



Canadian
Electricity
Association

Association
canadienne
de l'électricité

***ELECTRICITY
READY FOR CENTER STAGE***



Jan 2010



TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

INTRODUCTION: ENERGY CHALLENGES IN AN INTERDEPENDENT WORLD 2

ELECTRICITY: FROM REGIONAL SUPPLIER TO GLOBAL PROBLEM-SOLVER? .. 5

(TRULY) INTEGRATED RESOURCE PLANNING..... 6

LOW CARBON ELECTRICITY SOURCES 7

CARBON PRICING..... 10

CLEAN ENERGY CAPITAL 10

GOVERNANCE IMPROVEMENTS..... 11

CONCLUSION 12



EXECUTIVE SUMMARY

Increasingly, observers are looking to electricity to address an array of major energy challenges confronting society. Electricity is widely expected to play a greater role in the global energy system and in meeting societal needs than it has in the past. But if electricity is to answer this call, it must also be given the authority to proceed and the means to succeed.

This paper – intended to stimulate discussion among industry participants at the 2010 International Electricity Summit in Kyoto, Japan, in April 2010 – supports this path forward for electricity. It makes two related points: first, governments must exercise more leadership in supporting and enabling a long-term policy path for electricity. Governments can help electricity secure its social license and its enabling capital. Second, the electricity industry must focus as a community on some of the key issues it now faces – issues with important strategic and policy implications. In particular, five priorities have emerged for government and electricity industry leaders: (truly) integrated resource planning; low carbon electricity sources; carbon pricing; clean energy finance; and governance improvements.

Each of these priority areas gives rise to complex and important questions for governments and the electricity industry, the answers to which will help determine whether electricity can rise to the challenges outlined above.

Is electricity ready for centre stage?



INTRODUCTION: ENERGY CHALLENGES IN AN INTERDEPENDENT WORLD

The last two decades have seen some extraordinary changes in the world – changes that have only been accelerating. In the aftermath of the global financial crisis, centers of power, influence and capital are shifting faster than anyone anticipated even five years earlier.

There have been some positive developments – the pace of economic progress in Brazil and China, for instance or the rapid expansion of access to mobile phones in rural communities worldwide. But there have also been some troubling setbacks and even reversals of progress, such as growing numbers of people suffering from malnutrition, the return of tuberculosis as a major threat to humanity, and a host of major environmental concerns.

No one knows what kind of world we will face in another ten years. But the context for this evolution is clear: a highly interdependent global community, more so than at any point in history. We are interdependent not only in trade, as earlier times experienced, but also through capital markets, the Internet and media, science and technology, climate change, biodiversity, sustainability concerns related to oceans and forests, travel for business and tourism, immigration, and human security. In all these ways our choices and actions are shaping one another, and the future of our common humanity.

The next decades are likely to bring not only further astonishing forms of progress, but also momentous challenges, even under highly optimistic scenarios. Our interdependence presents us with a clear choice: with poor planning and inadequate global coordination, the stresses the planet is already facing will likely grow; conversely, imminent action and shared leadership may help us to mitigate and manage many of these challenges. Consider the range of pressing energy-related challenges the world will face in coming decades:

- **Infrastructure replacement.** Much of the planet's existing energy infrastructure – valued in the trillions of dollars – is aging, edging towards the end of its useful life. Life extensions and upgrades will only

buy so much time; the replacement challenge will require capital-intensive investments in new extraction equipment, transmission lines, power plants and indeed all aspects of the energy value chain.

- **Energy poverty.** About half the planet lives without adequate access to energy, and a quarter of humanity have no access at all. The energy options that are available to the poor often leave much to be desired on many counts. In India, for instance, many women die prematurely from exposure to dirty cooking fuels. As a solar company in India sums up the problem: “Often, the only energy options available are unhealthy, unreliable, environmentally unfriendly and expensive.”ⁱ
- **Population growth.** The global population may grow from six billion to nine billion by 2050. Basic systems in agriculture and food production, water, waste and sanitation will feel the strain.
- **Urbanization.** For the first time in history, more people live in urban than in rural settings, and the urbanization trend will continue, with more people moving into cities every year. The world’s cities already require massive quantities of raw materials and investment to support their burgeoning infrastructure and their demand for mining, energy and other resources will grow at a faster pace. In China alone, roughly 13 million people are moving from rural areas to cities each year.
- **Dramatic growth in new markets for energy demand.** The International Energy Agency estimates that global energy demand will grow by 44 percent over the next two decades. In transportation, there may be as many as two billion cars by 2030. For electricity, the challenge of meeting incremental demand for reliable lighting, heating, cooling, and appliances will be exacerbated by the need to renew and/or replace existing infrastructure. There is a further complication. Growth in demand will mainly come from Asian emerging economies and the small number of countries today that use the majority of the world’s energy will need adapt to stronger demand. The global community will be tested by commodity shortfalls, hoarding of resources and

unanticipated price escalations which could give rise to geopolitical tensions and conflicts.

- **Oil price risks.** There is a threat of major shocks arising from production shortfalls in conventional oil, as well as the rising costs of extraction and refining of unconventional resources.ⁱⁱ Regional tensions and conflict may contribute to an unstable world.
- **Nuclear proliferation.** As India has done in the past, countries may invest in the peaceful side of nuclear energy as a means of accessing the development of weapons technology and materials.
- **Resource depletion.** Oceans, forests, drinking water, and biodiversity are already under some threat, and depletion of these resources can be expected to accelerate.
- **Climate change.** British scientist James Lovelock argues that it is already too late to avert dangerous climate change, and that the future will be more about adaptation than mitigation. Other scientists contend we may have a few years yet to mitigate some of the effects of climate change – but we need to act quickly. Within the energy industry, there is still considerable uncertainty on the science and the claim for urgent action. But even skeptics acknowledge that carbon should be constrained as a prudent risk management strategy; that business-as-usual carbon emissions to 2050 would run counter to a broad social consensus. Under any of these assumptions, the capital investments of the next decade will tell us if we have any realistic prospect of shifting towards a low carbon electricity system by 2050.

While a concerted global response to these issues would be improbable, to do nothing in the face of them would disappoint public opinion. Business executives, government officials, NGO leaders and others increasingly recognize the need for decisive action in the next decade, including the need for visionary global leadership to address this range of energy-related challenges. And when they are considered together, a pattern emerges:



electricity is an indispensable variable and represents the locus of many potential solutions.

ELECTRICITY: FROM REGIONAL SUPPLIER TO GLOBAL PROBLEM-SOLVER?

Admittedly, not all the trends identified above have positive implications for electricity; resource depletion, for instance, may entail costs and shortfalls for the sector's water and material inputs, while climate change is not only a one-sided opportunity – it will also entail costly adaptation measures. And it is also true that electricity is not a panacea and will not replace fossil fuel use. But to the extent that the global community succeeds in solving or at least effectively managing this range of energy challenges, electricity will almost certainly play an integral role. Electricity is a vital part of expanding clean energy access, and of addressing growing demand. The prospect of carbon capture and storage, if it proves commercially viable, could enable the industry to dramatically reduce its own carbon emissions. Electricity is also a critical wedge for reducing carbon in the transportation sector, just as it has the potential to be an important hedge against oil price risks and instabilities. In short, electricity is emerging at the very centre of energy and environmental policy. While carbon-intensive fossil fuels have been at the heart of the energy economy since the Industrial Revolution, low carbon electricity is emerging as the potential new foundation for energy.

However, the electricity industry is only beginning to think through the full implications of this elevation in its scope and function. Where electricity has traditionally been thought of as a local or regional matter, there is more at stake now than sending electrons up the line at just and reasonable rates. These considerations still matter, of course, but executives are being asked by governments and stakeholders to do more and consider the matter of how to enlist their industry in the service of pressing global challenges. And they are being asked to move faster – to find ways to accelerate change in an industry known for long-lived investments, exacting science and engineering, and step-by-step methodical project planning and execution. Electricity, in other words, is arguably undergoing a revolution of its own, one in which traditional concerns are seen as out of date. Five priorities



must be addressed by governments and industry if this revolution is to be successful:

- (Truly) Integrated Resource Planning
- Low Carbon Electricity Sources
- Carbon Pricing
- Clean Energy Capital
- Governance Improvements.

(TRULY) INTEGRATED RESOURCE PLANNING

Electricity industry planners have traditionally looked to local resources, with emphasis on the cost and availability of local resources ahead of others (negative externalities aside in some cases). While some jurisdictions have moved towards the idea of integrated resource planning (IRP), the aspiration to do IRP is often at odds with reality, in which decisions are often driven by narrow constituencies and considerations.ⁱⁱⁱ Not just electricity planning, but energy planning generally, is full of contradictions, gaps and omissions. Departmental silos are common: environmental and energy ministries can pull in opposite directions, as occurred recently in Brazil where oil development plans contradicted environmental goals (similar examples can be found elsewhere).

Agriculture lobbyists and corn-based ethanol have captured transportation policy in many places, while urban infrastructure decisions are all too often made without properly taking account of their full energy and societal implications.

The global challenges we face call for 'walking the talk' on a more holistic planning basis: truly integrated resource planning. This raises a number of questions around how electricity planning can become more integrated so it is better equipped to rise to the challenges it faces:

- How can electricity planning better take account of issues related to energy efficiency, energy storage, and energy security?
- How will information technology, renewables integration and smart-grid mesh with customer education in support of all these things?
- With transportation looking more and more to electricity, it makes sense at a minimum to integrate planning across these two areas. Are we advocating for this integration?
- When should electricity planning be prepared to look farther afield for cleaner electricity sources? What are the opportunities and priorities for improving planning coordination across neighbouring jurisdictions?
- How should electricity planning take account of adaptation issues related to climate change?

LOW CARBON ELECTRICITY SOURCES

The world in the post COP-15 era recognizes as a priority the need to shift to low carbon electricity sources. What is less obvious, however, is how successful this shift will be, and which low carbon sources will prove most economic at the scale required. There are four notable trends we can see as part of this shift.

1. **Coal** The least expensive and most abundant fossil fuel, coal, is the electricity source that generates the most CO₂ emissions, but continues to power 50% of US electricity, 70% of India's electricity, 80% of China's, and fully 90% of Australia's electricity. There are identified opportunities to improve the efficiency of existing and new coal plants, through capital stock replacements and underground coal gasification, but carbon capture will be necessary to transform coal to a fuel that can be used in a low carbon world. For decades governments discussed collaboration on clean coal projects with little to show for their efforts. In the last year, however, the private sector has begun to step into this collaborative space,



notably in the partnership between Duke Energy and China Huaneng Group. Supporters of this latest initiative argue that it will achieve commercialization of CCS within years, not decades. But detractors caution that CCS may never be economic, given the additional energy (“parasitic load”) required to divert and capture CO₂, and the declining cost curve for rival technologies. Without bold commercial efforts such as the Duke-Huaneng partnership, however, we will never know if CCS can play the role so many are hoping it will.

2. **Natural gas** There is an expectation that gas – at least in some parts of the world – will serve as a bridging resource to replace coal until alternative technologies (including storage) become more economic and feasible for large scale deployment. The United States, for instance, recently discovered large shale gas deposits and has improved the technology to access shale gas, while liquefied natural gas (LNG) has also become a global commodity in the last few years. But gas still has a significant amount of carbon, and its pricing is volatile; there are also significant costs associated with LNG transport and security, as well as shale gas extraction and transport.

3. **Renewables** We are likely to see continued growth in renewables, lower costs and technological innovation. While even optimistic targets in many jurisdictions foresee no more than 25 percent of electricity generated from renewables by 2025, so many jurisdictions are starting from such a low baseline that even this number would represent impressive and speedy growth. On the global level, hydroelectricity represents by far the largest share of renewables. But locally available hydro resources have mostly been tapped in many jurisdictions, leading planners to look farther afield for potential energy from water.

Planners are also looking at other sources of renewables, like wind, solar and tidal power. To encourage investment in these and other emerging renewable technologies, many jurisdictions worldwide have adopted, or are adopting, feed-in tariffs, which guarantee premium electricity prices for renewable energy sources. But there are concerns that such inflated prices may not always be the most



economic means of reducing emissions in the energy system, and there are worries of public backlashes against much higher electricity prices. Spain, an early mover in providing renewable subsidies, announced in late 2008 that it would have to roll back some of its subsidies, while Germany is adjusting downward its tariff for renewables. It remains to be seen, therefore, whether jurisdictions worldwide will maintain feed-in tariffs in the medium- to long-term. Will they face a ratepayer backlash, or are higher prices for renewables here to stay?

4. Nuclear While the pace of new nuclear has been slow in the West, several European countries are warming to the prospect in response to their concerns about energy security and carbon in the transportation sector, and in the United States President Obama is calling for a new generation of nuclear plants. In emerging economies like India and China, there are ambitious plans to build reactors in the coming decades, and a number of Middle Eastern countries are weighing the nuclear option for the first time. Some economists would recommend that policy makers determine and guide overall policy but be technology neutral, leaving the decision on how best to achieve the policy goal to the market. In reality, however, many governments pick winners and losers – favouring some energy sources and putting up obstacles to others. And there is a view that governments should be making such choices: major projects like carbon capture and storage or nuclear new build will not go ahead without government support. Does it make sense in the context of growing global energy challenges for governments to be technology neutral? Or should they in fact be working aggressively to promote certain sources ahead of others? Does society need to decide now how much share renewables, gas, nuclear and coal will have in our respective jurisdictions by 2030, so we can establish the pricing mechanisms, regulatory frameworks and infrastructure necessary to achieve these targets? When it comes to sources of electrons, do we want governments to be active and involved or distant and trusting?

CARBON PRICING

The vision of a unitary, fully interlinked global carbon agreement is likely to be illusory. Even in a much more straightforward domain such as trade, we have failed to establish a single global agreement under the World Trade Organization (WTO).

But unitary or not, economic constraints on carbon are growing. The EU emissions trading system (ETS) is up for renewal, Japan is eyeing a green tax, and in 2009 Australia proposed its own trading system (although it was unsuccessful, the issue remains on the table). The United States appears less likely now than in 2009 to introduce a cap-and-trade regime over the next few years, while Canada will align itself with what the US decides to do on this score (no more, no less). China's carbon intensity targets for large emitters entail an implicit carbon price, because they will require retirement or replacement of inefficient technologies. As this diversity indicates, we are likely to see a spectrum of carbon constraints: taxes, cap-and-trade agreements, hybrids between taxes and caps, political commitments to replace capital stock, mandates and incentives for low carbon generation, and other ways of pricing carbon explicitly and implicitly. Important questions for electricity in connection with carbon pricing include the following:

- What carbon price or signal will it take to drive the electricity sector transition to low-carbon?
- The aviation industry recently became the first industry to adopt a global policy position and commitment on carbon reductions. Should electricity do so as well, and if so, why would this be helpful, either to itself or to the broader ambition of carbon reductions? What would the position be?

CLEAN ENERGY CAPITAL



The industry will need capital for electricity projects, both for replacement infrastructure and to meet new demand. Stimulus funding in G-20 countries may have helped in the short term, but is not a long term solution. Several questions emerge in connection with the need for clean energy capital:

- Are there alternatives to a rate base for long-term capital investments in generation, transmission and distribution? Are there other sources of patient capital we are overlooking which could complement ratepayer funding?
- How can we ensure that the next generation of infrastructure investment avoids locking in high emissions sources for another generation and instead goes towards clean energy investment? Will the global recession slow down, or help accelerate innovation in the electricity industry?
- How can we increase the industry's relatively small investment in R&D, as well as early stage innovations that have not yet achieved commercialization and scale?
- Electrical utilities are chasing the same machines, copper wires, transformers, etc. Will there be adequate capital to pay for these needed materials – and what are we competing against in the marketplace? Will regulated return on equity be sufficient?

GOVERNANCE IMPROVEMENTS

The world will need better regional, national and international governance – more effective and inclusive decision-making mechanisms and institutions. The following are key questions around improvements in governance and institutional design:

- Western-dominated institutions will need to adapt and expand, and there have been some changes already in this direction, as in the G8 being superseded by the G20. What else needs to happen? Should the International Energy Agency (IEA) expand its membership to include

countries outside the OECD, and should it look to expand its mandate beyond representing the interests of energy consuming nations?

- Should the electricity industry support a strengthened oversight role for the International Atomic Energy Agency (IAEA) so as to help ensure the peaceful expansion of nuclear energy is not compromised by the actions of rogue states or terrorists? Should the electricity sector support efforts to reform the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), encourage wider adoption of the Additional Protocol, and support disarmament through the Global Zero initiative?
- Do we need new problem-solving mechanisms for addressing issues at the nexus of water and energy?
- Stakeholder consultation processes in many jurisdictions have expanded to include NGOs, native peoples, and other local and community groups. What does best practice look like around stakeholder consultation, addressing 'not-in-my-backyard' (NIMBY) concerns, and addressing global needs? Is there an optimal balance to be found between good faith consultation and the need for leadership and tough decisions if the energy transition is to go ahead as required?
- Do we need to rethink electricity boundaries so as to strengthen inter-jurisdictional cooperation in such areas as carbon offsets, ultra high voltage transmission projects, and electricity storage to support intermittent renewables?

There are likely to be some major energy disputes in coming decades. But as Michael Dworkin of Vermont Law School puts it, "Nations tend to resolve energy disputes with either lawyers or soldiers. I prefer lawyers."^{iv} Are we comfortable that we have adequate mechanisms in place to help resolve such disputes, or do we need to develop new ones?

CONCLUSION

Energy has powered historical progress and fossil fuels led to extraordinary gains at an important moment in human history. But now we have entered



another era. The energy system faces myriad challenges and risks in an increasingly interdependent world, and these could become destabilizing factors in communities and regions.

Although there is now an expectation that a subset of energy - low carbon electricity - will have a central and expanding role in global energy use, many questions have yet to be answered in how this transition is to occur. And it will not happen by itself; if electricity is to answer this challenge over the next few decades, governments and the electricity industry today must work to develop a long-term policy path and identify priorities in such key transitional areas as integrated planning, low carbon supply, carbon pricing, clean energy capital, and energy governance.

As the stakes have risen and our fates have become more intertwined around global energy challenges, it is now incumbent on governments and industry to think more ambitiously and systematically in determining how electricity can answer the expectations and hopes that are being placed on its shoulders. Electricity must be given the authority to proceed and the means to succeed if it is to move from understudy to center stage.

ⁱ See: http://www.duronenergy.com/about_us/.

ⁱⁱ Dr. Charles Schlumberger makes this distinction in his paper "The Oil Price Spike of 2008: The Result of Speculation or an Early Indicator of a Major and Growing Future Challenge to the Airline Industry?" *Annals of Air and Space Law*, Vol. XXXIV, [2009], McGill University.

ⁱⁱⁱ Integrated resource planning is meant to synthesize inputs related to efficiency, transmission, supply, the environment and economics all at once.

^{iv} See:

http://www.vermontlaw.edu/Academics/Environmental_Law_Center/Institutes_and_Initiatives/Institute_for_Energy_and_the_Environment/Events.htm.