

The role of universities in the strategy for energy transition

Brief presented to Transition énergétique Québec
Public consultation regarding development of the
Energy Transition, Innovation and Efficiency Master Plan.

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By Normand Mousseau and Louis Beaumier, Institut de l'énergie Trottier

About Institut de l'énergie Trottier (IET)

IET was created in 2013 thanks to a generous donation from the Trottier Family Foundation. Its mission is to train a new generation of engineers and scientists with a systemic and trans-disciplinary understanding of energy issues, to support the search for sustainable solutions to help achieve the necessary transition, to disseminate knowledge, and to contribute to discussions of energy issues. By virtue of this mandate, IET is a unique institution in the energy sector in Canada.

Based at Polytechnique Montréal, the IET team includes professor-researchers from HEC, Polytechnique and Université de Montréal. This diversity of expertise allows IET to assemble work teams that are trans-disciplinary, an aspect that is vital to a systemic understanding of energy issues in the context of combating climate change.

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Introduction – the role of universities in the energy transition strategy

This brief is filed by Institut de l'énergie Trottier (IET) for the consultation held by Transition énergétique Québec (TEQ) in preparation for the formulation of its first master plan.

Its aims are to: (a) stress the academic community's potential for knowledge and analysis in support of a societal transformation as far-reaching as the one that TEQ is called upon to bring about in the coming decades; (b) underline the supporting role that academics play in countries that make successful progress towards the transition; and (c) put forward a strategy to enable Québec to attain the energy objectives of its Strategic Plan 2030, especially as regards reducing greenhouse gas emissions, while safeguarding its economic and social development.

More specifically, the proposal presented by IET elaborates on three of the functions defined in section 5 of the Act respecting Transition énergétique Québec (original text in French):

Section 5: Within the scope of its mission, Transition énergétique Québec may, in particular:

[...]

(6) prepare reports on energy in Québec and benchmarking studies on best practices with respect to energy consumption and production;

(7) support research and development in the energy sector;

(8) in collaboration with the main stakeholders in research and industry, establish a list of research subjects to prioritize[.]

The transition demands that energy be used more efficiently, of course, but by virtue of its scope, it requires a far more profound transformation of Québec society: beyond energy efficiency, energy sources must be changed, processes must be transformed, service offerings and consumption patterns must be altered, infrastructures must be overhauled and land occupancy must be adapted. To fulfil its mandate, TEQ must build the three above functions into all of its actions and address them in a coordinated manner in order to optimize transition efforts and maximize the ensuing environmental, social and economic benefits.

TEQ must therefore very quickly develop a close working relationship with universities in order to:

- contribute to the development of processes and technologies that will enable energy to be produced and used more efficiently and, above all, better services to be provided;
- support the development of better performance indicators;
- generate scenarios and assess the costs and possible benefits of various actions by developing and using sophisticated modelling and analysis tools.

Research as the cornerstone of the transition

Support for research in the energy sector being part of its mandate, TEQ must naturally forge a close relationship with the university community, to which the majority of Québec's leading researchers belong.

Basic and applied research certainly have a role to play in the energy transition. Technological development in connection with energy efficiency and the replacement of energy sources springs to mind. However, although necessary, research into these areas will not suffice. Two other lines of research must also be considered: changes to traditional approaches to energy use, and development of a better understanding of the technical, economic and social issues related to services provided by energy.

Efficiency being by its nature limited by the basic laws of thermodynamics, the gains that can be hoped for in certain areas are necessarily limited (this will be confirmed by benchmarking studies). Québec's ambitious energy and GHG reduction targets cannot be attained by relying mainly on energy efficiency. What is needed, rather, for a significant proportion of sectors of activity, is to change traditional approaches and replace manufacturing processes, and even to develop new ones to adapt to new sources of energy. The research required by changes of this kind will take time and effort, with no guarantee of results. But the absence of a guarantee must not be allowed to obscure the fact that this line of research is essential. Development of innovative processes will bring economic development and generate knowledge.

Similarly, it is important to go beyond technical and scientific energy-related issues and consider the question of energy service and its economic and societal benefits. For example, better management of transportation or of electricity consumption during periods of extreme winter cold would bring considerable savings while creating new business opportunities and improving the competitiveness of Québec's economy and the quality of service to all citizens.

This is why it is important to support research: to gain an understanding of how the programs and measures put in place by the government will act on the Québec economy, so that negative effects can be minimized (for example, by introducing additional mitigation measures), and an understanding of energy consumption patterns.

A better understanding of the needs underlying demand will make it possible to innovate in energy-supply solutions. These are avenues that research must explore if we want the transition to be more than a mere change of fuel.

Recommendation # 1

That TEQ, working with energy producers and users, the Fonds de recherche du Québec and universities, develop a program to support research into the energy transition aimed at creating lasting pluri-disciplinary groups.

Performance indicators inspired by best practices

For many reasons, we consider it vital to take the best practices in energy consumption, production and efficiency as a starting point. One of the most important reasons is to help in defining performance indicators, which TEQ must implement to assess the various programs and measurements that will appear in the master plan.

Since organizations that submit programs and measures are not asked to determine performance indicators (section 11, para. 2), it falls to TEQ to define and publish them (section 17). This will ensure that the various proposals are assessed consistently and fairly.

The performance indicators that TEQ will determine should not however serve merely for the evaluation of the master plan's programs and measures. They must go further than a simple estimate of GHGs avoided—although standardization work is required in this area also—and should include economic and social components, in keeping with TEQ's mandate.

Part of the research activities included in TEQ's mandate should therefore be devoted to defining performance indicators and, more important still, to the creation of tools necessary for their evaluation.

Recommendation # 2

That TEQ develop multifactor performance indicators (i.e. that go beyond mere GHG emission reductions), based on best practices, if necessary in collaboration with universities, and make them available to all stakeholders in the energy transition, and position itself as the reference organization on the subject.

A concerted approach through systemic monitoring

While indicators must not be restricted to GHG emissions only, neither should they be limited to evaluating individual programs and measures. They must allow a systemic evaluation of benefits and impacts.

(Evaluation of individual items is useful and relevant as regards energy efficiency. As a reflection of an organization's general efficiency, energy efficiency should be a matter of self-interested concern for any business.)

It is possible that a measure that is effective on its own proves otherwise when evaluated in a more global context. The sum of individually effective measures, although they offer short-term gains, may prove ineffective over the medium term, because efficiency gains will be limited for each energy-transformation system. To avoid such localized optimizations, the energy transition must be addressed from the point of view of systemic energy efficiency.

Consequently, energy assessments and calibration measures should be conducted regularly, since they will be essential to the definition and calibration of systemic performance indicators. Carefully defined systemic indicators will have a dual function: first, enabling the evaluation of existing programs and measures, but second, helping to identify research niches that should be prioritized. This dual function will help concertation with research and industry players by providing both a short-term and a medium/long-term perspective: not all the various actions can be evaluated over a single, five-year horizon.

Recommendation # 3

That TEQ commit to ongoing monitoring of progress and systemic gains achieved by existing programs and measures, and to ensuring that the systemic performance indicators used for this monitoring also serve to identify promising research niches in the medium term.

The importance of independent modelling and analysis

While energy modelling can be useful in choosing objectives, it proves indispensable in formulating strategies to attain these objectives. This is why the great majority of OECD countries use a variety of models to support policies, assess successes and challenges, and update their approaches.¹

¹ On this subject, see: IET (2017), For a Sustained Canadian Energy Systems Modelling Initiative, Institut de l'énergie Trottier (IET), Canada (available at: <http://iet.polymtl.ca/en/publications/for-a-sustained-canadian-energy-systems-modelling-initiative/>)

Specifically, models make it possible to:

- conduct a prospective evaluation of the energy sector’s evolution in response to various policies and constraints;
- compare scenarios using various criteria (feasibility, cost, impacts, etc.);
- identify the most fruitful strategies and approaches for attaining a set of objectives;
- develop criteria and scales for evaluating the impacts of various programs and measures over time, allowing a better understanding of the true impact of measures and of the corrections and improvements needed to increase their impact.

Most countries that are moving towards energy transition, such as the UK and France, have made university modelling and analysis an integral part of their climate change strategy—as can be seen, for example, in the plans of the British government² and in reports by the *Committee on Climate Change*³, which is headed by academics and is responsible for following up the UK climate action plan.

Although the Québec university community can already count on a number of energy-related institutions and research groups, they have insufficient funding to be able to structure, complete and integrate their modelling and analysis capacity in order to adequately support the energy transition and provide, particularly:

- access to resources for the development of energy models and prospective scenarios;
- identification of the socio-economic effects—both positive and negative—of the various scenarios;
- reference information on electricity transformation and use technologies (efficiency, costs, etc.);
- development of impact scenarios and support for the development and evaluation of programs or the implementation of energy transition scenarios.

Recommendation # 4

That TEQ set up a structure, possibly based in the university environment, aimed at supporting the development of the analysis tools and the expertise required to understand Québec’s energy transition quantitatively, and make them available to deciders. This understanding will require: 1) situation analyses; 2) quantification of proposed measures; 3) follow-up on programs and actions; 4) identification of appropriate solutions for Québec.

Universities as reference organizations

In addition to their leading role in research, universities collectively can act as a neutral, independent organization able to evaluate progress, estimate the effectiveness of existing and proposed programs and measures, and provide the government with scenarios based on these programs and measures.

As mentioned, development of the tools required for these various functions is in itself an area of research in which it will be important to invest—first to ensure that our objectives are

² <https://www.gov.uk/government/policies/energy-and-climate-change-evidence-and-analysis>

³ <https://www.theccc.org.uk/publications/>

attained effectively, and next to advance knowledge and develop leading-edge expertise that will allow Québec to distinguish itself on the international stage.

Moreover, since a number of government departments and organizations are in the process of formulating master plans or strategic plans in connection with climate-change issues—and hence with energy transition—we consider it vital that these plans should be developed, or at least their implementation should be monitored, with shared, open tools, accessible to all players, including the government, universities, businesses, non-governmental organizations and citizens' groups.

Recommendation # 5

That TEQ establish close collaboration with universities to produce the knowledge, datasets, analysis and modelling required to support its energy-transition mandate.

In this context, it is essential that this work be public and accessible to the entire population.

Recommendation # 6

That TEQ acknowledge the importance of open, accessible research and adopt a policy aimed at ensuring that the work, models and datasets generated by the research it funds should be freely accessible to all of society.

Appendix A – List of recommendations

1. That TEQ, working with energy producers and users, the Fonds de recherche du Québec and universities, develop a program to support research into the energy transition aimed at creating lasting pluri-disciplinary groups.
2. That TEQ develop multifactor performance indicators (i.e. that go beyond mere GHG emission reductions), based on best practices, if necessary in collaboration with universities, and make them available to all stakeholders in the energy transition, and position itself as the reference organization on the subject..
3. That TEQ commit to ongoing monitoring of progress and systemic gains achieved by existing programs and measures, and to ensuring that the systemic performance indicators used for this monitoring also serve to identify promising research niches in the medium term.
4. That TEQ set up a structure, possibly based in the university environment, aimed at supporting the development of the analysis tools and the expertise required to understand Québec's energy transition quantitatively, and make them available to deciders. This understanding will require: 1) situation analyses; 2) quantification of proposed measures; 3) follow-up on programs and actions; 4) identification of appropriate solutions for Québec.
5. That TEQ establish close collaboration with universities to produce the knowledge, datasets, analysis and modelling required to support its energy-transition mandate.
6. That TEQ acknowledge the importance of open, accessible research and adopt a policy aimed at ensuring that the work, models and datasets generated by the research it funds should be freely accessible to all of society.