

Environmental Challenges and Opportunities of the Evolving North American Electricity Market

**SECRETARIAT REPORT TO COUNCIL UNDER ARTICLE 13 OF THE NORTH AMERICAN
AGREEMENT ON ENVIRONMENTAL COOPERATION**

June 2002

Disclaimer

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We will work to deepen a sense of community, promote our mutual economic interest, and ensure that NAFTA's benefits extend to all regions and social sectors. Our governments will develop ideas on how we can work together to develop and expand hemispheric and global trade and promote broader international cooperation.

We consulted on the development of a North American approach to the important issue of energy markets. Towards this end, our Energy Ministers have created a North American Energy Working Group. This...will be a valuable means of fostering communication and coordinating efforts in support of efficient North American energy markets that help our governments meet the energy needs of our peoples. We stressed the importance of energy conservation, development of alternative energy sources, and our common commitment to addressing environmental impacts of energy use.

Excerpted from the North American Leaders' Statement, issued 22 April 2001, by US President George W. Bush, Canada's Prime Minister Jean Chretien and Mexico's President Vicente Fox, after their meeting during the Summit of the Americas in Quebec City <<http://usinfo.state.gov/regional/ar/summit/north22.htm>>.



Preface

The electricity sector across North America is currently experiencing a wave of unprecedented and rapid change. The opening of electricity markets to competition is underway or being considered in Canada, Mexico and the United States, and cross-border trade in electricity is growing, bolstered in part by the long-term stability conferred by NAFTA's trade and investment rules.

As these changes take place, many important questions are being asked about the emerging North American electricity market. One question—the focus of this Article 13 Report—encapsulates a key public policy challenge facing today's decision-makers. **How can we ensure that North Americans have an affordable and abundant supply of electricity without compromising environmental and health objectives?** Clearly electricity is vital for the North American economy and is a prerequisite for economic stability and long-term prosperity. Just as clearly, however, some forms of production, transmission and use of electricity may have significant negative impacts on human health and the ecological systems that sustain life, both of which are valued highly by North Americans.

As outlined by the CEC Electricity and Environment Advisory Board in this report, we believe that it is possible to realize the economic opportunities offered by the evolving North American electricity market and at the same time protect human health and the environment. The key to meeting both these goals is increased cooperation and collaboration among the NAFTA partners. Cooperation needs to encompass not only environmental protection policies, but also the collection of emission information, improved impact assessment, the promotion of renewable energy and energy efficiency, increased technology transfer, and other matters. By working together to a common end, Canada, Mexico and the United States can ensure that the transformation of the North American electricity market contributes to sustainable development by generating economic, social and environmental benefits.

Janine Ferretti
Executive Director
CEC Secretariat

Acknowledgments

The CEC Secretariat would like to acknowledge the many individuals and organizations who contributed time and energy to this initiative. We especially appreciate the efforts of the CEC Electricity and Environment Advisory Board members, chaired by the Honorable Phil Sharp, whose invaluable expertise, experience and commitment to improving public policies guided the initiative through a complex and controversial set of issues; the several external reviewers listed herein who provided comments and input into the working papers and background materials; senior advisors Miguel Breceda and Joseph Dukert, for their analysis, fact-checking and meticulous review of draft text; Odon de Buen, President, *Comisión Nacional para el Ahorro de la Energía* (Conae) and his staff for collaborating on green energy research and polling, in addition to supporting CEC outreach and educational efforts on renewables and energy efficiency; Juan Cristóbal Mata, *Director de Medio Ambiente*, and Francisco José Barnés de Castro of the *Subsecretario de Política Energética y Desarrollo Tecnológico*, both of the *Secretaría de Energía*, for their very useful and informed comments on the working papers and background materials; John Beale, Deputy Assistant Administrator, EPA Office of Air and Radiation, as well as Sarah Bjorkquist, Policy Advisor, Environment Canada and Jean Boutet, Senior Policy Advisor, Environ-

ment Canada, Robert Slater, Senior Assistant Deputy Minister, Environment Canada. The CEC would also like to thank the many government and public commentators not listed here for providing their helpful insights and coordinating agency review.

We also thank CEC staff members Scott Vaughan, Head, Environment, Economy and Trade, and Paul Miller, Program Manager for Air Quality, for authoring several working papers in addition to overseeing commissioned work, constituting the backbone of the Secretariat initiative; Vic Shantora, Head, Pollutants and Health for organizing and conducting the Toronto workshop on regional air emissions trading; and in-house consultants Zachary Patterson and Yolanda Clegg for their substantive input, stamina and teamwork in getting it all done.

Finally, the Secretariat would like to acknowledge the alacrity, patience and professionalism of Jeff Stoub, CEC Publications Manager, and the editors and translators who made it all readable.

Greg Block
Director of Programs
Electricity and Environment Initiative Coordinator



Executive Summary

The Statement and Recommendations of the CEC Electricity and Environment Advisory Board speak for themselves. Below the Secretariat provides an executive summary and procedural history of this initiative along with highlights of a number of the issues identified in the working paper series and discussed by the many individuals and groups who participated in this process. For a more detailed discussion of the following topics and related CEC documents, please see the working papers and reports in the Annex.

Choosing Our Future

The opportunities for North American cooperation on environment and energy were presented in a joint statement issued 22 April 2001,¹ by Canadian Prime Minister Jean Chretien, Mexican President Vicente Fox and President of the United States George W. Bush, after meeting as the North American leaders group during the Summit of the Americas in Quebec City:

As a result, Canada, Mexico and the United States are exploring North American approaches to help expand the production, distribution and trade in energy, including electricity. At the same time, the electricity sector in the region is in the midst of unprecedented change. Competitive electricity markets have been introduced, or remain under consideration, in Canada, Mexico and the United States. The three countries are considering important policy decisions that will affect the role competitive forces will play in the design and operation of North American electricity markets. They are also exploring ways in which electricity markets can be designed to deliver affordable and reliable electricity in the region, as well as to protect the health and environment of citizens and their neighbors.

The extent to which a more integrated North American electricity market captures the possible environmental benefits of more efficient resource allocation, technology diffusion and consumer choice will depend on the complex interplay between many variables. Many of these variables, such as fuel choice, technology, pollution control strategies and subsidies, are directly influenced by rules and policy measures. Where and when these policy interventions occur, and the degree to which they are coordinated

across borders, is likely to be a critical factor in achieving the twin goals of clean and abundant electricity. It is a matter of choice.

Years of experience demonstrate that proactive, preventative policies are almost always less expensive than reactive, remedial measures. An overriding question facing policymakers today is what, if any, regional environmental policy responses are called for in the early stages of the accelerating convergence of electricity trade and competition policies in North America.

One of the most striking features of the evolving North American electricity market is the rapid pace of change occurring in a sector once characterized by its almost unchanging nature. While the rate of change varies from country to country, and in some cases, jurisdiction to jurisdiction, the ripple effects of major structural changes increasingly affect electricity generation and transmission throughout those portions of the region currently engaged in electricity trade. Key elements of this dynamic sector include the environmental profile of the electricity sector, how market integration links to health and the environment, and the extensive opportunities for environmental cooperation in this field.

Throughout the process of developing the information for this report, the CEC Electricity and Environment Advisory Board members, governments and members of the public identified and discussed key policy considerations emerging from increased market integration. Central issues are summarized below, with specific proposals contained in the Advisory Board Statement and Recommendations which follow later in this document.

¹ Statement reprinted in full and available at <<http://usinfo.state.gov/regional/ar/summit/north22.htm>>.

- While important differences remain in each country, there is a clear trend towards convergence in competitiveness and trade policy underway in North America. Numerous participants in the initiative emphasized the economic and environmental benefits that could be achieved through greater efforts to coordinate or make compatible relevant federal, state or provincial environmental laws, standards and policies in the electricity sector. Generally, more compatible environmental approaches help to make domestic environmental policies, such as air pollutant reduction strategies, more effective, decrease the likelihood of environment-related trade disputes, (especially those concerning restrictions on market access based on product or production standards) and address concerns about so-called “pollution havens.”
- Current and future uncertainties about many fundamental characteristics of the electricity sector—such as planned and future generation capacity and location, demand, fuel type and technology—call for secure health and environment safety nets. Ambient air standards, guidelines, and objectives, already adopted in North America, represent a good common platform to build on. Participants identified additional environmental policies and management tools that appear to work well in restructured markets and advanced ideas on how these policies could be adapted to ensure that they enhance competitiveness and benefit the entire region.
- A number of environmental and free market advocates voiced concern over the effect of half-way measures which purport to open up electricity markets but lock-in competitive advantages gained through historic subsidies to conventional generation sources, or disadvantage access to the grid for distributed energy.
- In some instances, market-based mechanisms to avoid or reduce adverse environmental effects may prove efficient and effective at a regional scale, even generating resources for environmental protection and conservation. Participants explored the potential to regionalize these mechanisms and identified steps to enhance cooperation in this area.
- Building a more supportive North American policy framework for energy efficiency and renewables represents a significant opportunity for achieving “win-win” outcomes. Participants emphasized the need to identify concrete measures to ensure that domestic measures mesh well in the region.
- Finally, Canada, Mexico and the United States could enhance their policies on access to information, environmental impact assessment and integrated resource planning to better



The Process

Early in 2000, the CEC Secretariat launched an initiative on the “Environmental Challenges and Opportunities of the Evolving Continental Electricity Market” under Article 13 of the North American Agreement on Environmental Cooperation (NAAEC).² The initiative coincides with an emerging interest from Canada, Mexico and the United States in building a more seamless North American energy market and is intended to assist the Parties in identifying the environmental issues and areas of opportunity within the continental electricity marketplace. Guided by a multi-stakeholder Advisory Board, the initiative set out to:

- examine the environmental challenges and opportunities presented by the evolving continental electricity market, including the effects of restructuring, development and increased trade;

- examine the challenges and potential of “green electricity” in North American markets, including the identification of trends in the definition, production and marketing of “green electricity;” and
- foster a dialogue among a diverse group of representatives from business, government and the nongovernmental community, concerning the most significant environmental dimensions of the evolving North American electricity market.

Electricity and Environment Advisory Board

The CEC Secretariat established an advisory board to guide and inform it throughout the process. The Advisory Board was chaired by the Honorable Philip R. Sharp, a Senior Research Fellow at Harvard University and a ten-term former member of the US Congress, where he served on the House Energy and Commerce Committee. Board members included a distinguished and diverse group of key individuals from the electricity and

environment sectors of the three NAFTA countries (please see the Appendix for a list of members of the Advisory Board). The Board held numerous information sessions that helped to define the scope and goals of this initiative, and provided feedback and comments on the reports prepared, public events and recommendations.

The Advisory Board developed a statement and recommendations that are included in this document.

² NAAEC Article 13, in relevant part, provides that the Secretariat “may prepare a report for the Council on any matter within the scope of the annual program... In preparing such a report, the Secretariat may draw upon any relevant technical, scientific or other information, including information: (a) that is publicly available; (b) submitted by interested nongovernmental organizations and persons; (c) submitted by the Joint Public Advisory Committee; (d) furnished by a Party; (e) gathered through public consultations, such as conferences, seminars and symposia; or (f) developed by the Secretariat, or by independent experts... The Secretariat shall submit its report to the Council, which shall make it publicly available, normally within 60 days following its submission, unless the Council otherwise decides.”

Background Reports

The CEC Secretariat developed a number of working, background and discussion papers that examined the many environmental issues associated with changes in the continental electricity market. These are listed in Table 1 and were made available to the public on the CEC web site. A six-week public consultation period was held to gather comments on the reports, and the Secretariat posted a Call for Comments on its web site and invited over 10,000 organizations and individuals to provide comments. The comments that were received can be viewed on the Electricity and Environment section of the CEC's web site.

Table 1: Analytical Reports and Working Papers Produced for the CEC's Article 13 Initiative

- 1 Environmental Challenges and Opportunities of the Evolving North American Electricity Market**
Authors: Scott Vaughan, Zachary Patterson, Paul Miller and Greg Block, *CEC*
External Reviewers: Joseph M. Dukert, *Independent Energy Consultant*, Henry Lee, *JFK School of Government, Harvard University*, Michael Margolick, *Senior Advisor, Global Change Strategies International, Inc.*, Philip Raphals, *Helios Centre*, Rick van Schoik, *San Diego State University Foundation*, Eduardo Arriola Valdés, *Independent Energy Consultant*
- 2 Estimating Future Air Pollution from New Electric Power Generation**
Authors: Paul Miller, Zachary Patterson and Scott Vaughan, *CEC*
- 3 A Retrospective Review of FERC's Environmental Impact Statement on Open Transmission Access**
Authors: Tim Woolf, Geoff Keith and David White, *Synapse Energy Economics*, and Frank Ackerman, *Tufts University*
- 4 NAFTA Provisions and the Electricity Sector**
Authors: Gary Horlick and Christiane Schuchhardt, *O'Melveny & Myers LLP* and Howard Mann, *International Institute for Sustainable Development*
External Reviewers: Steve Charnovitz, *Attorney*, Richard Eglin, *Director of Trade and Investment, World Trade Organization*, María Cristina Hernandez, *Consultant*, Don McCrae, *University of Ottawa*
- 5 Modeling Techniques and Estimating Environmental Outcomes**
Author: Zachary Patterson, *CEC*
External Reviewer: Hillard Huntington, *Energy Modeling Forum of Stanford University*
- 6 European Electricity Generating Facilities: An Overview of European Regulatory Requirements and Standardization Efforts**
Author: Lisa Nichols, *Consultant*
- 7 A Review: "Environmental Challenges and Opportunities of the North American Electricity Market" A Symposium organized by the Commission for Environmental Cooperation of North America**
Author: Joseph M. Dukert
- 8 Policy Considerations for North American Emissions Trading**
Author: Douglas Russell, *Global Change Strategies, Inc.*
- 9 Assessing Barriers and Opportunities for Renewable Energy in North America**
Author: William R. Moomaw, *Tufts University*

Public Events

The Secretariat sought to foster a dialogue on the environmental dimensions of the evolving North American electricity market and get input from experts from industry, academia, government and the nongovernmental community. To achieve this end, three public events were organized as described below.

① Symposium: “Environmental Challenges and Opportunities of the North American Electricity Market,” 29–30 November 2001, San Diego, California

In November 2001, in cooperation with the Institute of the Americas, the Secretariat hosted a symposium to discuss and examine the environmental dimensions of a more integrated North American electricity market. Topics included prospects for renewable sources of energy, electricity conservation, energy efficiency, as well as relevant trade issues and enhanced cross-border/regional environmental planning. Over 150 participants attended, including leading industry, academic, NGO and government experts from Canada, Mexico and the United States. The symposium featured an opening keynote address from Canada’s Minister of Environment, the Honorable David Anderson, and was broadcast live on the web, drawing an additional several hundred observers. Archives of the sessions are available for viewing at <www.cec.org/electricity>.

② Workshop on Emissions Trading, 2 December 2001, Toronto, Canada

A number of experts identified regional emissions trading as a promising tool for achieving economic and environmental goals in integrated markets. Accordingly, the CEC convened a workshop on emissions trading in North America to explore the topic and approximately 40 experts from the three countries participated. A variety of issues were examined including: valuable lessons from emissions trading experiences in North America, the design elements of various trading schemes being planned or implemented in

North America, desirable features for operation of an efficient and environmentally sound multi-pollutant emissions trading market in North America, and issues that may arise in designing a system consistent with the provisions of NAFTA and other trade agreements.

③ Emerging Renewable Energy in North America, 18 February 2002, Montreal, Canada

The CEC’s Emerging Renewable Energy in North America workshop examined opportunities for increased cooperation in renewable energy among Canada, Mexico and the United States.

The workshop brought together over 65 representatives from the three NAFTA partners, including government officials, NGOs, and private sector representatives involved in the use, promotion or financing of renewable energy. Renewable energy discussion topics included the role of North American public policy in promoting it, multiple definitions of it, assessing the barriers and opportunities for trade in it, and market-based instruments to support it.

The Context

A North American Partnership for Energy Cooperation

In recent years, the economy of the North American region has become increasingly interconnected in the manufacturing, transportation, service and other sectors. Similar market integration is beginning in the electricity sector, as illustrated in Table 2. Cross-border trade in electricity is growing, bolstered in part by the long-term stability conferred by the trade and investment rules adopted in NAFTA.

Table 2 – United States Projected Gross Trade in Electricity (thousand GWh)

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Imports from Canada and Mexico	38.9	47.9	48	45.5	57.6	60.3	66.1	57.9	54
Gross Exports	13.5	13.0	13.1	13.1	12.7	16.6	16.7	16.8	16.9

Source: Energy Information Administration (EIA). *Annual Energy Outlook, 2002*.

The existence of affordable and reliable electricity supplies is a prerequisite for economic stability and long-term prosperity. However, concerns have been raised over the prospect of electricity shortages and their effect on economic development where these take place. There is also significant public concern about the impacts on human health and the environment from electricity generation, distribution and usage. The CEC's background and working papers series examine the regional environmental dimensions of the transformation of the North American electricity market, including the key features, trends and variables shaping events in this dynamic sector.

North America has asymmetrical levels of total production, numbers of electricity producers, consumption of electricity, intensity of emissions, and the investment required to add electricity generating capacity in the three countries.

Over the next decade, total investment required for the expansion of North American electric generating capacity will be

very high, particularly in Mexico, which is contemplating a radical transformation of its current generating fuel mix.³ In fact, according to the *Secretaría de Energía*,⁴ the addition of 29 GW through to the year 2010 in Mexico represents an amount equivalent to almost 3 percent of its year 2000 GDP. For Canada, whose expansion is estimated at an additional 19 GW, the investment amount is equivalent to 1.4 percent of GDP. For the United States, which is contemplating an additional 150 GW, the figure represents 1 percent of GDP. Financing of these capacity additions as well as general upgrading of existing capacity to reduce the environmental impact of the electricity sector, especially for Mexico, is likely to prove very challenging.

The interest from Mexico, Canada and the United States in building a more seamless North American energy market provides new opportunities to identify ways in which affordable and reliable electricity can be provided, while at the same time protecting human health and the environment in the region.

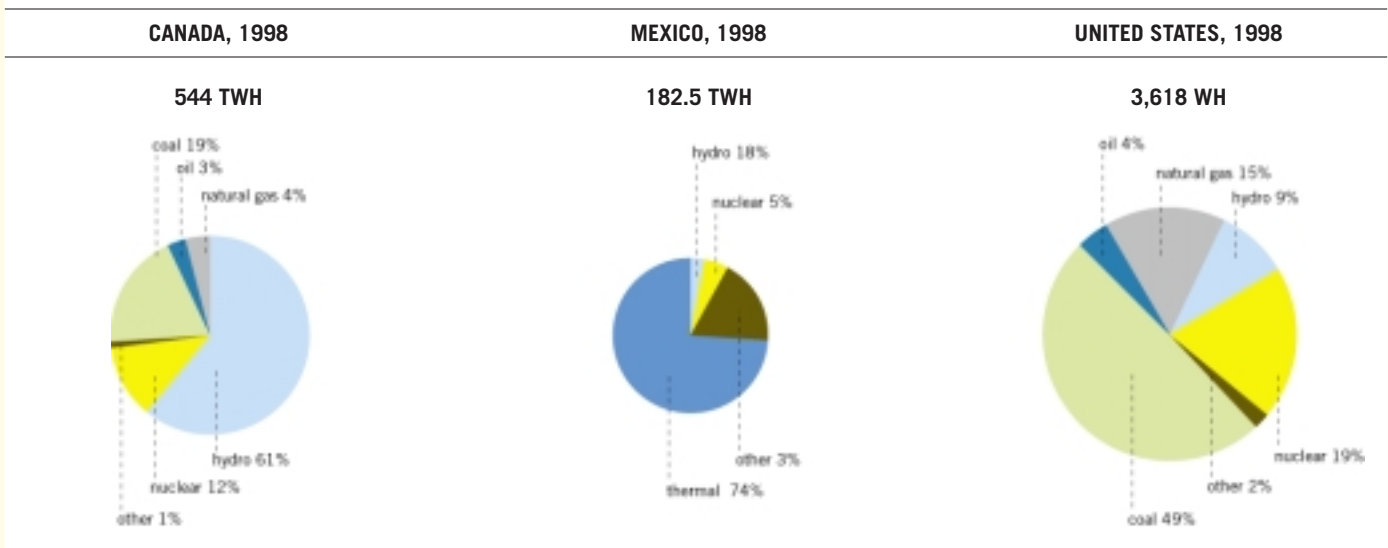
³ While currently very dependent on fuel oil, Mexico is planning on relying principally on natural gas as a fuel source for electricity generation.

⁴ These figures provided to the CEC by the *Secretaría de Energía*.

Emissions of Air Pollutants by Electricity Generators

When examining the environmental profiles of the electricity sectors in Canada, Mexico and the United States, it is important to bear in mind that there are significant differences in electricity generation, ownership and competition policy, in per capita energy consumption, aggregate emissions and in other relevant indices. Regional comparisons should also consider built-out infrastructure, available financing and levels of development. For an illustration of the main sources of electricity generation in North America, please refer to Figure 1 (circles depicting national generation are drawn to scale).

Figure 1 – Net Electricity Generation by Fuel Type in Canada, Mexico and the United States



Source; *Electric Power in Canada 1998*, Canadian Electricity Association; *Electric Power Annual 1998*, US Department of Energy, 1999. "Other" includes biomass combustion and renewable energy.

Notwithstanding the obvious benefits electricity provides, its generation, transmission and use has a considerable impact on both human and ecosystem health. For example, in the United States, the electricity sector emits approximately 25% of all NO_x emissions, roughly 35% of CO₂ emissions, one-quarter of total mercury emissions, and almost 70% of SO₂ emissions. The electricity sector is the single-largest source of nationally reported toxic emissions in the United States and Canada,⁵ and may represent a large source of toxic emissions in Mexico (publicly available data are lacking in Mexico at this time).

A fuller perspective of regional comparisons can be gained by examining a variety of measures. Some examples are provided in Table 3. This table shows aggregated amounts by country of the pollutants CO₂, SO₂, NO_x and mercury emitted by the electricity generation sector during a recent year (generally 1998)⁶ and emissions per capita, per square kilometer and per GWh of electricity generated.

⁵ CEC 2001. *Taking Stock 98*. Commission for Environmental Cooperation, Montreal.

Table 3 – Emissions of Selected Air Pollutants from the Electricity Generating Sector in North America (1998*)

	CO₂ equivalent (tonnes)	Annual SO₂ (tonnes)	Annual NO_x (tonnes)	Annual Hg (kg)
Canada	122,000,000	650,195	290,211	1,975
Mexico	90,095,882	1,683,199	280,931	1,117
United States	2,331,958,813	12,291,107	5,825,982	39,241
	per capita			
Canada	4.033	0.021	0.010	0.000
Mexico	0.918	0.017	0.003	0.000
United States	8.637	0.046	0.022	0.000
	per km²			
Canada	13.320	0.071	0.032	0.000
Mexico	46.128	0.862	0.144	0.001
United States	233.554	1.231	0.583	0.004
	per GWh			
Canada	217.229	1.158	0.517	0.004
Mexico	495.577	9.259	1.545	0.006
United States	608.789	3.209	1.521	0.010

* Some data are estimates, and not all come from 1998. For further details, see CEC background paper: Paul Miller et al. 2002. "Estimating Future Air Pollution from New Electric Power Generation." Commission for Environmental Cooperation, Montreal.
Population and Land Mass - Canada <www.statscan.ca>; Mexico (Mexico Economist Country Profile 1998) and United States (United States Economist Country Profile 1999), Electricity Generation - IEA - Electricity Information 2001.

All forms of large-scale electricity generation affect one environmental medium or another. Coal- and oil-fired plants contribute most of the sectoral emissions of air pollutants, although natural gas-fired plants emit a considerable amount of CO₂, a greenhouse gas. Large-scale hydroelectric facilities can displace communities, destroy or degrade critical habitat such as streams and rivers and harm wildlife and native fish populations. Nuclear power plants pose health, safety and security risks related to their operations,

and transport and storage of spent fuel. Even wind farms, depending on their location and technology used, can have impacts on visual aesthetics and avian wildlife.

Determining the relative environmental impact of different forms of electricity generation has proven to be a challenging task because of the difficulty of quantifying environmental impacts from different fuel sources and technologies throughout their lifecycle.

⁶ Mexico is in the process of replacing "combustóleo" fuel oil generators with new natural gas and/or coal facilities. The absolute improvements resulting from this development will depend on the choice of replacement fuel and pollution control equipment.

⁷ The "Power Scorecard," developed by the Pace Energy Project and Environmental Defense, attempts to define and quantify environmental impacts of electricity generation.

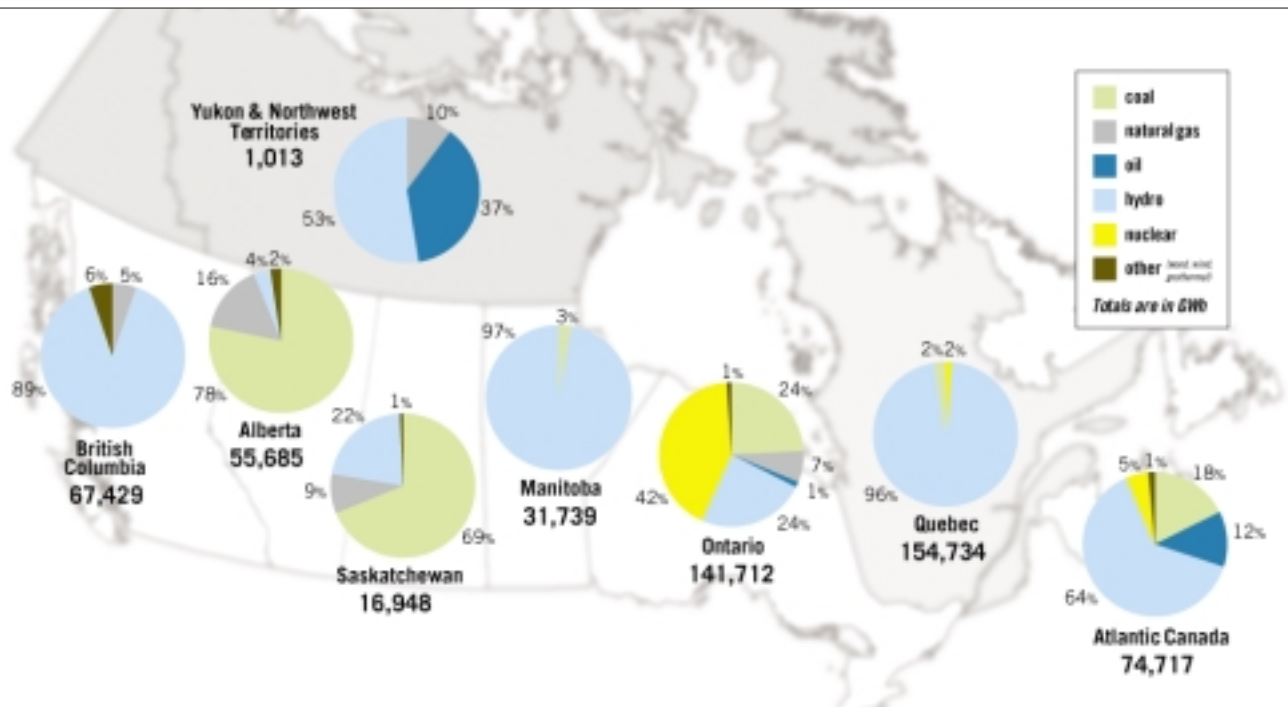
The Issues

Long-range and Cross-border Environmental Impacts

The environmental impacts associated with most conventional forms of electricity generation are often not limited to the immediate vicinity in which they operate (see Maps 1, 2, and 3 for Electricity Generated in Canada, Mexico and the United States, by region and fuel type [and/or] see Figure 1 for Net Generation by country). The medium- and long-range transport of pollutants from electricity generation plants—ground-level ozone and its precursors (especially NO_x), acid pollution, particulates and mercury, to name a few—has

been well documented.⁸ Persistent organic pollutants can also be transported on wind currents and deposited long distances from their point of generation, and can enter the food chain of distant communities. Other emissions, such as CO₂ and stratospheric ozone-depleting gases, are of global concern wherever they are emitted. Electricity plants can even cause impacts on wildlife long distances away, especially for migratory species dependent on corridors and specialized ecosystems in multiple regions.

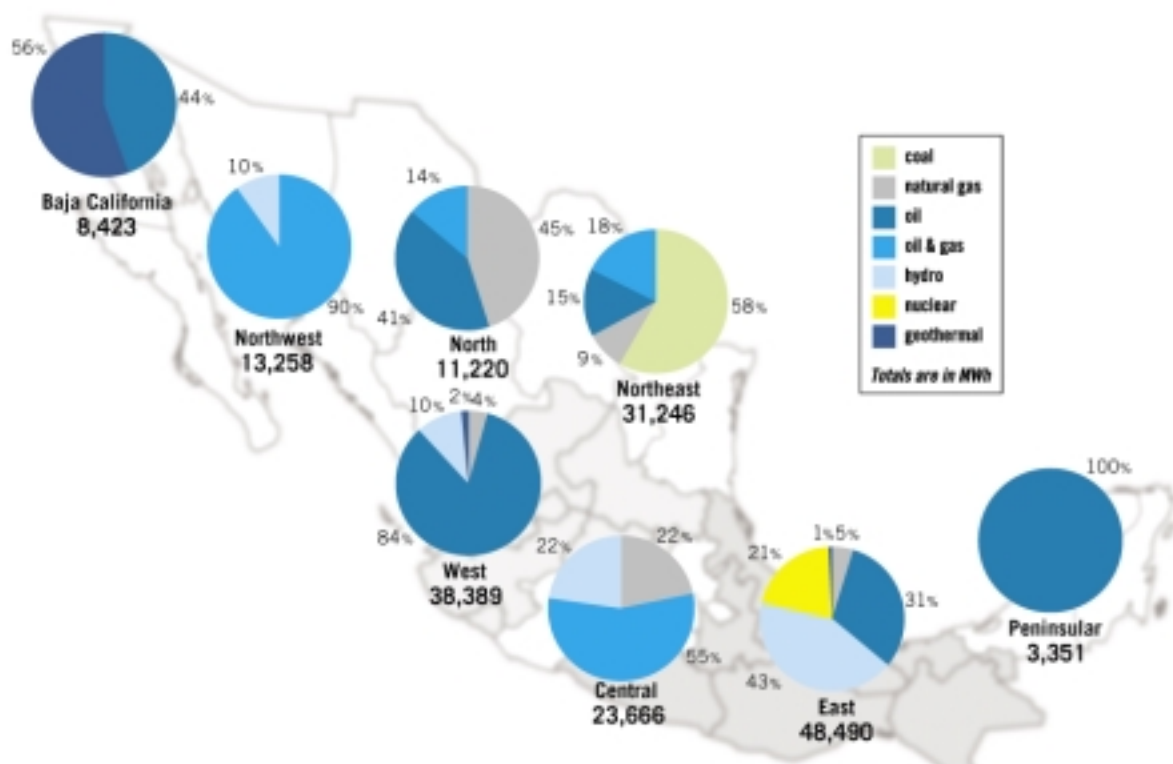
Map 1 – Electricity generated in Canada in 1998, by Fuel Type and Region



Data based on: *Electric Power in Canada 1998–99*, Canadian Electricity Association 2000. Numbers may not total 100 due to rounding.

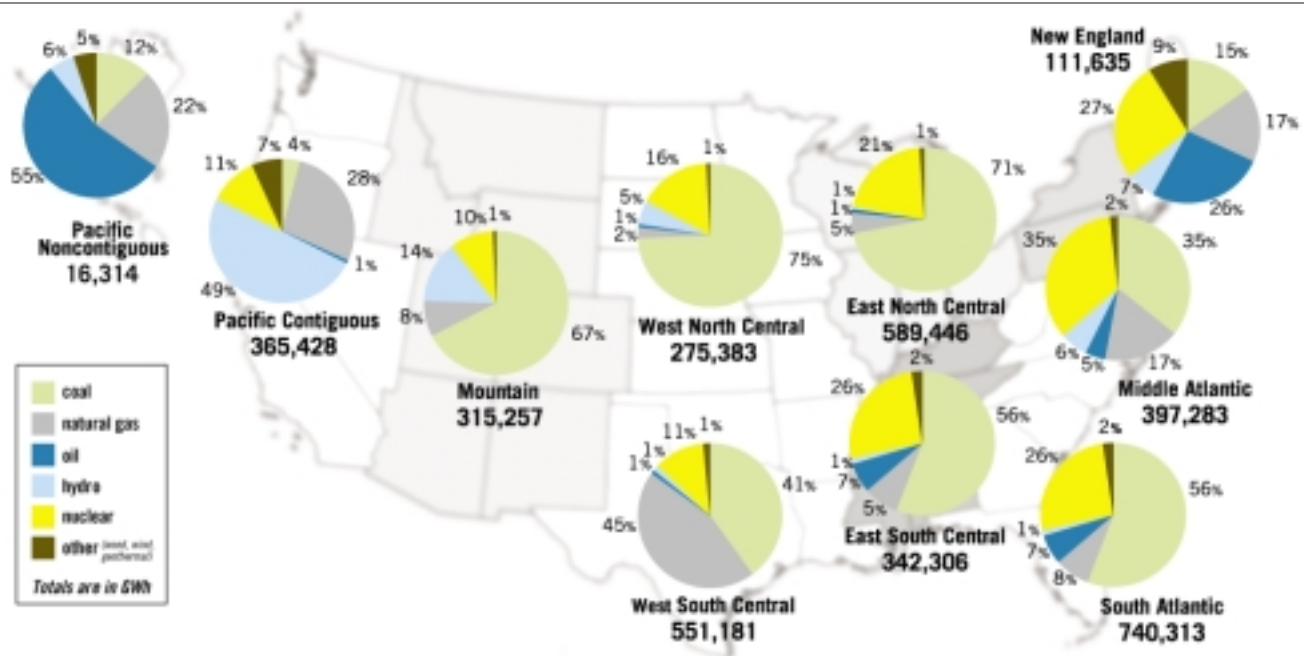
⁸ Several studies on air pollution transport are cited in CEC 1997, *Continental Pollutant Pathways: An Agenda for Cooperation to Address Long-range Transport of Air Pollution in North America*. Commission for Environmental Cooperation, Montreal.

Map 2 – Electricity generated in Mexico in 1999, by Fuel Type and Region



Data based on: Sector Eléctrico, Secretaría de Energía México 2000. Numbers may not total 100 due to rounding.

Map 3 – Electricity generated in the United States in 1999, by Fuel Type and Region

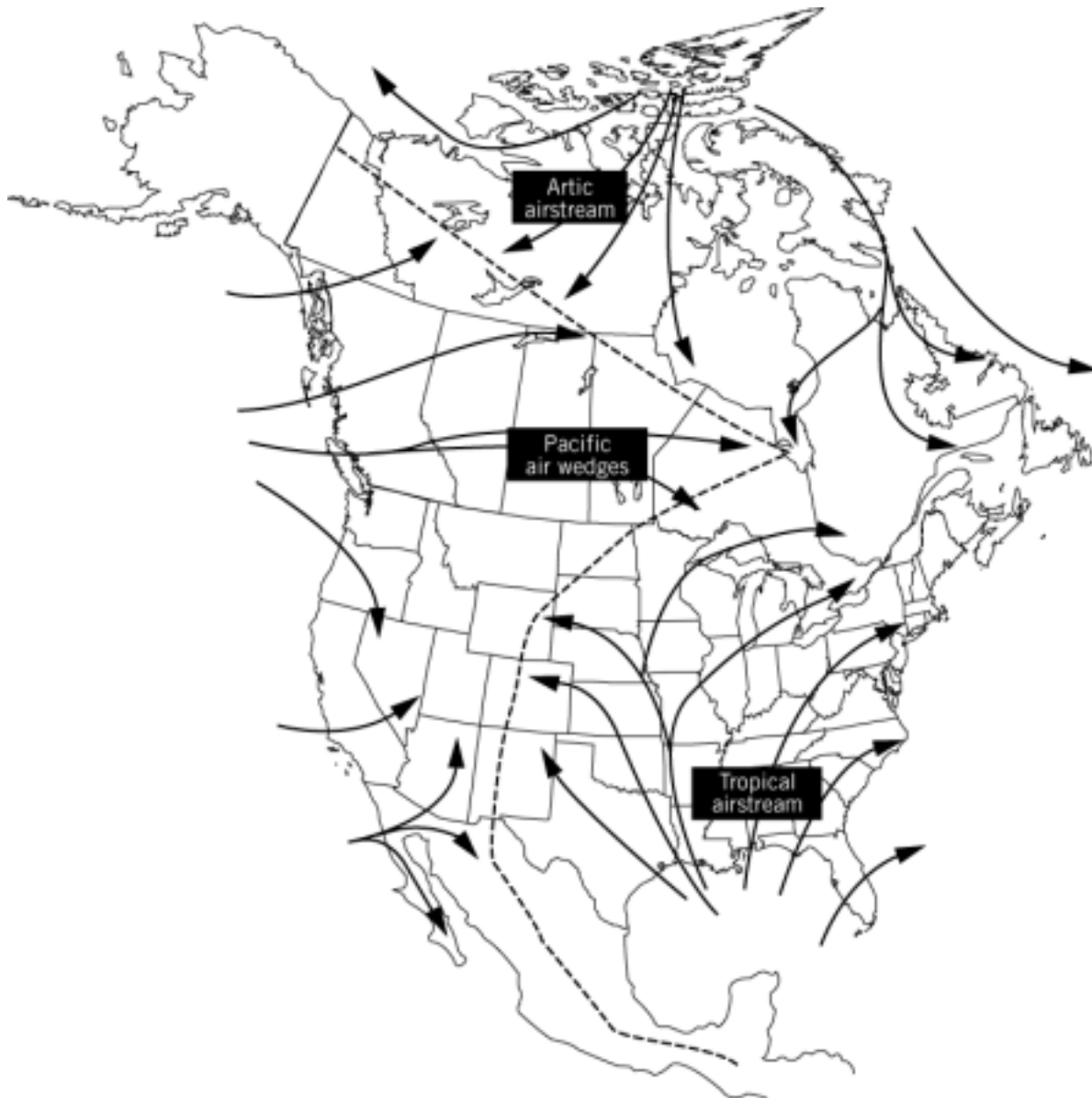


Data based on: *Electric Power Annual, 2000, Volume 1*, Energy Information Administration, US Department of Energy. Numbers may not total 100 due to rounding.

Addressing the harmful downwind impacts of such long-range transport of emissions is complicated by the fact that the extent of transport often crosses political boundaries. Through our linked airsheds, watersheds and migratory species corridors, the impacts of how electricity is generated in one place are likely to influence the quality of life elsewhere in North America. The figures below provide

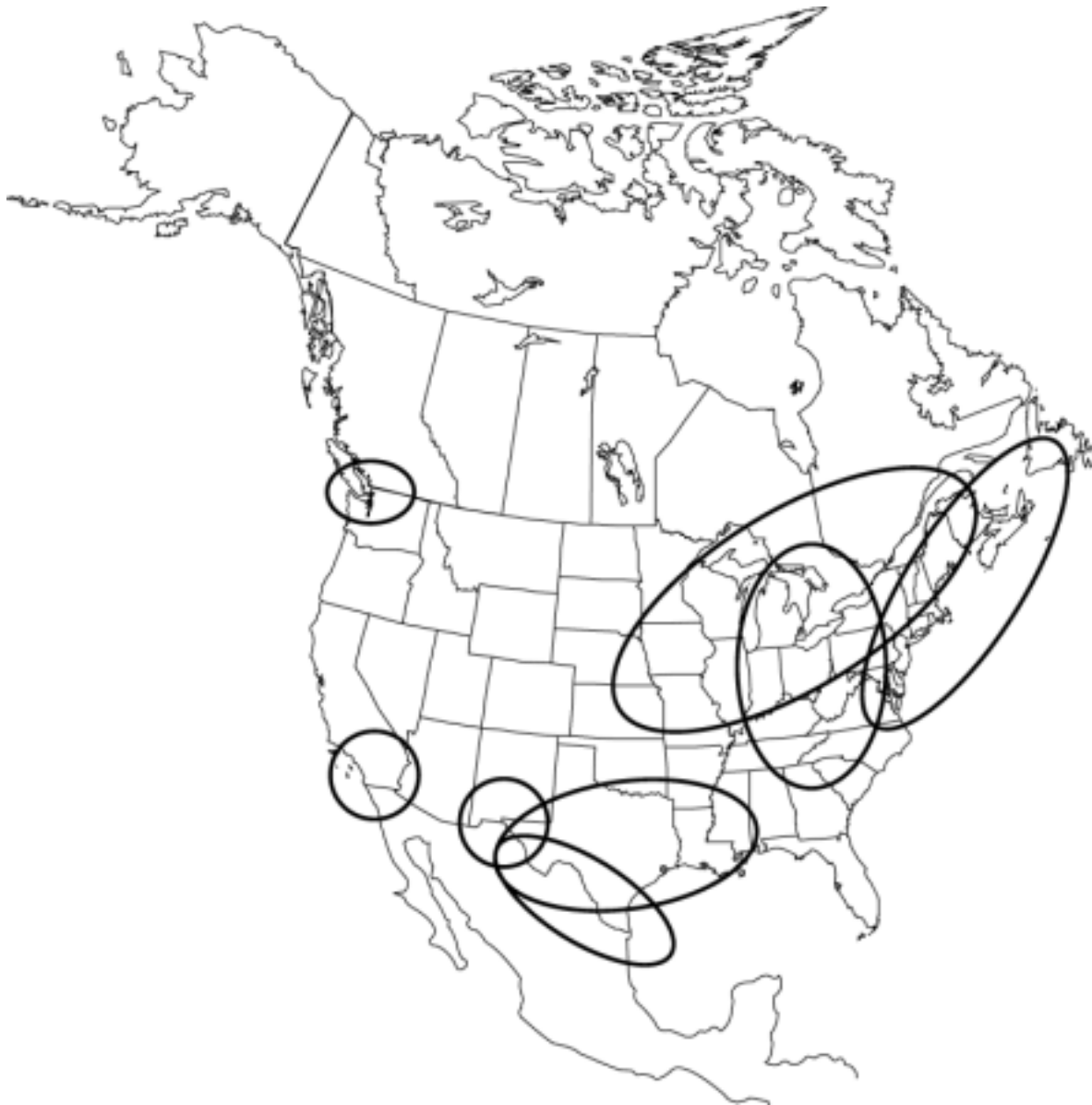
an illustration of the types of multi-jurisdictional air pollution transport systems that result in the need for cooperation among governing bodies that normally function independently of one another. Map 4 shows how prevailing wind patterns can carry pollutants across the continent. Map 5 illustrates some of the airsheds that straddle political borders.

Map 4 – Continental Pollutant Pathways: Surface Wind Flow across Canada and the United States, based on July Resultant Surface Winds



Source: From R.A. Bryson and F.K. Hare 1974. *Climates of North America*. Elsevier, New York. Also quoted in the United States-Canada Memorandum of Intent on Transboundary Air Pollution, MCARLO Interim Model Profile, July 1981

Map 5 – Examples of Shared Cross-border Airsheds

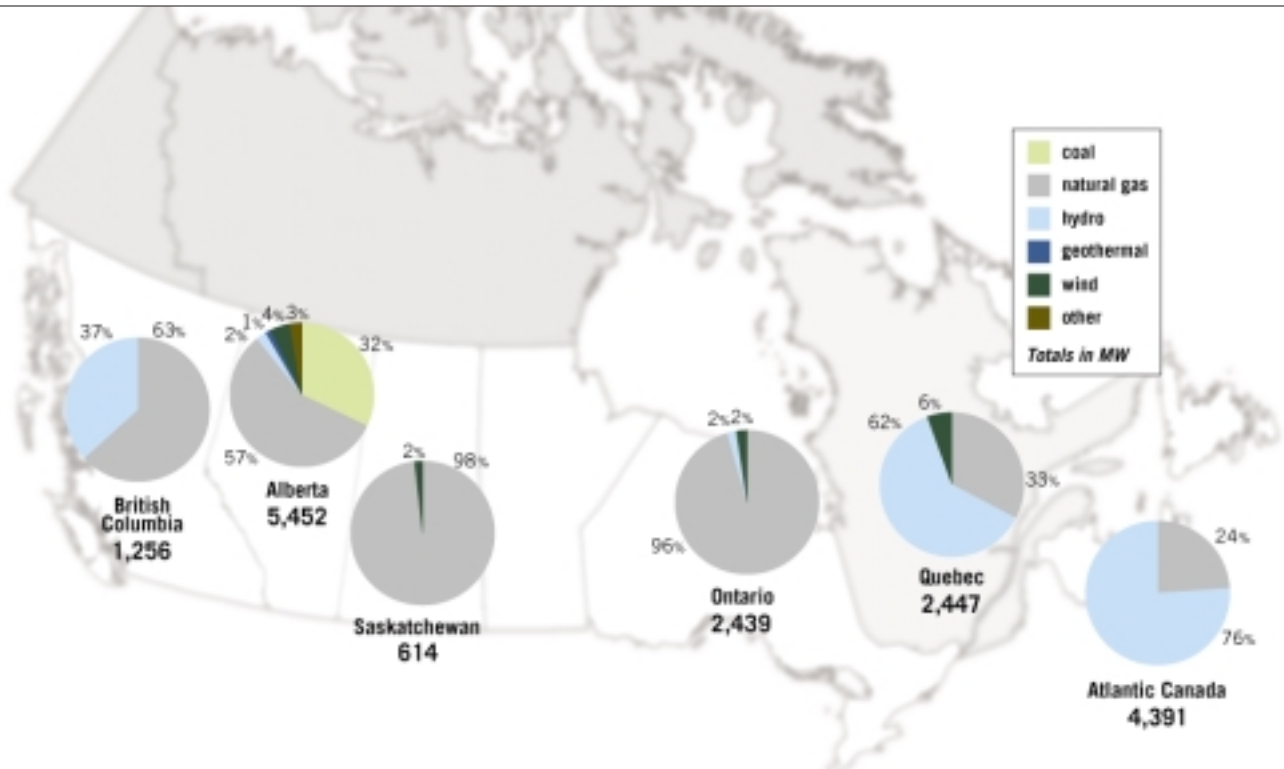


Source: Paul Miller, CEC, 2001.

New Generation Capacity

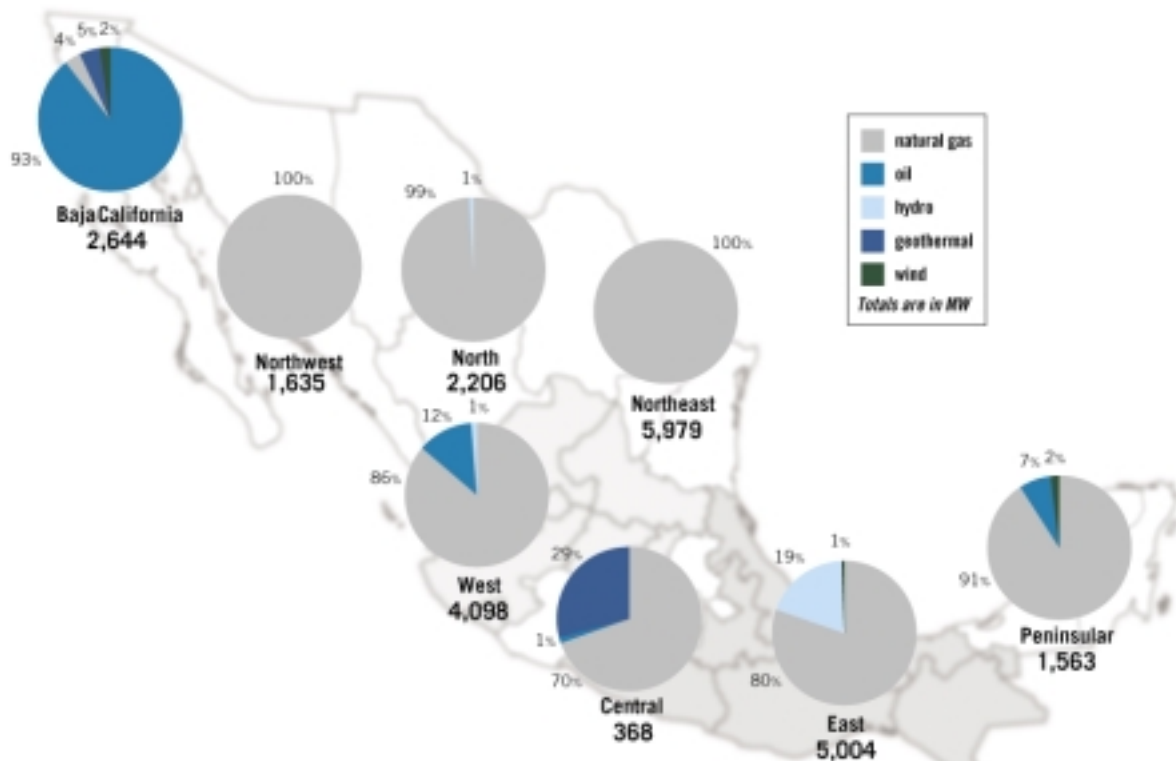
A thorough examination of the environmental implications of the evolving North America market for electricity must consider future generation needs and projected plans to meet those needs. Utilities, private developers and energy planners currently have announced plans (as of August 2001) to build nearly 2,000 new power generating units in North America by the year 2007. This represents roughly a 50% increase over current installed capacity (see Maps 6, 7 and 8 below for proposed new generation in North America by fuel type and location by region).

Map 6 – Proposed New Electricity Generating Capacity in Canada for 1999–2007, by Fuel Type and Region



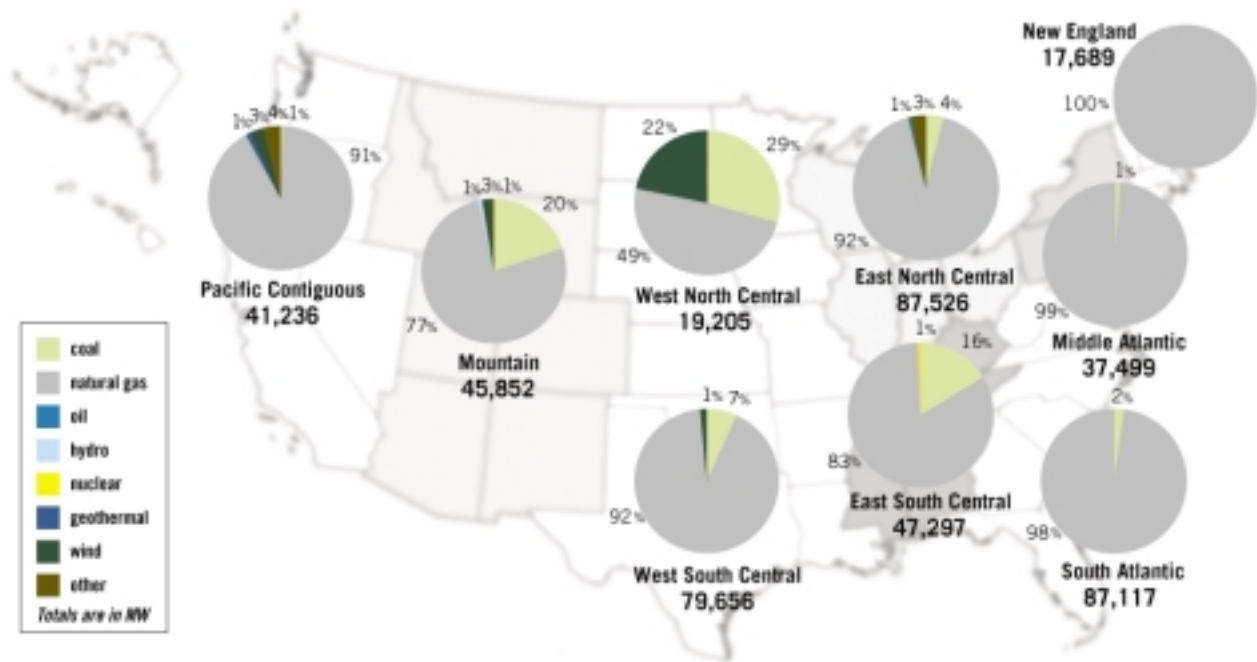
Proposed includes net MW of power plants that are under construction, scheduled for closure, in the early development stage, advanced development, proposed, tabled or began operation after 1998. Data based on: Resource Data International/Platts, NewGen data, Boulder, Colorado, 2001. Numbers may not total 100 due to rounding.

Map 7 – Proposed New Electricity Generating Capacity in Mexico for 1999–2007, by Fuel Type and Region



Proposed includes net MW of power plants that are under construction, scheduled for closure, in the early development stage, advanced development, proposed, tabled or began operation after 1998. Data based on: CRE (*Comisión Reguladora de Electricidad*), and CFE (*Comisión Federal de Electricidad*). Numbers may not total 100 due to rounding.

Map 8 – Proposed New Electricity Generating Capacity in the United States for 1999–2007, by Fuel Type and Region



Proposed includes net MW of power plants that are under construction, scheduled for closure, in the early development stage, advanced development, proposed, tabled or began operation after 1998. Data based on: Resource Data International/Platts, NewGen data, Boulder, Colorado, 2001. Numbers may not total 100 due to rounding.

While only a fraction of these projects will likely go forward, it is impossible at this time to determine which ones will move ahead or where they will be located. In Table 4, the CEC has estimated high boundary and low boundary values for selected air emissions based on planned new generation capacity in North America.⁹

Estimating emissions from announced generation capacity changes places some perspective on the potential emissions arising from announced capacity changes in relation to the electricity sectoral emissions from a recent year in North America (the reference case inventory). This also provides initial indications of what regions in North America may appear to be the most attractive to new energy developers, as reflected in the amount of new power plant capacity or emissions. This can lead to future lines of inquiry as to why developers deem these regions attractive, either because of greater local demand growth, access to transmission lines, differing regulatory requirements, availability of tax or other financial incentives, or other reasons. Furthermore, by developing a reference case emissions inventory for the North America electricity sector (the first of its kind), this analysis identifies key areas where access to improved information will help policymakers better evaluate the potential environmental consequences of an increasingly integrated electricity market. This analysis also underscores the value of having information on proposed new generation capacity available for North America for environmental policy makers to better assess the potential cumulative impacts on air quality.

It is important to point out what this analysis does not estimate. It does not estimate total emissions from the entire North American electricity generation sector in 2007. The analysis only attempts to account for emissions associated with proposed

changes (additions and closures) in electricity generation capacity in North America projected to 2007. It does not estimate emissions from existing sources that may still operate in 2007. For example, it does not account for potential pollution reductions at existing sources due to pending regulations, such as regional controls on emissions of nitrogen oxides in the eastern United States. It also does not estimate potential pollution reductions associated with reductions in electricity generation from existing sources where that generation may be displaced by newer, cleaner sources. This would require forecasting of demand growth and dispatch modeling that is beyond the scope of the analysis.

The boundary scenarios reflect differing assumptions of the probability of new generation projects going forward between 1999 and 2007. The difference in emissions between the high and low boundary estimates provides an indication of the dramatically different outcomes that are possible only in the present-day partially integrated market. Such variation underscores the importance of carefully considering which environmental policy tools are best suited to operating effectively in a climate of uncertainty. Across North America there is extensive experience with some policy tools, such as national ambient air quality standards, guidelines, and objectives, and less experience with other measures such as domestic or regional cap and trade programs.

⁹ "High boundary" values include all planned new generation capacity; low boundary values represent a much smaller fraction (approximately 40%) that consists only of power plants in advanced stages of development. For a complete explanation of the methodology employed in deriving these values, see CEC background paper: Paul Miller et al. 2002. "Estimating Future Air Pollution from New Electric Power Generation." Commission for Environmental Cooperation, Montreal.

Table 4 – Summary of National Emission Totals for the Electricity Generation Sector in the Reference Inventory Case and the High and Low Boundary Future Projections

Country scenario	Annual CO₂ (tonnes)	Annual SO₂ (tonnes)	Annual NO_x (tonnes)	Annual Hg (kg)
Canada reference inventory	122,000,000	650,195	290,211	1,975
Canada high boundary 2007	18,828,537 (+15%)*	-3,917 (-1%)	41,910 (+14%)	221 (+11%)
Canada low boundary 2007	3,743,487 (+3%)	20 (0%)	10,890 (+4%)	9 (0%)
Mexico reference inventory	90,095,882	1,683,199	280,931	1,117
Mexico high boundary 2007	48,199,112 (+53%)	36,131 (+2%)	175,707 (+63%)	270 (+24%)
Mexico low boundary 2007	25,712,762 (+29%)	34,779 (+2%)	110,978 (+40%)	212 (+19%)
US reference inventory	2,331,958,813	12,291,107	5,825,982	39,241
US high boundary 2007	875,036,007 (+38%)	64,580 (+1%)	459,286 (+8%)	5,762 (+15%)
US low boundary 2007	333,347,795 (+14%)	-77,468 (-1%)	147,150 (+3%)	1,039 (+3%)

* The percent value given in parentheses is the relative size of the new 2007 emissions in the boundary case compared to the reference inventory. For example, in the Canada 2007 high boundary case, the estimated CO₂ emissions from projected electricity capacity changes would be 15% of the reference inventory emissions. This provides a relative sense of the scale of potential emission changes. This, however, is not a projection of the total emissions increase from all electric power generation, as emissions from existing sources could decrease due to potential generation displacement by newer power plants or the installation of new pollution controls. In addition, emissions from new power plants could be "offset" through other measures, such as carbon sequestration in the case of CO₂ emissions.

How Electricity Market Integration Can Affect the North American Environment

The “integration” of electricity markets in North America refers to the operation of a more seamless market and is characterized by cooperative regulatory approaches supportive of regional trade, investment and infrastructure development. While far from completely integrated, North American markets have evolved to the point where retail prices in regions of the United States are affected by the level of snowfall in eastern Canada, natural gas pipelines cross thousands of miles from western Canada to Chicago and a growing number of electricity generation projects are designed for export.

The integration of electricity markets can potentially affect environmental quality in a number of ways. Removing trade and investment barriers, for example, may accelerate capital turnover, allowing for more rapid diffusion of state-of-the-art technologies and pollution control equipment. A competitive, price-based and transparent sector may also help to “get the price right,” by helping to internalize external environmental costs—costs that are not often reflected in electricity prices.

The effect that market integration will have on the environment will be influenced by a number of key factors. These include the choice of fuel (fossil, hydro, wind, solar, biomass, geothermal, hydrogen or other) which in turn is driven by price and policy considerations. Regional and cross-border dynamics are also relevant and may be influenced by infrastructure, fuel and market access as well as environmental standards and regulations.

Greater integration of North American electricity markets remains hindered by what are often severe limitations and constraints in the functioning of the “grid”—the linked supply and transmission infrastructure in the three countries. As an example, the ability to access the grid can be a key determinant for siting new facilities.

Pollution Havens, Halos and Generation Clusters

Currently, the key considerations for siting new electricity generators include the availability and cost of fuel sources, access to profitable markets, and deficiencies in the operation of the grid. As North American markets become more closely integrated, they will tend to favor the “least cost producer.” This may lead to some locational shifts in production and in environmental impacts. Put simply, in areas where electricity is imported, domestic air emissions will be displaced to the area where the electricity is generated (assuming fossil fuels are used). Similarly, in areas where electricity is exported, air emissions will increase (again assuming fossil fuels are used). The relative economic and environmental costs and benefits of these shifts will depend on how a particular region is affected by these changes. This is illustrated in Table 5, which shows for the high boundary case, what emissions of CO₂, SO₂, NO_x and mercury could be expected from new generation for the top three states/provinces in Canada, Mexico and the United States.

Table 5 – Emissions of CO₂, SO₂, NO_x and Mercury Associated with Planned Electricity Projects in 2007—High Boundary Case, Top Three States/Provinces in the Three NAFTA Countries

	Annual CO ₂ (tonnes)	Annual SO ₂ (tonnes)	Annual NO _x (tonnes)	Annual Hg (kg)
CANADA				
Alberta	11,724,264 (62%)	Alberta 18,582 (-)	Alberta 20,931 (50%)	Alberta 218 (99%)
Ontario	2,494,749 (13%)	Ontario 13 (-)	Ontario 7,257 (17%)	Ontario 6 (3%)
Quebec	2,252,505 (12%)	Quebec 12 (-)	Quebec 6,553 (16%)	Quebec 5 (2%)
MEXICO				
Tamaulipas	9,492,467 (20%)	San Luis Potosí 55,738 (154%)	Guerrero 63,547 (36%)	Guerrero 165 (61%)
Veracruz	8,649,978 (18%)	Quintana Roo 11,348 (31%)	Tamaulipas 27,614 (16%)	San Luis Potosí 25 (9%)
Guerrero	8,467,729 (17%)	Baja California Sur 1,234 (3%)	Veracruz 25,164 (14%)	Tamaulipas 22 (8%)
UNITED STATES				
Texas	59,705,611 (7%)	Kentucky 29,463 (46%)	Texas 31,207 (7%)	Kentucky 718 (12%)
Florida	46,201,965 (5%)	Utah 19,753 (31%)	Kentucky 28,438 (6%)	Utah 474 (8%)
Illinois	46,113,390 (5%)	Arkansas 15,757 (24%)	Illinois 27,862 (6%)	Arkansas 403 (7%)
<p>Note: Numbers in parentheses represent percent contribution of the given jurisdiction of total estimated national increase (see Table 4) in emissions from new capacity in the year 2007. See CEC background paper, Paul Miller et al. 2002, for a complete listing by state and province. The percent contributions for Canada's mercury emissions total more than 100% because national totals include a 13-kg decrease from New Brunswick.</p>				

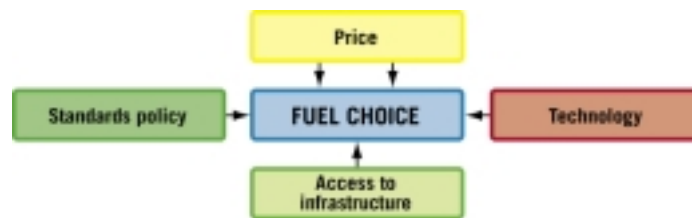
It must be noted that these data provide insight into what key stakeholders in the electricity sector are thinking *now*; repeated experience has shown us that unpredicted events can dramatically alter current paradigms. Nonetheless, the table does highlight potential regions where additional analysis may be warranted on fuel types, pollution control technologies and other factors affecting potential impacts.

One factor affecting production costs, and hence location, is the relative and absolute cost of environmental regulations. Concerns have been raised that in tight, highly competitive markets, widely divergent regulatory requirements could accelerate locational shifts in electricity generation to so-called “pollution havens,” to the detriment of those living in adversely affected airsheds or watersheds. Citizens have raised concerns about pollution havens in all three countries.¹⁰ Conversely, jurisdictions with strong

standards or which attract “clean” electricity may see associated health and environment benefits (“pollution halos”).

Even with high environmental standards, the magnitude of the impacts in regions preferred for new electricity generation—which are often near lucrative export markets—pose significant challenges for environmental managers charged with meeting air quality standards and other environmental goals. Without near-term technological breakthroughs, those regions that are likely to attract concentrated “clusters” of electricity generation facilities will require robust environmental policies to deliver the twin benefits of affordable energy and environmental protection. Jurisdictions downwind of new generation facilities will be interested in assuring that adequate measures are in place to protect their environmental and health interests as well.

Figure 3 – Factors Affecting Fuel Choice



A key consideration for environmental policymakers will be how market integration affects the competitiveness of particular fuels such as coal, natural gas or renewables, in larger areas or regions. The type of fuel used, along with pollution control technologies, performance standards, and related regulations, will largely determine the environmental impacts from a specific

facility. In 1996, this potential was examined by the US Federal Energy Regulatory Commission (FERC) in an environmental impact assessment that was carried out before the introduction of competition in US wholesale electricity markets by promoting open access to transmission lines.

¹⁰ Examples include Pembina Institute press release: “New standards position Alberta as a pollution haven for coal-fired plants: Standards that affect health and environment set with no public input,” (18 June 2001) at <<http://pembina.piad.ab.ca/news/press/2001/2001-06-18.php>>; (it is noteworthy that on 15 June 2001, Alberta’s Environment Minister committed to launch a multi-stakeholder process for establishing standards for power plants approved after 2005, while also looking at emissions from existing plants and the possible introduction of standards for CO₂ management within the context of Alberta’s climate change strategy); letter from The Border Power Plant Working Group to the Secretaries of State and Energy of the United States and Mexico, *et al.*, entitled “Urgent need for bilateral agreement between the United States and Mexico regarding sustainable environmental requirements for new power plants in the Border Region” (22 August 2001). Available on file at the CEC. See also Michael Janofsky, “In the race to produce more power, states are faced with environmental tradeoffs.” *New York Times*, 26 March 2001.

The experience gathered in the United States since the introduction of competition suggests that competition favored coal over other fuels, as FERC's "competition-favors-coal" scenario seems to have come the closest of the various scenarios evaluated describe what has taken place. (It should be noted that even the "competition-favors-coal" scenario underestimated actual CO₂ emissions by a considerable margin.¹¹) The historic difficulty of accurately forecasting electricity demand continues to plague planners of all types, especially those attempting to assess the potential environmental impacts of different scenarios.

Current information, including the fuel choice for proposed new generation facilities across North America, suggests that, for the moment, prevailing conditions favor natural gas, currently the cleanest of the fossil fuels. Relative fuel prices can shift rapidly, however, and a number of experts are already projecting an increase in natural gas prices as low-cost, accessible reserves are aggressively exploited. In the near term, the health and environmental impacts of electricity generation in North America will largely be determined by whether and where "cleaner" electricity generation fuels can compete favorably with "dirtier" ones. Over the longer term, impacts will also be affected by the still more uncertain pace of technological change and the advent of "breakthrough" technologies, such as hydrogen fuel cells.

Standards and Regulations

At a "macro" level, the NAFTA partners address air, water and land impacts in similar ways, employing a blend of command-and-control and market-based instruments to achieve environmental and health goals. All three countries set ambient air quality standards or objectives nationally or locally, for example. Nonetheless, there are major differences between the three countries with respect to jurisdictional issues, i.e., who sets and enforces standards or objectives, the level of allowable emissions, and monitoring and enforcement requirements.

In tight regional markets, differing approaches to regulating pollution can affect price, stability and certainty, including project development approval timelines. They can also influence siting, fuel or other choices that have an impact on environmental quality. Deeper market integration may lead to a more fluid and dynamic policy climate. The role environmental regulators play in this arena should be considered thoroughly as trade and competition policies are discussed in the region.

Differing environmental standards across regions can create differing comparative costs for environmental compliance. If power developers locate in regions of lower compliance costs (i.e., lower environmental standards), the question often arises, are these regions "pollution havens"? Identifying such regions, however, is complex, based simply on differing environmental standards. Specifically, a simple comparison of environmental "standards" across borders in an attempt to identify a "pollution haven" needs to take into account differing circumstances, such as the degree of the pollution problem in a specific region or local public demand for higher standards, which could rationalize differing levels.

The emergence of market-based regulatory programs, such as emissions trading, also complicates inferences made from direct comparisons of emission standards. Setting an emissions cap for a pollutant relies more on achieving a total emissions reduction across a region or country, rather than imposing a power plant-by-power plant emissions standard. Therefore, assuming all else is equal, even identical power plants can have different emission rates if their summed emissions comply with an overall cap. If the goal of environmental and public health protection is the reduction of overall pollution, these programs can meet that goal without imposing identical standards on all affected facilities. The existence of a pollution cap, however, can still allow for the setting of more stringent standards at specific power plants to account for local "hot spots." The severity of local impacts may not exist at other power plants in other locations,

¹¹ See CEC background paper: Woolf, Tim et al. 2001. "A Retrospective Review of FERC's Environmental Impact Statement on Open Transmission Access." Synapse Energy Economics, Inc. Cambridge, Massachusetts. The authors attribute the underestimation of emissions in FERC's analysis mainly to underestimating demand projections throughout the relevant period.

thus not requiring the same level of stringency, and this would not necessarily mean that the other power plants with less stringent standards constitute a “pollution haven.”

Examples abound illustrating the complexity of comparing differing emission standards, not just between countries, but within countries as well. For example, in the United States, many eastern states are subject to a NO_x reduction program called the “NO_x SIP Call” that will affect many power plants in the region. Because the reduction requirements do not apply to states outside the NO_x SIP Call region, there will be domestic differences in emission standards between affected power plants in the NO_x SIP Call region and power plants outside the region. Furthermore, even within the NO_x SIP Call region, there may be state-by-state differences. Some states could impose power plant-specific emission standards while other states could allow emissions trading to meet the reduction requirements. Therefore, while the overall reductions may be met across the region, there could be state-by-state differences in terms of allowed emission standards.

Under the current trend towards “market-based” regulatory programs such as emissions trading, cross-border differences may not necessarily arise because of perceived differences in power plant emission standards, but rather over the design of emission trading programs. For example, Ontario is implementing a NO_x emissions trading program to help meet Canada’s emission reduction commitments under the Ozone Annex to the 1991 United States-Canada Air Quality Agreement. Environment Canada, several NGOs, and the US EPA¹² (at Ontario’s request), have critiqued Ontario’s trading plan and have reservations about its environmental efficacy.

Despite the emergence of market-based regulatory programs, disputes can and still do arise over perceived differences in traditional emission standards. There is a heated debate currently

underway in the United States over differences in emission standards applied to new power plants and existing “grandfathered” power plants.¹³ New coal-fired power plants in the US, for example, are subject to pollution control requirements for NO_x and SO₂ under the Clean Air Act New Source Review (NSR) provisions that are more stringent than those required for existing coal plants that have never been subject to NSR (i.e., commonly referred to as “grandfathered” coal plants). Furthermore, one group in Canada is raising the issue of differing cross border emission standards in arguing that proposed new coal plants in Alberta, while meeting relatively more stringent requirements than existing plants, would not meet the more stringent emission limits achievable by a new coal power plant in Wyoming.¹⁴ Additionally, concerns have been raised about power plants being built in northern Mexico to serve the US market.¹⁵

Technological Innovation

In trying to predict what the shared North American energy future will look like, it is difficult to quantify the potential beneficial impacts of technological innovation and the emergence of breakthrough technologies. New energy technologies hold the promise of profoundly changing the face of energy markets and can address both the supply and demand side of the electricity sector. Examples of new energy technologies include fuel cells, conductive plastics, supercritical steam generators and integrated combined-cycle gasification technologies, along with progress in renewable energy sources, including solar, wind, geothermal and tidal generating technologies. Emerging technologies also include new ways of meeting familiar challenges, including the promise of “smart grid technologies,” cleaner coal plants, as well as longer-term prospects of the shift from a carbon to a hydrogen economy.

¹² Comments by Brian J. McLean, Director, Clean Air Markets Division, US Environmental Protection Agency, to John Hutchinson, Senior Policy Advisor, Air Policy and Climate Change Program, Ontario Ministry of the Environment (22 June 2001).

¹³ See for example, letter from John H. Adams, President, Natural Resources Defense Council, to US President George W. Bush (May 7, 2001) at <<http://www.nrdc.org/air/pollution/pbushcaa.asp>>.

¹⁴ Pembina Institute, *Best Available Pollution Control Technologies for Coal Combustion* (24 July 2001), at <<http://pembina.piad.ab.ca/news/press/2001/2001-07-24bg.php>>.

¹⁵ Letter from The Border Power Plant Working Group to the Secretaries of State and Energy of the United States and Mexico, et al., entitled “Urgent need for bilateral agreement between the United States and Mexico regarding sustainable environmental requirements for new power plants in the border region” (22 August 2001). Available on file at the CEC.

The Need for Greater Environmental Cooperation and Compatibility

The trend towards convergence of trade, investment and competition policies in the electricity sector in North America has been reinforced and reinvigorated by current trilateral discussions on advancing North American energy markets. A parallel effort towards more compatible environmental policies is essential to ensure that expanded and more integrated North American energy markets help the three countries to achieve their health and environmental objectives.

There are several compelling reasons for North American cooperation in developing compatible policies and progress related to the electricity sector. First, failure to at least ensure compatible (not identical) environmental laws, policies and programs in this sector could undermine carefully considered domestic strategies for striking the right balance between health, environment and abundant electricity. For example, in an increasingly integrated grid, generators could locate power facilities in neighboring jurisdictions without caps, offset requirements or mitigation rules, even though emissions from those facilities will enter the airshed of the neighboring jurisdiction maintaining such policies.

Moreover, failure to coordinate regional environmental responses to electricity markets may invite unwelcome environment-related trade disputes as local jurisdictions scramble to

enact policies to promote clean energy and/or protect their environment. An examination of early policy initiatives from a growing number of US states and Canadian provinces provides a glimpse of how some environmental policy options may be shaped, or constrained, by trade and commerce rules.¹⁶ Trade experts point out that a number of the environmental policy responses either in place or currently under consideration may be problematic under rules established by the WTO and in NAFTA's Chapter Six and elsewhere.¹⁷ While such disputes are not inevitable, environmental laws or policies are not insulated from trade challenges, and lawmakers need to be cognizant of how trade rules can shape, or in some cases constrain, environmental policy responses.

Compatible, mutually reinforcing regional electricity and environmental policies could provide the long-term regulatory stability and predictability conducive to private sector ventures. More compatible regulatory approaches may also establish a foundation for employing innovative market mechanisms on a regional scale. These mechanisms—such as cap and trade schemes—may achieve environmental goals while generating substantial resources that could be made available to help finance technology upgrades in poorer regions.¹⁸

¹⁶ Some eleven US states have enacted renewable portfolio standards. A significantly higher number of states and provinces have introduced consumer choice for "green electricity," or provide incentives for renewable energy. Emission Performance Standards are also under consideration in several jurisdictions, e.g., Ontario.

¹⁷ See CEC background paper: Horlick et al. 2001. "NAFTA Provisions and the Electricity Sector." The paper examines the relationship between NAFTA rules and electricity policies, such as renewable portfolio standard definitions and performance standards.

¹⁸ CEC 2001. *Mexico and Emerging Carbon Markets: Investment Opportunities for Small and Medium-size Companies and the Global Climate Agenda*. Commission for Environmental Cooperation, Montreal.

Opportunities for Environmental Cooperation

There are a number of areas where opportunities exist for greater cooperation and compatibility. Trinational focus in these areas could help realize important environmental gains and economic efficiencies in the electricity sector.

Transboundary Airshed Management

A clear opportunity exists to initiate a dialogue on overall environmental, health and economic goals in specific regions defined by common airsheds where deteriorating air quality is of concern. Several examples demonstrate the feasibility of innovative cooperation to achieve environmental goals that affect a broad region defined by the regional airshed of a specific pollutant. In the US, the Clean Air Act provided for the formation of the Ozone Transport Commission (OTC), composed of 12 northeast states and the District of Columbia. The purpose of this commission is to identify regional solutions to the regional ozone challenges facing the member jurisdictions, bound together from an air quality perspective by a common ozone airshed. From 1994 to 1997, the US EPA oversaw the efforts of the Ozone Transport Assessment Group (OTAG), formed as a result of the growing amount of data indicating that ozone transport affected an even broader region of the eastern US. Science had demonstrated that the northeast ozone airshed is actually larger than originally anticipated by the formation of the OTC. On the international level, the governors of the six northeastern states in the US have met regularly for two decades with the prime ministers of the five eastern Canadian provinces to address issues of mutual interest, including the transport of air emissions throughout an airshed that encompasses their combined region. Similarly, international coordination also exists between El Paso in the state of Texas in the US and Ciudad Juárez in the state of Chihuahua in Mexico to address air issues within their cross-border airshed.

These airshed management efforts may hold promise for developing equitable regional solutions to regional air quality challenges. As national barriers are reduced to allow for the expansion of trinational electricity markets, the emissions associated with the production of electricity will be directly affected. The resulting

impacts on cross-border airsheds will require increased international cooperation and present an opportunity to utilize an airshed management approach as an effective framework for addressing cross-border air quality challenges.

Innovative Economic Instruments

The use of economic instruments, in particular, emissions trading and trading in renewable energy certificates, has increased dramatically during the 1990s. The marketplace has proven effective as a means to deliver lower compliance costs for environmental objectives along with an associated price signal. In North America's electricity generation sector, domestic emissions trading for NO_x and SO₂ has succeeded in reducing emissions efficiently. There is interest in, and good potential for, transboundary emissions trading within North America. Some jurisdictions, (e.g., Ontario) have opened the door for international trades to be recognized within their system. Developing common approaches to transboundary emissions trading programs may enhance their environmental and economic effectiveness. An international market is emerging for greenhouse gases (GHGs) as well, though in North America the emergence of a carbon market faces a number of challenging hurdles.

Despite some broad-scale policy differences related to approaches to climate change, the emergence of multi-pollutant emissions trading regimes affords opportunities to examine what elements should be common to each system in order to maximize economic and environmental benefits, in addition to identifying barriers that hinder a broader, more liquid market in the long term.

Energy Efficiency and Renewable Energy

A more balanced and sustainable long-term policy framework for energy can be achieved through closer collaboration on national, state and provincial policies to promote energy efficiency and renewable energy. In addition to promoting energy security through a more distributed and diverse energy portfolio, greater attention to these areas could help cushion the region from the impacts of more conventional electricity sources.

The CEC workshop on “*Emerging Renewable Energy in North America*” presented information on a number of important renewable energy initiatives underway in the region. Surprising to some, renewable energy entrepreneurs are not sitting back awaiting the development of revolutionary (“disruptive”) renewable technologies. Rather, they are looking for a fair chance to compete (and raise financing) with their existing technology against historically subsidized conventional energy sources.¹⁹ Innovative programs such as California’s reverse auctions for renewables, and the wind farms in Quebec, Alberta and Oaxaca are examples of concrete renewable energy measures emerging in the market.

There are differing views regarding the size of the market-share renewable energy sources can capture. Nonetheless, in some regions renewable sources of energy have made impressive gains.²⁰ Also, an increasingly broad spectrum of industry and governmental entities have advanced bold and aggressive forecasts for increased renewables.²¹ Government action to stimulate favorable market conditions is needed to foster the kind of innovation needed to accelerate the use of renewable electricity sources. The recent proposal by Conae in Mexico to help encourage the development of renewable energy production in Mexico provides a good example.²²

There are also differing views regarding the definition of renewable energy. Development of national, regional and international guidelines, definitions and criteria for areas such as “renewables” could reduce the possibility of environmental policies clashing with trade rules.

Impressive gains continue to be made in energy efficiency in North America. To illustrate, although total energy consumption in North America rose throughout the 1990s, it did not rise at as steep a rate as the growth in national economies.²³ Through improvements in electricity generating technologies, coupled with a continued emphasis on demand-side energy efficiency, it is clear that total energy demand can be lowered while simultaneously delivering comparable or even higher levels of energy services. Reflecting the important role energy efficiency represents both for energy and environmental policies, a working group on energy efficiency has been convened under the North American Energy Working Group.

Improvements in energy efficiency vary by technology and by region. During the 1970s, following the oil-price shocks, energy efficiency in the United States increased by almost 40%. More recent estimates suggest that energy efficiency gains based on exist-

¹⁹ North America has lost significant marketshare to foreign competitors in some areas of renewables technology, such as wind turbines.

²⁰ By the end of 2001, Germany led the world with installed wind capacity of 8,000 MW, or one-third of the global total. Denmark now produces more than 15 percent of its electricity from wind power, and there are states within Germany that produce more than 20 percent. (See CEC background paper: “Assessing Barriers and Opportunities for Renewable Energy in North America,” Prof. William Moomaw, Tufts University, 2002). In 1999, non-hydro renewables made up between 2 and 3 percent of total generation in Canada, Mexico and the US (data from International Energy Agency, Electricity Information, 2001).

²¹ In the European Union, plans were recently approved by the Council of Ministers to double its reliance on renewable energy, from 6 to 12 percent, in the next nine years (See CEC background paper, Vaughan et al. 2002). The British government recently committed to ensuring that 10 percent of British electricity would come from renewable resources by 2010 <www.solaraccess.com>. See also, e.g., EIA and other sources cited in CEC background paper by Moomaw (2002).

²² This proposal drew heavily on a joint CEC-Conae survey of the interest in renewable electricity by 100 of the largest electricity consumers in Mexico.
²³ See Vaughan 2002, Table 1. Mexico and Canada rank roughly the same in terms of energy intensity (measured as amount of energy used to produce one unit of GDP), whereas the United States uses roughly 30% less energy for each unit of GDP that it produces. Mexico still uses large amounts of energy in the traditional industrial sector, while Canada still requires large quantities of energy for heating and transportation. In both Canada and Mexico, the trade and services sectors consume less energy than their counterparts in the United States.

ing technologies are in the range of 25 to 30%, with an upper boundary of 40%. The greatest potential for energy efficiency improvements in Canada and the United States lies in changing residential and commercial building codes. Mandatory energy performance standards covering a broad range of consumer products are also a highly effective environmental policy. The announcement in 2001 by Canada and the United States to market EPA's Energy Star product labeling in Canada underlines the potential for international cooperation in product labeling and certification efforts. Improvements in energy efficiency are further complicated in Mexico by the flow of tens of thousands of used, less efficient pieces of equipment and appliances, principally from the United States.

An important challenge for North America is to find ways of increasing private sector financing in renewable energy and energy efficiency. Two vehicles used to promote renewable energy are the creation of dedicated funds, including joint public-private sector "green" investment funds to help defray capital acquisition and start-up costs, and "green" pricing initiatives, which pass along the premium of green electricity to end-users.

Experience in California shows that the financing of renewable energy can succeed, provided certain conditions are met. Among the most important are long-term purchasing con-

tracts. These send signals to private investors about the longer-term commitment of public policy to renewable energy and energy efficiency goals.

Access to Information

Information plays a crucial role in integrated resource planning, assessment, including the consideration of cumulative impacts and transborder effects, and effective public participation. Paradoxically, while the electricity sector often appears awash in information on almost every aspect of generation, transmission, and consumption, the lack of timely, comprehensive, affordable and accessible data on many of the variables that affect the environment hampers significantly the ability to plan, forecast and mitigate regional and long-range effects.

Information on certain regulated emissions is reported by operating generators or is estimated by authorities, but only a handful of jurisdictions employ or maintain a database or clearinghouse of proposed projects that could enable authorities and the public to evaluate cumulative, regional or transboundary issues efficiently.²⁴ Even where considerable data exist, their usefulness is often diminished because they are often dispersed among multiple agencies and departments, are displayed in formats that are hard to access or are available only at excessive cost.

²⁴ In the US, projects subject to NEPA are posted at <<http://es.epa.gov/oeca/ofa>>. A clearinghouse approach has been successfully adopted in some jurisdictions such as California, which maintains an online inventory of all proposed sites at <<http://www.energy.ca.gov/sitingcases/>>. Canada lists projects subject to the authority of the National Energy Board <http://www.ceaa-acee.gc.ca/0008/index_e.htm> as well as those projects undertaken under federal assessment procedures <http://www.ceaa-acee.gc.ca/0008/index_e.htm>; Mexico lists projects evaluated under federal assessment law at <<http://www.ine.gob.mx/dgoeia/impacto/index.html>>.

Information, Planning and Transboundary and Cumulative Impact Assessment

An unprecedented degree of regional cooperation will be needed to maximize the potential environmental benefits of cross-border electricity trade, while avoiding or at least mitigating negative impacts to human and ecosystem health. Improved information, mechanisms for coordinated and transparent planning, and transboundary impact assessments will help fill these needs. Public processes to address these planning issues at the utility or state/provincial level through integrated resource planning were abandoned in many places as part of the shift to competitive electricity markets. However, the extreme volatility that has been seen in electricity markets over the last two years has led some to seek reinvigorated state and utility planning processes. The tools developed for integrated resource planning remain relevant, though much work remains to be done to apply them in the context of restructured markets.

Gathering data and developing information on the cumulative impact of additional generation capacity is especially important in light of the large number of new electricity generation facilities proposed for the near future, and the likely concentration of these in specific regions.

In recent years, advances in pollutant transport modeling, remote sensing, and other monitoring techniques have increased our appreciation of long-range source/receptor relationships. For example, it is now feasible to track any number of

emissions from area sources and to estimate their deposition rate and impact on distant communities. Yet these tools are not yet employed systematically throughout North America in assessment processes, often because affected parties may not even be aware of proposed projects or because reliable emissions databases (upon which such analysis depends) are unavailable. Projects that are not subject to environmental assessments are especially unlikely to employ such tools to consider the potential effects on a regional or transboundary scale.

Fundamental concerns persist about access to information and about effective participation in decision-making processes involving projects with the potential, either individually or cumulatively, to cause long-range and/or cross border impacts.

The environmental impacts of major projects, including those associated with the generation and transmission of electricity, are usually assessed pursuant to state, provincial or federal law. Often this is accomplished through environmental assessments, which consider the scope of the project in question, estimate likely environmental impacts, and evaluate mitigation measures where appropriate.²⁵ Electricity generation projects not subject to a formal environmental assessment usually undergo some scrutiny in state, provincial, or local permitting processes, but these may take a less disciplined approach to assessing long-range and cumulative impacts and may not examine impacts across all media. Opportunities for the public to be informed about, and to partici-

²⁵ For a comparative survey of the environmental impact assessment legal frameworks in North America, see CEC 1999. *North American Environmental Law and Policy: Environmental Impact Assessment Law and Practice in North America* (winter).

²⁶ *Ibid.* The report includes a description of how each country determines which projects or proposals are subject to federal EIA and includes examples of provincial and state environmental assessments.

²⁷ See e.g., United Nations Environment and Human Settlements Division, Espoo Convention on Environmental Impact Assessment in a Transboundary Context of 1991; European Directive on Environmental Assessment of 1985; and the Antarctic Treaty Protocol on Environmental Protection of 1991. For more information on transboundary environmental impact assessment in international law, see P. Sands, *Principles of International Environmental Law I*, Chapt. 15 (Manchester Univ. Press, 1995); D. Hunter et al., *International Environmental Law Concepts and Principles* (UNEP Trade and Environment Series, No.2)(1994); N. Robinson, "International Trends in Environmental Impact Assessment," 19 *BC Env'tl. Aff. Law Rev.* 591 (1992).

pate in, such decisions vary widely across jurisdictions.²⁶ In practice, local siting determinations that are not subject to environmental assessments tend to leave communities beyond the immediate locality unaware of the impacts such facilities might have on them.

Transboundary environmental impact assessment (TEIA) continues to gain acceptance worldwide.²⁷ TEIA employs a cooperative mechanism to extend environmental impact assessment across borders. It allows members of the public and government in areas that could be affected adversely to participate in the environmental impact assessment, according to procedures established in the country where the project originates.²⁸

While no formal continent-wide agreement has been reached in North America, certain bilateral institutions have participated in TEIA-type assessment; and a growing number of states and provinces are adopting TEIA procedures. For example, the environmental impacts of BECC/NADBank projects are subject to assessment, as are specific activities within the purview of the

International Joint Commission. The province of British Columbia and the neighboring state of Washington appear to be the first state and province to conclude a formal TEIA arrangement.²⁹ In an important step towards TEIA, the ten Mexican/US border states have declared their intention to notify each other of projects with the potential to affect neighboring jurisdictions adversely,³⁰ and the state of California recently invited neighboring Baja California residents to participate in its environmental impact assessment for a new generation facility in the border region.³¹ Another example of transborder cooperation is the Border Energy Forum, established in 1994, which has worked with a wide variety of partner agencies in the US and Mexico. The goal of the organization is to improve the exchange of information on energy and its relationship to the environment throughout the Mexico/US border region.³²

A more informed and active citizenry can help ensure that the integration of the North American electricity market benefits our shared economic, environmental and health goals.

²⁸ See CEC 2000. *North American Law and Policy*, Vol. 4 (spring). Montreal: CEC.

Article 10(7) of the North American Agreement on Environmental Cooperation provides: Recognizing the significant bilateral nature of many transboundary environmental issues, the Council shall, with a view to agreement between the Parties pursuant to this Article within three years on obligations, consider and develop recommendations with respect to:

a) assessing the environmental impact of proposed projects subject to decisions by a competent government authority and likely to cause significant adverse transboundary effects, including a full evaluation of comments provided by other Parties and persons of other Parties;

b) notification, provision of relevant information and consultation between Parties with respect to such projects; and mitigation of the potential adverse effects of such projects.

²⁹ Joint Statement of Cooperation on the Georgia Basin and Puget Sound Ecosystem.

³⁰ See <<http://www.westgov.org/wga/publicat/annrep99.htm>>.

³¹ Personal communication with EPA employee.

³² See <www.glo.state.tx.us/energy/border> for more information.

Transmittal letter

Montreal, March 7, 2002

Ms. Janine Ferretti
Executive Director
Commission for Environmental Cooperation
393 St-Jacques West, Suite 200
Montreal, Quebec
Canada H2Y 1N9

Dear Ms. Ferretti:

I am pleased to transmit to you the final text of the CEC's Electricity and Environment Advisory Board Statement and Recommendations. The document reflects the consensus views and considerable expertise and experience of the talented group of Canadians, Mexicans, and Americans who participated in the Advisory Board.

We hope that these recommendations will help in assisting the Council in their consideration of the important environmental dimensions of deeper integration of North American electricity markets, as well as point out some areas for cooperation among the NAFTA partners in this area.

The Advisory Board would like to acknowledge and commend the CEC Secretariat for providing the high quality research and analysis contained in the Electricity and Environment working papers, as well as hosting multiple meetings related to the topic. The Secretariat's efforts facilitated our arriving at consensus positions on issues of great moment and complexity.

We wish you the best for future CEC efforts in this area.

Sincerely



The Honorable Philip Sharp
Chair
The Electricity and Environment Advisory Board

Statement and Recommendations of the CEC Electricity and Environment Advisory Board

La Jolla, California

29 November 2001

Final text

Once a visionary idea, the prospects for developing an integrated North American electricity market have never been better. Though not widely recognized, continental energy links have proliferated over the last two decades, spawning a complex array of cross-border transactions and relationships. Indeed, the sale of electricity by a British Columbia marketer to Baja California, the construction of the 2,300-mile Alliance Pipeline to transport natural gas from western Canada to Chicago, and the fact that the size of the snow pack in eastern Canada directly influences wholesale electricity prices in the US northcentral and New England states, provide eloquent testimony to our growing regional connectivity.

While the process of deeper economic integration is underway, a parallel effort must be made to address the environmental challenges we face. In taking on this challenge, we must recognize our differences—both nationally and regionally within countries—to ensure that the path we follow is tailored to meet the practical concerns of our citizens, wherever they reside.

Affordable and reliable electricity provides a foundation of economic stability upon which prosperity depends and a sustainable long-term energy policy remains central to our economic well being. At the same time, electricity—its type, production, distribution and usage—has a significant impact on human health and the ecological systems that sustain life.

As recent events in the western United States have made clear, it is very difficult to predict how future developments relating to energy and electricity will unfold. While we can place some fairly crude boundaries around overall electricity supply and demand, our ability to foresee growth or constriction on regional or local scales is limited, at best.

Given the nature of nascent markets, delay in formulation of policy decreases the likelihood that the policy will be effective.

Likewise, our ability to anticipate technological innovation and diffusion has also proven elusive.

At the same time as we must acknowledge the inherent uncertainties of our predictive tools, long-range planning is still imperative, requiring us to make judgments and base decisions on the best available evidence. Accordingly, the environmental policy safeguards and measures implemented must, to a great degree, be capable of functioning well in a climate of uncertainty. Furthermore, these measures must also be designed to work well in a region governed largely by market forces, as is likely to be the case in the emerging North American electricity markets.

As the North American electricity market takes shape in the context of freer trade and a closer regional partnership on energy, we face vital matters of public policy to ensure that the transformation of the electricity market promotes sustainable development—that it generates both economic and environmental benefits.

To achieve the environmental benefits of greater efficiencies, technological diffusion and improved regional environmental performance, environmental policy considerations must be addressed at the earliest planning stages. This will require an unprecedented degree of North American cooperation, but much is at stake and we are optimistic that our three societies can meet this challenge. It is in that hopeful spirit that the undersigned Advisory Board members respectfully submit the following recommendations to the governments of Canada, Mexico and the United States.

1 On maintaining high levels of protection for human health and the environment

Owing to the uncertainties in future patterns of electricity generation, transmission and usage, and in order to ensure that high standards of environmental and health protection are maintained throughout North America, governments should maintain national ambient environmental standards or other measures based on human and ecosystem health. Evolving national minimum standards and regional cooperation will protect against “pollution haven” concerns, minimize claims of environmental dumping, and decrease the likelihood that regional clusters of generating facilities will adversely impact on the health and environment of localities.

1.1 Given the expected uncertainties within the electricity market, the environmental policy measures must be flexible, recognize the differences between countries and within regions and include adequate safety net mechanisms to protect human and ecosystem health in a preventative (not reactive) manner.

2 On developing improved information on pollution emissions, facility siting and assessment

The Advisory Board agrees that the governments and public would be well served by improving on current efforts to collect, make comparable and report regionally on emissions from the electricity sector (new and existing facilities), in addition to enhancing access to information for the siting and assessment of electricity-related projects.

2.1 Develop transparent and comparable pollution emission data for the North American electricity generation sector at sufficiently detailed level to support trends analyses, emissions trading policies, and public right-to-know.

2.2 In considering historical emission reduction inventories and strategies, particularly in Mexico, one should not lose sight of the importance of measuring aggregate improvements rather than merely marginal improvements (as in the case for large-scale conversion processes, e.g., oil combustion to natural gas) and the consideration of per capita energy use.

2.3 Develop a model framework of necessary elements for a North American (bilateral or trilateral) emissions trading regime that can include emissions of sulfur dioxide and nitrogen oxides. The policies needed to develop this framework should be coordinated with and complement the proposed carbon trading regime recommended in section 4.0 of this document.

2.4 Commission a survey of the consistency of North American environmental standards governing the construction and operation of electricity generating facilities, including but not limited to, those sited in border areas.

3 On regional assessment and transboundary environmental impact

Under most projections, meeting demand for electricity in the next twenty years will require the addition of a significant increase in generation capacity. Avoiding adverse regional impacts on environment and health will require stronger efforts to coordinate regional, cross-border assessment, as well as consideration of cumulative impact of projects.

As the CEC expert report “Opportunities and Challenges of the Evolving North American Electricity Market” notes, taken as a whole, the electricity sector heavily affects environmental media—air, water and land. These impacts are typically assessed only within the jurisdiction(s) in which an activity takes place, even though adverse impacts may occur well outside of the area of assessment. In a similar fashion, the collective impact of various activities may have significant regional dimensions, including the long-range transport of atmospheric pollutants, (including mercury and emissions that contribute to acid rain) and habitat destruction or fragmentation affecting migratory species.

The Advisory Board joins the Joint Public Advisory Committee in calling for the implementation of Article 10(7) of the North American Agreement on Environmental Cooperation, which enjoins the CEC Council to develop recommendations for the conduct of transboundary environmental impact assessments on projects which may adversely affect the territory of another Party.

4 On the North American emissions of greenhouse gases and the potential to promote forest conservation, energy efficiency and renewables through the establishment of a carbon emissions trading regime

The Advisory Board recognizes the great challenge we face in addressing the complex dynamics of climate change. It is estimated that the electricity sector accounts for approximately 35 percent of the generation of carbon dioxide gases in North America. Absent effective national carbon reduction strategies, future increased generating capacity is likely to significantly elevate carbon emissions to the atmosphere.

The CEC Council has emphasized the need for the Parties to work together to explore actively the application of market mechanisms to reduce carbon through sequestration, renewables and energy efficiency. The Advisory Board notes the potential for these strategies to generate substantial resources for cleaner energy sources. Accordingly, the Advisory Board urges the Parties to act immediately to define and implement compatible carbon reduction strategies in the region in 2002. Specific actions should include:

4.1 Develop North American greenhouse gas emission inventories that can support the integrity of joint implementation projects and greenhouse gas emissions trading policies.

4.2 Establish a framework of necessary elements for a greenhouse gas trading regime in North America, designed and governed by principals that ensure transparency, measurable and meaningful environmental benefits and economic efficiency.

4.3 Demonstrate, through North American pilot programs, that carbon trading can generate resources for Mexico to accelerate investment, capital turnover and state-of-the-art pollution control technologies.

4.4 Considering the US contribution to CO₂ levels globally, the Advisory Board recommends the US adopt an aggressive, long-term program to stimulate clean and renewable energy production.

5 On promoting the development and use of renewable energy sources

Renewable electricity sources represent a key component of a diversified energy portfolio, helping to cushion the impact of conventional sources. The Advisory Board agrees that better internalization of the environmental cost of electricity (including, for example, costs to the health care system and from lost productivity) will help level the playing field for renewable sources of electricity.

Recently, some jurisdictions and entrepreneurs have introduced mechanisms that allow consumers to dedicate part or all of their electricity bills to sources deemed “clean” or “renewable” by local jurisdictions or third-party certification bodies. While it remains too early to evaluate the effect of these mechanisms, the Advisory Board regards them as promising developments and supports their introduction.

5.1 Aggressive efforts should be made to support renewable energy, including market-based incentives, tax inducements, research and development funding.

5.2 A dialogue should be commenced among industry, government and nongovernmental organizations to explore opportunities for developing a more consistent regional approach to defining “renewable” energy; including a better understanding of the rationale behind the many existing definitions, and examining the criteria employed for so-called “renewable” energy and “environmentally preferred” electricity.

5.3 The Advisory Board encourages the NAFTA Parties, through the CEC, to discuss mutually agreeable clarifications that would indicate whether and to what extent the way that electricity is generated is an integral part of the electricity “good” itself, for purposes of construing the Treaty and related agreements.

5.4 Mechanisms should be established to create “green markets” in the three countries along with a fund for financing renewable energy projects.

6 On demand-side measures to conserve electricity and promote environmentally preferred electricity

Coupled with other supportive policies, a host of demand-side conservation measures represent effective policy tools to help address electricity supply considerations. An array of available programs, approaches and initiatives enjoy a long history of application and a proven, cost-effective track record, without constraining economic growth.

6.1 Conservation and energy efficiency initiatives, including incentives for combined heat and power and minimum efficiency standards for buildings and equipment, should be pursued aggressively by all parties.

6.2 Electricity distribution companies should provide an economic incentive to support conservation and energy efficiency.

7 On technology transfer and assistance for adopting cleaner generation technologies

Deeper market integration offers the potential to increase investment in cleaner technologies and infrastructure, increasing capital turnover of older equipment and accelerating the diffusion of new technologies. The governments must continue to build supportive policy frameworks to catalyze these positive effects, by:

7.1 Expanding incentives for research and development in North America for cleaner technologies.

7.2 Creating a North American fund to promote the adoption of best available control technologies and best practices in energy efficiency and conservation.

Members of the CEC's Electricity and Environment Advisory Board

Philip Sharp (Chairman)

Canada

Ron Daniels
Richard Drouin
Jack Gibbons
Jean-Étienne Klimpt
Elizabeth May
Robert Page

Mexico

Rubén Dorantes
Alberto Escofet
Gastón Luken
Pablo Mulás del Pozo
Jesús Reyes-Heróles
Rosío Vargas Suárez

United States

Ralph Cavanagh
Robert Kelter
Elizabeth Moler
Tom Rawls
Susan Tomasky

JPAC

Peter Berle

Appendix—Electricity and Environment Advisory Board Members

CHAIRMAN

Professor Philip Sharp

Kennedy School of Government, Harvard University

Philip R. Sharp is currently a senior research fellow at the Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University. He is associated with the Harvard Electricity Policy Group and is a former lecturer on the politics of restructuring the electric utility industry. From July 1995 until February 1998, he was director of Harvard's Institute of Politics and currently serves on the Institute's Senior Advisory Board. He is a member of the US Secretary of Energy Advisory Board and chaired its Electric System Reliability Task Force, which published its final report, *Maintaining Reliability in a Competitive Electricity Industry*, 29 September 1998. He serves as co-chair of the Energy Board of the Keystone Center and as a member of the boards of directors of the Energy Foundation, the Cinergy Corporation, the New England Power Company, and Proton Energy Co. Sharp was a ten-term member of Congress (1975–1995), representing the second district of Indiana. He was a member of the House Energy and Commerce Committee and the Interior Committee. He chaired the Subcommittee on Fossil and Synthetic Fuels (1981–1986) and the Energy and Power Subcommittee (1987–1995). He was involved in nearly all energy legislation during his tenure and received numerous awards for his work. He played a prominent leadership role in such major legislation as the Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992.

CANADA

Ron Daniels

Dean, Faculty of Law, University of Toronto

Ron Daniels is dean and professor at the Faculty of Law, University of Toronto. He was appointed to the Faculty of Law in 1988, where he teaches corporate law, securities and finance, mergers and acquisitions, and regulation of financial institutions. He has been dean of the faculty since 1995. He is the author (or co-author) of numerous scholarly articles on topics as diverse as corporate and securities law, federalism and financial institution regulation, privatization and government reform. He is active in public policy formulation, and has contributed to several policy related task forces, including: Chair of the Ontario Task Force on Securities Regulation, as a member of the Toronto Stock Exchange Committee on Corporate Governance (the "Dey Committee"), and chair of the Ontario Market Design Committee the Committee that was charged with the task of developing the market rules for the new Ontario electricity market. Currently, Professor Daniels is chair of the Ontario Law Deans and past-president of the Canadian Law Deans. He also serves on the boards of Moore Corporation Limited, Great Lakes Power Inc., the Mutual Fund Dealers Association of Canada and Computershare Investor Services. Professor Daniels received his J.D. from the University of Toronto in 1986 and his LL.M. from Yale University in 1988.

Richard Drouin

McCarthy Tétrault, Barristers and Solicitors

Richard Drouin is chairman of Abitibi-Consolidated, the largest newsprint producer in the world, and a partner in the law firm of McCarthy Tétrault (Canada's largest law firm). He is the former chairman and CEO of Hydro-Québec (1988–1995), a government owned utility with sales of over \$7 billion. At Hydro-Québec, he oriented the utility toward a greater emphasis on customer satisfaction through a comprehensive total quality management program and has intensively developed the international sector. He has chaired (1994–1997) the Committee on Transmission and

Generation at UNPEDE (International Union of Electricity Producers and Distributors) in Europe. He is the founding member of the E-7, which brings together the largest utilities from the G-7 countries. He was honorary chairman of the World Energy Congress in Montreal in 1989. He chaired the Organizing Committee for Electricity 2000, convening the electric utilities of the world in Montreal in June 2000. Mr. Drouin has recently been co-chair of a "Blue Ribbon" panel of the North American Electric Reliability Council (NERC) of which he was appointed a Trustee in January 1999. Aside from Abitibi Consolidated, Mr. Drouin sits on the boards of Altersys, American Superconductor Corporation (Boston), Canadian Niagara Power, Provigo, Memotec Communications, nStein Technologies, Stelco and TVA Group (French TV network). He is a Fellow and Governor of the Royal Canadian Geographical Society. He is a chairman of the Board of Trustees of l'Université Laval. Mr. Drouin is an honorary consul for Great Britain in Québec.

Jack Gibbons

Chair, Ontario Clean Air Alliance/Pollution Probe

Jack Gibbons is chair of the Ontario Clean Air Alliance and Senior Economist, Pollution Probe. His previous employers include Energy Probe, the Ontario Energy Board and the Canadian Institute for Environmental Law and Policy. From 1995 to 1997, Mr. Gibbons was a Toronto Hydro Commissioner.

Jean-Étienne Klimpt

Directeur, Environnement, Hydro-Québec

Mr. Klimpt is Director of Environment at Hydro-Québec's head office. He is in charge of environmental strategies and monitors the company's environmental performance. He is also responsible for the implementation of Hydro-Québec's Environmental Management System. Hired by Hydro-Québec in 1975, Mr. Klimpt has been in charge of the Environmental Impact and siting studies for high voltage transmission lines, hydroelectric projects and access roads. He was in charge of the EIS for the proposed Grand-Baleine hydroelectric complex, and the 880MW Sainte-Marguerite-3 project, which is under construction. During his career at Hydro-

Québec he managed research and studies on human ecology. Between 1985 and 1991, Mr. Klimpt worked in the industrial development field. He went back to the Environment division and since 1996 he has been a senior manager in the Strategic Planning Division. Mr. Klimpt is Hydro-Québec's representative at the Federal Table on Electricity for the Canadian climate change consultation process. He is an active participant in the Canadian Hydropower Association (CHA) and the Canadian Electricity Association (CEA). He is the Canadian representative and leader of Subtask 5 for the IEA's Implementing Agreement on Hydropower. Mr. Klimpt is also a forum member at the World Commission on Dams, representing Hydro-Québec and the IEA's Implementing Agreement on Hydropower.

Elizabeth May

Executive Director, Sierra Club of Canada

Elizabeth May is an environmentalist, writer, activist and lawyer. Ms. May is currently executive director of the Sierra Club of Canada, a member of the board of directors of the International Institute for Sustainable Development and is the former vice chair of the National Round Table for the Environment and Economy. She was the first chair holder of the "Elizabeth May Chair in Women's Health and Environment" at Dalhousie University. A graduate of Dalhousie Law School, she was admitted to the Bar in both Nova Scotia and Ontario. Ms. May has held the position of associate general council for the Public Interest Advocacy Centre, representing consumer, poverty and environment groups in her work. In 1986, Elizabeth became senior policy advisor to the then federal environment minister, Tom McMillan. She was instrumental in the creation of several national parks, including South Moresby, as well as in drafting new legislation and pollution control measures. In 1988, she resigned on a point of principle when the Minister granted permits for the Rafferty-Alameda Dams in Saskatchewan as part of a political trade-off, without environmental assessments. The permits were later quashed by a Federal Court decision, which ruled that they were illegal. Ms. May is also the author of four books, *Budworm Battles* (1982), *Paradise Won: The Struggle to*

Save South Moresby (1990), At the Cutting Edge: The Crisis in Canada's Forests (Key Porter Books, 1998) and her most recent, co-authored with Maude Barlow, Frederick Street; Life and Death on Canada's Love Canal (Harper Collins, 2000).

Robert Page

Vice President, Sustainable Development, Trans-Alta Corporation

Robert Page is vice-president for Sustainable Development at Trans-Alta Corporation. Prior to joining TransAlta in 1997, Dr. Page spent 25 years in consulting, academic teaching and research. Most recently, he was dean of the Faculty of Environmental Design at the University of Calgary. Dr. Page is known nationally and internationally for his work on energy and the environment in areas such as environmental impact assessment, environment and trade, climate change, and policy and regulation. Dr. Page is co-chair, Credit for Early Action Table, National Climate Change Process; member, Panel of Advisors, Federal Commissioner of the Environment and Sustainable Development; and a former member of the National Round Table on Environment and Economy. He is also vice-chairman for the International Emissions Trading Association of Geneva, Switzerland. In the private sector, Bob is a member of the Board of Governors Petroleum Communication Foundation and a member of the Environment Committee, National Chamber of Commerce. Bob is also the interim chair of BIOCAP Canada, a national university research program on climate change.

MEXICO

Rubén Dorantes

Chairperson, *Asociación Nacional de Energía Solar (ANES) y Universidad Autónoma Metropolitana*

Mr. Dorantes did undergraduate studies in physics at the School of Sciences of the National Autonomous University of Mexico (*Universidad Nacional Autónoma de México—UNAM*) and later obtained a diploma in advanced energy studies at the University of Nice, France. He completed his doctorate at the National Institute of Applied Sciences of Lyon, France, receiving the "highest distinction" in his doctoral examination. Since 1979, he has worked as a professor and researcher in the Department of Energy at the Division of Basic Sciences and Engineering of the Metropolitan Autonomous University, Azcapotzalco campus (*Universidad Autónoma Metropolitana, unidad Azcapotzalco—UAM-A*). He has organized academic and scientific events, including various National Solar Energy Weeks, which represent the most important renewable energy forum in Mexico and Latin America. He is chairman of the National Solar Energy Association and executive secretary of the Advisory Council for Renewable Energy Development.

Alberto Escofet

Alesco Consultores, S.A. de C.V.

Alberto Escofet A., is the president of *Alesco Consultores, S.A. de C.V.*, a consulting firm established in June 1991. In 1956, he joined the *Comisión Federal de Electricidad*, the government electric utility that would later become the sole electric utility in the country. There he served the positions of plant commissioning engineer, electric supervisor of the Northwest Division, head of the electric engineering department, head of system operations, assistant manager of planning, general manager of operations, assistant director general, and was appointed director general in July 1980. In December 1982, he became director general of *Uranio Mexicano*, the state company responsible for the fuel cycle of the Mexican Nuclear Program. When the program was postponed, he promoted the cancellation of *URAMEX*, and participated

in the formulation of the new Nuclear Law that was approved in February 1985. During 1985 and 1986, he consulted for several Mexican and foreign companies. In April 1987, he was appointed Undersecretary of Mines and Heavy Industry and in December 1988, he assumed the position of Undersecretary of Energy, a post he held until February of 1991. He has participated in several national and international forums, mainly related to power systems and energy matters. He belongs to several professional associations, and he was president of the Faculty of Engineering Alumni Association and of the Association of University Mechanical-Electrical Engineers. He is a member of the Mexican Academy of Engineering, founder and member of the Academy of Music of the *Palacio de Minería*.

Gastón Luken

President and Director General, *GE Capital*

Mr. Gaston Luken is the chairman of *GE Capital México, S.A.* (a subsidiary of the General Electric Corporation), *Próxima, S.A.* and *Próxima Gas, S.A.* (infrastructure development and investment) and is a board member with numerous Mexican corporations. He graduated (C.P.A.) from the *Instituto Tecnológico de Estudios Superiores de Monterrey (ITESM)*. Since 1958, Mr. Luken has been active in the Mexican financial, business and civic sectors.

- CEO *Centra, S.A.* 1960–1972 (a diversified holding company)
- CEO *Unibanco, S.A.* 1972–1982 (a regional full service bank)
- Personal Investor 1982–1985
- Chairman *Operadora de Bolsa, S.A.* 1985–1990 (a major securities and brokerage firm)
- Chairman *Grupo Financiero Obsa, S.A.* 1990–1992 (a non-bank financial group which acquired *Banca Serfin*, Mexico's third-largest bank).

He is the vice chairman of Mexico's largest conservation organization, *Pronatura, A.C.*, and is the chairman of *Pronatura Península de Baja California*.

Pablo Mulás del Pozo

Director, Programa Universitario de Energía, Coordinación de la Investigación Científica, UNAM

Presently Dr. Mulás is a professor in the faculty of engineering of the National Autonomous University of Mexico (UNAM). He has also held the following appointments: director of the nuclear reactor laboratories of the Nuclear Research Center of Mexico (1970–1973), director of the energy resources division (1976–1991) and president (1991–1996) of Mexico's Electric Power Research Institute. After a short period as chief advisor to the Secretary of Energy, he was appointed in March 1997 as director of the Energy Program and recently (January 2001), director of university programs in the scientific research coordination department at UNAM. In January 1999, the World Energy Council appointed him as its regional coordinator for Latin America and the Caribbean. Besides participating in over fifteen professional scientific and engineering national and international associations, as well as in various advisory and standing committees in academic, industrial and publishing institutions, Dr. Mulás received an *honoris causa* doctorate in science from the University of Salford, United Kingdom in 1993.

Jesús Reyes-Heroles

Presidente Ejecutivo, Grupo de Economistas y Asociados

Jesús F. Reyes-Heroles is the executive president of *Grupo de Economistas y Asociados*. He is also co-founder and president of MBD (2001). An economist from the *Instituto Tecnológico Autónomo de México* (1976), he completed law studies at the National Autonomous University of Mexico (*Universidad Nacional Autónoma de México*—UNAM) and, with the support of a Fullbright fellowship, obtained his PhD in economics at the Massachusetts Institute of Technology (MIT) in 1980. His professional career has been a combination of private practice and public service. Mr. Reyes-Heroles was Ambassador from Mexico to the United States of America from October 1997 to 30 November 2000. Prior to this he was the Secretary of Energy in President Ernesto Zedillo's cabinet. In that capacity he was president of the

board of diverse enterprises, such as *Petróleos Mexicanos* (PEMEX), *Comisión Federal de Electricidad* (CFE) and *Compañía de Luz y Fuerza del Centro*. During 1993–1994, Mr. Reyes-Heroles was the Mexican member of the “Eminent Persons Group” of APEC. From 1989 to 1990 he was chief of staff for the Secretary of Foreign Affairs. From 1983 to 1988, he served as Director General of Financial Planning at the Treasury, a position he held for a full six-year term.

Rosío Vargas Suárez

Profesora y Investigadora, Centro de Investigaciones sobre América del Norte, UNAM

Rosío Vargas Suárez is a doctoral candidate in energy engineering and holds a postgraduate degree in engineering from the National Autonomous University of Mexico (*Universidad Nacional Autónoma de México*—UNAM). Coordinator of four books on US-Mexican relations and the energy market. Author or coauthor of 33 articles on the Mexican energy sector, US-Mexican energy relations and the US energy sector, including “US Energy Safety, from the Seventies to the Nineties” (*La Seguridad Energética de los Estados Unidos de los Setenta a los Noventa*) published in *Foro Internacional*, *El Colegio de México*, and “Energy Reform in Mexico: a New Development Model or Modernization of Statism?” published in collaboration with Víctor Rodríguez in *Energy Policy*, 1996. He is a member of the International Advisory Group and, since April 1997, of the Pacific Economic and Cooperation Council's Energy Forum. He did research at Harvard University's Center for International and Foreign Affairs, 1990–1991, and at California State University, Los Angeles, 1999.

THE UNITED STATES

Ralph Cavanagh

Senior Attorney, Natural Resources Defense Council (NRDC)

Ralph Cavanagh co-directs the energy program of the Natural Resources Defense Council, a nonprofit environment-advocacy organization that he joined in 1979. He also serves on the US Secretary of Energy's Advisory Board. Cavanagh was a member of the board of E-Source, a Colorado-based energy services company, from 1992 until 1999. He has held appointments as a visiting professor at the Stanford and Boalt Hall Law Schools, and as a lecturer on law at the Harvard Law School. Before arriving at NRDC, Cavanagh was employed by the US Department of Justice as an attorney advisor. He is a past member of the Energy Engineering Board of the National Academy of Sciences and the Advisory Council of the Electric Power Research Institute. Cavanagh is vice chair of the Center for Energy Efficiency and Renewable Energy Technologies (CEERT), which unites representatives of the environmental, energy efficiency and renewable energy communities. He is also a founding board member of the Northwest Energy Coalition. His awards include the Heinz Award for Public Policy in 1996 and the Bonneville Power Administration's Award for Exceptional Public Service. He received his undergraduate and law degrees from Yale University.

Robert Kelter

Attorney, Illinois Citizens Utility Board

Robert Kelter is the litigation director for Citizens Utility Board (CUB) in Chicago, IL. He has been an attorney at CUB since September 1995. He litigates cases and supervises attorneys in the areas of electricity, gas, and telecommunications. Mr. Kelter has argued cases before the Illinois Commerce Commission and the courts, including the SBC-Ameritech merger. He has focused extensively on electric utility restructuring and environmental issues, and represented CUB in negotiations culminating in Illinois' recently enacted Electric Service Customer Choice and Rate Relief Law of 1997. He litigated the first residential customer choice pilot

program in the country. Before joining CUB in September 1995, Mr. Kelter served as attorney for the Energy Project at Environmental Action, where he worked on market structure issues and litigated cases before the Federal Energy Regulatory Commission and the US Court of Appeals. Prior to joining Environmental Action, he served as assistant people's counsel at the DC Office of the People's Counsel, where he specialized in energy conservation and environmental issues. Mr. Kelter was appointed by EPA Administrator Carol Browner to serve on the National Advisory Committee to the US Representative to the North American Commission for Environmental Cooperation (CEC). Mr. Kelter is author of the book, "A Citizens' Guide to Electric Utilities."

Elizabeth Moler

Senior Vice-President, Government Affairs & Policy, Exelon Corporation

Ms. Moler joined Unicom Corporation (now Exelon Corporation) as senior vice president, government affairs and policy, in January 2000. She heads the firm's Washington, DC, office, and serves as a member of Exelon's Senior Management Committee. During 1999 she was a partner in the law firm of Vinson & Elkins and a member of the Unicom Board of Directors. Ms. Moler had a long career in government service and was a staff member on Capitol Hill for 20 years. She served as counsel and senior counsel for the United States Senate Committee on Energy and Natural Resources from 1976 to 1988. In 1988, she was appointed by President Ronald Reagan, and confirmed by the United States Senate, to serve as a member of the Federal Energy Regulatory Commission. She was reappointed twice by Presidents William Jefferson Clinton and George W. Bush. In 1993, she was designated by President Clinton to serve as the Commission's chair. She continued to serve as in capacity until June 1997, when she was appointed by the President, and confirmed by the Senate, to serve as the Deputy Secretary of Energy. She resigned her duties in governmental service in October 1998.

Tom Rawls

Vice President and Chief Environmental Officer, Green Mountain Energy Company

Thomas H. Rawls is vice president and chief environmental officer of Green Mountain Energy, the nation's leading provider of green power in competitive electricity markets. He sits on the Steering Committee of the National Wind Coordination Committee and the Legislative Committee of the American Wind Energy Association. A former journalist and magazine editor, Mr. Rawls is the author of *Small Places, In Search of a Vanishing America* (Little, Brown & Co.). Mr. Rawls is the former vice-chairman of the board of the Vermont Natural Resources Council, a statewide environment group. He lives in Vermont and owns and manages a woodlot certified by the Forest Stewardship Council.

Susan Tomasky

Executive Vice President & General Counsel, American Electric Power

Susan Tomasky is executive vice president-policy, finance and strategic planning for American Electric Power and also serves as chief financial officer. Tomasky joined AEP in 1998 as senior vice president and general counsel and served as executive vice president and general counsel before her current appointment. Prior to joining AEP, Tomasky was a partner with the Washington, DC, office of Hogan & Hartson, where she was a member of the firm's energy group. From 1993–97, Tomasky served as general counsel of the Federal Energy Regulatory Commission (FERC), where she was a primary legal and policy advisor to the commission in the development of a broad range of policy initiatives to promote competition in US electricity and natural gas markets. Tomasky was a staff attorney at FERC from 1979 to 1981. Prior to joining FERC, she was in private practice, specializing in energy and environmental matters. A native of Morgantown, West Virginia, Tomasky holds a *juris doctor* degree with honors from George Washington University National Law Center in Washington, DC, where she was a member of the Law Review. She also is an honors graduate of the University of Kentucky in Lexington.

JOINT PUBLIC ADVISORY COMMITTEE (JPAC)

Peter Berle

Mr. Berle is a lawyer and former president/CEO of the National Audubon Society. He also served as Commissioner of Environmental Conservation for the State of New York and as a member of the New York State Assembly. He currently hosts and directs the Environment Show on public radio. Mr. Berle was nominated to JPAC in 1994.