Shepherd Rubenstein

BY EMAIL and RESS

Jay Shepherd
jay@shepherdrubenstein.com
Dir. 416-804-2767

September 14, 2020
Our File: EB20190294

Ontario Energy Board
2300 Yonge Street
27th Floor
Toronto, Ontario
M4P 1E4

Attn: Christine Long, Registrar & Board Secretary

Dear Ms. Long:

Re: EB-2019-0294 – Enbridge Low Carbon Pilot – SEC Submissions

We are counsel to the School Energy Coalition ("SEC"). Pursuant to Procedural Order #4 in this matter, this constitutes SEC's Submissions on the merits of the Application.

Background

A hydrogen-based energy system is in some respects the stuff of science fiction. While we have known for hundreds of years that hydrogen is an energy dense material that can provide energy in a multitude of ways, and have seen it as a key part of our energy future for at least fifty years[1], it has only had limited application in an era of cheap fossil fuels and widespread indifference to carbon emissions.

More recently, governments and the private sector have realized that hydrogen should have a larger role on the way to decarbonizing our energy systems.

It is important, however, to be clear on the potential roles that hydrogen could actually play. The evidence in this proceeding, and available in many external studies, shows:

1. ***Hydrogen will never replace natural gas in the gas transmission or distribution system.*** This is for three reasons:

[1] See, e.g., the European Commission's publication in 1983: G. Imarisio, A.S. Strub, Hydrogen as an Energy Carrier, Kluwer, 1983. There are many other examples from the 70s and 80s, spurred in part by the oil crisis.

a. ***Technical Limits.*** Hydrogen above very low levels is simply incompatible with both the existing distribution components[2], and the existing appliances used by most people that currently use natural gas. The system itself cannot handle more than about 10% hydrogen before components start to fail[3]. Gas appliances such as furnaces, water heaters, stoves and fireplaces have various limits on safe inclusion of hydrogen, from 2% to 10%[4]. Some industrial applications that use natural gas cannot use hydrogen at all without completely replacing their equipment. Replacing natural gas with hydrogen at any significant level would likely require replacing, and thus stranding, the entire gas infrastructure (transmission, distribution and end use appliances).

b. ***Physics.*** While hydrogen has a high energy content for its mass, it has only about a third of the heat content relative to natural gas[5]. That means that even if we can get up to 10% hydrogen in the natural gas system, that is only displacing 3.3% of the carbon emissions.

c. ***Cost.*** Relative to natural gas, hydrogen – however it is created – is very expensive. While it is undoubtedly true that the cost of hydrogen from electrolysis will go down considerably (as did solar and wind when they were deployed in volume), other technologies that can be used for space and water heating would also go down in cost with similar investments and economies of scale. There is no reasonable scenario in which a primarly hydrogen-based fuel can be distributed to homes and businesses through distribution pipes at a lower cost than the use of any of multiple low carbon alternatives.

2. ***Hydrogen is fundamentally an energy storage medium***, and should be looked at in that light. It is a mistake to compare it to natural gas, a natural (in the longer term) material that we mine to use its inherent energy content. Instead, it should be compared to a battery, i.e. a way we can store and transport energy. Particularly in the case of green hydrogen[6], hydrogen can be used to make non-dispatchable

---

[2] I.STAFF.6.

[3] I.SEC.1, Attach 1, Last Presentation (undated), p. 7. See also I.ED.12(j) and I.CCC.7.

[4] Ibid. p. 8, 11.

[5] B/1/1, p. 17.

[6] Throughout these Submissions, SEC uses the terms Grey Hydrogen, Blue Hydrogen, and Green Hydrogen as they are defined in the draft Executive Summary of Hydrogen Strategy for Canada, July 9, 2020, found at Ex. I.ED.12, Attachment 1. The definitions are at page 7 of the Exhibit. Grey Hydrogen (producing hydrogen from natural gas without carbon capture) is not a viable option for any purpose, as it produces as much carbon emissions as burning natural gas. Blue Hydrogen essentially amounts to "cleaning" natural gas, i.e. removing the carbon from natural gas, leaving just hydrogen, and sequestering the carbon. The result is that two-thirds of the energy content of the natural gas is lost. Green Hydrogen, the method proposed in this Application, uses electrolysis to separate the hydrogen and oxygen in water (sometimes called "cracking" or "splitting"). The question of whether to use Grey or Blue Hydrogen, or Green Hydrogen, for existing end uses has so far been largely one of cost, but in the longer term it is about whether a) the feedstock for hydrogen is more sustainable if it is a non-renewable resource, natural gas, or a renewable resource, water, and b) a process that produces a harmful byproduct, carbon, that has to be sequestered, is better than a process that produces a beneficial byproduct, oxygen, that can be released or sold.

electricity dispatchable (like a battery)[7], or to transport energy in containers or in vehicles[8]. Used for energy storage, hydrogen has two issues:

a. ***Efficiency.*** While the energy efficiency of storing energy in hydrogen is significantly better than batteries, the efficiency of the full cycle (original source, conversion to storage, and release from storage) is about the same for both of them in many applications[9].

b. ***Cost.*** To date hydrogen energy storage has been more expensive than recently improved lithium batteries, although it is likely that the costs to store energy using hydrogen will decline as the technology is deployed more widely[10].

3. ***Hydrogen may have a role as a transition technology for natural gas.*** While clearly a 3-5% reduction in carbon emissions from building heating, for example, is not the end goal for the carbon strategy of Canada or any other country, it is at least plausible that it could be a short term goal so that the entire gas infrastructure (transmission, distribution, and end use appliances) does not become stranded. The evidence in this Application provides no support for that proposition, but it is a logical possibility that could be drawn from information in the Application. For this reason, it is included as a possibility in things like the upcoming Canadian hydrogen strategy[11], and in the IEA's June 2019 study for the G20[12].

SEC believes that it is crucial to understand the context of this Application. While hydrogen has considerable potential to help decarbonize our energy systems, the Enbridge Low Carbon Pilot is not, and cannot be, a gateway to replacing natural gas with hydrogen in their pipes at any more than a tiny percentage. That having been said, there may still be value in the pilot project, as long as we set our expectations to achieve, at the very most, a relatively modest, transitional benefit.

Recommendation of SEC

Against that backdrop, SEC recommends that the Board approve the Application, subject to the following conditions:

1. ***Reporting.*** The Applicant should provide an annual, public report to the Board and all parties setting out:

    a. Project status and costs.

---

[7] Hydrogen Strategy for Canada, op.cit, note 6, p. 6.
[8] Hydrogen Strategy for Canada, op.cit., Note 6, p. 9.
[9] Pellow, Emmot, Barnhart, and Benson, "*Hydrogen or Batteries for Energy Storage: A Net Energy Analysis*", Energy and Environmental Science, 2015, Vol. 8, p. 1938.
[10] Most government hydrogen strategies assume this. See, e.g. Hydrogen Strategy for Canada, op. cit. note 6, p. 8.
[11] Hydrogen Strategy for Canada, op. cit. note 6 , p. 8, 11.
[12] International Energy Agency, The Future of Hydrogen, June, 2019, at p. 123. The report had many authors and other contributors (including, we should add, Peter Fraser).

b. Investigations of impacts and results of those investigations
c. Conclusions, if any, based on project-generated knowledge.

2. ***Intellectual Property.*** The intellectual property and other knowledge generated by the pilot project shall *prima facie* be for account of the ratepayers.

3. ***Rebasing.*** It should be open to the Board panel on rebasing to determine:

a. The extent, if any, to which the project is included in rate base.
b. The extent, if any, to which project operating costs are included in revenue requirement.
c. The terms under which the utility acquires hydrogen from its affiliate going forward.
d. The structure and amount of rate riders to compensate customers for reduced energy content.
e. The scope of the project, and any changes necessary to enhance its value.

Value of the Pilot Project

Enbridge implies that this pilot project is just the first step in replacing natural gas with hydrogen in the Enbridge system[13]:

> *"The LCEP is a pilot project that will allow the Company to green a portion of the natural gas grid in Ontario. The experience gained through the implementation of the LCEP will position Enbridge Gas to then expand hydrogen injection into other parts of its gas distribution system, further enhancing reductions to greenhouse gas (GHG) emissions across the province…*
>
> *Enbridge Gas submits that the LCEP is an opportunity for customers, the Company and the province of Ontario to take steps to introduce hydrogen into the natural gas stream and, over time, reduce GHG emissions."*

As noted in the section "Background", above, the implication that hydrogen will replace natural gas in any significant way is simply not true. However, if Enbridge intends to imply only that a small percentage of the natural gas in the system may be replaced by hydrogen eventually, that may be true.

Assuming the latter goal, the pilot project can provide useful information for Enbridge, the Board, and the customers about the impacts of hydrogen blending on the physical system, the operation of the system, and the end use equipment deployed by some customers. Although undoubtedly some of that information is known already from research by others[14], the details are important. Enbridge has never operated with any

[13] AIC, p. 1, 2.
[14] See, e.g., the attachments to I.SEC.1.

hydrogen blending.

Enbridge acknowledges that this is a learning exercise in many places in the Application, including for example[15]:

> *"The lessons learned from the LCEP pilot project can be used to determine whether, when, where and how hydrogen blending can be expanded to other parts of the Enbridge Gas distribution system. Within 5 years, Enbridge Gas will report to the OEB and stakeholders about its experience with the BGA, including observations and recommendations about whether and how to expand hydrogen blending."*

SEC believes that it is important for the Board to look at this project as a learning exercise, in which success is measured not by proving that hydrogen can solve all our problems. Rather, success should be measured by how much more we know than we did before the project, even if what we learn is that hydrogen has severe limitations in this type of deployment.

Like any process of scientific discovery, if the experiment shows new problems associated with hydrogen blending, or even proves more clearly the truth of the existing problems with hydrogen blending, that is still valuable to know. For example, if at 2% there is a material increase in safety issues for end users, that may allow Enbridge (and therefore customers) to avoid future imprudent investments. Hydrogen would be shown to be of limited value in the decarbonization of the natural gas system.

Of course, if the experiment shows that there are workarounds that can get hydrogen blending up to 20% for most end uses, for example, that is also of value. That could create a scenario in which we can transition away from natural gas (for some uses) at a lower cost.

The bottom line is that the Board should not, in our view, try to ascertain if the future of the natural gas system involves blended gas. This project is not a way to meet the Clean Fuel Standard. It simply cannot have enough impact to matter. This is a pilot project. Learning enough to help assess later what role hydrogen can play, if any, is the goal. This project can be used to enhance that knowledge.

What Can We Learn?

There appear to be three categories of knowledge that can be developed using this pilot project (in conjunction with the many other projects around the world in this area):

- ***Impacts on the physical distribution infrastructure.*** Some impacts have been found in other studies, but in this closed loop environment Enbridge should be able to do extensive testing on all components of the system, and get much more detailed data. This will be especially true if Enbridge ends up using various percentages of hydrogen in the blending over time as part of this pilot project.

[15] AIC, p. 2.

- ***Operational Impacts.*** It is likely that operating a distribution system that includes hydrogen will be different from one that has only natural gas. That is not just things like the failure of components, etc. Are there increased customer care costs as customers need assistance with the impact on their end uses? Are maintenance schedules changed due to the physical impacts on the pipes or other components? Are there normal operational techniques (pigging, for example) that are affected by the hydrogen in the blend? Does the blending process itself present costs, risks, or other operational impacts other than those already known or expected? Enbridge should be expected to use this pilot project to investigate all operational impacts.

- ***End User Impacts.*** Clearly the lower energy content of hydrogen, and its higher combustion temperature, are known to have potential impacts on end user equipment and uses. Enbridge should be directed by the Board to ensure that it actively engages with all users in the BGA to learn as much as possible about the impacts they are experiencing.

All of these potential impacts will have cost ramifications, and will likely influence the extent, if any, to which hydrogen can be included in the Enbridge system in the future. This is all valuable information.

SEC submits that the Board's decision should include clear expectations as to the investigations and other activities Enbridge should undertake to ensure that this pilot project generates value for the ratepayers.

Reporting

Enbridge is not proposing that it carry out this project on its own dime. At all times the pilot project will have a potential impact on rates, and therefore in whole or in part will be paid for by customers.

That is not a bad thing. Enbridge should pursue innovation and develop more knowledge that could benefit customers in the future, and customers should be willing to pay for reasonable expenses associated with innovation.

However, the quid pro quo of customer financing of these activities is that the value derived – which is knowledge in this case – must be delivered to the customers. That is done through ongoing reporting of the results of the pilot project.

SEC submits that the Applicant should be required to provide an annual, public report to the Board setting out the status of the project, all project costs (on a fully-allocated basis), all investigations undertaken by Enbridge as part of the project, and all knowledge developed through the project. This report is likely similar to the reporting that the project would have to undertake internally as part of Enbridge's normal corporate practices, so it should not involve any significant incremental expense for the Applicant.

Affiliate Issues

Enbridge is proposing to procure hydrogen solely from an affiliate[16]. This raises an obvious question as to whether this project will generate undisclosed profits for the Enbridge group of companies.

This question is made more difficult for the Board because Enbridge has refused to provide the Board with basic information about the affiliate, and about the affiliate's economic and financial relationship with Enbridge[17].

On the other hand, there are reasons to believe that there are no significant undisclosed profits arising out of the pilot project. The most obvious is that the production of green hydrogen through electrolysis is expensive, and the project's gas procurement plan would pay the adjusted natural gas cost for this hydrogen[18].

The other piece of evidence that suggests the offshore profits will not materialize is the contract of the affiliate with IESO[19]. While it is not completely clear, it looks from the contract like the contract price is intended to represent the costs of the affiliate to provide the services to IESO, including a reasonable return. In addition, section 3.11 of the contract[20] makes clear that if the affiliate gets additional revenue sources, those are netted out against the payments from IESO. Because the contract was only provided in response to interrogatories, and there was no subsequent discovery available, we cannot be sure that this is the correct interpretation, but it appears on the face of it to be the case.

We request that the Applicant disclose, in their Reply, whether it is correct that any net profits from the relationship between the affiliate and Enbridge under the pilot project will reduce the payments to the affiliate from IESO dollar for dollar.

On the evidence before the Board, it would therefore appear to us that there are unlikely to be any undisclosed profits to the affiliate during the deferred rebasing period of Enbridge.

That leaves two affiliate-related issues.

First, what happens on rebasing? Our comments on that are detailed below.

Second, what happens to the intellectual property (knowledge, etc.) developed as part of the pilot project? Enbridge's position on this is not clear. It says both that the IP is a utility asset for the benefit of customers, and that it is not[21].

---

[16] Ex. B/1/1, p. 5. Enbridge told the Ministry that the plant belonged to them (I.CCC.5, Attach 2), but that appears to be inadvertent, and nothing turns on it.
[17] I.SEC.7; I.ED.6(a) to (g).
[18] I.STAFF.2, p. 5 and Attachment 1.
[19] I.SEC.9, Attachment 1.
[20] Ibid, p. 11 of 31.
[21] See I.SEC.2, I.H2GO.1, p. 3, and I.CCC.15.

SEC submits that *prima facie* the intellectual property should be for account of the customers, as this is a utility project for which the customers are being asked to contribute. The onus should be on Enbridge, either when it files its annual reports on the project with the Board, or on rebasing, to demonstrate that any part of the intellectual property generated by the pilot project should not be for account of customers.

Rebasing

At the time of rebasing, five issues may arise related to the pilot project. The Applicant appears to assume the results for some of them. SEC submits that this Board panel should make clear that these five issues will be determined by the Board panel hearing the rebasing application, and nothing in the current decision will limit their discretion to do so.

The five issues are as follows:

1. ***Inclusion of capital costs in rate base***. For normal infrastructure approved in a leave to construct, inclusion of the capital costs in rate base on rebasing is pretty much assumed (subject to cost overruns, etc.). Enbridge assumes that in their Argument in Chief[22]. SEC submits that, because this is a pilot project, it should not be assumed that the capital costs will be added to rate base. There will be evidence on rebasing related to the pilot project, its costs and benefits. If the situation remains as today, we would expect that the cost will be added to rate base. However, if what we know at that time is materially different (e.g. early operational problems mean that the project is no longer going to produce valuable information), it should be open to the Board to determine that the pilot project is not used and useful, and should not be included.

2. ***Inclusion of Operating Costs in OM&A budgets.*** The Board has limited information on the costs to operate this pilot project. That information will be provided at the time of rebasing, and will be subject to full discovery. It should be open to the Board, on rebasing, to determine that all or some part of the incremental costs to operate this project are either not prudent, or not properly for account of customers, and so should not be included in revenue requirement.

3. ***Hydrogen Procurement Costs.*** The letter of intent between Enbridge and its affiliate related to procuring the hydrogen has not been subjected to any significant discovery, and as noted earlier much of the background information the Board would normally have about the affiliate has been refused. If the project continues beyond rebasing, SEC submits that it should be open to the Board panel in that case to assess the appropriate terms under which Enbridge should acquire hydrogen from its affiliate going forward. This may include the provision of more information about the affiliate, as well as the current agreement with

[22] AIC, p. 13.

IESO (since the current one will have expired by then unless extended). SEC anticipates requesting the same information as we requested in I.SEC.7.

4. ***Rate Riders.*** The current proposed rate rider does not adjust for individual customer volumes, but a separate rate rider for Rate 6 is planned[23]. It is not clear whether the proposed rate riders provide an advantage or a disadvantage to customers with larger volumes, like schools or commercial businesses. Because the numbers are small, this is not a concern in the near term, but on rebasing it should be open to parties to argue that any rate riders or rate treatment should be more reflective of actual impacts on each customer.

5. ***Project Scope.*** The key value in the project is the gathering of information. During the rebasing application, it should be open to parties to argue that the scope or parameters of the project should change so that the value of the information being generated is increased.

Conclusion

Based on the above submissions, SEC recommends to the Board that the pilot project be approved, subject to the conditions proposed above with respect to:

1. Annual Reporting,

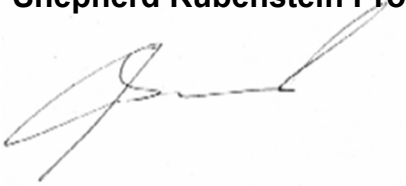
2. Ownership of Intellectual Property, and

3. Matters open to determination by the Board on Rebasing.

SEC submits that, while it is not likely that blending a significant amount of hydrogen into the existing natural gas distribution system is a viable option in the future, the knowledge that may be gained by Enbridge, the Board, and customers as a result of this pilot project is useful, and commensurate with the cost.

All of which is respectfully submitted.

Yours very truly,
Shepherd Rubenstein Professional Corporation



Jay Shepherd

cc: Wayne McNally, SEC (by email)
Interested Parties (by email)

[23] I.SEC.11, I.SEC.4.