The Coordinating Sector appreciates the opportunity to provide feedback on the issues outlined under the Future of the Grid in the MISO Region for the December 6, 2017, MISO Advisory Committee meeting.

EXECUTIVE SUMMARY:

The Future of the Grid in the MISO Region is a timely topic for discussion between the MISO Advisory Committee and Board of Directors as changes in the energy industry continue to accelerate. There are a number of trends the Coordinating Sector has identified (some of which will be discussed further, below) that will drive the Future of the Grid, many of which we are already familiar and which will continue: the use of coal as a fuel source will continue to decline despite efforts to maintain its historical importance; carbon pricing may become a reality at least at the State level; there will be a continued push for more renewables; increased storage will become a reality particularly to the extent it offsets otherwise significant generation and transmission investment (and of course, assuming that the price signals are there to encourage its development and participation); load growth for traditional load will remain flat as there is an increased emphasis on demand resources, energy efficiency and smart metering efforts (but should decarbonization prevail, electrification of transportation and space heating could drive new load growth); customers will continue to be more knowledgeable in the area of energy and will want more choice and control over their energy supply; increased DER penetration will require better visibility and transparency at the T-D interface and will necessitate enhanced communications amongst all the players (DER owners and providers, transmission owners, RTO’s, customers); and development of large transmission projects needed to cope with new consumer behaviour (electric vehicles and space heating) and new generating sources (whether local and distributed or remote and renewable) will continue to be a challenge.

The Future of the Grid will be impacted by severe weather disturbances, increasing numbers of smart devices connected to it as well as the growing level of cyber threats, a relatively recent phenomenon. As a result, reliability and resiliency will be a pressing concern necessitating a comprehensive review of existing systems and equipment and making the necessary upgrades and investments to ensure the grid is adequately protected.

All of these changes that will drive the future (and the list is not exhaustive) will require participation by a vast array of stakeholders and perhaps most significantly, will require a shift in the paradigm that has been the status quo for the last number of decades. Stakeholders are up for
the challenge as they start to understand and adapt to the new approaches and technologies which in the end will continue to support a reliable and resilient grid.

**Hot Topic Questions**

1. What are the medium- to long-term actions that Sectors are contemplating or expecting, either to be responsive to evolving customer preferences or otherwise? This could include, but not be limited to, State plans related to Renewable Portfolio Standards, energy efficiency and/or economic development; utility strategies related to load trends, economic efficiency and/or anticipated growth of emerging technologies such as distributed energy resources and energy storage; and customer interests in technology options and control. Also, how might these actions impact future grid needs, functions and operations? In your response, please address the timeframe you are considering, as well as the roles of the various parties involved.

The Coordinating Sector anticipates several trends that will be seen over the coming 5 to 15 years which will significantly disrupt the current energy industry environment. These include: advancements in the volumes and types of distributed energy resources (DERs) including distributed generation (ie: solar), energy storage (including electric vehicles (EVs)), behind the meter generation and microgrids; increasing demand side management (DSM) efforts (energy efficiency, demand response and net metering including the use of smart meters); a continued push for cleaner energy solutions including, at least at the State level (and more recently in Canada) the introduction of carbon pricing mechanisms; and changing customer demands and expectations particularly as ongoing advancements in the interconnectedness of the digital world continue at a rapid-fire pace.

Each of these trends will bring with it opportunities and challenges

Advancements in DER and DSM will disrupt traditional business models as we know them today. Comprehensive pricing mechanisms currently are not in place that would enable the integration of the distribution system with the wholesale energy market. Those same pricing mechanisms need to be enhanced to ensure that price signals create the impetus for resources (both at the distribution and wholesale levels) with unique attributes to participate in the market and offer their products and services (for example, batteries including hydro resources, capable of offering energy storage). As these technologies become better understood, adopted and integrated into the grid, resources may well end up be situated “closer to home”. Depending upon the variable nature of local distributed resources and changing customer behaviour, planning and development of both long distance transmission and the local distribution system may face new challenges including the need for better coordination between the two systems.

While taking advantage of these new technological capabilities may be possible for many customers (thereby placing pressure on more traditional generation resources), accessibility will not be universal and will depend on the customer’s willingness and ability to pay (even considering the potential revenue stream associated with reduced energy usage/time-of use-charges and/or the ability to sell the stored energy back to the grid). In the end, however, as with all things, there is not a one-size, fits-all, solution and what may make sense in some areas and for some customers, may not for others. For example, electricity prices in the Province of Manitoba are among the lowest in North America (approximately 8¢/kWh) and Manitoba Hydro
continues to develop its vast hydro resources. In such jurisdictions, as long as prices remain competitively priced and energy supply remains adequate, development of non-conventional forms of generation may not be required. In other areas however, rising energy prices and the availability of a diverse set of resources will have the opposite effect, driving customers to explore alternative options and technologies in how their electricity is delivered. Having said all of this, lowest cost on a strict €/kWh may not in the end, be the deciding factor as much as the effects of incorporating the true cost of carbon and DSM programs. Local conditions and preferences, which will drive public policy, will significantly impact the future of the grid.

While Manitoba Hydro’s generation portfolio continues to favour hydro development, DSM, including our Power Smart energy efficiency program, will continue to be an area of focus. Under Manitoba Hydro’s current long range plan for DSM, Power Smart initiatives are targeted to achieve energy and demand savings of approximately 4,500 GWh and just over 1,200 MW by 2030/31. It is worth noting that the Province of Manitoba has tabled legislation to create a new crown corporation to be known as Efficiency Manitoba which will have a mandate to provide DSM programming. While Efficiency Manitoba is still in its formative stage, Manitoba Hydro continues to deliver Power Smart programs to meet the needs of Manitoba customers.

Manitoba Hydro launched its Solar Energy Program on a pilot program basis in 2016. This two-year pilot offers incentives to qualifying customers for the installation of Solar Photovoltaic (PV) systems to displace a customer’s electricity requirements. This pilot program targets residential and small commercial customers and forecasts 95 customers to participate. Installation of PV self-generation is forecast to supply a total of approximately 2 GWh of energy annually over the two years with a utility investment of $1.4 million. After 12 months, 47 residential customers have installed a PV system representing just over 0.5 GWh of self-generation with 182 customer applications pending. To date, no installations have been completed by commercial customers under the pilot.

The Solar Energy Program pilot offers the ability for Manitoba Hydro to evaluate the opportunities and challenges of PV in the Manitoba market, the processes required to support the technology, and the effects on the Manitoba Hydro distribution system.¹

Local conditions may also see the development of more microgrids which may have profound effects on the utility business model by reducing revenue but still requiring the utility to continue to be able to supply the power needed by the microgrid when it is unable to operate independently. For a comprehensive review of types of microgrids in existence or currently under development, see:


Cleaner energy solutions will continue to be at the forefront for many States regardless of what may occur at the federal level. Even the use of natural gas could lose some of its luster as public policy drives the preference for increased use of greener options (wind, solar, hydro) and new-and-improved technologies, noted above, continue to decrease demand. Advancements in the establishment of carbon pricing mechanisms may be seen increasingly at the State level,

regardless of the federal approach. Several States (Massachusetts, Rhode Island, Connecticut, Vermont and Washington), are continuing in their efforts to introduce such legislation designed to reduce GHGs by placing a price on carbon. In Canada, the federal government announced in May, 2017, its intentions to implement a federal carbon tax starting at $10 per metric tonne of GHG emissions commencing in 2018 (for those provinces that do not currently have a carbon tax in place, including Manitoba) and increasing by $10 per metric tonne every year until reaching $50 per metric tonne by 2022. Corporations (including BP, Xcel Energy, Shell and Google) too, are recognizing the price of carbon and incorporating it into their risk analysis of future projects.

In the end, the evolution of the grid will be significantly dependent upon on the end-use customers’ preferences and demands which will drive many of the public policy decisions around resource and technology preferences and which will increasingly play a role in shaping the evolving utility business model. We will continue to see customers placing increased value on choice and controlling their energy “lives” at the same time they will call for simplicity in the process in addition to accessing the full value of the revenue stream to which they will feel entitled. Customers will play a major role in shaping the future of the grid.

2. What reliability and resiliency attributes should the future grid possess to enable and support the resource fleet of the future?

The ability to deliver electricity (reliability) and the ability of the grid to recover from a disruptive event (resilience) will become more challenging as the sheer number of and types of devices that interconnect to it significantly increase (net meters smart meters, EVs etc.). In addition, extreme weather events (the leading cause of power outages in the US between 2003 and 2012) will pose challenges for planning and designing of the systems in order to increase grid resilience. Lastly, the growing interconnectedness of the grid will give rise to increasing cyber-attacks, a relatively recent phenomenon occurring over the past decade.

When reliability and resiliency attributes of the future grid are being discussed, an inclusive listing of the major grid outages should be considered: cyber-attacks, drought and water shortages, earthquakes, floods and storm surge, hurricanes, ice storms, major operations errors, physical attacks, regional storms and tornadoes, space, weather and other electromagnetic threats, tsunamis, volcanic events and wildfires.3

Whatever the issues, operational and planning functions will be challenged. But grid reliability and resiliency can be enhanced by a number of things already going on including increasing energy storage, investment in transmission and generation infrastructure and maintaining a diverse portfolio of resources. As in the case of customers’ choices and preferences in how their energy is delivered, there is not a single solution for resiliency which may differ region-by-region.

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As efforts continue to modernize the grid, systems that were installed years ago will need to be upgraded. Real time environments will be required for proper security evaluation by security experts. Information systems will need to connect all the elements of the grid. Smart meters will aid in resiliency by predicting, alerting and identifying the potential problem spots, whether man-made or occurring naturally. Reviewing and analyzing previous outages while engaging in exercises that simulate outages caused by nature or man-made, will improve emergency preparedness. Overall, a reliable and resilient grid will include fewer outages and interruptions (for all customers including perhaps most importantly, critical consumers of electricity like hospitals and first responders) while maintaining or lowering the overall societal costs associated with those events when they occur.

3. Reflecting on your responses to the previous questions, are there aspects of the future grid for which additional study and research would be beneficial? Who should conduct it?

This report, Enhancing Resilience, referenced above, takes a comprehensive view of grid resilience and offers a series of practical recommendations in moving toward a more resilient grid. Two of the overarching recommendations are for more regional emergency preparedness exercises and for investment in infrastructure to expedite recovery from failures. For example, it recommends that issues like the failure of a high percentage of hospital backup generators in New York City to start during Superstorm Sandy, be addressed. Other recommendations call for the considerable expertise in the Department of Energy, the Department of Homeland Security, FERC, NERC and the utility industry to be coordinated and focused on grid resilience. Enhancing Resilience recognizes that the causes of grid failure are diverse and that decisions about grid reliance are inherently a political process involving state and regional grid operators and emergency preparedness organizations (who can provide systematic assessments of threats and options for enhanced grid reliance) as well as national and state regulators (who can decide what levels of grid enhancement should be implemented, who should pay and what other responses are appropriate such as achieving a balance between efforts to prevent failures, manage and recover from failures).

In addition to ongoing work to both predict and address man-made and naturally occurring disruptions, the impact of increased renewables and DER – both of which are intermittent and will require sufficient backstopping of resources – will require ongoing study and research the extent to which will become more clear once there is increased visibility into the levels of penetration (particularly as that applies to DER). While opinions abound as to who should be charged with these studies (distribution system owners, distribution system operators, transmission owners, States, MISO, NERC) it is clear that all have a role to play. Preliminary discussions then, need to include all parties in addition to involving leading industry experts and drawing upon the myriad of studies already taking place now and in the future. These discussions will better inform as to the roles and appropriate jurisdictions of each of the parties as the issues are identified and investigated and the industry moves forward.

While MISO no doubt has the modelling expertise to study the probability of unserved load for a variety of large scale emergencies, defining the scenarios and assumptions for a comprehensive study of grid resilience requires input far beyond traditional MISO stakeholders. However, there may be some externally defined scenarios (such as whether a 90-day fuel supply at selected resources would have a significant impact on the probability of unserved load for historical emergencies) which are more limited in scope and which may be valuable to external decision makers.
makers. But even such focused studies should only be undertaken after broad input beyond traditional MISO stakeholders.

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The Coordinating Sector
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