

Standing Committee on Crown and Central Agencies

“Meeting future needs as a community benefit.”

Disclaimer:

The comments made in this submission are solely those of the author, they do not necessarily represent the views of the University of Regina.

Summary:

1. We (in the province) need to consider our energy future within the context of continental energy policy development. This means that we have to be prepared for a continent wide cap and trade system to reduce greenhouse gas emissions and that the price of CO₂ will increase with time. This will occur in a framework of increasingly stringent standards for other criteria air contaminants.
2. We need to be good resource managers and use our resources for their greatest value, coal should continue to be part of the electricity mix, gas should be reserved for higher value uses such as petrochemicals, heating and peak power production. This means that we will need to deal with the climate implications of coal use in order to continue using coal as part of our energy mix. The production of electricity should not occur in the absence of an understanding of provincial resources and provincial benefits from use of these resources.
3. We need to rethink the economics and ownership of electrical production. Distributed energy use can be one of the mainstays of sustainable communities in the province. The economics of energy production need to be rethought from the perspective of “community economics”, which is more forgiving of cost due to local economic and environmental benefits. Electricity pricing and procurement could reflect the need to expand distributed generation and to support local manufacture of distributed generation systems.
4. We need to understand the costs and benefits and other implications of CO₂ capture and storage. This has to include the broader benefits of emissions reductions (non-CO₂ emissions like SO_x) and the benefits of the economic development of home-grown technology leading to manufacturing and export potential. Encouraging public-private-academic partnerships will be a powerful tool to this end.
5. Beyond electricity, there are numerous opportunities for energy and economic development in the province. In many instances, these developments will require advanced technology and a willingness to “think and act outside the current framework”. Our goal should be a systematic review of our resources and the technologies available to produce and use these resources – this is not as easy and straightforward as it may seem. There has to be a willingness to look at the opportunities for technologies from different segments of the energy sector. This concept is only superficially evaluated in this document since the primary purpose is to look at meeting electrical requirements for the future.

6. Alignment of procurement policy to support and encourage new technology development and deployment from provincial sources in Saskatchewan should be encouraged, recognising limitations created by Interprovincial Trade agreements. The province can play a significant role in helping communities to develop their energy strengths with the ensuing economic benefits that will accrue to the communities.

Introduction:

The Standing Committee has asked stakeholders in the province to comment on how the province should meet its growing energy needs. The terms of any discussion were outlined as:

“How should the Government best meet the growing energy needs of the province, in a manner that is safe, reliable and environmentally-sustainable, while meeting any current and expected Federal Environmental Standards and Regulations, and maintaining a focus on affordability for Saskatchewan residents today and into the future?”

The province of Saskatchewan is blessed with a huge and diverse energy resource base. This is an opportunity in the sense of providing reliable and competitively priced energy to the residents of the province, but it carries with it an obligation to use these resources in a responsible manner. It is also an opportunity in the sense that we have the resource base to provide energy from a wide variety of sources and can evaluate their use in Saskatchewan and beyond.

As the Standing Committee evaluates the growing need for energy and how this energy is provided, it is important that it also look at the overall impacts and benefits of those energy sources to the residents of the province. This paper will attempt to identify some of the issues and how those issues may be turned to opportunities. While conservation and energy efficiency are usually the best way to get started in meeting future energy needs by reducing energy consumption and the need for new infrastructure, they will not be discussed in this paper beyond saying that they should be pursued aggressively. The Committee will receive many view points on conservation and the efficient use of energy. The only caution to add here is that energy efficiency is not always the most economical route forward and so the technologies being evaluated need to be compared to other options on a “level playing field” basis.

Fossil Energy Resources:

Saskatchewan has available significant oil and coal resources, as well as some gas resources. It also has resources of oil shale.

The accessibility of our oil resources is very much an issue of technology development and deployment. For example, economic access to the premium quality oils of the Bakken Formation (the Bakken Play) is a result of the development of better systems for fracturing the rock along a horizontal well. Access to heavy oil is dependent on the development of technology to reduce the viscosity of the oil to allow it to flow more freely to the production well.

The accessibility of coal is easy from a technical perspective, but more complex when it comes to dealing with the emissions. Coal is also a low quality, but abundant resource in the province, with extensive

resources in the southeast/south central regions and a developing understanding of our resources in the northeast.

For the future, we have oil shales and oil sands that have the potential for development if technology can be demonstrated that is environmentally friendly.

In short, Saskatchewan is well endowed with fossil resources that can be used to the benefit of the citizens of Saskatchewan. Many of these resources require technology for effective development and environmental protection.

Other Non-renewable Resources:

The province is also home to significant Uranium resources. While we mine these resources, we do no further processing or, currently, make use of these resources. There is significant potential for use of the resource to produce electricity and other energy forms in the longer term. Other uses might include heat (steam) for the production of oil from our oil sand deposits and the production of hydrogen for upgrading of our heavier oils.

Renewable Fuels:

The province is also blessed with an extensive inventory of renewable resources. These include the conventional resources of wind and water, as well as biomass and geothermal. Solar can play a role in terms of water heating, but solar photovoltaic and solar concentrators have some distance to go before being economically viable.

In addition to thinking of renewables as stand-alone sources of energy, there is also the potential to integrate them with the production or use of fossil resources, thereby reducing the greenhouse gas impact of the fossil fuels.

Issues:

There are huge opportunities in the province to take leadership in the development and deployment of technology to allow us to provide reliable and competitively priced electricity and other forms of energy to our population, as well as to open new economic benefits. No form of energy comes without its challenges, be they siting, technology, environment or competition for resources. These must all be viewed in context and appropriate policy and regulation developed.

Fossil energy: the resource base is huge, but the environmental issues are equally large. As a province, we have benefitted from the use of fossil energy for our development to a prosperous province with a high quality of life for our residents. There is no reason that we should not continue to enjoy the rewards of this natural endowment, but we need to play our role in dealing with the issues created by fossil fuel use.

The province must be a leader in dealing with issues of pollution and CO₂ production from fossil fuel use and its recovery. We have gone some distance in deploying

technology for criteria air contaminant reduction, but have a long way to go yet. SaskPower deserves commendation for its work on mercury capture for example. The next step is dealing with CO₂ emissions from our use of fossil fuel. For this, the province has invested significantly in technology development in the province.

Our coal is a low value commodity, with limited economics for transport. This suggests that our coal should be used to produce electricity in the province, dealing, as noted above, with the emissions from coal, since export is limited. As technology progresses, we should also be looking at coal as the supplier of multiple products (gasification, coal to liquids, petrochemicals). Expertise to evaluate technology is available at our two Universities and the Saskatchewan Research Council. Our gas supply, on the other hand, is limited, but is easily transported for high value uses such as space conditioning and petrochemicals. This suggests that gas is not a good choice from a resource management perspective for base-load power generation. Gas, however, is an excellent choice for peak power generation to offset the use of intermittent renewable energy systems. While gas is cheap today, it is also very volatile from a price perspective, unlike coal.

Heavy oil, oil sands and oil shales all have great potential. They all require extensive use of energy to produce, upgrade and refine to final products. We must continue to be a leader in technology development to make use of these resources and we must also be willing to evaluate new technologies for their exploitation. We have certainly been guilty of ignoring potential opportunities in favour of conventional schemes for their exploitation. New concepts could include the use of biomass to help reduce the climate impact of the recovery of these resources, use of techniques to produce gas as opposed to liquid fuels and probably many other opportunities. In particular, the opportunity is there to downscale development to create more regional economic benefits in the province.

Nuclear: While nuclear power is essentially free of air pollutants and CO₂, it carries with it a series of other issues. These include public concern about radiation from power plants and waste storage. The result is long lead times to develop nuclear energy. The biggest issue is nuclear waste. As with the use of fossil fuel, waste can no longer be seen as “someone else’s problem”. If we are to take advantage of the convenience offered by extensive use of energy, we should also be willing to deal with the side effects of that energy use and be leaders in developing ways to mitigate these side effects. This latter statement applies whether we use nuclear energy or fossil energy.

Given our history with the development of nuclear energy in Canada and many other parts of the world, the long lead times for development and commissioning of nuclear facilities means that this is not a short or even a medium term option for our energy needs. Understanding costs today may well be irrelevant by the time a nuclear plant could come on stream. This is not to say that nuclear will not be an important part of the long term energy supply in the province, just

that we need to consider it in the context of entering it into the long term mix and not in the more immediate term.

In addition to the aforementioned issues, the use of large scale nuclear energy development will not be practical for the provision of heat for recovering our vast resource of heavy oil and oil sand. There needs to be the development of small scale nuclear reactors to generate the steam for enhanced oil recovery (steam cannot be transported more than about 10-15 km). To make nuclear reactors a source of hydrogen for upgrading, there will need to be the demonstration of new generation, high temperature reactors and the development of catalysts for the thermal breakdown of water to produce the hydrogen. This will need to go hand in hand with the demonstration of pipeline technology to transport hydrogen over long distances. These all require time.

Renewables: Renewable energy falls into two categories, those that are intermittent and those that can operate on a 24 hour basis. Wind and solar fall into the former category. Wind is becoming very cost competitive (see the report from SaskPower), but has an issue due to the need to have replacement capacity for the periods of time the wind is not blowing. There is also a need to ensure the stability of the grid as the intermittent supply of electricity increases. Beyond its use for water heating and in niche applications, solar is still too expensive to be deployed for electrical generation. Its intermittency raises the same issues as wind. In addition to the technical issues facing intermittent electricity supply, there are issues around the aesthetics of major solar and wind installations. The local population must be prepared for and accepting of such energy systems.

Biomass offers the opportunity for continuous or base load generation as well as the production of other fuels such as hydrogen and syn-gas. Biomass comes with its own set of issues that include the inability to transport low-energy density feedstocks over large distances, requiring small scale systems. Transport and the location of energy systems literally in “someone’s back yard” will need to be dealt with. Distributed systems offer the solution to long distance transport. Energy densification can also provide a mechanism that will allow material to be transported over greater distances to larger scale installations.

Opportunities:

Fossil fuels:

1. Coal is a major, stable-priced commodity in the province with limited transportation opportunities due to its low quality. It has provided a competitively priced, reliable electricity supply in the province for many decades. It can and should continue to provide electricity for many decades to come. The opportunities for coal lie in the development of clean coal technologies, particularly CO₂ Capture and Storage. By continuing as global leaders, we can reap the benefits of the economic development that come with aggressive promotion of our technology. Opportunities also lie in the value-added development of our coal reserves by the private sector for activities such as

coal to liquids, coal gasification and the production of electricity (all with CO₂ capture). Our goal should be the ongoing effort to ensure that energy can be supplied to the consumer in the most competitive and environmentally friendly way possible.

2. While limited in their application in the electrical sector, the development of our non-conventional oil resources (heavy oil, oil sand and oil shale) offer great long term economic development. Technology is the key to development in an environmentally sustainable manner. There is, however, a need to look at a broader variety of technology options and to be willing to assist in the demonstration of these technologies. Leaders need to be willing to take risks for longer term development when the private sector is inherently conservative in its technology outlook. Biomass technologies may well be good adjuncts to development of our non-renewable, non-conventional resources.
3. CO₂ capture from all sectors of our fossil fuel industry will be a key component of our ability to continue use of these resources. Saskatchewan has been recognised globally as a leader in this area of research and stands to benefit from this ongoing leadership. This will require a commitment from the province to continue to support its institutions and industries to make Saskatchewan technology a “household name” globally. Countries such as Norway and France offer precedents for the active engagement of the public sector in commercialisation and deployment of domestic technology development through the use of public procurement to integrate the benefits of economic development and domestic technology deployment.

Nuclear:

Nuclear energy offers a clean alternative to fossil energy in the province in the longer term. Technology will allow the province to make decisions on scale as these technologies become viable. Large scale would allow for centralised generation of electricity and small scale would potentially allow for the production of steam for heavy oil recovery. High temperature with the thermo-chemical cracking of water would provide hydrogen for oil upgrading. Work is underway on some of these technologies, but the use of nuclear for hydrogen production is not in place yet. The province, probably through the UoFS, should be maintaining a close watch on technology development and potentially engage where gap areas are identified.

As noted, while this is a controversial subject, the storage of used nuclear fuel in a safe and environmentally friendly way is critical for the broad acceptance of the full nuclear fuel chain. As a beneficiary of the sale of Uranium and a potential user of nuclear energy in the future, the province should also be involved in understanding more about the methods for safe storage. The evaluation of CO₂ storage has taught us much about safety in the subsurface and this knowledge could be used to advantage in developing solutions to the waste issue, even if the province is not directly involved in this activity.

Renewables:

Renewables are truly exciting from many perspectives. It is my belief that the greater opportunity lies in biomass systems (as opposed to other renewable energy systems) and so will focus on the opportunities presented in these rather than make further comments on wind and solar (or even micro-hydro), which have been covered in other discussions. In addition, I will comment briefly on geothermal, but the Committee has received an excellent review from Brian Brunskill.

There are several ways of obtaining electricity from biomass, but the most effective are gasification and pyrolysis. Each of these processes offers its own strengths and weaknesses. The route to electricity is through the creation of a syn-gas (Carbon Monoxide and Hydrogen primarily) which can then be burned in an internal combustion engine or a gas turbine to produce electricity in a generator. The heat can be used for heating purposes or production of electricity or both. These systems are robust and can be operated in remote locations.

Moving to biomass in a community setting offers the opportunity for supporting sustainable communities. More of the resources stay in the community and new jobs are created with incomes and related taxes circulating in the community. In addition, biomass systems can be used to turn municipal solid waste into electricity as well as using agricultural surplus and forestry waste. This local use of commodities adds to diversification in the community. The value of keeping money and people in the community will lead to different economics than for the conventional private sector – these include jobs, money staying in the community, local taxes, services from within the community, lower tipping fees for landfill and so on. Public-private partnerships offer a model for developing this type of symbiotic relationship.

One of the issues with biomass is its low energy density restricting transportation distances. To some extent, this can be overcome by the use of energy densification processes. This means the creation of “bio-coal” or “bio-liquids” in more remote locations allowing longer transportation distances for these more energy dense products to be realistic. These processes may also create useful by-products such as bio-char for soil improvement and carbon sequestration in soils.

As a final note, biomass systems can also be designed to produce hydrogen, offering the potential for hydrogen to be used in field scale heavy oil upgrading processes and as we move to hydrogen for transportation. Additionally, these biomass technologies may also be part of the answer to using our unconventional energy resources such as oil shales.

Geothermal in the province is widespread, but low quality. Many aging oil wells are producing little but warm water. While these are usually remote from places that need heat, the potential to use these for heating such things as greenhouses remains and could be investigated.

Conclusions:

The province sits on a wide variety of energy resources that offer the opportunity to meet our future needs in a diversified way. Managed effectively, these resources can provide competitive and environmentally friendly electricity and other energy forms, and can be used as the basis for assisting our rural and remote communities to become more sustainable both socially and economically.

While much of the technology exists, there is still a need to work on technology adaptation to Saskatchewan needs, developing systems that are optimal to our needs and to continue research into improved systems. The use of public-private-academic partnerships to meet our needs will be crucial. It is also important that we move expeditiously as a province to develop opportunities and to capitalise on the ancillary benefits that accrue such as manufacturing, export and reduced dependence on landfills.

Public-private-academic partnerships are powerful, but are underutilised. The province should look more to fostering these relationships to the benefit of the province. This will include the willingness to invest in post-secondary educational facilities research and demonstration capacity as well as creating the appropriate procurement practices in the province to encourage the deployment of technologies once they are ready to move to commercial – this can be accomplished with appropriate provincial policies as well as creating the framework that allows smaller communities to easily access energy opportunities.

Thank you for the opportunity to present.

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