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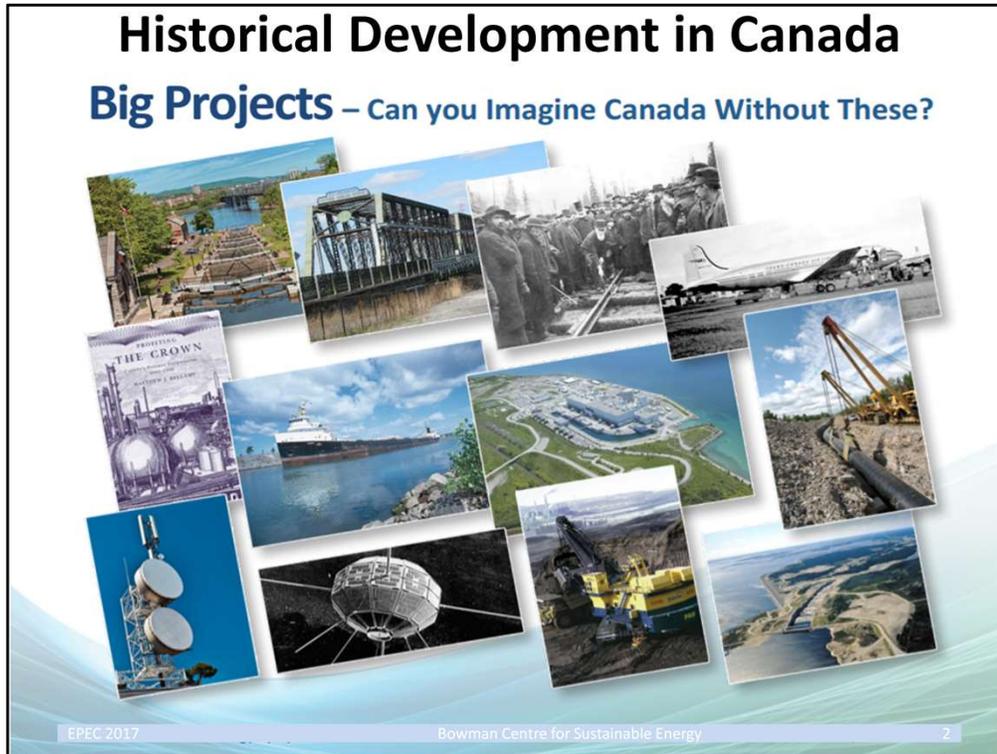
Bio

Marshall Kern is a Director of the Bowman Centre for Sustainable Energy, and one of the first Associates. He enjoyed a successful career at Dow Chemical with international leadership roles in regulatory compliance, and risk management. He has over a decade of experience as a corporate director. He holds a teaching position with the Nipissing University School of Business.

Abstract

*TITLE: "Nation-Building: Pathway to Canada's Sustainable Energy Future"
The Bowman Centre for Sustainable Energy proposes an organization that will guide the selection of big energy projects and prepare them for funding, and approvals. We are working on projects in several energy value chains within a Canadian energy system to build Canada's sustainable energy future.*

Thank you for the introduction and the opportunity to address this group of leaders.



Let's look first at some Canadian history. These are some images regarding Big Projects that have shaped Canada.

All these Big Projects were first put forward and then developed, for reasons quite different than their current operation. All these Big Projects owe their existence to visionaries who, through personal commitment and often in the face of obstacles, helped create the Canada we know. Here are a few short examples:

The Rideau Canal connected Kingston and Montreal via Ottawa – to avoid having Canadian forces travelling along the St. Lawrence River and possibly subjected to military engagement from American forces. It was completed after the War of 1812 demonstrated that Canada needed a secure passageway. Colonel John By of the Royal Engineers oversaw construction. Now it is a UNESCO World Heritage Site and still stimulates economic development in the area.

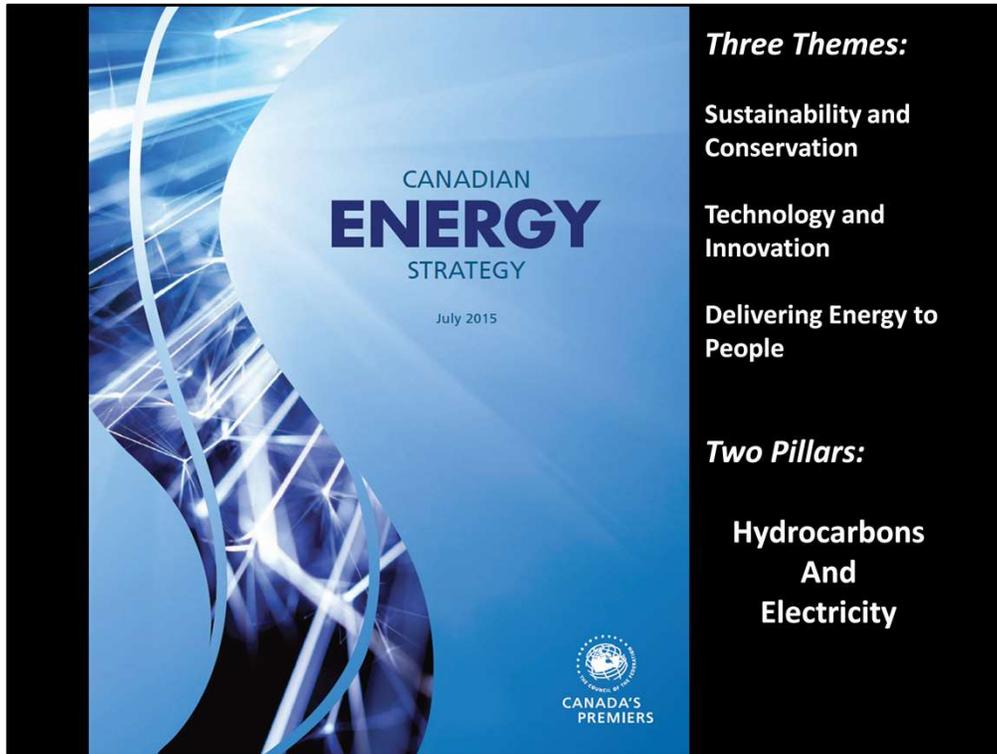
Pierre Berton called the transcontinental railway “The National Dream”. British Columbia joined Confederation with the promise of being linked by a ribbon of steel. Many, many settlers in Western Canada, including my own great grandparents, arrived by the CPR. The man at the centre of the photo and the centre of making it happen was Cornelius Van Horne. Now the CPR and CN haul a tremendous amount of freight, taking Canadian goods to transshipment points on the coasts or to market in the US.

I live in Sarnia, still called the Chemical Valley. During World War II, synthetic rubber was needed because supplies of natural rubber were cut off. J.R. Nicholson was charged with bringing support from 6 private companies to create a crown corporation and make rubber. The Polymer Corporation facility was built in record time and by war's end had produced 95,000 tons of rubber. It was honoured by being depicted on the back of a ten dollar bill.

In an era of free wifi hot spots being almost everywhere, we need to be reminded that the longest microwave communication system in the world was completed in 1958. The system of long-distance telephone wires was becoming overburdened. 139 towers enabled telephone, teletype, and television signals to cover the 6275 kilometres between east and west in one-fiftieth of a second. Bell Canada president Thomas Wardrop Eadie spearheaded the development of the system that is the precursor to our current broadband highway.

As a final example, it was J. Howard Pew, the chairman of Sun Oil, who risked his company and his reputation of a first-of-its-kind project to start surface mining of the Alberta Oil Sands. Fifty years later we know that the Alberta Oils Sands are important to Canada's economy because when the Fort McMurray fire forced closure of some oil sands operations, Canada's economy took a measureable hit.

What is the common thread connecting these nation-building big projects? It is leadership. People with vision, with courage, with resilience and a long term view led these projects.



To achieve a sustainable energy future, Canada needs the same visionary leadership now. The groundwork has been laid with the Council of Federation 'Canadian Energy Strategy' looking at three themes, and in the twin pillars of hydrocarbons and electricity. And there are ongoing efforts to contribute to a Canadian Energy Strategy, including consultations this year by Minister Carr under the theme of "Generation Energy". Because of the integrated nature of energy generation, transmission, and consumption, we the Bowman Centre for Sustainable Energy suggest that we need to get away from thinking of the components of energy in discrete units or silos. From a policy perspective, Canada needs a sustainable energy system. We also hope that from all this discussion, we can identify the visionary leaders for the Canadian energy system.


THE BOWMAN CENTRE

Who are we?



Mission Statement: Catalyze big energy projects which drive Canada's energy strategy and generate sustainable wealth and jobs

The Bowman Centre for Sustainable Energy can help our visionaries and leaders get the winning projects identified as a pre-requisite to getting them funded, and launched.

Who are we – the Bowman Centre for Sustainable Energy?

Our mission statement is to catalyze big energy projects which drive Canada's energy strategy and generate environmentally and economically sustainable wealth and jobs.

We are a non-profit think tank with Associates in BC, Alberta, Saskatchewan, Ontario and Quebec. Our Associates have centuries of accumulated energy sector expertise ranging from executive, management, engineering, business, and operational experience.

We are researching and evaluating Big Projects that Canada will need so we can have a sustainable and prosperous energy future.

We've submitted a brief to the Standing Senate Committee on Energy, Environment & Natural Resources.

We've met with senior officials in the Energy Policy Branch of the federal government.

We continue to enjoy ongoing engagement with indigenous peoples.

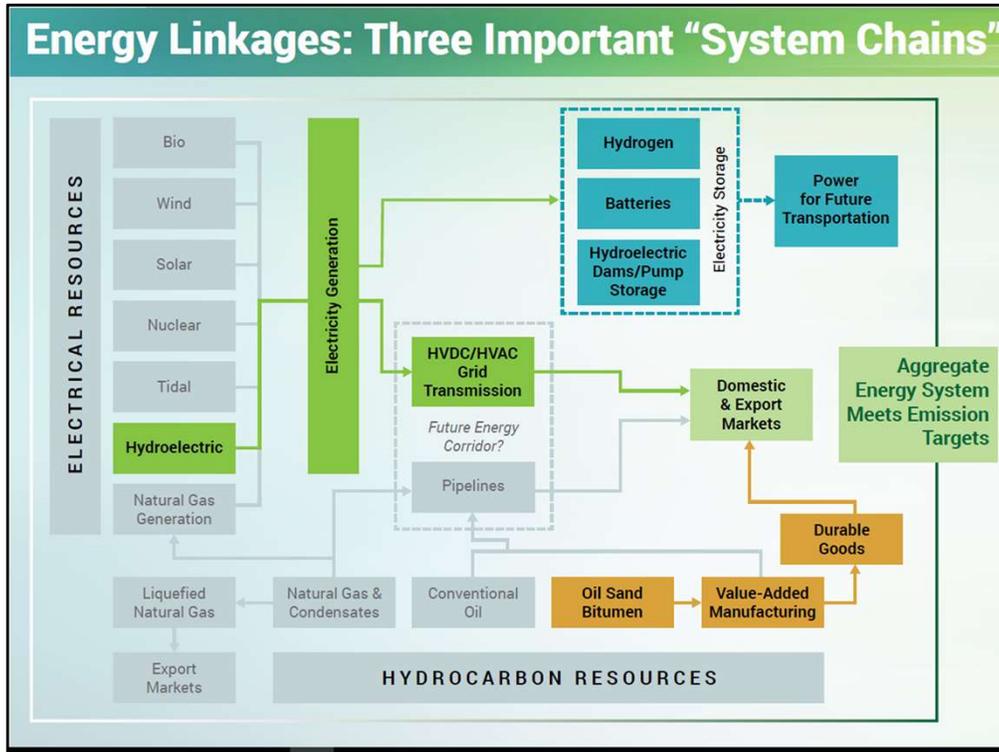
We are actively working with industry, government agencies, and academia. We have published our work in newspapers, journals, and have published books.



We have published two major reports in 2012 and 2014.

These are free on our website and also via the Canadian Academy of Engineering. These reports set out a benchmark for the state of Canada's energy capabilities with respect to hydroelectricity, electrical grid connections, nuclear capabilities, as well as fossil fuels and biomass.

These reports also set out a trajectory to tap additional sources of hydropower. And a step-wise progression for a national electrical grid that will engage renewables while avoiding the stranding or constraining of existing assets.



We also participated in a special feature on energy in the Globe & Mail. Last April, on Earth Day, we put forward the idea of energy chains within a Canadian sustainable energy system.

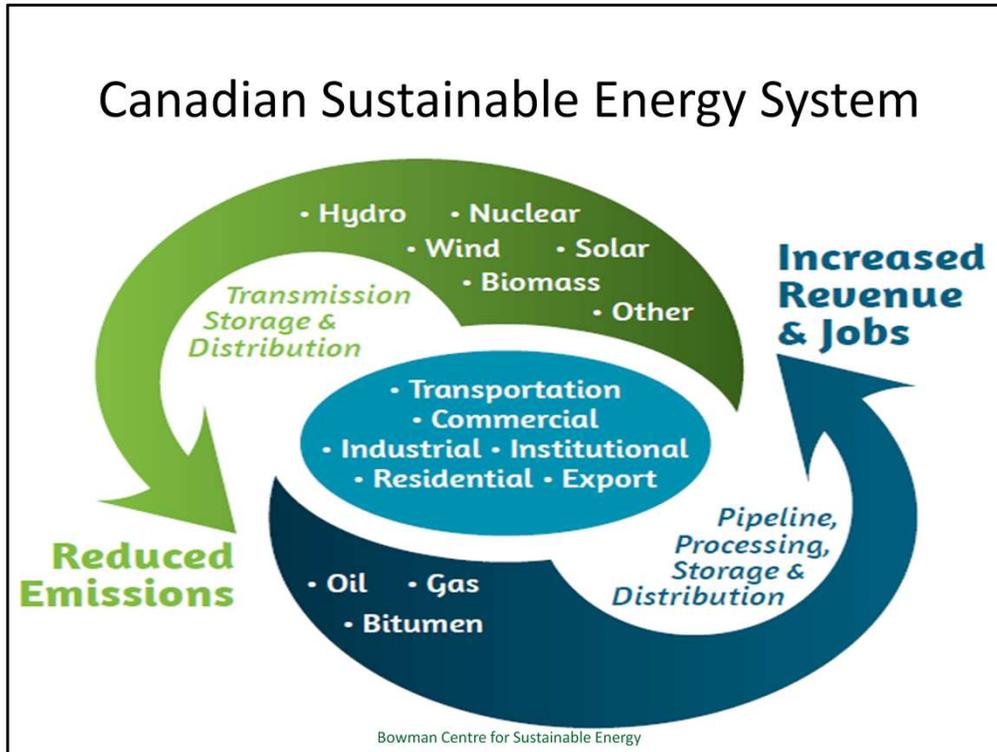
The BCSE thinks the best way to develop a 21st energy system is to recognize all the components of our energy infrastructure as part of an energy system. This drawing shows that all components of energy infrastructure are integrated. Recognition of these interconnections is key to developing these components in a way that approaches an optimized energy system. A system that maximizes benefits of each component while minimizing the impacts associated with each component.

As we think of energy as a complete system, we can recognize several components where there are opportunities to achieve success.

First, we can look at Canada's hydroelectric capacity.

Second, we can look at the energy needed for future transportation.

Third, we can look at non-fuel uses for hydrocarbons.



There are three characteristics that distinguish the Bowman Centre for Sustainable Energy from other Canadian energy think tanks.

First, we are looking at a complete Canadian sustainable energy system. It is intimated in this slide of one graphic from the Globe & Mail special feature.

We see the value to Canada of our oil, gas, and bitumen resources as spinning off increased revenue and jobs. We also see the importance of hydro, nuclear, wind, solar, biomass, and other energy sources, as being key to reducing our emissions of greenhouse gases.

How we allow these resources to achieve the overarching objectives of economic growth and environmental performance is through the decisions we make regarding transmission, processing, storage, and distribution.

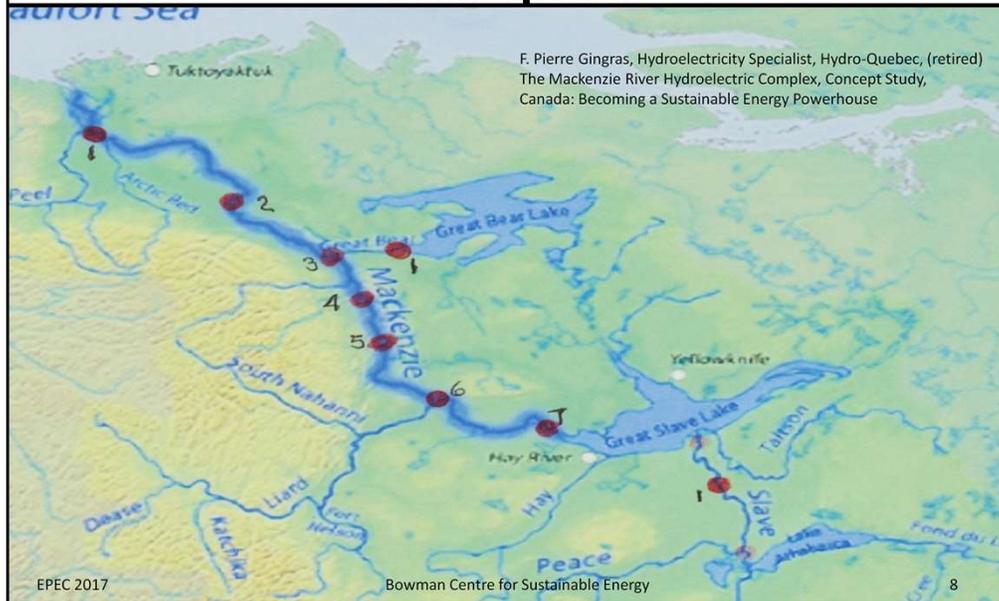
And central to the Canadian Sustainable Energy System is our quality of life which is described in terms of our transportation system, our industrial, commercial, institutional and residential environments as well as our export trade with the world.

The Second distinguishing characteristic is our mission. We are looking deeply into the far future for Canada. We know from our history as a nation that our future will be enabled by big projects.

The third distinguishing characteristic is our methodology, which I shall explain in a few moments.

I will now look as some of the big projects we are developing as examples that can be progressed within a Canadian sustainable energy system.

Mackenzie River Hydro Development Conceptual



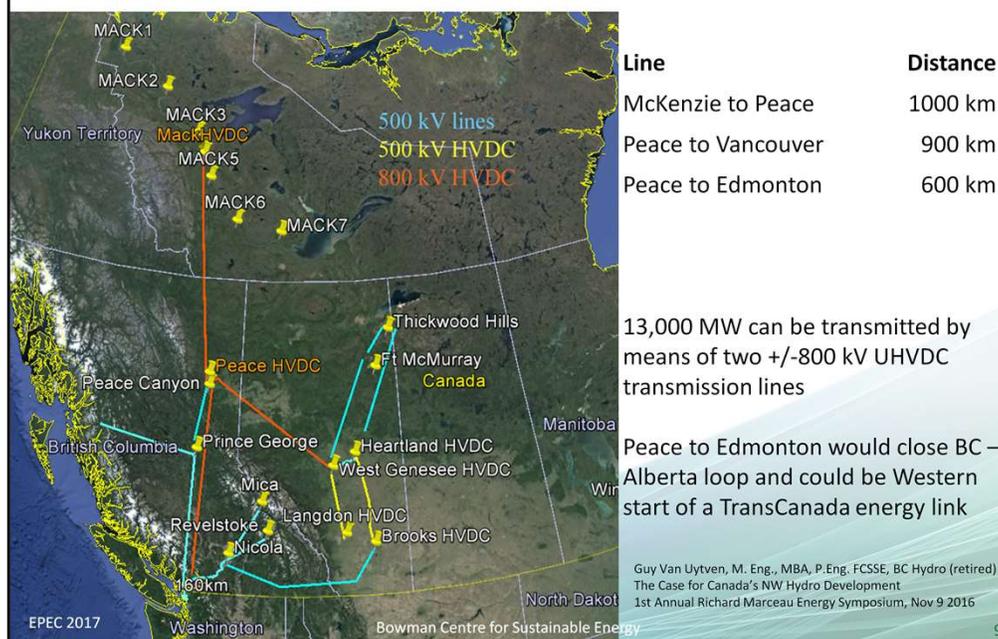
As an example of the scale and scope of the nation-building projects we are examining, consider this:

The Mackenzie River runs in gorges so deep, from 15 to 40 meters, that dams from 22 to 27 meters high would produce little significant flooding of adjacent lands.

7 dams could produce 13,000 MW of power, roughly ½ of Ontario’s consumption.

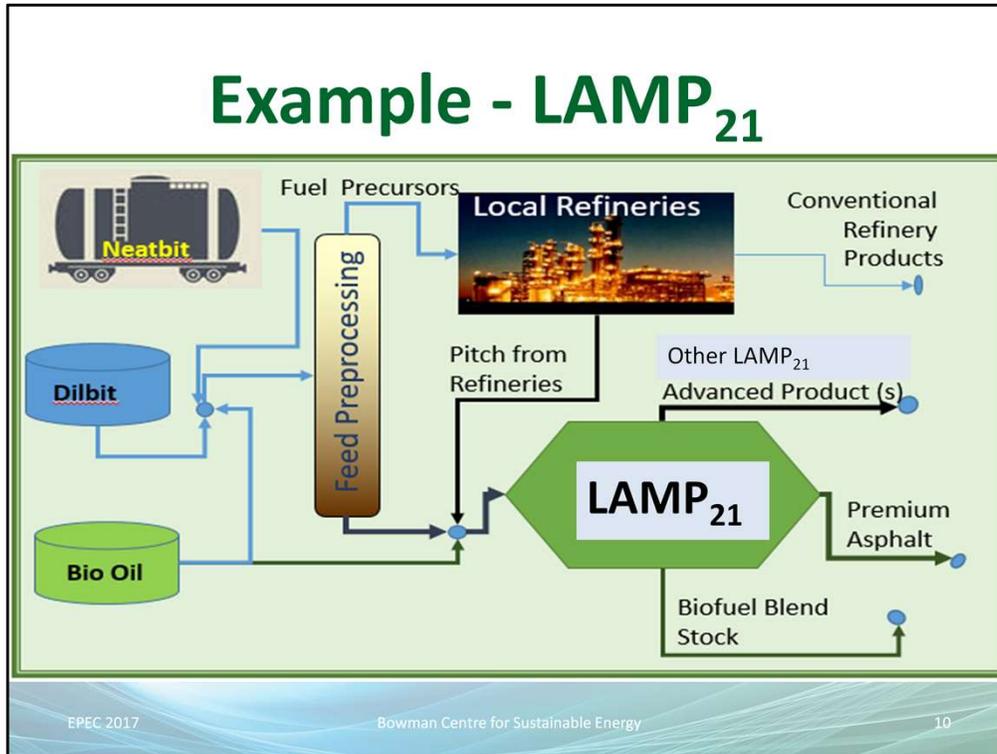
There is not a current proponent of such a project. The economic scale of such a project exceeds the resources of a single company, and the time-scale exceeds the mandate of a single government. Should we find a proponent, we would offer our evaluation to them.

Hydro Electric Power Market Example



Hydro power from the Mackenzie River would:

- Open up the Western Arctic to development benefiting residents
- Hydro Project development will provide economic benefit to Canadians on a national scale.
- Our Analysis shows that Hydro power
 - Will be cost competitive with natural gas fired thermal power project for producing bitumen, significantly reducing the GHG emissions per barrel of bitumen produced
 - Would be available to replace Alberta coal fired power generation on cost competitive basis
- Using the Canadian Sustainable Energy System approach, this example:
 - Would contribute substantially to enabling Canada meeting its GHG emission reduction commitments
 - WHILE providing Canada wide scale employment and value creation
 - AND reducing GHG per barrel of bitumen produced.
- This is achieved via HVDC transmission deliver over long distances to competitively access markets
 - And become the Western start of a trans-Canada energy link for a National Grid



Another example of a nation-building project is a non-fuel use for bitumen from Alberta's Oil Sands. This is the Lambton Advanced Materials Project for the 21st Century or LAMP21

Bitumen will be diverted from the fuels pool to durables not meant for combustion. Future evolutions of LAMP21 would convert an ever increasing amounts of the bitumen to non-fuel products as demand for fossil fuels declines.

Examples of the products include:

Hi Tech Asphalts

Reduce rolling resistance – reduced transportation GHG emissions

Enhance Highway life - Reduced road construction related GHG emissions

Coatings, Adhesives

Advanced Materials

Carbon Fibers, graphenes, advanced chemicals, polymers

Our initial design is a 21st Century Process Unit design, Efficient operation

Integrated with grid to help balance load peaks

Use less natural gas and more electricity

Waste heat recovery

Zero Liquid discharge

Incorporate biogenic feedstocks

Again, we have pursued finding a proponent for this project.

ProGrid® Evaluation Matrix

Economic Impacts	Readiness (Enablers)	Environmental Impacts
A1: National and Regional Economic Impacts	B1: Science and Technology Readiness	C1: National Environmental Targets
A2: Breadth of Economic Impacts	B2: Commercial Readiness/Canadian Advantage	C2: Local/Regional Environmental Impacts
A3: Future Economic Impacts	B3: Societal Readiness	C3: Environmental Sustainability/Value-add

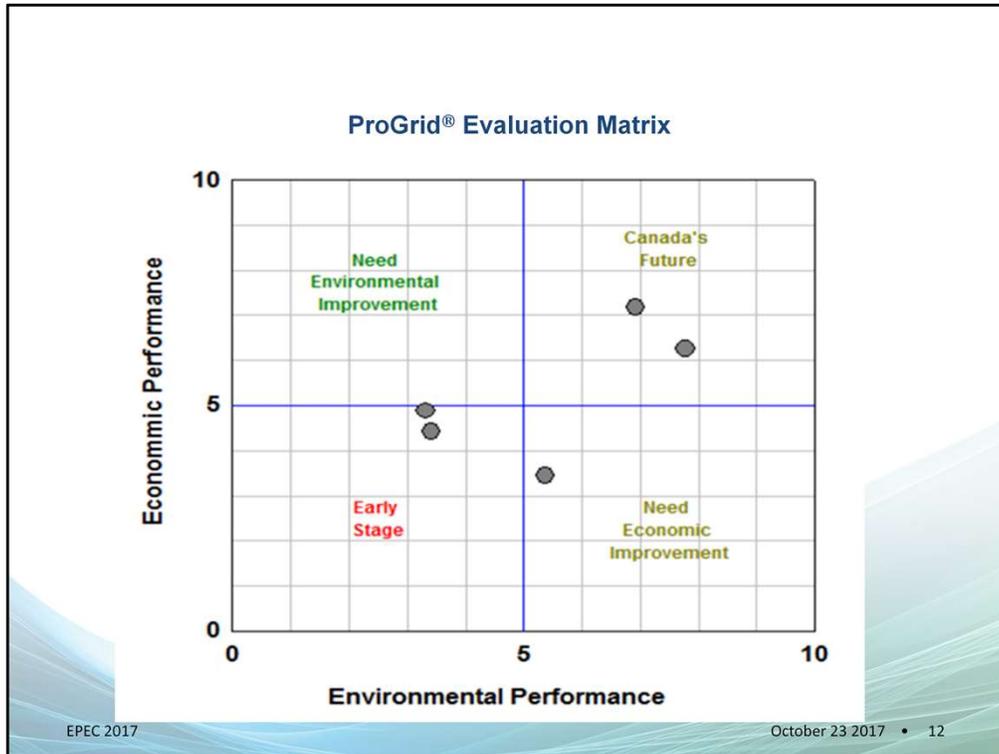
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Our methodology is this:

Drawing from the AO STRA experience of finding and implementing successful projects, we are using the Progrid Evaluation tool. Note this table is an early example we've shared before. The methodology is more advanced now because of the work we've done over the past few years.

Most business case proposals focus on economic benefits as listed in the first column. It is relatively easy to estimate the CAPEX costs of construction of a project, and estimate the lifespan of an energy project. We know it is more difficult to anticipate the changes in expectations for environmental impacts as presented in the third column.

We have developed a clear methodology, as intimated in the centre column, to be sure that there are the proper enablers of success in-place.



We can, and do, assess how a project will meet the requirements for Canada’s sustainable energy future.

We can, through a peer evaluation system, place a project on a matrix to show how well it will contribute to Canada’s future.

THE CANINFRA CHALLENGE

CanInfra Challenge is a public contest inviting infrastructure ideas to tackle our current set of challenges

We seek bold and innovative ideas across:

- Major economic infrastructure to bolster Canada's productivity & growth
- Public transit ideas to foster faster commutes & innovative communities
- Green infrastructure for clean air and water
- Social infrastructure to build better neighborhoods for our kids
- Inclusion of rural & northern communities
- ... and all ideas that promise a better future for our country

Grand prizes offered to teams who can develop compelling short pitches for Canadian transformational infrastructure

www.caninfra.ca

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We aren't the only ones working on Canada's sustainable energy future. You are probably aware by now of the CanInfra Challenge, information on which is shown here.

Dr. Clem Bowman



Photo by Jeff McCoy for BCSE

- Founder of The Bowman Centre for Sustainable Energy
- Fellow of the Canadian Academy of Engineering
- Former President of AOSTRA

We have big ambitions. We are looking far into the future to set Canada on a clear trajectory that uses our storehouse of energy and resources in a sustainable manner, while providing ongoing wealth and jobs for generations of Canadians. We are guided by visionaries in our midst. Dr. Clem Bowman.

Dr. Richard Marceau (1953 – 2016)



- Associate of The Bowman Centre for Sustainable Energy
- Past-President of the Canadian Academy of Engineering
- VP of Research; Memorial University Newfoundland
- Past Provost and VP Academic at UOIT

And Dr. Richard Marceau

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