



UNIVERSITY OF SASKATCHEWAN

School of Environment
and Sustainability

USASK.CA/SENS

SUSTAINABLE ENERGY OPTIONS FOR SASKATCHEWAN

**May 27, 2016 Conference
Summary Report**

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Credits

Author and Layout: Martin Boucher and Sharla Daviduik
 Editor: Chris Morin and Meagan Hinthier
 Photo Credits: HenryTye Glazebrook
 Reviewers: Toddi Steelman and Keane Gruending

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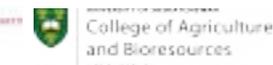
A great event cannot be made great without the ideas, energy, and effort of many. This conference was no different and would not have been possible without the generous support and hard work of many individuals and organizations.

The backbone of this conference was the organizing committee: Martin Boucher, Sharla Daviduik, Chris Morin, HenryTye Glazebrook, Meagan Hinthier, and Brett Dolter. Toddi Steelman as Executive Director of SENS helped with programming oversight. Keane Gruending, from Carbon Talks and Renewable Cities at the SFU Centre for Dialogue, developed and delivered the deliberative dialogue workshop activity, which fueled an invigorating discussion among the attendees. Our facilitation and note-taking team, which documented the event, included Kathleen Aikens, Hayley Carlson, Ann Coxworth, Josh Cronmiller, Darren Gall, Jenna Gall, David Henry, Nathan Jones, Sandra Moore, Rick Moore, Kelechi Nwanekezie, Jason Praski, Bethany Templeton, Bert Weichel, Ross Willness, and Kelly Winder. Conference volunteers Gurdeep Hehar, Maria Mora Garces, and Bethany Templeton provided logistical support on the day of the event.

We would also like to acknowledge our participants. We were fortunate to have speakers and attendees from very diverse backgrounds and perspectives. Representatives from environmental groups, activist organizations, unions, industry associations, First Nations, government, research institutes, and academia were in attendance.

The conference received support from:

- Sylvia Fedoruk Canadian Centre for Nuclear Innovation
- SaskPower
- Office of Sustainability, University of Saskatchewan
- Association of Professional Engineers & Geoscientists of Saskatchewan
- College of Agriculture and Bioresources, University of Saskatchewan
- Greater Saskatoon Chamber of Commerce
- Saskatchewan Environmental Society
- Saskatoon Regional Economic Development Authority
- Simon Fraser University's Centre for Dialogue/Carbon Talks and Renewable Cities



Executive Summary

A transition to a sustainable energy system can seem daunting. A myriad of challenges, such as cost, public engagement, education, values, and environmental concerns, exist. At the same time, a safe and reliable energy source must be maintained for the people and businesses of the province. Saskatchewan, however, is fortunate to have many options for its sustainable energy future. This province has an abundance of sustainable energy resources. Additionally, Saskatchewan has proven to be a world-leading innovator in energy technologies. Thus, reasons for optimism exist as the province moves toward a sustainable energy future.

The School of Environment and Sustainability (SENS) organized “Sustainable Energy Options for Saskatchewan,” held on May 27, 2016 at the Neatby-Timlin Theatre, University of Saskatchewan

in Saskatoon. The intent of this conference was to bring together stakeholders from diverse perspectives to discuss sustainable options for Saskatchewan’s electricity system. The purpose was to create an opportunity for dialogue to develop a collective vision of principles, values, technologies, and ideas for a future electricity system for the province.

The conference featured keynote presentations, breakout panel discussions, networking breaks, and a dialogue workshop. From the day’s discussion, we provided a number of recommendations and highlights, including:

- Saskatchewan is uniquely positioned to embrace community focused energy projects. This may include projects with First Nations, rural municipalities, or urban districts. Given Saskatchewan’s history and current appetite



(from left to right): Panelists Brenda Wallace, Nathan Ziegler, Jose Etcheverry and Keane Gruending (moderator) discuss Renewable Cities.

for community focused projects there are likely opportunities for unique social innovations in the province.

- No single source of electricity will be sufficient to provide affordable and reliable energy for the province. Therefore there is an imperative to uncover a mix or portfolio of technologies suitable to this end.
- Megawatts are a cost effective and in many instances a quickly implementable energy reduction strategy.
- Stakeholder knowledge of options and the technical and economic feasibility of each are important to foster effective solutions-oriented discussion on Saskatchewan’s electricity future.



- Given the public perception challenges faced by many jurisdictions it would be worthwhile to take this into account in the Saskatchewan context. Public engagement and involvement is highly important.
- Disagreement among stakeholders on technological options exists. A focus on principles or evaluation criteria, however, can create bridging opportunities between stakeholders.
- Saskatchewan has the opportunity to benefit and learn from the energy transitions that have already occurred around the world.

The conference brought together one hundred stakeholders and leaders from experts in the provincial utility, union representatives, First Nations, industry, engineering consulting firms, environmental groups, and researchers to discuss the options for transitioning to a sustainable electricity system in Saskatchewan. There was a strong desire among participants for new and innovative configurations, both institutional and technological, for the electricity system of the future. This could involve consideration for new ownership opportunities for communities, higher levels of distributed generation, and a general openness to new innovations on the horizon. There are of course challenges with such a transition, but the imperative to respond to the concerns of climate change and rising GHG emissions could not be greater.

It is our hope that the conference and this summary report offer a springboard for further dialogue on Saskatchewan’s electricity future.

Introduction

Increased pressure from all levels of government and the scientific community suggests an immediate imperative to respond to the concerns of climate change and reduce Greenhouse Gas (GHG) emissions. With 2015 being touted as the hottest year on record, records have followed a continuous trend towards warmer global yearly temperatures. In 2015, 193 nations signed on to the Paris Climate Accord at the COP21 Climate Change convention agreeing to keep warming within 1.5 degrees above pre-industrial conditions. To meet this target, Canada has set targets to reduce emissions. In Saskatchewan, the province is at an important crossroads with its electricity system. In November 2015, Premier Brad Wall, announced a goal of increasing the renewable energy portfolio in Saskatchewan to 50% capacity by 2030. Current capacity, which includes hydropower, is at approximately 25%. In other words, the new plan will represent a two-fold increase in renewable energy capacity in 15 years. Saskatchewan Power Corporation (SaskPower), the utility responsible for this transition, is a public electric utility that owns



Brenda Wallace

the majority of the generation, transmission, and distribution of electricity in the province.

Building on the momentum generated by the Premier's announcement, as well as the success of a renewable energy panel discussion hosted by the School of Environment and Sustainability (SENS) on January 15, 2016, the School organized a conference entitled "Sustainable Energy Options for Saskatchewan" on May 27, 2016 at the Neatby-Timlin Theatre, University of Saskatchewan, Saskatoon, Saskatchewan. The intent of this conference was to bring together stakeholders from diverse perspectives to discuss sustainable options for Saskatchewan's electricity system. The conference created an opportunity for dialogue to develop a collective vision of principles, values, technologies, and ideas for a future electricity system for the province, rather than determining which options or pathways would be best, although this was certainly discussed.



Anouk Kendall and Burt Weichel

Summary of Panel Discussions

The intent of the panel discussions was to focus on key important issues faced by Saskatchewan's electricity system. Panel topics were selected based on preconference stakeholder interviews. This feedback was collected and used to make a determination on the panel discussion topics. The conference content developers, Martin Boucher and Brett Dolter, selected the panel discussion topics based on this feedback. The breakout panels featured short presentations by expert panelists followed by moderated discussion and an open forum with attendees.

First Nations and Northern Communities

Highlights:

- **Upfront capital and regulatory hurdles as barriers to energy project development in the north**
- **Local energy projects have the potential to bring increased jobs and autonomy**
- **Energy efficiency is both cost effective and relatively simple to implement**

Electricity distribution in Saskatchewan needs to reach the most northern, and some of the most isolated, locations in the province. This session concerned opportunities and barriers regarding sustainable energy projects for First Nations and northern communities in Saskatchewan. Kathleen Aikens, a PhD student at SENS, moderated this panel, which featured the following experts:

- Ian Loughran (VP – Projects and Business Development, First Nations Power Authority)
- Dan Cox (Director, Project Development, Se-

quoia Energy Inc)

- Alfred Gamble (Beardy's and Okemasis First Nation)

Twitter Feed

Conference participants were encouraged to share their thoughts using the twitter #EnergyOptionsSask throughout the conference. On May 27th the hashtag trended in Saskatoon. Throughout this report we have included selected portions of the twitter feed.

Jenna Gall @JennaKorenGall May 27

Focus on developing First Nations-owned #renewables projects, not just consulting with FN for their land @FNPower #EnergyOptionsSask

Toddi Steelman @EnviroWonk May 27

Utility solar power more expensive than rooftop solar by 2-5 cents #EnergyOptionsSask

Anouk @AnoukKendall May 27

@FNPower Canada's largest rooftop solar projects 2x65 kW rooftop solar fond du lac & hatchet lake north Sask FN Schools! #EnergyOptionsSask

Alfred Gamble spoke about the opportunities and challenges facing his community. Local renewable energy projects can offer opportunities for community development and energy independence. However, he noted that significant upfront capital costs associated with such projects can be prohibitive. A lack of knowledge within his community about the technologies and pathways to move to renewable energy

was another hurdle. He emphasized that the Indian Act and treaty rights have a profound impact on how communities can choose their own energy path. The Indian Act was not designed to encourage economic independence; localized energy projects are typically dependent on the question of First Nations nationhood.

"... the Indian Act and treaty rights have a profound impact on how communities can choose their own energy path."
-Alfred Gamble

Dan Cox presented a case study of the Jamie Creek Run of River Hydro Project in British Columbia; his firm Sequoia Energy worked on this project. He noted that the project had many shared benefits for the local First Nation and the developer. The project provided the community with jobs, education and

training, funding for traditional use surveys, and right of first offer. The community provided shared royalties, cooperation with construction, access to land, and gave up title to project area. Key challenges were determining the First Nation communities for consultation and understanding who is using that particular land.

Ian Loughran discussed his role with First Nations Power Authority (FNPA) and the importance of community development to energy projects. With a mandate to develop First Nations-led projects, FNPA has a key goal of offering objective third party project analysis driven and owned by the needs of First Nations. This includes developing master agreements, bridging gaps, offering experience, and facilitating knowledge transfer and accessibility. A number of power projects for First Nations have included technologies such as a utility solar, biomass, hydro, flare

gas, and rooftop solar. For Loughran, the low hanging fruit to energy sustainability generally is to address the building stock through reduced energy use, passive solar design, energy conservation, and solar installations. He also noted that virtual net metering is key to community-owned energy projects. Projects are also beginning to have favorable economic returns, which Loughran said was a minimum 10% rate of return for a typical solar installation. He emphasized that Community Power Plans must be included in community planning moving forward.

When asked about the biggest challenge facing First Nations energy projects, Cox identified infrastructure costs, Loughran responded with upfront capacity and training, and Gamble spoke about the hurdles and loops of policies and government regulations. Overall, the session outlined important challenges, such as treaty rights, education, regulations, and capital costs, and addressed the variety of opportunities available, such as local job creation, First Nations empowerment, and energy cost savings.

Renewable Cities

Highlights:

- **Cities have been leaders in the uptake of localized renewable energy implementation**
- **Energy efficiency and conservation initiatives are one of the cheapest options to reduce GHGs for cities**
- **Saskatoon is working on an ongoing basis to reduce its GHGs while managing expected population growth**

"Community Power Plans must be included in community plan[ning]."
-Ian Loughran

Twitter Feed

Keane Gruending @KeaGru May 27
[@renewablecities](#) panel, Brenda Wallace, [@cityofsaskatoon](#): citizen expectations & willingness to pay for RE not synced [#energyoptionssask](#)

Climate Friends Zone @CFZSask May 27
[@bwallace1970](#) says [@cityofsaskatoon](#) committed to climate action in Why Cities Matter session at [#energyoptionssask](#) conference in [#yxe](#)

GIWS_SENS @GIWS_SENS May 27
Brenda Wallace's presentation touches on the importance of renewable options at a city level: [#energyoptionssask](#)

Hayley Katherine @hkjcarlson May 27
[@bwallace1970](#): [@cityofsaskatoon](#) committed to providing diverse transit choices & protecting natural area carbon sinks [#energyoptionssask](#)

Cities, both in Canada and internationally, are increasingly leading in the implementation of renewables and energy efficiency, including adopting 100% renewable energy targets. With the majority of the world's energy consumed and emissions generated in cities, local governments are in a position to capitalize on new and potentially disruptive technologies and reshape how energy is consumed and produced. This session explored what Canadian cities are doing in terms of renewables and energy efficiency, and examined options for Saskatchewan's cities. The panel moderated by Keane Gruending, Communications Manager, Renewable Cities, featured the following expert panelists:

- Jose Etcheverry (Associate Professor, Faculty of

Environmental Studies, York University)

- Brenda Wallace (Director of Environmental and Corporate Initiatives, City of Saskatoon)
- Nathan Ziegler (Sustainable Electricity Engineer, Saskatoon Light & Power)

Jose Etcheverry discussed the role of cities in reducing emissions, and the opportunities, both economic and social, in creating a renewable city. He cited examples of two Canadian districts that have adopted 100% renewable energy targets for the electricity, heating and cooling, and transportation sectors: Vancouver, BC and Oxford County, ON. He emphasized that renewable energy initiatives in cities could have increased benefits for the local economy.

Brenda Wallace discussed the City of Saskatoon's plan to mitigate emissions; she also spoke about updates

Compact of Mayors

The Compact of Mayors is a global coalition of mayors and city officials committing to reduce local greenhouse gas emissions, enhance resilience to climate change and track their progress publicly. It is an agreement by city networks – and then by their members – to fight climate change in a consistent and complementary manner to national efforts. The Compact establishes a common platform to capture the impact of cities' collective actions through standardized measurement of emissions and climate risk, and consistent, public reporting of their efforts. (*Compact of Mayors 2015*)

"...energy efficiency is one of the lowest cost options to reduce emissions."
- Brenda Wallace

Twitter Feed

Sandra Moore [@sledmoore](#) May 27
Great panel discussion & audience questions for the Risk Perception & Decision Making session [#EnergyOptionsSask](#)

UofS Sustainability [@usos_usask](#) May 27
Session on risk perception recognized the role of emotion & fear on public sentiment. Facts need positive emotions! [#energyoptionsask](#)

to city agreements and initiatives. For instance, Saskatoon recently signed the Compact of Mayors. As part of this agreement, the City has one year to do a survey of emissions and three years to implement a plan to reduce emissions. Wallace noted that energy efficiency is one of the lowest cost options to reduce emissions. The City of Saskatoon's Growing Forward¹ plan, which is based on Saskatoon's population growing to half a million people over the next 30 to 40 years, will include provisions for greenhouse gas reductions. She emphasized that citizens' expectations and their willingness to pay for local renewable energy projects are not well aligned.

Nathan Ziegler discussed various projects that Saskatoon Light and Power (SL&P), the electric utility in Saskatoon, is currently undertaking, including a methane gas-waste treatment facility, the Saskatchewan Environmental Society (SES) solar co-op, the net-metering program, and the proposed micro-hydro recreation facility at the weir on the South Saskatchewan River. SL&P also has education and community outreach programs. SL&P serves approximately 60% of the residents of the City of Saskatoon; the remain-

¹ City of Saskatoon: Growing Forward. Available at www.growingfwd.ca

ing 40% are served by SaskPower.

The discussion following the panelists' presentations emphasized the importance of communication regarding renewable energy initiatives, and the local benefits they can bring to cities. For instance, renewable energy has the potential to localize energy production in the city, thereby creating more local job opportunities – these jobs would otherwise be exported out of the city. Thus, localized renewable energy generation can create both environmental and social benefits. Cities offer a unique opportunity for citizens to engage in energy production, as well as the chance to closely connect with solutions to emissions reduction.

Risk Perceptions and Decision-making

Highlights:

- **Perceptions of risk are often a key challenge to many energy projects**
- **Public discourse and information are important to help mitigate dissonance between actual risks and perceptions of those risks**
- **Project knowledge and familiarity can reduce risk perceptions**

Electricity generation projects can create risks to human health and safety, and to natural ecosystems. Stakeholders involved in energy decisions may have different perceptions of the risks posed by electricity generation technologies. This session explored the chal-

Perceptions of risks decrease as stakeholders get more experience with the electricity generation technologies.

lenges of decision-making in the context of the risks and risk perceptions of energy options like nuclear, coal, and wind energy.

To order to engage in a discussion on this broad topic, experts from a range of backgrounds in political science, nuclear energy, wind energy development, and environmental activism were invited. The panel was moderated by Ken Belcher, Professor, Department of Agricultural and Resource Economics, College of Agriculture and Bioresources/School of Environment and Sustainability, University of Saskatchewan, and featured following expert panelists:

- Loleen Berdahl (Professor, Department of Political Studies, University of Saskatchewan)
- Neil Alexander (Executive Director, Sylvia Fedoruk Canadian Centre for Nuclear Innovation)
- Tanya Christidis (PhD Program, School of Planning, University of Waterloo)
- Gideon Foreman (Policy Analyst, David Suzuki Foundation)

The panelists agreed that perceptions of risks decrease as stakeholders gain more experience with electricity generation technologies. Dr. Alexander noted that people are often not against the technology; they are against specific projects. Gideon Foreman cited an example in Ontario where Bruce Power² had made contributions to the community that resulted in a more positive perception of nuclear energy. Dr. Berdahl added that the agent of communication is also important and credibility plays a large role in knowledge mobilization. When asked about the importance of communication and safety, Gideon Foreman noted

² Bruce Power is a consortium of corporations that own eight nuclear reactors on Lake Huron, Ontario, Canada, that total 6300 MW of supplied electricity to the Province of Ontario.

Twitter Feed

MiEnergy [@MiEnergy](#) May 27
"We've got the tech, we've got the people/expertise, we need the regs and policies to support this"
[@AnoukKendall](#) [#EnergyOptionsSask](#)

Jenna Gall [@JennaKorenGall](#) May 27
Canada's technology accelerator for #decentralized energy [@AnoukKendall](#) [@DEassociation](#) [#EnergyOptionsSask](#) [#solar](#) [#geothermal](#) [#biomass](#) [#yx](#)

that there has to be a conversation about what is reasonable risk. Tanya Christidis emphasized the importance of environmental justice and fairness as key considerations while Dr. Alexander added we need to look at the system holistically.

Overall, the panelists discussed varying perspectives on risk perceptions. However, the viewpoints had underlying similarities. For instance, the level of risk perceived diminishes or becomes reasonable with familiarity and local social benefits. Also, communication and public discourse are essential to understand stakeholder perceptions of risk.

The Role of the Utility Moving Forward

Highlights:

- **Upfront capital and regulatory hurdles as barriers to energy project development in the north**
- **Local energy project have the potential to bring increased jobs and autonomy**
- **Energy efficiency is both cost effective and relatively simple to implement**

The institutional structures of electric utilities around the world and in Canada have undergone dramatic changes. Given the portfolio of technologies that currently exist, the utility is likely to change yet again. Furthermore, social and environmental pressures are creating a space for new expectations of electric utilities. This session explored possible reforms of Saskatchewan's major utility to increase access to the Saskatchewan electricity grid. The panel was moderated by Brett Dolter, Postdoctoral Fellow, University of Ottawa. The expert panelists were:

- Bert Weichel (President, Saskatchewan Environmental Society)
- Anouk Kendall (President, Decentralised Energy Canada)
- Doug Opseth (Director, Supply Planning and Integration)

Bert Weichel spoke about the challenges and opportunities associated with the Saskatchewan Environmental Society's solar co-op, established in 2015. He outlined the need for a broader vision for the electricity system and a sustainable future for humanity that requires a transition towards zero emissions. He discussed how society can fundamentally transform how it sources its energy and how electricity will play a crucial role in this process. To him, a focus on the big picture is important, and the electricity system is part of that picture. The electricity utility can be reconfigured to be more socially oriented and community focused. This will involve a rescaling of energy projects and of the institutional and ownership structures of the utility. He suggested a path forward may be a "prosumer" model, in which individuals and groups are no longer just consumers of energy services but are also producers.

Similarly, Anouk Kendall argued that we are in a tran-

sition from a centralized to a decentralized electricity system. Decentralized energy includes a portfolio of technologies such as: district heating, combined heat and power, solar, geothermal, bioenergy, small modular reactors, and smart grids. She noted that by 2020, \$206 billion per year of global annual investment will be in decentralized energy. There has been a confluence on interactions, such as disruptive technology, aging infrastructure, and cost, that have acted together to influence this change. She also emphasized that we should not ignore the future of gas in our energy production.

Doug Opseth made the point that the role of the electric utility in Saskatchewan has been continually changing and will continue to change into the future. Initially, our electric utility was a localized and disjointed system. It transitioned to a more centralized configuration with focus on economies-of-scale, grid reliability, and security. However, stakeholder pressure, environmental considerations, and technological developments are leading to demands for new changes to the system. SaskPower is aware of this and is actively considering how its role will evolve into the future. At the moment, SaskPower's primary goal is to provide reliable and cost-effective energy services for the people of Saskatchewan.

The Future of Carbon Capture and Storage in Saskatchewan

Highlights:

- **Saskatchewan has become a global innovation leader in Carbon Capture and Storage**
- **SaskPower's Carbon Capture and Storage facility opened in 2014 at the Boundary Dam Station**
- **There is disagreement on the environmental and cost benefits of Carbon Capture and Storage technology**

Twitter Feed

GIWS_SENS @GIWS_SENS May 27
Max Ball of @SaskPower talking about carbon capture and storage #EnergyOptionsSask

GIWS_SENS @GIWS_SENS May 27
Is CCS competitive now? And will it be competitive in the future? Via Max Ball of @SaskPower #EnergyOptionsSask

SaskPower recently undertook an ambitious, innovative project to capture and store carbon dioxide from one of its Boundary Dam coal power stations. This project was the first of its kind in the world, and Saskatchewan has since become a global leader in carbon capture and storage (CCS) technologies. CCS technology is included in all the International Panel on Climate Change (IPCC) scenarios and it is estimated it will contribute 13% to the achievement of the 20C target. However, the Boundary Dam project, and the technology generally, have been scrutinized due to high cost and environmental challenges.

*"... decision-making process in SaskPower means that there'll probably be a different suite of choices in the future. Present choices are just speculation."
-Max Ball*

This session explored the future of carbon capture and storage in Saskatchewan.

The panel was moderated by Toddi Steelman, Executive Director, SENS, with the following expert panelists:

- Ken From (CEO, Petroleum Technology Research Centre)
- Brian Banks (Research Associate, Canadian Centre for Policy Alternatives)
- Mark Bigland-Pritchard (President, Low-Energy Design)
- Max Ball (Senior Business Advisor, SaskPower)

The panelists had different perspectives on the economic and environmental benefits and challenges of CCS technology in Saskatchewan. Favourably, the Boundary Dam project, which came into service in October 2014, has been an opportunity for SaskPower, along with other utilities and researchers around the world, to learn about and further develop this technology. The project created 5 million person hours of employment during construction, and has had a positive regional economic impact. It has captured 839,000T of CO₂ to date. Additionally, the cost of generated electricity can be cost competitive when the reclaimed CO₂ is used for enhanced oil recovery. Not all the panelists were convinced of the economic benefits. The cost burden of the Boundary Dam project was a general concern: one panelist noted that, "it's a nice experiment to have done but we shouldn't do it any more." Another panelist argued that other cost effective ways exist to reduce CO₂ emissions in Saskatchewan. According to one participant, "SaskPower's financial charges rose from \$57 million in 2012 to \$362 million in 2015." These extra costs, it was argued, would have a disproportionate impact on the province's poor population, due to the overall costs of CCS as compared to more affordable alternatives—namely, energy efficacy and renewable energy. Environmental challenges were noted: CCS projects are located close to oil fields and are dependent on the sale of CO₂ for enhanced oil recovery.

Eight out of 12 global CCS projects are linked to enhanced oil recovery. However, CCS technology could be used to help India and China reduce emissions, given the projected expansion of coal fired power in these countries.

The future of CCS technology will be dependent on both its continued development as well as the development of the many other forms of electricity generation available in Saskatchewan. CCS is a controversial subject with important considerations of cost and environment that have yet to be resolved, at least according to the views of this panel. Max Bell put it well when he said that the decision-making process in SaskPower means that there will probably be a different suite of choices in the future. Present choices are just speculation. Instead of speculation, a balance must be struck between being open to the prospects of new technologies and being capable of making decisions based on current options. In terms of CCS, it is still uncertain what the learning curve will be to make the technology more affordable and environmentally benign.

Disruptive Technologies

Highlights:

- New and new version of old technologies are creating disruptions in the current electricity system model
- Innovation and potentially disruptive technologies can come from a variety of sources
- Combined heat and power, battery storage, electric vehicles, and small modular reactors are all examples of disruptive technologies

The electricity system in Saskatchewan and around the world, has continually faced disruptions due to novel technological developments. Only in the mid-

1960s did Saskatchewan establish a province-wide electrical system. Before that time, Saskatchewan relied primarily on a disjointed system of localized electricity production. Developments in transmission technology paved the way for Saskatchewan to create a highly integrated and centralized system of electricity production. Similarly, new innovations, or adaptations of previous technologies, are paving the way for new opportunities and reconfigurations of the electric utility. This session explored the impact that these disruptive technologies, such as combined heat and power, battery storage, electric car charge

Twitter Feed

Fedoruk Centre @FedorukCentre May 27
It's a full house listening to panel on disruptive tech #EnergyOptionsSask @usask @SRCnews

GIWS_SENS @GIWS_SENS May 27
Ryan Jansen discusses the remote, micro-grid HERC system he helped design. #EnergyOptionsSask

UofS Sustainability @usos_usask May 27
Great to see @jamesgatessask championing Combined Heat and Power at #EnergyOptionsSask!

Sandra Moore @sledmoore May 27
Informative discussion on disruptive technologies (nuclear, elec vehicles, comb. Heat & power) #EnergyOptionsSask

stations, and small modular reactors, can have on the electricity grid.

The panel was moderated by Martin Boucher, PhD Student, School of Environment and Sustainability, University of Saskatchewan, and featured the follow-

ing expert panelists:

- Ryan Jansen (Research Engineer, Saskatchewan Research Council)
- James Gates (Director of Customer Solutions, SaskEnergy)
- Brooke Longpre (Solar Industry Consultant)
- Dr. Esam Hussein (Dean of Faculty of Engineering, University of Regina)

Ryan Jansen discussed his projects with the Saskatchewan Research Council which focus on addressing energy volatility. His project at Cowessess First Nation addressed the challenge of wind power intermittency by combining a wind turbine with on-site battery storage facility and monitoring. Similarly, his Hybrid Energy Container (HERC) system is mobile and ideal for remote locations. The HERC system uses a synergistic combination of a diesel generator and batteries to provide cost effective and reliable electricity for projects that cannot connect to SaskPower's grid. James Gates discussed Combined Heat and Power (CHP) technology and its potential application in Saskatoon. CHP, often referred to as cogeneration, is an approach to conserve energy inputs by using electricity production and heat energy at the same time. He noted that multiple CHP projects exist in the US with extremely high reliability rates. Saskatoon is considering CHP projects. Brooke Longpre discussed the current state of solar technology and electric vehicles and emphasized the importance of integrated solutions. She noted that linking electric vehicle technology with information communication technology will change the way electricity is configured and used. Dr. Esam Hussein discussed Small Modular Reactor (SMR) technology and its potential suitability to provide low carbon energy to remote rural localities that are not connected to the central electrical grid. He emphasized

that SMRs can be improved to ensure increased safety and cost competitiveness. Overall, the panelists presented a variety of disruptive technologies that ranged from new innovations, new opportunities emerging from old ideas, and combinations of diverse ideas. An important lesson from this panel is that innovative technologies can come from a variety of sources. Innovation, in this regard, involves openness to the many unknown possibilities.

From the perspective of the electric utility, in this case SaskPower, this poses future planning challenges because the trajectories of new innovations are not always certain. A regular evaluation of new technological developments is an important planning measure.

Dialogue Workshop – Low-Emissions Electricity in Saskatchewan: Beyond 2030

Highlights:

- There are multiple pathways that can achieve a low-emissions electricity system in Saskatchewan
- Community owned projects were a common vision amongst participants
- A focus on principles and values allowed participants to see alignment between each others ideas despite disagreement on technological options

Chatham House Rule

When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed (*The Royal Institute of International Affairs 2002*)

This session brought together individuals from different sectoral and professional backgrounds to have a conversation about the future of electricity in the province beyond the current 2030 renewable energy target (see Appendix A for list of participants). The conversation was intended to be engaging and acces-

sible. Dialogic techniques were used to promote conversation and surface ideas. The session was conducted using the Chatham House Rule to create a spirit of openness and sharing of information.

To begin, the dialogue workshop proceeded a presentation by Dr. Brett Dolter on sustainable energy pathways for Saskatchewan. Dolter is an ecological economist specializing energy pathways and modeling. He presented his dissertation work on the Saskatchewan electricity system which considered economic, engineering, social and environmental impacts of various energy pathways. His findings suggest that there are multiple options available for Saskatchewan that would meet the goals of a sustainable energy system. This presentation offered participants a portfolio of possibilities of future energy pathways. Dolter emphasized, however, that there are options and considerations even beyond his model. Values, social benefits and risks, new technologies, path dependency are difficult to incorporate within a model.

Many participants had a vision of a renewables and community focused electricity system for the future

Conference participants were placed in nine groups for the workshop activity. The session was divided into three sections: Visioning, Principles, and Plenary Dialogue.

Visioning

For the first exercise, participants were asked to create their individual visions for a low-emission Saskatchewan electricity system by the year 2050. A vision is an aspirational and ideal snapshot on the future; participants were asked to individually draw their vision on an 8.5x11" piece of paper (see Appendix C).

The most common vision was one that included a diversity of low carbon energy sources with localized community projects. Participants also envisioned a reliable, distributed, and intelligent grid. Notable differences existed in the preferences for generation technologies. The role of nuclear energy and CCS with coal were contested topics. Further differences included challenges faced by rural and urban settings (see Appendix C and D for participant responses).

Principles

In this exercise, participants each indicated the top principle they felt should govern a low-emissions electricity system in Saskatchewan after 2030. A principle is a core guideline that should not be compromised. Through a process of 'dotmocracy' participants voted on the principles they determined to be of the highest priority. After the principles exercise, the conference attendees returned to the plenary for a report-back exercise led by Keane Gruending. Representatives from each group were asked to share their principles discussed in their workgroups. Affordability and reliability were the two main principles that stood out to

the participants. Further principles included environmental sustainability and social responsibility (see Appendix E and F for participant responses).



James Gates, Director, Customer Solutions, SaskPower



Martin Boucher, PhD student, SENS

Recommendations

The Sustainable Energy Options for Saskatchewan conference aimed to create an opportunity for an open and informed discussion about Saskatchewan's electricity future. Attendees and speakers from a diverse range of backgrounds conveyed that a shift to a sustainable electricity system will involve the ideas, vision, and passion of many. This conference did not set out to establish a pathway forward for Saskatchewan. However some ideas were prevalent during the both the breakout panel discussions and the deliberative dialogue exercise:

A desire for community projects

In nearly all of the groups in the visioning and principles exercises, community involvement and ownership were emphasized. Given the portfolio of technological options available and the low cost of new generation technologies, community based projects can provide important economic and social benefits.

There is no "right" energy mix

Many agreed that a mix of various energy sources is needed. For some, this meant a renewables-only future; for others, the vision included CCS and nuclear power. But all participants understood that a single energy source would not provide a complete solution. A variety of sources are needed.

Negawatts are a low hanging fruit

Energy saved from energy efficiency and conservation, known as "negawatts," is typically significantly

cheaper energy produced by nearly all generation options. A focus on improved building standards, efficient lighting, and education on energy saving techniques, to name a few, are all affordable ways to take advantage of negawatts and alleviate the pressure for more generation options.

Address the knowledge gap

Attendees had extremely different expectations of generation technologies that led to irreconcilable differences between participants. Some were convinced that a renewables-only approach was the most viable on a technological basis while others were convinced that the pathway to near zero emissions must include nuclear energy and CCS. The plenary presentation by Dr. Brett Dolter demonstrated that there are many options that can be technologically and economically feasible. To have informed discussion on the options for Saskatchewan's future, decision makers, experts, and the public alike should come to the table with a reasonable level of agreement on economic and technological capabilities.

Public engagement is key

Challenges of risk perception and NIMBYism (Not-In-My-Back-Yard) can often make energy projects onerous and changes to the current electricity regime a challenge. Attendees expressed concern that the public would challenge any major change or plan. The province has many options from which to choose. These range from choosing an energy portfolio to ownership structures. However, a desire for more

public involvement also came from the discussions; this ranged from having the ability express concern to bringing forth potential ideas. Effective public engagement can ameliorate resistance to changes in the electricity system in this time of transition.

Focus on principles first, then on technologies

Many participants came to the conference with a preference for a set of technologies or one in particular, especially in terms of generation options like solar, nuclear, CCS, wind, and gas. Over the course of the day, it became apparent that to have an effective conversation on technological options, starting from principles or evaluation criteria is critical. When participants had the opportunity to discuss how they might evaluate a set of options or what governing

principles an electrical system should have, they were able to find more common ground.

Learn from other districts

Saskatchewan has one of the highest per capita emissions from its electricity system in Canada, second only to Alberta. Notwithstanding the local challenges that Saskatchewan faces (long transmission distances, low provincial population density, and cold winter temperatures), important lessons can be learned from other districts in Canada and the United States. Many attendees looked to other districts for sources of inspiration and practical application.



Conference facilitators

About the Authors

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Martin Boucher

Martin Boucher is a PhD student at the University of Saskatchewan's School of Environment and Sustainability researching socio-technical transitions and sustainable energy pathways. He has received a number a top awards for this work including: SSHRC Doctoral Fellowship, Queen Elizabeth II Scholarship, Peter MacKinnon Fellowship, and the Nexen Sustainable Energy Scholarship. Martin completed his BSc in Natural Science from the University of Waterloo in 2008 and his MA from Athabasca University with a research focus on sustainable urbanization in 2014. While working through his MA, Martin managed the Ottawa office of an environmental and civil engineering firm.

Sharla Daviduik

Since November 2016, Sharla Daviduik is the Manager of the Administrative Support Group for the College of Arts of Science at the University of Saskatchewan. Prior to that, she was the Administrative Officer for the School of Environment and Sustainability. She holds a BSc in Land Use and Environmental Studies from the U of S, and a Masters in Resource Management from Simon Fraser University.

Appendix A: Conference Schedule

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8:00 - **Registration**

8:30 am

8:30 am **Opening Remarks**

- Martin Boucher, PhD Program, School of Environment and Sustainability
- Toddi Steelman, Executive Director, School of Environment and Sustainability

8:40 am **Planning a Sustainable Energy Future: Decisions, Options, and Timelines**

- Doug Ospeth, Director, Supply Planning and Integration, SaskPower

9:30 am **Break - brought to you by SaskPower**

9:45 am **Morning Concurrent Breakout Sessions**

First Nations and Northern Communities

Moderator: Kathleen Aikens, PhD Program, School of Environment and Sustainability

- Ian Loughran, VP - Projects and Business Development, First Nations Power Authority
- Dan Cox, Director of Project Development, Sequoia Energy
- Alfred Gamble, Beardy's and Okemasis First Nation

Renewable Cities

Moderator: Keane Gruending, Communications Manager, Renewable Cities

- Nathan Ziegler, Sustainable Electricity Engineer, Saskatoon Light and Power
- Brenda Wallace, Director of Environmental and Corporate Initiatives, City of Saskatoon
- Jose Etcheverry, Associate Professor, Faculty of Environmental Studies, Institute for Research and Innovation in Sustainability, York University

Risk Perceptions and Decision-Making

Moderator: Ken Belcher, Professor, Department of Bioresource Policy, Business, and Economics, College of Agriculture and Bioresources/School of Environment and Sustainability

- Loleen Berdahl, Professor, Department of Political Studies, College of Arts and Science, University of Saskatchewan
- Neil Alexander, Executive Director, Sylvia Fedoruk Canadian Centre for Nuclear Innovation
- Tanya Christidis, PhD Program, School of Planning, University of Waterloo
- Gideon Forman, Policy Analyst, David Suzuki Foundation

11:15 am **Lunch - brought to you by the Sylvia Fedoruk Canadian Centre for Nuclear Innovation**

12:30 pm **Address by His Worship Don Atchison, Mayor of Saskatoon**

12:45 pm **Practical Climate Change Mitigation Strategies for Canada**

- Jose Etcheverry, Associate Professor, Faculty of Environmental Studies, Institute for Research and Innovation in Sustainability, York University

Conference Schedule, continued

1:15 pm **Afternoon Concurrent Breakout Sessions**

The Role of the Utility Moving Forward

Moderator: Brett Dolter, Post-doctoral Fellow, Institute of the Environment, University of Ottawa

- Bert Weichel, Board of Directors, SES Solar Co-operative Ltd.
- Anouk Kendall, President, Decentralised Energy Canada
- Doug Ospeth, Director, Supply Planning and Integration, SaskPower

The Future of Carbon Capture and Storage in Saskatchewan

Moderator: Toddi Steelman, Executive Director, School of Environment and Sustainability

- Ken From, CEO, Petroleum Technology Research Centre
- Brian Banks, Associate, Canadian Centre of Policy Alternatives
- Max Ball, Clean Coal Technology and Senior Business Advisor, SaskPower
- Mark Bigland-Pritchard, President, Low Energy Design

Disruptive Technologies

Moderator: Martin Boucher, PhD Program, School of Environment and Sustainability

- Ryan Jansen, Research Engineer, Development Engineering & Manufacturing, Saskatchewan Research Council
- James Gates, Director, Customer Solutions, SaskEnergy
- Kent Rathwell, President and Founder, Sun Country Highway Ltd.
- Esam Hussein, Dean and Professor, Faculty of Engineering and Applied Science, University of Regina

2:45 pm **Break**

3:00 pm **Low-Emissions Electricity in Saskatchewan: Beyond 2030**

- Brett Dolter, Post-doctoral Fellow, Institute of the Environment, University of Ottawa
- Keane Gruending, Communications Manager, Renewable Cities

5:00 pm **Closing Remarks**

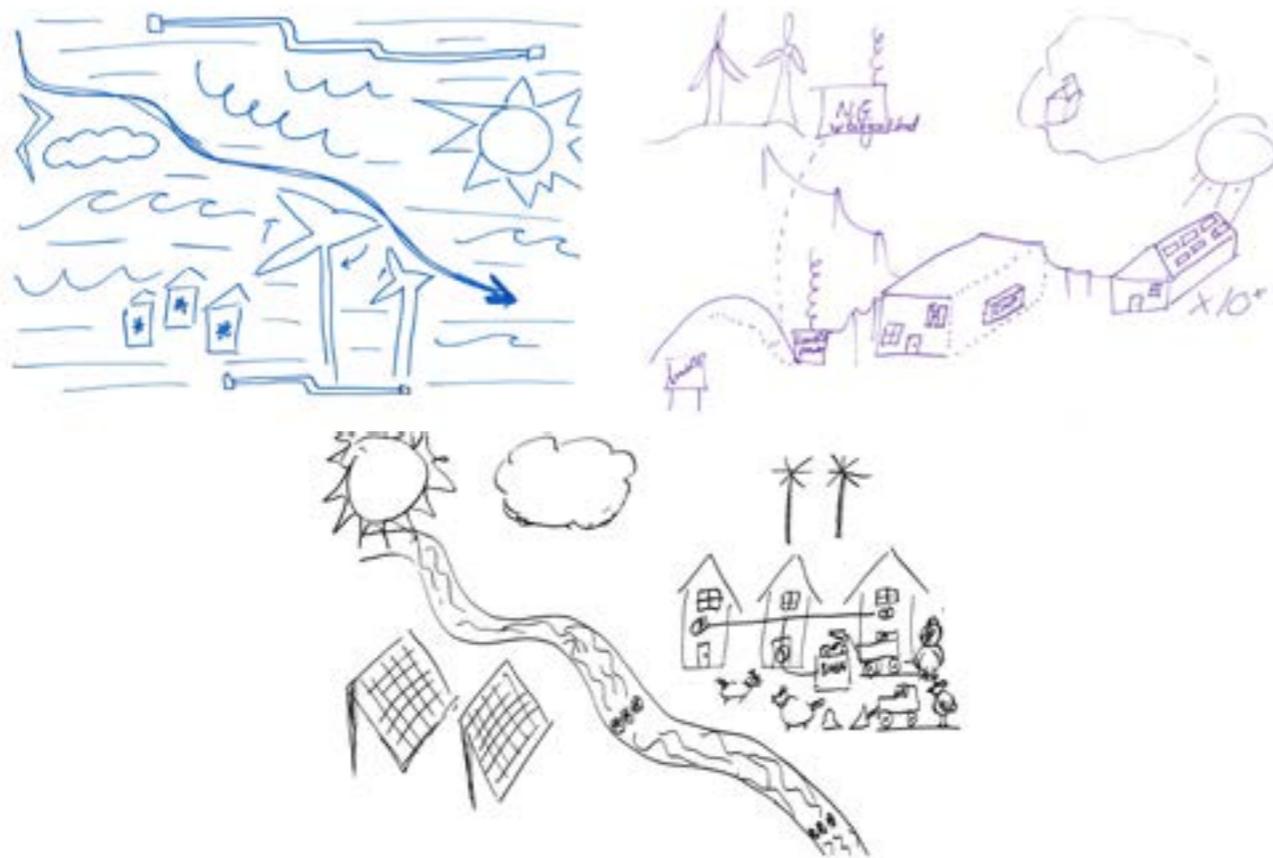
- Brenda Wallace, Director of Environmental and Corporate Initiatives, City of Saskatoon
- Toddi Steelman, Executive Director, School of Environment and Sustainability
- Martin Boucher, PhD Program, School of Environment and Sustainability

Appendix B: Participants

- Kathleen Aikens, PhD Program, School of Environment and Sustainability
- Erin Akins
- Neil Alexander, Executive Director, Sylvia Fedoruk Canadian Centre for Nuclear Innovation
- Max Ball, Clean Coal Technology and Senior Business Advisor, SaskPower
- Brian Banks, Associate, Canadian Centre of Policy Alternatives
- Nathalie Baudais, Dillon Consulting Ltd.
- Ken Belcher, Professor, Department of Bioresource Policy, Business, and Economics/School of Environment and Sustainability, University of Saskatchewan
- Pam Belcher, Saskatchewan Environmental Society
- Samantha Benesh
- Loleen Berdahl, Professor, Department of Political Studies, College of Arts and Science, University of Saskatchewan
- Mark Bigland-Pritchard, President, Low Energy Design
- Martin Boucher, PhD Program, School of Environment and Sustainability, University of Saskatchewan
- Ben Buhler, Saskatchewan Urban Municipalities Association
- Hayley Carlson, Conference Facilitator
- Robert Chabot
- Arthur Chan
- Chris Chovin
- Tanya Christidis, PhD Program, School of Planning, University of Waterloo
- Doré Collett
- Dan Cox, Director of Project Management, Sequoia Energy
- Ann Coxsworth, Conference Facilitator/Saskatchewan Environmental Society
- Ewen Coxsworth, Saskatchewan Environmental Society
- Josh Cronmiller, Conference Facilitator
- Matthew Dalzell, Sylvia Fedoruk Centre for Nuclear Innovation
- Sharla Daviduik, Administrative Officer, School of Environment and Sustainability, University of Saskatchewan
- Darcy Deforest
- Brett Dolter, Post-doctoral Fellow, Institute of the Environment, University of Ottawa
- Tara Donovan
- Andrea Duncan
- Jose Etcheverry, Associate Professor, Faculty of Environmental Studies, Institute for Research and Innovation in Sustainability, York University
- Jodi-Lynne Falk
- Alex Fallon
- Melanie Fauchoux, Department of Mechanical Engineering, College of Engineering, University of Saskatchewan

- Gideon Foreman, Policy Analyst, David Suzuki Foundation
- Ken From, Chief Executive Officer, Petroleum Technology Research Centre
- Karl Harasyn
- David Henry, Conference Facilitator
- Kevin Hudson, City of Saskatoon, Saskatoon Light and Power Division
- Darren Gall, Conference Facilitator
- Jenna Gall, Conference Facilitator
- Alfred Gamble, Beardy's and Okemasis First Nation
- Shaun Gardner, PCL Construction Management
- James Gates, Director, Customer Solutions, SaskEnergy
- Jaz Gatin
- Henry Glazebrook, Communications Coordinator, School of Environment and Sustainability, University of Saskatchewan
- Ramakrishna Gokaraju, University of Saskatchewan
- Pam Groat, MSEM Program, School of Environment and Sustainability, University of Saskatchewan
- Keane Gruending, Communications Manager, Renewable Cities and Carbon Talks, Simon Fraser University
- William Hale
- Gurdeep Hehar, Conference Logistics
- Bruno Hernani Merino
- Phil Hesse, Dillon Consulting Limited
- Esam Hussein, Dean and Professor, Faculty of Engineering and Applied Science, University of Regina
- Kelly Kalinski
- Anouk Kendall, President, Decentralised Energy Canada
- Ryan Jansen, Research Engineer, Development Engineering and Manufacturing, Saskatchewan Research Council
- Brian Johnston, Roots Rock Solar
- Nathan Jones, Conference Facilitator
- Aaron Laughlin, International Brotherhood of Electrical Workers Local 2038
- Steve Lawrence, Green Energy Project of Saskatchewan
- Lisa Leis
- Natasha Levesque
- Amanda Lindgren
- Brooke Longpre, Sound Solar Systems
- Ian Loughran, VP - Projects and Business Development, First Nations Power Authority
- Shawn Macdonald
- Kevin Mack
- Janet Milburn
- Rick Moore, Conference Facilitator
- Sandra Moore, Conference Facilitator
- Maria Mora Garces, Conference Logistics
- Andres Moreno

- Chris Morin, Communications Specialist, School of Environment and Sustainability, University of Saskatchewan
- Andrew Munro, Manager, Supply Planning, SaskPower
- Thai Nguyen
- Kelechi Nwanekezie, Conference Facilitator
- Doug Ospeth, Director, Supply Planning and Integration, SaskPower
- Kathryn Palmer, Dillon Consulting Ltd.
- Eric Paproski
- Olena Pavlyuk
- Cory Pike
- Jason Praski, Conference Facilitator
- Peter Prebble, Conference Facilitator
- Ron Quarrie
- Bibian Rajakumar
- Rick Retzlaff
- Chris Richards, City of Saskatoon
- Vince Russell, Johnson Controls
- Brian Sawatzky
- Brent Schwartz
- Al Shpyth, International Minerals Innovation Institute
- Kurt Soucy, Saskatchewan Polytechnic
- Toddi Steelman, Executive Director and Professor, School of Environment and Sustainability, University of Saskatchewan
- Jeff Sweet, International Brotherhood of Electrical Workers Local 2038
- Bethany Templeton, Conference Logistics
- Kathryn Theede
- Brenda Wallace, Director of Environment and Corporate Initiatives, City of Saskatoon
- Bert Weichel, Board of Directors, SES Solar Cooperative Ltd.
- Ross Willness, Conference Facilitator
- Kelly Winder, Conference Facilitator
- Matt Wolsfeld
- Kurt Woytiuk
- Stan Yu, International Centre and Northern Governance and Development, University of Saskatchewan
- Femi Yusuf
- Nathan Ziegler, Sustainable Electricity Engineer, Saskatoon Light and Power



Appendix D: Responses from Visioning Exercise

What was common among participants' visions?

- Diversity of sources (x5)
- Community-focused (x4)
- Renewable-focused (solar, wind, biogas, hydro) (x4)
- Integrated, distributed and intelligent electricity system (x3)
- De-carbonization/low emissions (x2)
- Role of nuclear power and CCS
- Reliability
- Rural versus urban focus
- Holistic picture

What was different among participants' visions?

- Nuclear vs. no nuclear (x3)
- Some were family focused, green building, and sustainable communities.
- Cost expectations for various options
- Energy storage and smart grid capabilities
- Rural versus urban perspectives
- Self-propelled transit
- Local generation versus utility scale generation
- Impacts of local economy and jobs

What stood out to participants? *After participants had a chance to observe each other's visions for the provinces electricity system, they were asked what stood out to them.*

- Increased renewables (x2)
- Pointing out relationships and partnerships beyond economic impact
- Benefits of community ownership
- Risk and familiarity of energy projects
- Still using current technology
- Passion for the topic
- Similar to transition in food and planning
- Focus on Canadian energy policy
- The need for increased wind production in the province
- Better storage is needed for renewables

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After seeing other people's visions, would anyone change theirs? If so, how?

- Focus on efficiency/reducing load (x2)
- More social and community focused
- Regional partnerships
- Bigger picture (community, provincial, national, regional)
- Useful to have a discussion between rural and urban perspectives
- The need for more storage options
- Speed of technological innovation and future unknowns

Appendix E: Responses from Principles Exercise (Groups)

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What stood out to participants?

- Consensus among three main areas that were SaskPower mission statement considers: Sustainability, Reliability, and Cost Effectiveness
- The need for public awareness, education, and engagement
- Economic well being and community development
- Cost, reliability, and justice
- Renewable energy with as little to no emissions production
- The importance of a reliable grid

Dotmocracy:

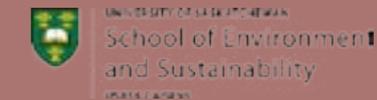
- Clean power and energy (11 votes)
- Health based (10 votes)
- Education, knowledge, and awareness (10 votes)
- Accountability of both supply and demand side at all levels of production, use, and demand (8 votes)
- Acceptable environmental performance for the lowest cost (8 votes)
- Decision-making for common good and quality of life (7 votes)
- Flexible community ownership and participation (7 votes)
- Be an economic and environmental benefit to people of Saskatchewan (6 votes)
- Saskatchewan will have zero emission for power generation (5 votes)
- Build local communities both socially and economically (5 votes)
- Obtain 100% renewable energy (5 votes)
- Pass a sustainability impact assessment (5 votes)
- Factoring in externalities (5 votes)
- Should have pricing regime that rewards conservation and efficiencies (4 votes)
- Investment into research of renewable energy (4 votes)

Appendix F: Responses from Principles Exercise (Plenary)

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Principles	Groups
Sustainability – social, economic and environmental factors	1, 4, 8, 7
Accountability for supply and demand, accountability from the consumer	2
Zero emissions for power generation (for Saskatchewan)	3
Knowledge and awareness of the public/consumer to be more accountable	4
Flexible community ownership and participation	5
Diversified, unsubsidized portfolio based on community needs and ownership while minimizing health and environmental impacts for present and future generations.	6
Holistic approach in engaging industry, education and government institutions	7
100% renewable energy	8
Acceptable environmental impacts for the lowest costs	9

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School of Environment and Sustainability
 University of Saskatchewan
 Room 323, Kirk Hall
 117 Science Place
 Saskatoon, SK S7N 5C8
 Canada