGY EFFICIENCY	55	53%	56%
COST SENSITIVITY	23	78%	81%
NEED INFORMATION/ HELP TO SAVE ENERGY	31	31%	33%

Slightly higher proportion reporting they **DON'T KNOW (9%)** how their household electricity use compares with the average

Slightly higher share who report **RARELY (19%)** having had difficulty paying their electricity bill, but no strong skew one way or the other

More likely to rank **building a more environmentally friendly system** among their 'top 2' important features of the electricity distribution system

NO. OF UPGRADES MADE (PAST 5 YEARS) **3.3** vs. 3.3 Total

NO. OF UPGRADES PLAN TO MAKE (NEXT 5 YEARS) **2.8** vs. 2.3 Total

MEAN SCORES

" We all have different schedules so our usage is at different times and we should not be penalized for usage at 'wrong' hours.


It is not fair to charge more for energy when you need it.

The potential benefits [of grid modernization] are likely to be swamped by out of control transmission charges.


| THE STRATEGIC COUNSEL

Mixed Feelings (RESIDENTIAL)


While acknowledging the importance of grid modernization, they are not particularly enthusiastic about the opportunities for consumers to become more empowered. They do not view themselves as 'prosumers,' sensing it may be overly complicated, disruptive and costly.




24%




Split almost evenly




Skews older




Slight skew to higher income




Skews to two-person household



No differences



81% Say it's important to modernize the grid



46% Favour time-of-use pricing

Component	Score	Compared to Total
PRO SELF-SUFFICIENCY/ GREEN ENERGY	40	40%
PRO TECH/AUTOMATION	55	58%
TECH COMFORT (GENERAL)	55	57%
INFRASTRUCTURE/ RELIABILITY IMPROVEMENTS	16	86%
ENERGY HEALTH/ COMFORT CONCERNS	25	26%
BARRIERS TO ENERGY EFFICIENCY	48	49%
COST SENSITIVITY	30	73%
NEED INFORMATION/ HELP TO SAVE ENERGY	5	34%

Key Insights:

- One-third report household electricity use is **LOWER** relative to the average
- Somewhat more likely to report **NEVER (64%)** having had difficulty paying their electricity bill
- More likely to rank **lowering costs to consumers** among their 'top 2' important features of the electricity distribution system

NO. OF UPGRADES MADE (PAST 5 YEARS) **3.3** vs. 3.3 Total

NO. OF UPGRADES PLAN TO MAKE (NEXT 5 YEARS) **2.8** vs. 2.3 Total

MEAN SCORES


Quotes:

- I could change the time at which I use electricity to get a lower rate, although if everyone started doing the same thing, it would defeat the purpose.
- I don't own any smart technology and can't afford to purchase it. My electricity bill is low now and I can't afford for it to go up.
- It's too complicated. It's based on old ways of living, not on today's world. I work from 1-7 p.m. ... It has to work around my schedule.


| THE STRATEGIC COUNSEL

Rejecters (RESIDENTIAL)


Reject renewable energy options. Generally less comfortable and/or disinterested in home automation or tools/technologies aimed at helping customers to become active energy managers. More likely to feel they would be inconvenienced and possibly at risk, given some of the changes associated with grid modernization.




12%




Skews male




Skews older




Skews higher income




Skews to two-person household



Largest proportion in detached/semi detached



50% Say it's important to modernize the grid



40% Favour time-of-use pricing

Component	Score	Compared to Total
PRO SELF-SUFFICIENCY/ GREEN ENERGY	0	0%
PRO TECH/AUTOMATION	33	34%
TECH COMFORT (GENERAL)	52	54%
INFRASTRUCTURE/ RELIABILITY IMPROVEMENTS	14	82%
ENERGY HEALTH/ COMFORT CONCERNS	41	41%
BARRIERS TO ENERGY EFFICIENCY	54	55%
COST SENSITIVITY	30	76%
NEED INFORMATION/ HELP TO SAVE ENERGY	26	27%

Key Insights:

- One-third report household electricity use is **LOWER** relative to the average (highest percentage who heat homes with gas furnace)
- Largest share who report **NEVER (73%)** having had difficulty paying their electricity bill
- More likely to rank **lowering costs to consumers, improving reliability and improving resiliency** among their 'top 2' important features of the electricity distribution system

NO. OF UPGRADES MADE (PAST 5 YEARS) **3.7** vs. 3.3 Total

NO. OF UPGRADES PLAN TO MAKE (NEXT 5 YEARS) **2.1** vs. 2.3 Total

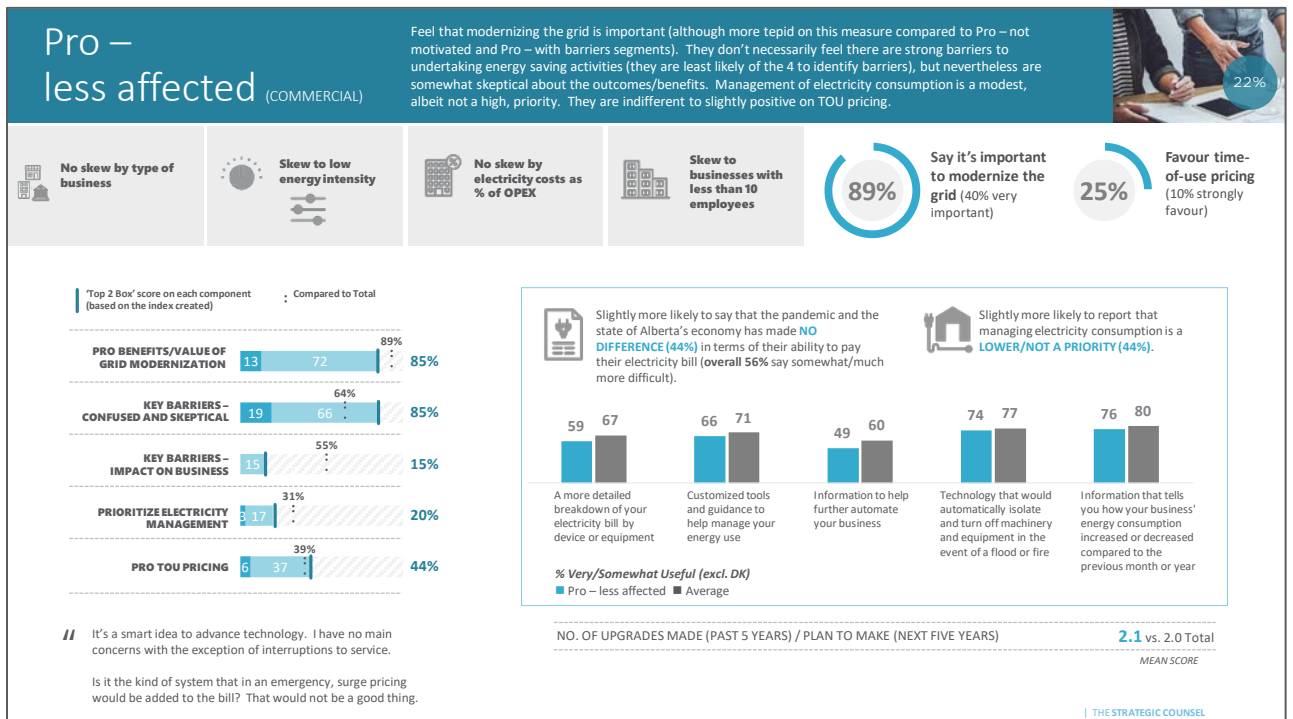
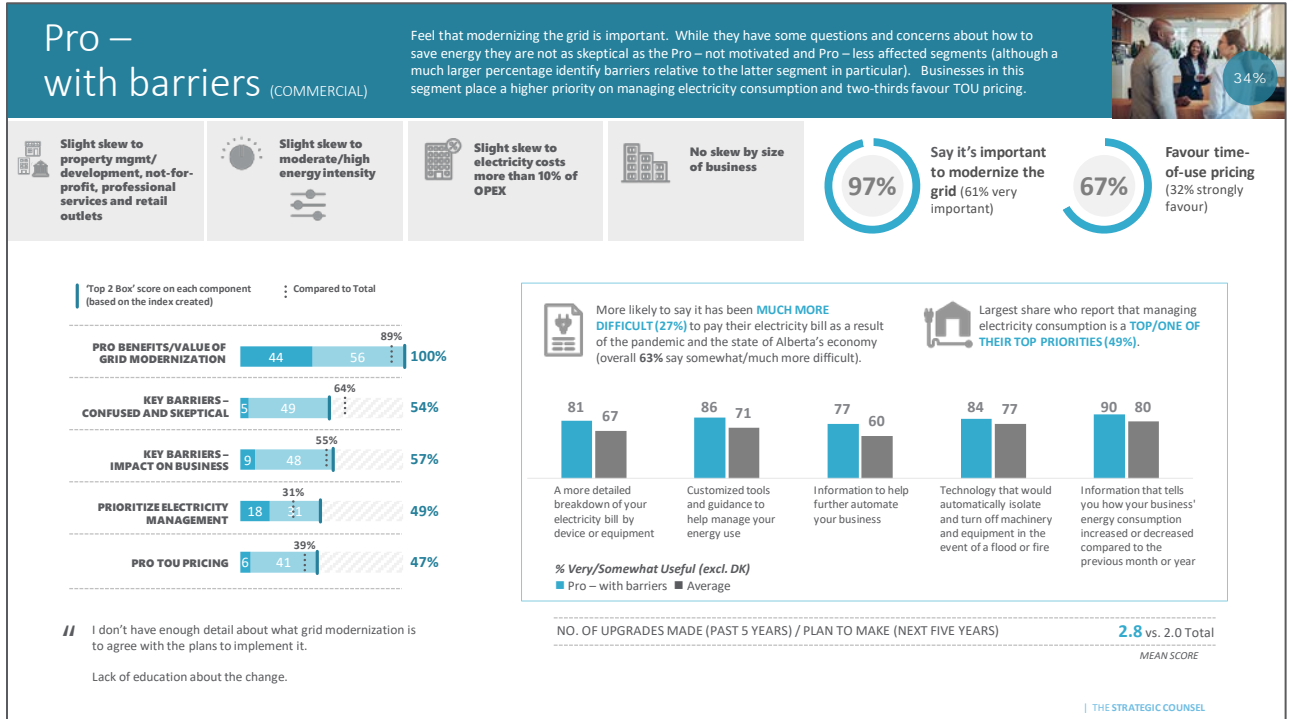
MEAN SCORES

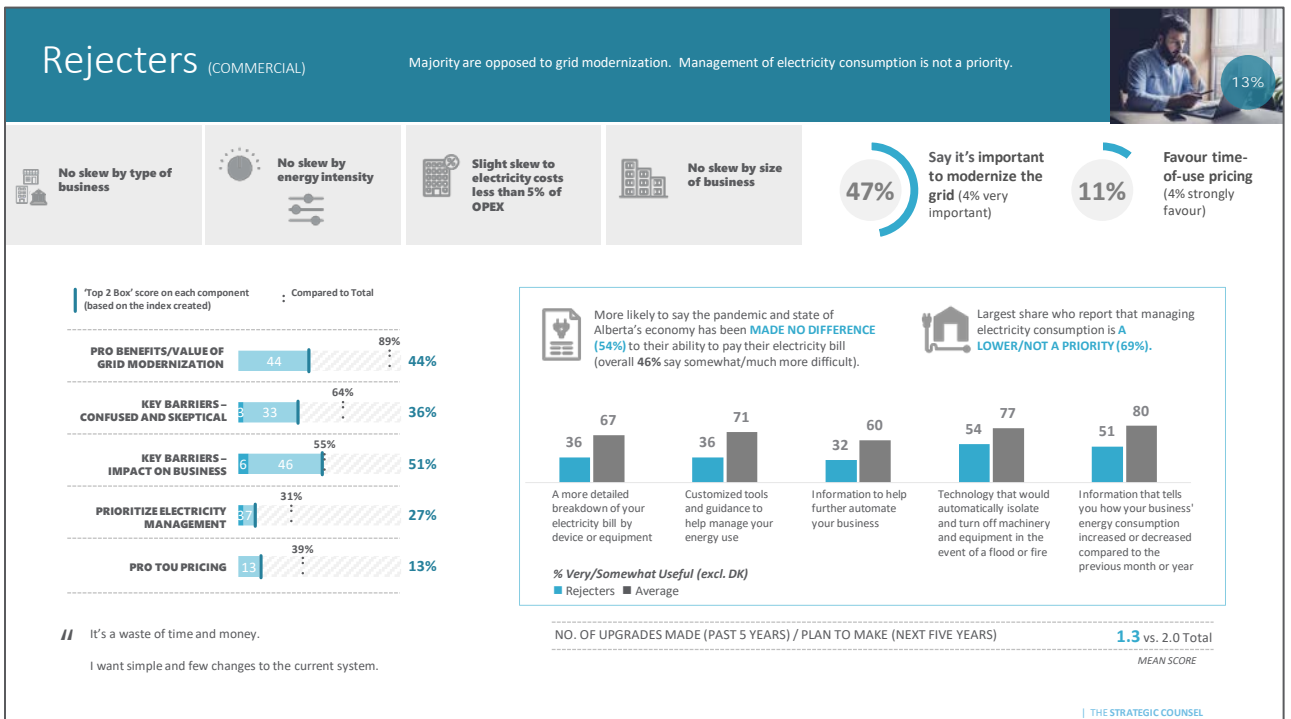
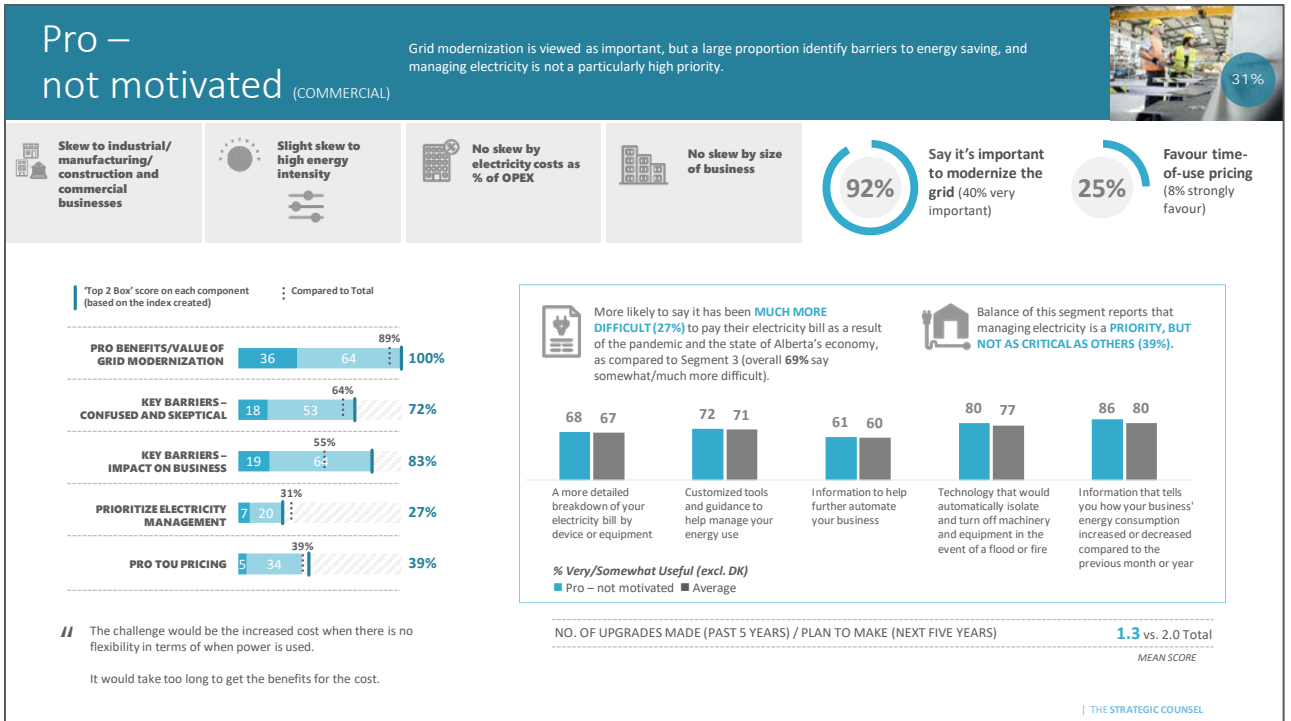
Quotes:

- I might be interested when people come to realize that manmade global warming is a hoax, and we then stop WASTING millions upon millions of dollars building wind and solar. Put that money into something useful like nuclear.
- I prefer things the old-fashioned way. Enough of the smart home stuff. No smart meters. No green energy. No big brother.
- My main concern is that energy efficiency becomes a burden on the consumer and gets more expensive with no real progress.

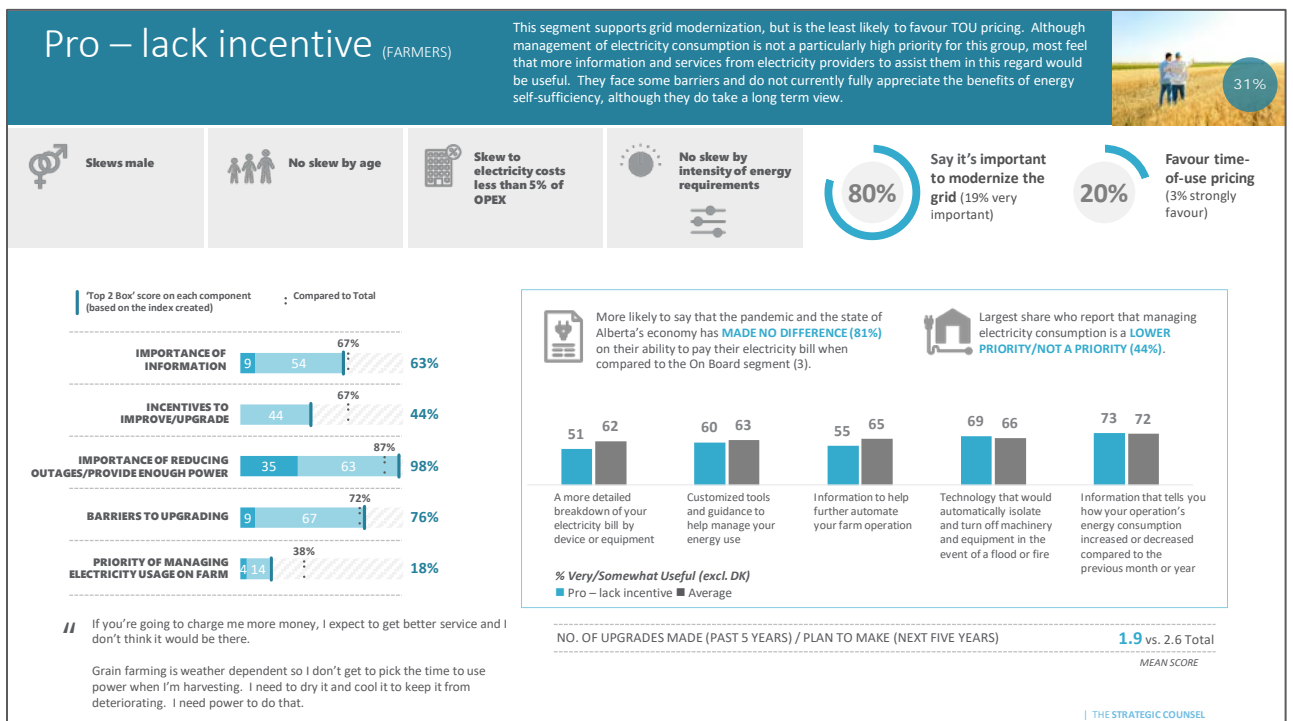
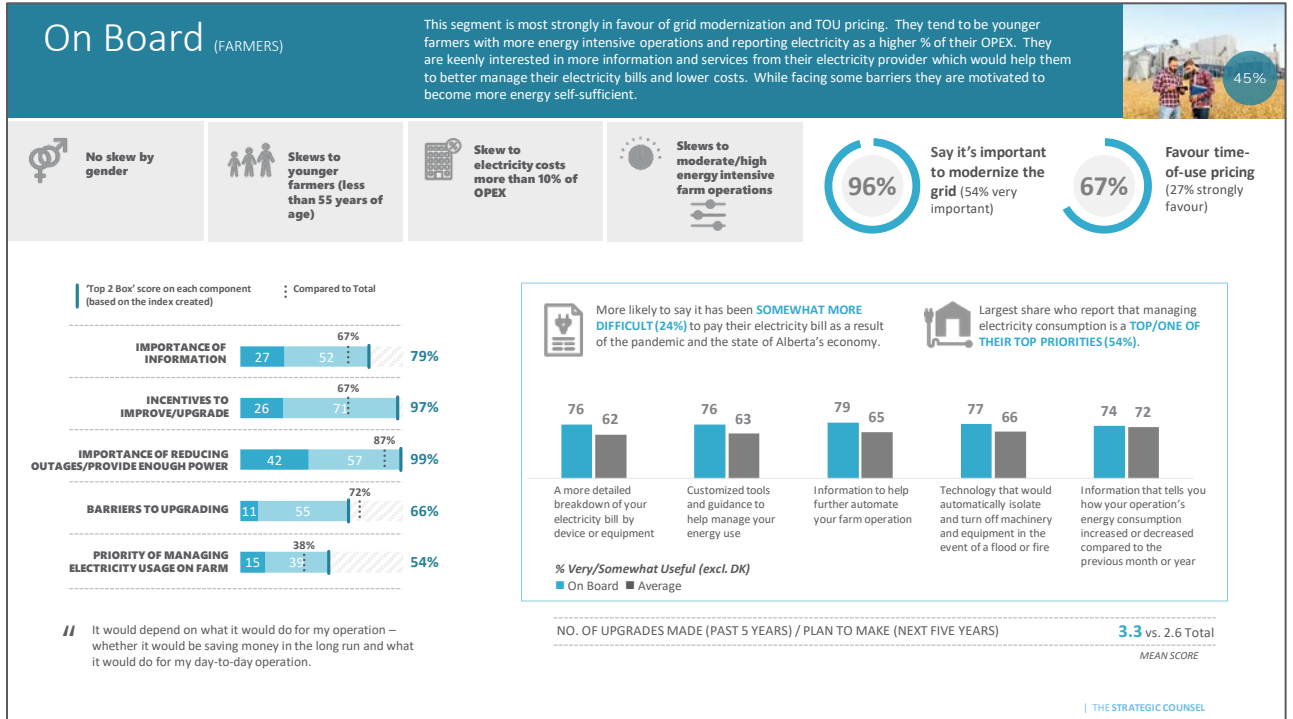
| THE STRATEGIC COUNSEL

Commercial Customer Personas





Farm Operator Customer Personas



Rejecters (FARMERS)


They see the importance of grid modernization, but not to the same degree as the On-Board Segment. Like the Pro – lack incentive segment, they feel there are issues with TOU pricing. Given that their operations tend to be low energy intensive, they are the least likely to feel that any of the proposed energy management services would be useful. Preventing/reducing outages, meeting requirements for more electrically powered equipment, and building the infrastructure to drive Alberta's economy is not that important to this group.



24%

 Slight skew to female

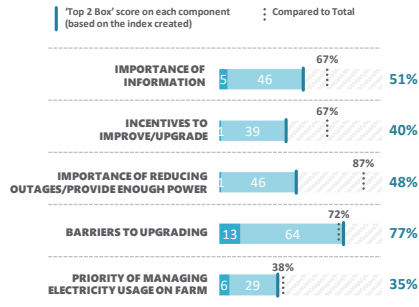
 Slight skew to farmers over the age of 55

 No skew by electricity costs as % of OPEX

 Skews to low energy intensive farm operations

75% Say it's important to modernize the grid (17% very important)

38% Favour time-of-use pricing (4% strongly favour)

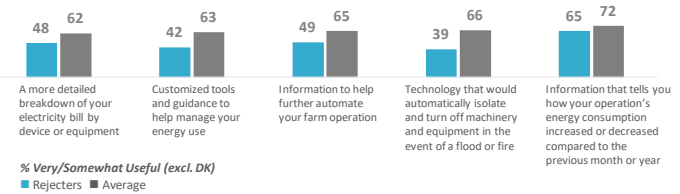


// The consumer always pays for the infrastructure at the end of the day. We are still paying for line charges that they said would be a one-time thing. All these charges are 1/3 of the bill.

It's going to cost us more money, it always does whenever somebody makes a change. I've been around for 75 years. I have seen this many times.

More likely to say that the pandemic and the state of Alberta's economy has **MADE NO DIFFERENCE (74%)** on their ability to pay their electricity bill when compared to the On Board segment (3).

Split between managing electricity consumption is a **PRIORITY BUT NOT AS CRITICAL AS OTHER ISSUES (39%)** or a **TOP/ONE OF THEIR TOP PRIORITIES (35%)**.



NO. OF UPGRADES MADE (PAST 5 YEARS) / PLAN TO MAKE (NEXT FIVE YEARS)

2.1 vs. 2.6 Total

MEAN SCORE