

Clean Energy Systems and Services

The Underlying Need – Better Integration and Innovation

Energy consumption is a major contributor to greenhouse gas emissions in North America. While much has been done to increase the energy efficiency throughout our economy, there is more we can do by using a systems approach to mitigate our energy use.

The complexity of energy systems across North America suggests an opportunity for more integration. Consider the multitude of players in the sector: from resource developers to end users, from researchers to distributors, from procurement managers to system designers, and from financiers to engineers. Clean technologies, decentralized power, time-of-use rates, feed-in tariffs and demand-side management programs are but a few examples of opportunities that would benefit from a systems perspective.

Many investors, decision-makers and policy analysts do not understand the complexity of energy supply and demand systems. In the pursuit of cleaner energy, decision-makers frequently focus on products, overlooking the opportunities for improved systems and services. Financiers and entrepreneurs focus on venture capital for new technology start-ups. While new technologies are needed, service companies and engineering consultants can provide more immediate and less risky options. For example, with regard to mobile energy storage, the focus on building better products (such as improved fuel cells or batteries) has overshadowed the system design opportunities (such as hydrogen distribution systems or exchangeable battery packs).

Innovative new technologies can succeed or fail for a variety of reasons – not just technical but also social, commercial and financial. For example, consider carbon sequestration: a level playing field is needed to ensure this technology's cost-effectiveness is compared to a systems perspective of emerging alternatives such as carbon mineralization¹. Evaluations of longer-term clean energy development initiatives would benefit from more credible and factual analyses of the longer-term impacts.

The Opportunities – Our Strengths in Systems and Services

Canada possesses world-class expertise and experience in energy technologies and systems. Unlike most other nations, we deal with dramatic differences in climate, vast geographies, urban/rural/remote challenges and a variety of natural resources. On the supply side, we have researched, piloted and commercialized a variety of technologies based on our plentiful resources in oil, gas, coal, uranium, biomass, flowing water, sun, wind and tides. On the demand side, we have deployed the full gamut of institutional and market approaches: demand-side management programs, regulation, voluntary initiatives, fiscal incentives, grant programs, feed-in tariffs, etc.

Service industries have a dramatic effect on the commercialization of innovative technologies – a fact often overlooked, even ignored. Canada has an incredible wealth of knowledge workers in the energy and related sectors, including researchers, energy modelers, consulting engineers, lawyers and financiers:

- Engineers and technicians/technologists represent one of the fastest growing employment areas in Canada, currently 3.3 percent of all jobs²,
- Science and engineering represents 14% of all paid employment³, and
- Engineering consulting is a \$15 billion industry, including \$4 billion in exports⁴.

¹ See new research into combining CO₂ with rock minerals to produce a solid carbonate, Abo University (Finland) & Carbon Sciences.

² Prism Economics and Analysis, Toronto; "Engineering and Technology -- Labour Market Study"; sponsored by Engineers Canada (EC) & Canadian Council of Technicians and Technologists (CCTT); May 2009

³ Statistics Canada; Beckstead & Gellatly; "Innovation Capabilities: Science and Engineering Employment in Canada and the United States", May 2006

⁴ Prism Economics and Analysis, Toronto; "Engineering and Technology -- Labour Market Study: Canada's Consulting Engineering Sector in the International Economy"; Sponsored by Engineers Canada (EC) & Canadian Council of Technicians and Technologists (CCTT); March 2009.

Canada is active throughout the world in designing and building energy systems and infrastructure (e.g. China, Dubai).

From both the economic and environmental impact perspectives, these system and service factors are often missing in policy discussions of climate change, energy supply systems, energy demand programs and clean energy development. While investment choices in some near-term energy and infrastructure projects embrace a systems approach – utilizing the value of consultants, systems analysts and designers – longer term strategies and policy discussions tend to focus on particular technologies or products.

There are three specific areas that must be addressed:

- Despite the fact that Canadian capabilities in energy systems design are substantial and world-class, they are poorly recognized both domestically and internationally. These capabilities present tremendous opportunities for export growth as well as domestic progress on GHG emission reductions.
- Canada's investments in clean technology lag those of other countries (on a per capita basis). Furthermore, our investments in clean technology focus on products, missing the equally tangible opportunities in services (and especially in systems design).
- Despite the near-term cost-effective opportunities, many public and private infrastructure projects lack consideration of systems integration, energy efficiency or clean technology options.

The way forward can be guided by a few fundamental principles and objectives:

- Take an integrated systems approach. Consider a practical mix of energy sources and demand-side efficiency measures.
- Avoid short-term policy thinking. Focus on market-based approaches, including appropriate price signals for energy and carbon. Avoid having governments “picking winners”. Promote transparency in investment choices.
- Build capacity in energy systems and services. Grow our skilled labour force and target the most effective R&D investments. Grow both domestic and export opportunities in energy services.

Public and private institutions can both influence and benefit from more integrated development of clean energy systems and services. Opportunities abound, not only through new technologies and companies, but in integrating existing technologies, training our existing workforce, exporting our world-class services and making better funding and procurement decisions.

Recommendations

That the federal government:

1. Take a systems approach to ensure that the impact on the entire energy sector value chain is considered when developing policies designed to encourage the development of clean energy.
2. Include funding for energy services (such as system design) and related infrastructure needs within the clean energy development funding umbrella.
3. For larger research, development and demonstration projects, carry out sustainability studies such as life-cycle and socio-economic impact analyses.
4. Work with the provincial and territorial governments to provide increased accessibility and funding for training in energy systems design, green technology and sustainability analysis focusing equally on graduating more skilled workers (in degree/diploma programs) and retraining existing skilled workers (e.g. consulting engineers).

5. When implementing green procurement policies, use performance-based tendering to ensure the maximum innovation at minimum cost.
6. Aggressively pursue opportunities for exporting our energy systems and services through, for example, DFAIT's Cleantech Practice and the Trade Commissioner Service.