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ELECTRICITY TRANSMISSION POLICIES: **ISSUES AND ALTERNATIVES**

Editors:

Robert Mansell

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We would like to express our appreciation to all participants in the “Electricity Transmission Policies: Issues and Alternatives” workshop sponsored by the School of Public Policy and acknowledge the substantial contributions made to the organization of the workshop by Dr. Michal Moore, Jillian Dowding, and Ashley Jones.

CONTENTS

Summary	3
The Alberta Context	3
Transmission Policy Challenges and Alternatives	4
Concluding Observations	6
About the Workshop	8
Exploration of Transmission Policies	8
The October 7 Workshop	8
Agenda	9
Participants	9
Short Bios For Presenters, Discussants and Panel Members	11
SESSION 1: The Alberta Context	13
Jeffrey Church: Presentation of Discussion Paper	13
Joseph Doucet: Discussant	14
Larry Ruff: Discussant	16
Richard Tabors: Discussant	16
General Discussion	17
SESSION 2: Transmission Policy Challenges and Alternatives in the New and Emerging Energy and Environmental Context	20
Panellist: Michal Moore	20
Panellist: Sheldon Fulton	21
Panellist: Gary Holden	21
Panellist: Steven Stoff	22
Group Discussion	23
Wrap Up Summary and Next Steps	25
Overarching Elements of the Discussion	25
Closing Points on the Day	25

WORKSHOP PROCEEDINGS

SUMMARY

The School of Public Policy at the University of Calgary hosted a workshop on Oct. 7, 2009 for the purpose of exploring transmission policy issues and alternatives. The workshop was attended by about 40 individuals by invitation representing electricity sector stakeholders and experts from industry, government, non-governmental organizations and academia.

An efficient and reliable electrical system is the backbone of any modern economy and society. It is also central to policy discussions concerning the growing energy and environmental challenges and opportunities. Electricity can facilitate or prevent many of the changes required to meet these challenges. In both Canada and the United States, there has been relatively little new investment in this important component for many decades. But this is beginning to change. At the national and regional levels in both countries, policy-makers are heeding calls for expansion, upgrading and better integration and pricing of transmission facilities. These investments will achieve goals in efficiency, reliability, security and environmental or clean energy.

The Alberta Context

The first workshop session focused on transmission policies in Alberta, an innovative region that has adopted a market approach to electricity generation. The provincial government is proposing, through Bill 50, to alter the regulatory process and introduce the concept of Critical Transmission Infrastructure. With this approach, the government determines certain transmission and related facilities to be in the public interest. It suspends the regulatory process which, under the *Electric Utilities Act*, requires the Alberta Electric System Operator (AESO) to demonstrate a need for the facilities and a finding by the Alberta Utilities Commission (AUC) that such facilities are in the public interest.

The discussion paper by Jeffrey Church, William Rosehart and John MacCormack* focused on the evolution of the institutional framework and a test of the efficiency implications based on an evaluation of the economic benefits and costs of the two large High Voltage Direct Current (HVDC) lines proposed as critical transmission infrastructure in the Edmonton-Calgary corridor. There was also a brief evaluation of the regulatory process under Bill 50. The efficiency analysis was based on published estimates of costs for the facilities, the basic assumptions used by the AESO, a model of the Alberta Integrated Electrical System (Alberta's power grid) and a number of scenarios reflecting variations in such things as the development of wind power, natural gas prices and carbon policies. Based on this analysis, the authors concluded that the net present value of the additional costs of the proposed lines for the Edmonton-Calgary corridor under the most probable conditions were about \$2 billion,

* To access this paper, please visit
www.policyschool.ucalgary.ca/files/publicpolicy/TransmissionPolicyONLINE.pdf

compared to alternatives involving the placement of gas-fired generation closer to the load. Further, it was argued that while there would be other benefits associated with the lines, there was no evidence presented by the proponents of Bill 50 that such benefits would be large enough to justify these additional costs. Finally, the paper concluded that there are significant benefits of a regulatory process in making decisions on the need for such facilities. It also expressed doubts that the state of reliability and supply adequacy justify the type of emergency response embodied in Bill 50.

The general conclusions in the discussion paper were that “the existing system creates excessive demand for expansion of transmission facilities and discriminates against generation located near to load, raising the cost of delivered energy”, that the new transmission capacity proposed as part of Bill 50 is “economically inefficient and unwarranted” and that restoration of the regulatory process is advisable. These conclusions drew both compliments and criticism.

While the technical analysis in the paper was not challenged, there were numerous suggestions for improvements. These were centered on: the advisability of taking a broader approach, including consideration of: demand side management; incorporating generation from other energy sources than those chosen in the analysis for comparison; evaluating changes in market power by generators; recognizing the political issues, including the Government’s Energy Strategy, driving Bill 50; and incorporating the breadth (rather than just a slice) of the electricity system. It was suggested that the economic and regulatory questions addressed could be “two separate papers.”

Finally, it was felt that dissenting views on the effect of Alberta system’s locational signals, which the paper concludes are largely absent or weak, may warrant more detailed investigation to determine their actual efficacy. (Note that a revised version of the discussion paper was produced incorporating many of the suggestions and more clearly articulating the paper’s limitations.)

Transmission Policy Challenges and Alternatives

The second session of the workshop (*Transmission Policy Challenges and Alternatives in the New and Emerging Energy and Environmental Context*) was intended to focus on the broader and longer-term issues associated with the development of electrical transmission. Specifically, the group discussed state of the art in determining and achieving efficient and appropriate levels and types of transmission infrastructure and examined what could be learned from other jurisdictions.

The panel members represented a wide range of experience and discussion by the experts on the panel was at a more general level. However, the discussion often gravitated back to the discussion paper and Bill 50. Observations from this session are summarized below.

- There were concerns with the process Alberta is undertaking and with the singular solutions proposed, but few expressed direct opposition to the need for new or reinforced transmission facilities.

- There was a view that costs and benefits of transmission should be quantified and better incorporated in decisions relating to the way the Alberta transmission system is developed in the future. There is also concern that pursuing a constraint-free system threatens long-term competitiveness of electricity supply in Alberta and those sectors most highly dependent on it.
- Participants viewed the regulatory/involvement process as a “quite separate issue” from the economic question of the proposed transmission improvements. The concurrence of the two issues complicates reactions to Bill 50. The regulatory/involvement process appears to warrant re-examination. There were concerns that dissenting views will not find a place in the revised process applied to Critical Transmission Infrastructure (CTI), and that the regulator’s traditional role appears to be usurped by government. As one of the workshop speakers observed: “There is no greater public policy challenge than trying to get the process right.”
- With respect to the solution set out by Bill 50, there is a body of sentiment that questions the government’s overall intent. This is spurred in part by the insufficiency of the business case underlying the government’s policy of zero transmission congestion. In dealing with this or other drivers of transmission development (such as water issues, export potential, or the political cost of system interruptions), the debate and decision making needs to be better informed by a transparent and explicit articulation of alternatives and their net public interest benefits. Even for investments that are a small fraction of those contemplated under Bill 50, good practise requires that the business case be documented, tested and made public.
- The generation-transmission planning structure prior to deregulation no longer exists. In its absence, the use of pricing to influence economic decisions regarding the location of generation should be re-examined. Lacking effective pricing signals to ensure transmission development costs are properly incorporated in generation location decisions, other jurisdictions have turned to regulatory solutions to ensure these costs are taken into account. Concerns were expressed that without a regulatory check on excessive or inefficient transmission development, decisions will be made on the basis of short-term political considerations rather than transparent expert analysis and informed debate of what are complex issues with significant cost implications. However, it was noted that it may be the elected officials who are ultimately held responsible if the “lights go out.” As well, the view was expressed that Alberta’s political response to getting transmission facilities built reflected a long period of frustration with what some called a “broken” regulatory system.
- In general it was observed that the North American electricity grid is a very large and complex machine. It was suggested that for major transmission development, it is extremely important to have thorough analysis (including cost-benefit analyses). The ultimate decisions must be made within an effective, efficient and predictable regulatory structure based on technical, economic and public interest merit.
- It was also suggested that this approach incorporate the notion of option value. Transmission projects involve large, sunk, specific and long-lived capital investments. Given these characteristics, transmission investment decisions must reflect the considerable uncertainty about such things as future electricity demand, energy prices and generation options. In such an environment, it is very important that the analysis reflect the substantial value in maintaining the flexibility required to create better solutions in the future.

Concluding Observations

Overall, discussion highlighted the complexity of electricity transmission challenges and generated a robust debate of the issues and alternatives. The main points outlined above and in the detailed workshop notes are presented to help inform an open and constructive discussion of these issues and solutions.

Of particular note are a number of issues suggested by the discussions at the workshop that would seem to warrant further thought and analysis in the development of transmission policies. These include the following.

- The importance of a complete and thorough business case for all transmission investment projects that is available for public scrutiny and independent testing. While recognizing the costs and frustrations with regulatory processes, having these decisions being made in the political arena with inadequate transparency, impartial testing and documentation may well undermine even the best of intentions.
- This business case should include a quantitative evaluation of all aspects of the determination of need and a quantitative evaluation of the benefits and costs of all viable alternatives in meeting need and standard reliability criteria.
- The alternatives evaluated should recognize the tradeoffs and complementarities between electricity generation and transmission capacity and the analysis should incorporate appropriate techniques (such as scenario analysis and the use of option values) to take into account the considerable uncertainties with regard to future loads, technologies and generation sources. There should also be attention paid to the addition of ‘smart’ attributes to the grid that can significantly expand the options for and effectiveness of demand management.
- Policies with regard to transmission investments must take into account broader energy and environmental policies and strategies at the regional, national and international levels. Of particular importance are the growing challenges associated with carbon management policies and the new natural gas supply situation that provides opportunities associated with the expanded use of natural gas in electricity generation. However, there is still need to keep a sharp eye on the overall cost of delivered electricity which can depend on transmission costs as much as generation costs. Particularly in situations where there is an absence of strong locational price signals to ensure transmission costs are factored into generator’s locational decisions, it will be critical that there be effective checks on the tendencies to overbuild transmission capacity. While excessive transmission costs will negatively impact residential consumers, the largest burdens will be borne by the industrial and commercial sectors and this can significantly impact the competitiveness of an Alberta location.
- There are a number of specific issues that appear to warrant examination or re-examination. Experts in market design are not generally convinced that a policy of zero congestion for transmission planning is socially optimal or in the public interest. There are disagreements as to the strength of locational price signals and suggestions that these need to be significantly strengthened if market-based generation decisions are to be consistent with minimizing the delivered price of electricity. And, while it has been argued that significant

expansion of the transmission system is required to have workable competition in the generation of electricity, this issue requires a careful evaluation. Further, some generators have argued that they entered the Alberta market on the basis of promises of zero congestion transmission and any departure from that would amount to an expropriation or undermining of their large, sunk investments. While there are frequently used 'grandfathering' approaches to deal with such issues, this nevertheless highlights the importance of explicitly taking into account the impacts of policy changes on sunk investments.

- The issue of electricity exports requires evaluation and needs to be incorporated in the development of transmission policy. There has been a reluctance to acknowledge the possibility that new transmission facilities, such as those envisioned under Bill 50, might facilitate electricity exports in the future. This reluctance appears related to concerns that Alberta electricity consumers will be 'subsidizing' such export activities through their payment of the costs of the new transmission facilities. However, it may well be that substantial electricity exports over the long term represent a viable, high valued-added activity that can strengthen and help diversify the provincial economy. Rather than ignore such a possibility in the interest of avoiding the perception of Alberta ratepayers subsidizing exports, it may be better to acknowledge that the only real issue and one that can be dealt with openly is the appropriate sharing of these costs between exporters and Alberta ratepayers.

ABOUT THE WORKSHOP

Exploration of Transmission Policies

The School of Public Policy at the University of Calgary has embarked on a series of events to explore the issues and alternatives for the purpose of informing policy development in our changing environment. Possible changes to transmission policies in the United States and Canada are the first topic for exploration.

The workshop focused on policies in Alberta and relevant to the province, an innovative region that has adopted a fairly unique market approach to electricity generation and pricing. With proposed changes to the Electric Utilities Act (Bill 50), the Alberta government intends to significantly spur the development and upgrading of transmission facilities.

Subsequent exploration of transmission policies is expected to encompass developments and lessons from other jurisdictions, as well as alternatives in achieving appropriate levels and types of transmission in the new and rapidly changing environment.

The discussions at the workshop are highlighted in the following sections. It should be noted that the workshop was conducted under the Chatham House Rule. In keeping with this rule, there is no attribution to viewpoints or arguments expressed, except in relation to the discussion paper, the comments of the discussants and the panel members.

October 7 Workshop

The objective of the workshop was to gain a better understanding of:

- The effects of the current regulatory framework on incentives for investment in transmission and generation in Alberta.
- The impacts and implications of proposed policy changes on core objectives such as reliability, supply adequacy, equity and efficiency.
- Lessons from other jurisdictions
- Challenges and general approaches to the determination, achievement and pricing of efficient and appropriate levels and types of electricity transmission infrastructure.

Some 40 individuals representing a diversity of views attended the four-hour workshop, which The School of Public Policy hosted at Hotel Arts in downtown Calgary. The workshop was followed by lunch and a keynote address by Richard O'Neill, chief economic advisor to the Federal Energy Regulation Commission.

Agenda

INTRODUCTION AND OPENING REMARKS

- Jack Mintz, Palmer Chair in Public Policy and Director, The School of Public Policy

THE ALBERTA CONTEXT

- Presentation of The Evolution of Transmission Policy in Alberta and an Assessment of Key Policy Issues (J. Church, W. Rosehart, J. MacCormack: 2009)
 - Jeffery Church, Professor of Economics, University of Calgary
- Discussants
 - Joseph Doucet, Larry Ruff, Richard Tabors
- Open Discussion

TRANSMISSION POLICY CHALLENGES AND ALTERNATIVES IN THE NEW AND EMERGING ENERGY AND ENVIRONMENTAL CONTEXT

- Panel
 - Sheldon Fulton, Gary Holden, Michal Moore, Nancy Southern (unable to attend), Steven Stoft
- Group Discussion

WRAP UP SUMMARY & NEXT STEPS

- Michal Moore

LUNCH AND KEYNOTE ADDRESS

- Richard O'Neill, Chief Economic Advisor, Federal Energy Regulation Commission *Wind, Rain and Fire: Transforming the Grid*

Participants

CHAIR

- Jack Mintz, Palmer Chair in Public Policy and Director, The School of Public Policy, University of Calgary

MODERATORS

- Robert Mansell, Academic Director, The School of Public Policy, University of Calgary
- Michal Moore, Institute for Sustainable Energy, Environment and Economy, University of Calgary

PRESENTERS

- Jeffrey Church, Professor, Department of Economics, University of Calgary
- John MacCormack, Independent Consultant and Department of Electrical Engineering, Schulich School of Engineering, University of Calgary
- William Rosehart, Professor, Schulich School of Engineering, University of Calgary

DISCUSSANTS

- Moderator: Robert Mansell, Professor, School of Public Policy and Department of Economics, University of Calgary
- Joseph Doucet, Enbridge Professor of Energy Policy, School of Business, University of Alberta
- Larry Ruff, Electricity Market Design Expert, Special Advisor, Market Reform
- Richard Tabors, Vice-President, Charles River Associates and Senior Lecturer, Massachusetts Institute of Technology

KEYNOTE SPEAKER

- Richard O'Neill, Chief Economic Advisor, Federal Energy Regulation Commission

PANELLISTS

- Moderator: Michal Moore, Institute for Sustainable Energy, Environment and Economy, University of Calgary
- Sheldon Fulton, Executive Director, Industrial Power Consumers Association of Alberta
- Gary Holden, President and Chief Executive Officer, ENMAX Corporation
- Steven Stoff, Electrical System Consultant, Carbonomics

INVITED ATTENDEES

- Gerry Angevine, The Fraser Institute
- Evan Bahry, Independent Power Producers Society of Alberta
- Guy Bridgeman, EPCOR Utilities Inc.
- Geraldine Byrne, WADE Canada
- Michael Carten, Sustainable Energy Technologies
- Jeffrey Church, University of Calgary
- Marcey Cochlan, TransAlta Corporation
- Carolyn Dahl Rees*, Alberta Utilities Commission
- Joseph Doucet, University of Alberta
- Heather Douglas*, Calgary Chamber of Commerce
- Katie Emond, Calgary Economic Development
- Sheldon Fulton, Industrial Power Consumers Association of Alberta
- Marie Gallant, EnCana Corp.
- Karin Gashus, Utilities Consumer Advocate
- Gary Holden, ENMAX
- Ian Mackay, Alberta Department of Energy
- Robert Mansell, School of Public Policy
- John MacCormack, University of Calgary
- Jack Mintz, School of Public Policy
- Michal Moore, Institute for Sustainable Energy, Environment and Economy
- Douglas Heath, Balancing Pool
- Robert Heggie*, Alberta Utilities Commission
- Robert Hemstock, ENMAX Corporation
- Theresa Howland, Bullfrog Power

- Eddy Isaacs, Alberta Energy Research Institute
- Anouk Kendall, WADE Canada
- Sterling Koch, TransAlta Corporation
- Cathryn Landreth, Premier's Council for Economic Strategy
- Leah Lawrence, Alberta Economic Development Authority
- Elan MacDonald, Office of the Premier
- Marwan Masri, Canadian Energy Research Institute
- Neil Millar, Consultant
- J.R. Modray, National Energy Board
- Richard O'Neill, Federal Energy Regulatory Commission
- Alex Pourbaix*, TransCanada
- William Rosehart, University of Calgary
- Larry Ruff, Consultant
- Martin Salloum, Edmonton Chamber of Commerce
- Wayne Silk, Alberta Market Surveillance Administrator
- Ken Stickland*, TransAlta Corporation
- Steven Stoft, Consultant
- Richard Tabors, Charles River Associates / MIT
- Scott Thon*, AltaLink

* = *registered but did not attend*

Short Bios of Presenters, Discussants and Panel Members

Jeffrey Church (PhD, Economics, Industrial Organization, University of California at Berkeley). Professor of Economics and Institute for Advanced Policy Research Professor, University of Calgary. He specializes in industrial organization with an emphasis on network externalities, competition policy and regulatory economics. Jeffrey frequently serves as an expert witness on regulatory and competition issues.

Joseph Doucet (PhD, Economics, Operations Research, University of California at Berkeley). Enbridge Professor Energy Policy in the School of Business, University of Alberta. He is also Director of the School of Energy and Environment, Academic Director of the Centre for Regulatory Affairs (Van Horne Institute) and Director of Centre for Applied Business Research in Energy and the Environment. Joseph specializes in applied energy policy and regulatory issues and has published extensively in these areas.

Sheldon Fulton (MBA, Operations Research, University of Manitoba). Executive Director of the Industrial Power Consumers Association of Alberta and previously Director of Market Structure at the Ontario Power Authority. He has extensive experience in energy markets, including the development of both natural gas and electricity exchanges in Alberta.

Gary Holden (BSc in Mechanical Engineering, University of Calgary). President and CEO of ENMAX Corporation and CEO of ENMAX subsidiaries. Prior to joining ENMAX in 2005, he was President and Chief Operating Officer of AltaGas Income Trust. Gary was also previously the Chairman and CEO of EnSource Energy Services, Executive Vice President, Generation, at TransAlta Corporation and CEO of TransAlta New Zealand Limited.

John MacCormack (MSc, Electrical Engineering, University of Saskatchewan, PhD candidate in electrical engineering, University of Calgary). From 1988 to 1997 he held various positions with TransAlta and since September 1997 has worked as an independent consultant in the areas of reliability centred maintenance, power system analysis, transmission planning, regulatory support and analysis and production simulation modelling.

Robert Mansell (PhD, Economics, Regional/Resource Economics, University of Alberta). Academic Director of the School of Public Policy, Professor of Economics and Senior Fellow, Institute of Sustainable Energy, Environment and Economy, University of Calgary. He has authored many studies on energy and regulatory issues and frequently serves as an expert witness and advisor on energy policy and regulatory issues.

Michal Moore (PhD, University of Cambridge, UK). Professor of Energy Economics and Senior Fellow at the Institute for Sustainable Energy, Environment and Economy. He formerly served as Chief Economist at the National Renewable Energy Laboratory in Golden, Colorado and as a Regulatory Commissioner with the California Energy Commission. He has published widely in the areas of electricity and other energy and related policy and regulatory issues.

William Rosehart (PhD, Applied Science, University of Waterloo). Professor of Electrical Engineering, University of Calgary). He is an expert in the areas of dynamic performance of electrical energy systems and the application of stochastic and multi-objective optimization techniques to solve power system problems. William recently received the 2008 IEEE Power and Energy Society Outstanding Young Engineer Award.

Larry Ruff (PhD, Economics, Stanford University). He has held senior positions in government, industry (including as a principal in a major consulting company) and non-profit organizations. He is an internationally recognized expert on the restructuring of electric and gas utilities to create competition and on the operations of resulting competitive markets. Larry played a major role in the initial (1988) design of the England and Wales electricity market and has served as advisor to many governments in North America, Europe, Latin America and the Asia-Pacific regions regarding competitive electricity and gas market restructuring.

Stephen Stoft (PhD, Economics, University of California at Berkeley). Consultant on electricity policy and regulatory issues, including roles as an expert witness before the Alberta Energy and Utilities Board and the Federal Energy Regulatory Commission. He previously held positions at the Federal Energy Regulatory Commission, the University of California Energy Institute, the University of California, Santa Cruz, and Boston University. Stephen has published extensively on electrical generation and transmission markets and on carbon management issues. He was co-designer of locational electricity capacity markets for the New England ISO.

Richard Tabors (PhD, Geography and Economics, Syracuse University). Vice President, Charles River Associates and Senior Lecturer in Technology and Policy at MIT. He is an internationally recognized expert in energy planning and pricing and was a member of the group at MIT that developed the theory of spot pricing that forms the foundation for real-time electricity pricing and locational marginal pricing for electricity transmission systems. Richard has frequently provided expert testimony and advice on restructuring of electricity markets in the United States and Canada.

SESSION 1: The Alberta Context

At the outset of this session, Jeffery Church provided a summary of the background discussion paper titled *The Evolution of Transmission Policy in Alberta and an Assessment of Key Policy Issues* (J. Church, W. Rosehart, J. MacCormack: 2009). The main points are noted immediately below and followed by the views of the discussants and those expressed in the open discussion.

JEFFREY CHURCH: PRESENTATION OF DISCUSSION PAPER

Church indicated that the genesis of the study was work funded by the Institute for Advanced Policy Research to build and operate integrated electrical system models (including the AESO models) for research and teaching. The study involved a review of the regulatory framework evolution, a quantitative assessment of the Critical Transmission Infrastructure for the Edmonton-Calgary corridor proposed under Bill 50, and a brief evaluation of the regulatory process under Bill 50.

Church noted that congestion management principles were developed by the regulator in 2002, but the government later reversed this regulatory action with respect to pricing. This resulted in the current approach, which is essentially “postage stamp” pricing, with only weak locational signals.

He noted that congestion-free transmission is the overriding policy today. Generators have little or no incentive to take location or transmission into account in their planning, so the cost of generation is the dominant factor. This amounts to an incentive to expand in situations where expansion may not be socially or economically efficient.

Introduction of Bill 50 and the Critical Transmission Infrastructure identified in that legislation afforded an opportunity to compare the costs and benefits of the transmission projects proposed for the Edmonton-Calgary corridor. The analysis recognizes there is a trade-off between transmission costs and generation costs. For example, higher transmission costs might be incurred to gain access to lower-cost generation.

The analysis does not suggest that a generation-only solution (that is, only building additional generation for the load in southern Alberta) would be optimal, only that it would be more efficient than the proposed HVDC lines. It may be the case that a mix of generation and transmission would be even more efficient.

The analysis employed a power flow model with data taken as often as possible from publicly available AESO information. The main comparison was between the costs of the two large high voltage direct current (HVDC) lines set out in Bill 50 and the costs with no transmission line expansion, but increased generation near the load, or customers. Both alternatives modelled meet load as forecast by AESO and meet current criteria for reliability.

Assumptions about the future carbon policies and the development of wind generation make a big difference in the model. Several scenarios were used to take into account different future rates of wind generation development and different future carbon policies. The analysis takes into account the benefits from a reduction in line losses that the north-south HVDC lines would generate by assuming the reduction would be 25%.

Church said the study concluded that in all cases, any increased costs of generation would be significantly lower than the cost of building the two HVDC lines as set out in Bill 50. Specifically, the additional costs associated with the two HVDC lines ranged from \$1.1 billion to \$2.2 billion above that for the generation-only case, while maintaining supply adequacy and continuing to meet reliability requirements. The lowest estimate of additional costs assumes no additional wind generation and that greenhouse gas offset costs are zero. Under the most likely scenarios, the additional costs range from about \$1.7 billion to \$1.8 billion.

Church noted there are advantages and disadvantages to using a regulatory process to determine the appropriate amount and type of transmission to be added. The advantages include the greater likelihood that a long-term perspective will dominate short-term political interest; the greater ability to draw on expertise, process and public participation to evaluate and adjudicate complex issues; and the transparency and rationale provided by written decisions. The disadvantages are that regulatory decisions are often costly and may not be timely. Unilateral government action, as set out in Bill 50, may provide a superior solution in cases where there is widespread agreement on the problem and the solution, where time is of the essence and where the cost of not addressing the problem is far more expensive than exploring alternatives.

JOSEPH DOUCET: DISCUSSANT

Doucet noted that it is important for academics to focus on real and significant policy issues and this is certainly one worthy of such attention. In general, he liked the discussion paper's historical account of electricity regulation, the outline of the role of transmission system development and the recognition that whoever pays for that development should have an important impact on decisions regarding the location of generation. He agreed with the observation that generation and transmission are both substitutes and complements; and that decision making within the system should recognize that the location of generation does matter. Finally, he agreed that a policy of zero congestion is not necessarily the best goal to pursue.

Doucet suggested that the one paper should really be two: one focused on the tension between generation and transmission; and the other providing a more detailed evaluation of the regulatory process.

He said there are myths that should be debunked to provide the proper context for this paper. These include:

1. Generation-transmission tension is a new issue.
2. This tension is an easy problem that can be solved by restructuring.
3. Generation and transmission can be perfect substitutes.
4. Distributed generation will do away with the need for transmission.
5. Competition in the generation market removes need for co-ordination with transmission and will lead in some way to competition in the transmission “market.”

Doucet had some questions concerning the results. Specifically, he noted that the cost benefit results are staggering and wanted more explanation. Are there other benefits that need to be incorporated, such as network benefits, and how should these be calculated? Did the AESO in fact recommend the facilities listed in Bill 50 and, if so, how did they reach the decision that those facilities were the most cost efficient overall?

He noted the generation-only solution may create two (or more) separate energy markets. He said an assessment must be done that determines the impact on reliability, how rationing would be implemented, what north and south markets would look like and how they would operate. Regarding the paper’s second approach to generation stacking order, Doucet said it is not clear that this is consistent with the operation of a well-functioning wholesale market. He questioned how the north-south line would impact the development of wind, and what impact that much wind in southern Alberta would have without north-south reinforcement.

Doucet said additional issues should be explored:

1. There is a view that some of the additional capacity proposed is ultimately intended to support electricity exports. In that case, one could argue that the real issue is not the total cost of the proposed facilities so much as it is how the costs should be allocated.
2. In the longer term, it would seem there is some potential for additional co-generation at Fort McMurray or possibly development of nuclear options. Doucet questioned how should this be taken into account and raised the suggestion that perhaps the real issue involves carbon capture and storage, given that it may have the best chance of success in the electricity sector.
3. How can we properly cost and incorporate external factors, being aware that some energy alternatives have more non-market impacts than others.

Doucet questioned if any parallels could be found with oil and gas development. For example, does the co-existence of a well-functioning virtual gas market in the province (the Notional Inventory Transfer or NIT market) along with distance sensitive pipeline tolls suggest that locational pricing in the case of electricity would also be consistent with a well-functioning (energy-only) electricity market?

Doucet wondered if it would be possible to elicit the value of transmission from the market, a course being followed in Chile. He also questioned what could be done to fix Alberta’s regulatory system if the government’s move into direct political intervention stemmed from a “broken” process.

LARRY RUFF: DISCUSSANT

Ruff said the congestion management principles were reasonable before they were reversed by the Alberta government. He noted that the best thing to do is to get the pricing right. While this won't solve all problems, it makes the situation a whole lot easier to handle.

Ruff said that if locational pricing signals aren't going to be used, the regulatory approach should provide a check against excessive and inefficient transmission development. However, in the case of Alberta the government has overridden the regulatory approach by insisting on constraint-free transmission.

He described the results of the discussion paper's quantitative analysis as so dramatic they beg the question: 'What's going on here?' If the critical transmission infrastructure projects are not justified based on economics, how can the choice be explained? Politics? Ideology? Interests of the various players?

Ruff said the paper makes good points about advantages of a regulatory process. He added that the best way to deal with the location issues/trade-offs is to use pricing. If locational pricing of energy cannot be used, locational access charges are another option. If that isn't possible, use a regulatory process. In Ruff's experience, the worst outcomes arise when the transmission decisions are made in the political arena.

He said that in the past, generation and transmission people did a reasonable job of trading off generation and transmission, with the goal of minimizing the delivered cost of electricity. Separating generation and transmission creates the need for a different approach. He noted that while Bill 50 certainly reflects a different approach, he did not see the underlying rationale that would make the change make sense.

RICHARD TABORS: DISCUSSANT

Tabors said unconstrained transmission is, by definition, not socially beneficial nor socially optimal. He said experience throughout the world bears this out. He also noted that things seldom turn out as expected and forecasts are always wrong. Huge uncertainties involving future demand, technologies and capital must be taken into account. This is critical given that transmission facilities have a 40- to 50-year life expectancy.

Tabors described the North American electric power system as the world's largest machine, and to run it, one needs professionals with experience in the field and operating within rules and regulations. These regulations need to be established to serve the public interest and must be immune from political interference. There are examples, like Georgia, where there exist "the best regulations that money can buy" but these should never be confused with advancing the public interest.

Tabors noted several other uncertainties that are particularly relevant in the context of decisions regarding transmission development. He said the Field of Dreams scenario, where 'If you build it, they will come,' does not work. He noted that there is no way to tell what carbon policies will look like. He also said the utility of the 21st century will be very different. The fact that A.G. Bell would probably not recognize his industry today may be an example of the extent of likely changes in the future of Edison's industry.

He said that in the realities of transmission investment decision-making, transmission is only one element of an integrated system. What's required is an analysis of alternatives and some cost-benefit evaluations, including the incorporation of real option value. He also said transmission corridors are about economic development, not parochialism.

Given the scale of the electricity machine, Tabors said it's important to undertake a thorough economic and cost-benefit analysis, get the decision making back into a regulatory structure and ensure that professionals are making the decisions. Further, it is extremely important to take into account the value of maintaining some flexibility as envisioned in real options analysis.

General Discussion

Q: *What is being assumed regarding expansion of interconnections to relieve current constraints?*

A: The assumption used in the model was that interconnections with other regional grids would not change going forward.

Q: *Generation and transmission as complements/substitutes. What about demand side management?*

A: Demand response was not considered as an active participant in the market and was left static. Demand side management deserves to be on table.

Q: *Why didn't the analysis in the discussion paper use a co-generation option in Fort McMurray instead of supercritical pulverized coal? Why was this not considered?*

A: Co-generation is usually project specific or location specific. We know that most of our coal is in Wabamun region in the north. Most of the co-generation is in the Fort McMurray area. The same assumptions as used by the AESO were used in the modelling work presented here. These show a net inflow of electricity to the Fort McMurray area rather than a net outflow.

Q: *The lack of transmission has plagued developers of co-generation in the Fort McMurray area. The value of transmission infrastructure is in access to lower-cost generation.*

A: The analysis followed the AESO's assumptions. That assumption is that coal-fired generation would be at the margin the north given that the variable cost of such generation is quite low and lower than that for combined cycle generation. The re-dispatch cost of gas in the north wouldn't have improved the cost-benefit picture.

Q: *The views expressed by the government and the views expressed in the discussion paper seem quite different. We have had expansion of transmission capacity in recent years, albeit not mammoth investments. Perhaps what is required is a detailed options analysis as suggested by the discussants. Gas-fired generation is more flexible and more scalable. It is easier to adapt to future scenarios; is that the next step?*

A: Perhaps.

Q: *Is there sufficient public trust to have the Critical Transmission Infrastructure dealt with by the regulator? We need to assume that we have a regulatory process that works: a process that delivers the advantages and doesn't break down. Landowners didn't get to provide input to the needs assessment and land costs were considered only at a high level in the 2004-05 process.*

A: Perhaps we should work on fixing the regulatory process, rather than abandoning or circumventing it.

Q: *What are the decision criteria? The paper focuses on an economic analysis of options but doesn't address the broader public policy issues. For example, it doesn't incorporate the Alberta government's vision or issues related to water or renewable energy development. The paper doesn't recognize the value of the smaller footprint of HVDC lines or that landowners want transmission built that will be sufficient for the long term so that we do not have to go back to them again. Nor does it recognize the desire of the government for a competitive energy market or the costs if certain generators take advantage of regions of high congestion. All of these factors should be part of the debate. Further, there should be recognition that in a democracy the elected government has the right to make these decisions. When the lights go out, it will be the elected leaders who are held accountable, not the regulator. Finally, the analysis presented in the paper needs to consider the whole integrated system (including the western Canadian interconnected system) rather than just a slice of it.*

A: The analysis in the paper does not preclude attaching values to the factors noted, but it does suggest that these values would have to be large to compensate for the economic inefficiency identified. What is suggested is the need for a detailed business case that identifies, quantifies and evaluates the factors and the associated costs and tradeoffs involved in deciding on a particular set of transmission projects.

It should also be recognized that we are creating a distorted market by subsidizing certain generators.

As indicated in the paper, two large HVDC lines do not appear to be the most economic option to prevent a "lights out" scenario.

Q: *What are risks associated with not going forward with the Critical Transmission Infrastructure identified in Bill 50? Might this not impair competition?*

A: The objective of competition is to keep electricity costs low. If you start subsidizing costs, you're not accomplishing the objective of minimizing overall electricity costs and prices. Yes, the analysis might have more explicitly incorporated other factors such as impacts on competition.. But more importantly, this simply highlights the fact that before such important decisions are made all of these factors should be analyzed and incorporated in a business case for the projects. The business case for the critical infrastructure projects identified in Bill 50 is missing.

Q: *Forecasts are always wrong. If you under-forecast, blackouts are tougher to deal with if you're a politician as opposed to an economist.*

A: The forecasts used in the analysis are those used by the AESO. In general it would be reasonable to use a range of forecasts to minimize the likelihood of significant underestimation. A good analysis covering a reasonable range of future loads will minimize the future regret factor.

Q: *It is a myth that there are only minor locational signals in the system in Alberta. Generators are paying to get to interconnect with the system, although this is a refundable contribution. Further, there are some costs related to line losses. Generators are going to respond to these locational signals if not held hostage by the location of the fuel (e.g. coal, co-generation). And what about lead time? Why were those points not dealt with in the paper? (We) need an even-handed paper that reflects the current views in industry about line losses.*

A: The analysis provided in the discussion paper explains why line losses are not sending adequate location signals and in cases such as the Rainbow area that is used as an example of how the signal is correct, the signal in fact goes the wrong way. Not only are line loss charges typically relatively small regardless of location but, given the policy of zero congestion, generators know that these losses will decline. Further, line loss costs are volatile and difficult to predict without knowledge of where future generators will locate on the system. As such, they are not an appropriate instrument to guide long-run locational decisions that involve large sunk costs. Further, existing tariffs for access to the transmission grid do not promote efficient use of the grid in the short run because they do not reflect marginal line losses and congestion costs. And, because they do not reflect the long-run costs of providing service to a location, they fail to promote the efficient development of the grid and efficient location of generators. See footnote 36 in the Discussion Paper for examples of the wrong price signals given by loss factors.

Q: *A more complete paper would include DSM (demand side management), generation from other sources, and a splitting of the regulatory question from the economic question. Does this paper adequately address the policy issues associated with this question or just the economic aspects of it? Does this paper address only a slice of the system and thus miss the larger points? Does the paper correctly address the weakness of the locational signals in the current policy?*

A: These issues should be addressed in a publicly available, detailed business case that identifies, quantifies and evaluates all costs and benefits and clearly demonstrates the reasons for any decisions regarding the need for costly transmission infrastructure.

SESSION 2: Transmission Policy Challenges and Alternatives in the New and Emerging Energy and Environmental Context

Panel members including moderator Michal Moore, Sheldon Fulton, Gary Holden and Steven Stoft (panellist Nancy Southern was not able to attend) provided comments on transmission policy challenges and alternatives in the new and emerging energy and environmental context. Their presentations are summarized below, followed by a summary of the subsequent group discussion.

MICHAL MOORE: PANELLIST

Moore said in order to make headway in discussions about the appropriate type and amount of transmission infrastructure, goals must be clarified. Should the goal be a minimum delivered price for electricity? Should it be a good price signal that will encourage optimal efficiency while providing reliability? Should it be robustness of the system?

Moore said new technology has the potential to flip the market on its head. Predictions can be wrong and the high levels of uncertainty need to be incorporated in the assessment of transmission requirements. He noted the uncertainty about alternative sources of power in the future and about the likelihood of these alternatives displacing “King Coal.” What happens to the installed load base if the prevailing dynamics of the system change?

Moore said fundamental questions should be addressed concerning the reasonableness of planning based on a goal of zero congestion. There are also basic questions concerning how far ahead we should plan, and what levels of flexibility should be incorporated in those plans.

Moore also called for an regulatory process that includes open and transparent hearings, noting a process that closes out public debate will be flawed, perhaps fatally. He said there is no greater public policy challenge than trying to get the process right.

SHELDON FULTON: PANELLIST

Fulton, who represented the Industrial Power Consumers Association of Alberta, said his group represents about 35 per cent of the electricity load in the Alberta market. He agreed that having well-functioning markets for power generation is the right way to go, but he questioned the breakdown of who should pay for that transmission. He noted that the industrial sector will pay 61 per cent of the cost, with 19 per cent paid by the commercial sector, 16 per cent by residential customers and four per cent by the farming sector.

Fulton argued that the transmission projects planned for the province will add significantly to the cost of power for industrial users. To justify these costs, it will be necessary to clearly demonstrate the benefits not to the generators who won't bear the costs, but to the ratepayers.

Fulton said the industrial power consumers have several concerns with Bill 50, starting with the removal of a "needs" application process. The group believes there is a lack of justification for HVDC technology and there is no effective cost-oversight process. It is also concerned that the government has allocated the Critical Transmission Infrastructure without requiring competition and that no effective cost-allocation mechanisms exist.

Fulton said new transmission may be required, but wanted a proper cost-benefit assessment to be done first. That analysis should include the impacts on the delivered cost of energy and take account of opportunity values including those associated with electricity exports. The analysis should also allocate the costs to those who benefit as is done in other jurisdictions such as California. Fulton said the industrial consumers group believes a proactive ratepayer oversight committee should be established.

Fulton questioned HVDC lines as a technical solution to any transmission shortfall. He pointed to the Brooks aqueduct, noting that government awarded that project to a monopoly and it was eventually replaced by a simple ditch. He said Teshmont is under contract to AESO and said it was important to understand how the system would work before building it.

Fulton said more information was needed. For example, how would wind generation be integrated to the power grid? Would the projected load growth actually occur and how much of the new customer base would require transmission? What is the potential impact of 80 per cent of demand being industrial or commercial? Will more of these loads go off the grid given the higher transmission costs or for other reasons? How will carbon pricing impact generation supply?

GARY HOLDEN: PANELLIST

Enmax CEO Gary Holden said electricity transmission was a big deal and noted that Bill 50 would commit Albertans to a cost equivalent to as much money as that in Alberta's Heritage Savings Trust Fund.

Holden, head of the Calgary-based energy distribution company, questioned if Albertans are OK with the idea of abandoning economic efficiency. He said deregulation does not mean economic efficiency should be abandoned. High-cost solutions have an impact on competitiveness. He said there will be customer impacts and demand destruction, and warned that companies can move or grow elsewhere.

Holden said Bill 50 seems like a complete destruction of the Alberta Advantage in terms of electricity. He expressed fears over regulatory decay and said the legislation will disenfranchise the Alberta Utilities Commission. He called for a continuous assessment of capacity, not a one-time evaluation. He said there is enough power capacity to supply the needs of the customers in southern Alberta.

Holden said the eventual cost of the new transmission lines may be 10 to 20 times higher than it needs to be and questioned why alternative sources are not being considered. He noted the rising competition for transmitted energy, including dispatchable energy and solar power. He also expressed concerns that the \$14 billion envisioned by AESO may turn into \$20 billion for all the system/generation enhancements required.

The Enmax president said transmission capacity utilization is falling and is down to 2005 levels. Given Crossfield, Bonnybrook, Shepard, wind, and district/decentralized energy, by around 2013 the north-south flow may approach zero. Expenditures on distribution and generation spends are anticipated to be much lower than the planned expenditures on transmission. Transmission will cost more than the generation itself.

He suggested that power from a coal-fired plant in Brooks and a combined cycle gas facility south of Calgary could supply southern Alberta's needs to 2020.

Holden said it was necessary to examine the costs associated with policies that do not encourage efficient location decisions. He noted that the peaking costs of a plant in Calgary are much lower than one in Edmonton, but current policy does not support the lowest cost solutions. He said the AESO is not mandated to not consider alternatives..

Holden said there is a disproportionate fear of location charges and questioned if generators are seeking "location payments." He said wise location of generation does not need to be subsidized and that technology can be used to address needs.

Holden said the issue of additional north-south power transmission will only need to be addressed in the decade after 2020. This leaves lots of time to evaluate future options and alternatives.

Holden said coal fights with wind at night, while gas complements wind. He suggested Alberta do a "capital stock turnover" that would build plants and use gas smartly as long as possible. Combined cycle gas (CSG) provides the solution for carbon. He suggested that we let economics dictate replacement of coal plants with co-generation and CCG.

STEVEN STOFT: PANELLIST

Stoft said three market failures drive climate issues. One factor is that carbon is often priced at zero. Another is that consumers ignore future energy costs. Third, there is insufficient reward for advanced research.

Stoft said transmission should be planned optimally, minimizing the combined cost of wires and generation. But what is the cost of carbon? And how is subsidized wind generation handled?

He noted there is a real option value to waiting, especially given uncertainties in climate policy.

He suggested charging generators for the wires they use. In turn, the generators will lobby for reasonable upgrades, and if they don't want the upgrades, don't build them. Generators will be a lot more sensible if they're paying for the wires. They will help to determine the optimal plan. Stoft suggested the result will be no transmission subsidies for coal plants and no transmission subsidies for wind turbines. In theory, there will be congested lines for both.

Stoft said Alberta has imposed uniform pricing, not competitive pricing and noted we are working backwards to make those uniform prices competitive.

He cited several poor reasons to build transmission power wires:

1. Zero congestion is the law in Alberta.
2. To keep lights on (generators can do this, congestion does not equal unreliability).
3. To provide economic benefits for upstream generators.
4. To reduce market power. (This works, but it's costly.) Distant generators may get more access to the Calgary market, but there are cheaper ways to ensure sufficient competition
5. To minimize the total cost of supply. This is the right reason, but it's against the law and generators don't look at the transmission cost in the Alberta market.
6. Build so a one-price market will almost work. No locational signal, no congestion, too many wires. This leads to subsidies for coal and wind: wasted money.

Group Discussion

The following generator comments/areas of concern were raised following panel discussion:

Market success to date is clear: there has been a substantial increase in generation capacity achieved through an unconstrained transmission system. There has been reduced emissions intensity and electricity pricing below replacement cost of new supply technology.

The future generation and load growth factors are unknown, so an unconstrained system allows for higher than expected levels for the next 20 to 30 years.

Increased transmission capacity reduces the costs of a market disruption. Costs could be profound should the market be disrupted.

Building more transmission will reduce market power. Has the Rainbow issue (generator taking constraint payments) gone away? No.

Optimizing transmission and generation is essentially central planning. Let's be careful about risks posed by central planning.

Note that not all future projects are classified at this time as Critical Transmission Infrastructure. Yet within the long term plan of the AESO, only \$8 billion of the facilities are critical infrastructure, with the rest of the projects going through the public process.

The group discussion raised other points:

The market power issue was not fully treated within the discussion paper in Session 1, but the evidence doesn't suggest that the two HVDC lines would be justified on the basis of a more complete consideration of this issue.

The proposed process for new power transmission lines has left many suspicious. Ratepayers will pay the cost, but have insufficient recourse on any decision. They would like answers but aren't getting them. What's left for debate are siting questions and that's not what ratepayers want.

The technical challenge of integrating HVDC is not a significant issue. AESO has a statutory mandate to do the planning and operate in the public interest. The organization has the professionalism to develop the plan.

There is some question about the numbers often used to indicate the cost impact on consumers. They should use the cost impacts associated with a \$5.6 billion in transmission expenditures under Bill 50 and not the impacts associated with the \$20 billion for the longer term plan. The impact then becomes 0.8 cents a kWh for residential consumers, a \$3-per-month increase which is much more modest than the cost impact associated with the \$20 billion in expenditures on transmission.

On the other hand, focusing attention on just the impact on residential consumers is misleading since they will only bear about 15 percent of the increased costs. The cost impacts on the other 85 percent of load are much larger and the effects of these on competitiveness needs to be recognized.

Participants wondered if Alberta can afford not to build the transmission lines. It was expressed that all facts must be considered and that a more balanced, less biased presentation on the issue would have been preferred.

Alberta needs to pay attention to an integrated electrical/energy management system.

Co-generation has dramatically reduced the province's transmission needs. One cannot sensibly evaluate a transmission plan without consideration of demand side management, co-generation, etc.

We should look at a future where decentralized energy plays a central role and transmission the backup role. Should we spend \$14 billion now on the secondary system?

WRAP UP AND SUMMARY

Overarching Elements of the Discussion

- Electricity is central to the economic health of the province.
- Cost is critically important. Research such as that provided by the discussion paper ought to be taken into account in the process, as well as utility and all consumer concerns (not just those of the residential sector).
- Some suggest the regulatory and policy roles be separate.
- Experts are strongly encouraging more significant and transparent locational pricing.
- The long-run transmission planning is not well thought out. Long-term planning in semi-deregulated markets happens elsewhere and can provide some lessons for Alberta.
- Zero congestion is not a reasonable goal. Congestion does not equal unreliability.
- Relationships between transmission development and market power have not been adequately evaluated in the province.
- Generators are generally in favour of an “energy only” or single-price market. However, it should be recognized that this does not ensure a truly competitive market outcome that will minimize overall electricity costs to Alberta consumers and may simply distort the market

Closing Points on the Day

There is no dispute about the need for generation capacity and supply in the future, but there is divergence on future generation growth rates that will be required to meet Alberta electricity demand.

There is no dispute about the use of net present value (NPV) calculations as the basis for the analysis presented in the discussion paper, but there is a question about breadth of the analysis. There appears to be a need for more cost-benefit analysis to inform efficient levels and types of transmission development. The absence of such analysis and the associated business case for the critical infrastructure projects proposed in Bill 50 is a serious shortcoming.

Industry electricity consumers need greater input into the decision process; they will pay the bulk of the increased costs associated with investments in transmission infrastructure.

There is doubt about the need to choose one solution based on assumptions about the cost of technology, location of new generation and dominance of one technological mix. There may well be a broader mix in the future.

There is a strong need to incorporate uncertainty and risk in the analysis. We need a process that properly takes these critical factors into account. There is a need for clarity on whether this is an engineering and economic plan, or a political solution. Are there other objectives? What about the implications for long run average costs? Shouldn't there be a transparent bidding process? How can we incorporate the need for flexibility to respond to changes in demand, changes in amounts and types of generation, or changes in primary fuel (for example, increased use of gas for economic and environmental reasons)?

Assumptions with respect to alternative energy sources, such as wind, are critical and need to be more fully explored.

There is a requirement for transparency in the needs assessment.

There is a need to incorporate the impact of carbon management initiatives, taking into account the costs, risks and uncertainties.

All of the factors noted above should be evaluated, and the evaluation should be independently assessed and tested. Further, there should be a strong, transparent and documented business case for all transmission projects and this business case should incorporate evaluation of the various factors noted above.

The School of Public Policy at the University of Calgary greatly appreciates the participation of all who attended, and will keep electricity sector stakeholders informed of upcoming related events in its exploration of transmission policies in Canada and the United States.

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