L'Académie canadienne du génie

The Canadian Academy of Engineering

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BACKGROUNDER

Final Report of the Canadian Academy of Engineering Energy Pathways Task Force Phase 1

Background

Clean Energy Innovation is an issue that is of critical importance for the future well-being and prosperity of Canadians. In March 2002, responding to the challenges being faced by the global energy industry, including regional instability, depleting conventional resources, climate change and price volatility, the Canadian Academy of Engineering (CAE) released a study titled, *Energy and Climate Change – A Canadian Engineering Perspective.* It concluded that, "A long-term, sustainable energy strategy needs to be developed, which will necessarily require a larger choice of energy sources and technologies than [are] presently available". The Report noted that the CAE could play an important role in the assessment of technologies that are already available or entirely new energy technologies.

With support from a group of eight Sponsors: Alberta Research Council; Natural Resources Canada; Suncor Energy; Petro-Canada; EnCana; AECL; Hatch; and the Alberta Energy Research Institute; a Task Force was formed under the leadership of Dr. Clem Bowman, FCAE, to continue the work of the Academy on this subject. Dr. Bowman, a chemical engineer, spent more than 40 years in the petrochemical industry, including working as head of research for one of the first Canadian oil sands operations, and decades ago was asked to coordinate the Alberta government's $100 million infusion of capital into energy projects that ultimately led to many of today's energy mega projects.

Dr. Bowman who lives in Sarnia, Ontario, is a member of the Order of Canada. He is also a developer of the ProGrid methodology for incorporating so-called "intangible" factors into decision making. ProGrid is being used in both the public and private sectors and is hailed as being a breakthrough methodology for understanding and acting on complex decisions. ProGrid was used to conduct the evaluations of the Energy Pathways.

The specific goal of the Energy Pathways Task Force was to define the barriers that are preventing the development of economic and environmentally acceptable energy sources and carriers in Canada and to identify the technologies that can overcome these barriers. The focus of this project has been on technology options that would permit Canada to achieve its greenhouse gas (GHG) emission targets, while continuing to provide an adequate supply of energy, at competitive rates, to meet the growing demand for energy.

The foci of the Academy's efforts are to assist governments in laying out their policies and strategies and to provide options for industry to achieve production targets while meeting future environmental regulations. The process began with the development of an Energy Pathways Model, an examination of prospective pathways against that model, a workshop with key stakeholders to obtain additional input, leading to the evaluation effort described in this report. The goal is to define major Canadian Energy Technology Projects that have the potential to achieve the vision previously described.

The report, ***Canadian Academy of Engineering Energy Pathways Task Force Phase 1 – Final Report***, identifies four key recommendations.

Summary of Recommendations

Recommendation 1
National Technology Projects

Canada should undertake the following three National Technology Projects:

- Gasification of Fossil fuels and Biomass
- Greenhouse gas (GHG) Emission Reduction (carbon dioxide capture followed by transportation, long term storage and/or use)
- Upgrades to Electrical Infrastructure (with improved access by wind and solar sources, and capacity for energy storage)

A National Technology Project is considered to be a commitment by Canada to plan and implement major energy programs which have both economic and environmental benefits, involving significant public/private sector participation, at federal, provincial and regional levels. These three projects will provide an integrated approach to provide higher valued energy products, reduce carbon dioxide emissions and facilitate the entry of additional renewable energy sources into the Canadian electrical grid.

Gasification involves the reactions of carbon-based fuels with steam and oxygen to produce electricity, hydrogen and other value-added products. Although commercial in other countries, it has not been demonstrated for Canadian low rank coals and biomass, and has not been integrated with carbon dioxide capture, transportation, use and storage technologies. The latter is the second of the three National Technology Projects. Hydrogen is needed now for upgrading hydrogen-deficient fossil fuels and as a potential future transportation fuel. It is also one of the options for storing the electrical energy from intermittent renewable energy sources such as solar and wind, whose capacity to feed into the electrical grid is restricted, as well as from baseload nuclear sources during off peak hours. These and other limitations of the national energy grid are the subject of the third National Technology Project.

It is recommended that these projects be each funded for a ten year period, and be managed by a national cross-sectoral board. This board should set objectives, allocate resources, and track performance against the objectives. The mandate of the Board should also include Life Cycle Assessments to assess both the net energy gain and the net environmental impacts for each energy initiative. It is worth noting the success that the Alberta Government had, commencing in 1975, in the establishment of the Alberta Oil Sands Technology and Research Authority (AOSTRA). This body carried out major innovative programs over fifteen years with combined private/public sector funding in the order of one billion dollars. A similar commitment in each of the above three national projects would put Canada on the path to a sustainable energy superpower and would attract the skilled people needed to achieve this vision.

Recommendation 2
Network of Bioconversion Demonstration Processes

There are many opportunities across Canada for distributed and environmentally friendly processes for generating energy products from agricultural, forestry, meat and fish waste processing and municipal solid waste feedstocks, which in total would make a significant contribution to Canada's energy requirements. Existing organizations such as BIOCAP Canada and CBIN (Canadian Biomass Innovation Network R&D Program) will be able to assist in the identification of priority feedstocks and processes. A national network to conduct regional demonstration projects should be formed and funded.

Recommendation 3
Pursuing Energy Opportunities and Challenges

There are challenges in the Canadian energy sector which need new or advanced technology. In some areas, Canada has significant opportunities related to unique energy resources and should lead in carrying out basic and applied research leading to future commercial applications and technology export opportunities. In other areas, there will be opportunities to adapt technologies developed elsewhere for application in Canada. Organizations active in these areas should prioritize and coordinate their activities with the objective of significantly accelerating the pace of progress.

Examples of these challenges are:

- Water supply, treatment and management
- Wind and solar
- Natural gas hydrates
- Lower impact surface mineable oil sands
- Higher valued products from heavy oil and bitumen
- Alternative hydrogen supplies
- Potential for nuclear power for insitu oil sand production
- Advanced nuclear fission reactors, including nuclear waste management
- Bituminous carbonates
- Geothermal
- Tidal and wave

Recommendation 4
Fusion Energy

Canada should maintain sufficient expertise in fusion research to monitor and periodically assess the progress made by the international community.

- The international effort in magnetic confinement fusion is very large and commercialization is many decades in the future. Canada should maintain a watching brief on ongoing international efforts and contribute in areas where we have appropriate expertise, such as in the production and handling of tritium.

- Inertial confinement fusion, once considered to be even further away in application, has made recent advances and it is recommended that a university-based effort in Canada be defined and supported as a contribution to the international effort.

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