

Power2X proposes destroying ancient forest for a technology with a long record of failure



Summary

A Dutch start-up company, Power2X, is proposing to build a large industrial development in the Estonian town of Pärnu. They are promising to make Pärnu the site of the world's first large-scale wood-to-methanol plant, creating 200 permanent jobs directly, as well as 800 jobs indirectly by investing €1 billion. In a country that has just experienced two years of economic recession, it is easy to see why such promises sound almost too good to be true. Ministers and local government representatives have been expressing their strong support. The town council is looking at selling Power2X the site that the company wants to acquire, most of which is forested, much of it by ancient, highly biodiverse forest which provides habitat to many different species.

Amidst the excitement about the economic prospects of siting the world's first large bio-methanol plant, national and local policymakers have so far failed to ask whether the project might be sounding too good to be true because it really is. i.e., they have as yet failed to examine the likelihood of success of such a scheme.

For forests and climate such a 'success' would be bad news: it would mean removing an additional 1 million cubic metres of wood from forests to turn it into methanol, used in fuel and chemical products. This in a country where logging has been intensifying, where forest birds are in steep decline, and where, as a result of over-exploitation, forests now represent a net source of CO₂.

In reality, however, the project is highly unlikely to succeed. Not only do start-up companies in general have a failure rate of around 90%, but the failure rate of comparable projects stands at 100%. Comparable projects in this context are projects that involve gasification of biomass or mixed waste and catalytic conversion of the resultant syngas to different products, including (but not confined to) methanol. Two such projects, both in the USA, have recently ended in bankruptcies. Another, in Canada, has closed down, having failed to deliver on its promises despite having attracted tens of millions of Canadian dollars in public funding. Power2X itself has no experience with this technology and has, in fact, not so far produced anything (not in itself surprising because they were only founded in 2020).

Tragically, the ancient, diverse forest on the site which Power2X is asking for will be lost for good if they get to try to build a plant, however, unsuccessful, there.

What is the “green” methanol and hydrogen plan for Pärnu?

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In March 2024, the Dutch start-up company Power2X announced plans to develop a large bio-methanol plant in Niidu, on the outskirts of Pärnu. Most of the site where the plant would be



built is currently forested and home to large numbers of species, as discussed below.

Power2X proposes to turn 1 million cubic metres of forest wood into 500,000 tonnes of methanol via gasification followed by catalytic conversion to methanol. Gasification involves exposing feedstock to high temperatures with a controlled amount of oxygen and/or steam to produce syngas. Syngas consists of carbon monoxide, hydrogen and carbon dioxide, but also contains impurities, such as small particulates. It therefore needs to be cooled down and cleaned before it can undergo

chemical reactions to produce different chemicals, such as methanol.

As shown below, such a technology has never been demonstrated at scale. In addition, the company wants to build a 400 MW electrolysis plant to make green hydrogen, which would also be used to make methanol.¹ The electricity for making hydrogen would come from the Liivi Lahe offshore wind farm being developed in the Gulf of Riga, 40 km from the beach of Pärnu. Why Power2X would want to site an electrolysis plant using offshore wind energy in a forest in Pärnu is not clear. Company spokespeople have, however, mentioned a nearby biomass combined heat and power plant, operated by the energy company Gren, as a reason for choosing this site. This would relate to the main, methanol-from-biomass, element of the project.²

Power2X promises to invest €1 billion in Pärnu and to create 2,000 construction and 200 long-term direct jobs. It is unclear where they expect the money to come from.

Who are Power2X?

Power2X is a Dutch start-up company, founded in 2020 with private equity backing.³ They were set up to provide “strategic energy consulting services and project development, technical services strategy, site conversion, tank storage diversification, energy transition consulting, feedstock transition analysis and other related services.” They have, as yet, not got as far as commissioning any plant, i.e. producing anything.

In 2023, Canadian Pension Plan (CPP) invested €41 million in the Power2X.⁴

The company has two other projects, one in Portugal, the other in Spain. In Portugal, Power2X has partnered with Madoqua Renewables and Copenhagen Infrastructure to produce ammonia from hydrogen made via electrolysis, using offshore wind power. They have been guaranteed substantial support from the EU’s European Hydrogen Bank for this.⁵

In Spain, they are developing plans for possible hydrogen electrolysis plant using power from a large solar farm. There, they have partnered with the Spanish company Soto Solar.

Hydrogen electrolysis, unlike the production of methanol via wood gasification and catalytic conversion, has been demonstrated by numerous companies. Nonetheless, the projects in

Spain and Portugal are highly ambitious: Each would have an electrolyser with 500 MW capacity, nearly twice as large as the world's largest green hydrogen plant, which opened in China in 2023.⁶

What would the development mean for forests and forest-dwelling species?

The proposed development poses a two-fold threat to forests: First, because it would require 1 million m³ of forest wood per year, and second, because it would be built on a site which is currently a highly biodiverse forest. The first threat is contingent upon the success of the project. As discussed below, there are good reasons to doubt that Power2X's plans can succeed.

Turning 1 million m³ of wood into methanol would inevitably speed up the degradation of forests and increase net emissions from the land (LULUCF) sector in Estonia. The rate of logging has been dramatically increasing since the early 2000s, and 95% of logging is done by clearcutting forests.⁷ According to Global Forest Watch data, Estonia lost between 36,000 and 46,000 hectares of tree cover each year from 2016 to 2020.⁸ In 2023, Estonia lost a further 31,100 hectares.⁹ This is based on the Global Forest Watch definition of tree cover as referring to trees higher than 5m. According to a study published in 2019, forest bird populations declined by 50,000 breeding pairs between 1983 and 2018.¹⁰ Estonia's forests and, as a result, the country's entire LULUCF sector, turned from a carbon sink to a net carbon source in both 2020 and 2021 (the most recent years for which data has been submitted to the UN Framework Convention on Climate Change).¹¹



The **most immediate threat, however, is the destruction of 17 hectares if the Harutee Forest.** According to a 2024 excerpt from the National Register of Forest Resource Accounting, 11.08 hectares of the site contain, amongst other trees, pine trees of up to 200 years of age, significant amounts of deadwood, and fungi typical of mature forests. According to an assessment by ecology expert Indrek Tammekänd, it constitutes a high-conservation value forest that should be protected, as an endangered forest type, under the Habitats Directive.

It is rich in its diversity of flowers, liverwort and fungi as shown, on photos published in an article by Pärnu Postimees in October 2024.ⁱ Clearly, this is a highly-biodiverse, mature if not old-growth forest which should be protected, not sacrificed for an industrial development.

How (un)realistic is the proposed project?

Extensive web searches have shown up just one operational methanol project that uses wood as the feedstock in the world, operated by Södra Cell in Sweden. It has a capacity of just over 1% what Power2X proposes in Pärnu. Importantly, Södra Cell uses a very different technology, one that relies on anaerobic digestion rather than wood gasification.¹²

A proponent of the Power2X project has referred to a large Finnish plan to produce “green methanol” in Kokkola.¹³ There, however, the plan is to produce e-methanol from CO₂ captured from a biomass cogeneration plant, and not from biomass directly. This is an entirely different process and technology from what is proposed in Pärnu.

There are two major technical problems with the approach chosen by Power2X, i.e. gasification of biomass (or mixed waste) followed by catalytic conversion to make different chemicals:

The first challenge is the formation of acid gas and tars, which need to be prevented or removed because they cause corrosion, blockages and deposition on surfaces of the plant, as well environmental pollution.¹⁴ There are some operational biomass gasification plants that produce heat and sometimes also electricity. However, tar and acid gas formation remains a serious problem, and, appears to have been a key reason why the Fulcrum BioEnergy project referred to below failed.¹⁵

The second challenge is that of cleaning the syngas to such a high degree of purity that catalytic conversions to different chemical products works well. In one example, findings from a European research project showed that impurities need to be kept in the parts per billion range for it to succeed.¹⁶

Power2X might, in its favour, cite from a 2021 report by the International Renewable Energy Agency (IRENA) and the Methanol Institute (MI).¹⁷ IRENA and the MI do not present any example of bio-methanol made via biomass gasification. However, they present a list of projects that involve gasification of biomass or Municipal Solid Waste (MSW), followed by catalytic conversion to different products. They state: “*Projects under way as per Table 4 have been ranked as achieving technical readiness level (TRL) 8 or 9, where TRL 8 stands for “First of a kind commercial system” and TRL 9 ‘Full commercial operation’.*” In reality, only two of the plants listed in that report have been operational, and both of them closed down after a long period of technical problems. None of the projects cited are currently operational, with the exception of the Södra Cell methanol plant mentioned earlier, i.e. the one using anaerobic digestion and not gasification. Two other projects listed (one pre-construction, the other closed down) also involve completely different technologies from what the authors of the report claim.

Company	Location	Status	Additional information
Chemrec.	Örnsköldsvik, Sweden.	Proposal abandoned.	Project abandoned pre-implementation in 2021. ¹⁸
Enerkem Inc.	Edmonton, Alberta, Canada.	Plant closed January 2024, cancelling 25-year agreement with the City of Edmonton. ¹⁹	Plant was built to produce 36 million litres of ethanol a year via gasification and catalytic conversion of mixed waste. ²⁰ It opened 2014, two years behind schedule and was embroiled in legal action. ²¹ Total biofuel production during almost 10 years was 5m tonnes of methanol, ²² all of it produced before March 2018. ²³
Enerkem Inc.	Varenes, Quebec, Canada.	Plant under construction.	Same technology as in Edmonton.
Enerkem Inc.	Tarragona, Spain.	Construction has not yet started. ²⁴	Same technology as in Edmonton.
Enerkem Inc.	Rotterdam, Netherlands.	Enerkem is not listing Rotterdam as a project site ²⁵ and no announcement has been made about them building a plant there.	
Eni.	Livorno, Italy.	Final Investment Decision January 2024 – but not a relevant technology.	Not gasification but Hydrotreated Vegetable Oil production (used widely for commercial bio production). ²⁶
E.On/SNG.	?	?	Extensive websearches show no evidence that such a project was ever announced, let alone developed.
Fulcrum BioEnergy.	Reno, Nevada, USA.	Facility closed after only 350 gallons of fuel were produced; ²⁷ company has filed for bankruptcy. ²⁸	Mixed waste as feedstock.
LowLands Methanol B.V.	Moerdijk, Netherlands. ²⁹	Construction was to originally have started in 2017, ³⁰ but the company now expects it to start late 2025, with commissioning forecast for 2027. ³¹	
New Hope Energy and TotalEnergies.	Texas, USA.	Facility closed. ³²	Very different technology, i.e. pyrolysis and cracking of waste plastics.
Red Rock Biofuels.	Lakeview, Oregon, USA.	Plant built but never produced any fuel. ³³ Foreclosure sale of the site to a company planning to make different products using a different technology. ³⁴	Wood gasification and Fischer-Tropsch reforming plus upgrading to make aviation fuels.
Södra Cell.	Sweden.	Commissioned 2023 with a nameplate capacity of 5,250 tonnes a year.	Very different technology, which involves anaerobic digestion and not gasification.
Trans World Energy (TWE).	Florida, USA.	No progress reported following a FEED study.	
VTT Technical Research Centre.	Espoo, Finland.	Research project from 2016-2018.	This project involved gasification experiments in a small pilot plant and a desktop feasibility study about methanol production, i.e. no methanol was produced. ³⁵

Why Estonia's government and Pärnu City Council must study the legacy of past projects involving gasification and catalytic conversion of biomass or mixed waste

As shown above, Power2X is a start-up company, which has not so far delivered any successful project. The overall failure rate of start-up companies has been estimated as around 90%.³⁶ However, the failure rate of commercial-scale projects that involve biomass or mixed waste gasification followed by catalytic conversion to different products is currently 100%, according to extensive desktop research by Biofuelwatch.

Some of those failures have left local and federal or state governments as well as investors with substantial losses.

The earliest attempt to commercialise this technology pathway was one by Choren Industries GmbH in Germany. The company failed to achieve continuous large-scale production during a time-scale acceptable to its investors, and went bankrupt in 2011.³⁷ Choren used wood as its feedstock. Choren, unlike many other biofuel start-up companies, did not rely on subsidies.



In 2011, Red Rock Biofuels (RRB) was set up to develop a wood-to-aviation-biofuels refinery in Oregon, using gasification and catalytic conversion. RRB's plans so impressed policy makers that the company obtained \$75m in funding from the Department of Defense, \$2m in infrastructure improvements funded by the town of Lakeview and Business Oregon,³⁸ and \$245m in bonds from the Oregon State Government.³⁹ In 2023, Oregon State eventually recouped at least some of the \$355m (including interest) that they were owed when the site and equipment were sold off at an auction,⁴⁰ but nothing has ever been produced at the site.



Fulcrum BioEnergy's mixed-waste-to-aviation-fuel plant in Nevada closed down after producing a total of just 350 gallons (one load) of fuel, leading to the company having to file for bankruptcy. The company had sold around \$290m of environmental improvement revenue bonds through the government of Nevada to fund the construction of the plant.⁴¹

Enerkem was got C\$40 million from the City of Edmonton for the waste treatment and sorting plant meant to supply the biofuel feedstock, and C\$23.35m from Alberta Province.⁴² In 2018, the City Council published an audit report of its waste services, showing that Enerkem's failure to successfully operate the plant had seriously undermined the City's goal to reduce landfill.⁴³ In the same year, Enerkem informed Biofuelwatch that they had so far produced a total of 5 million gallons of methanol (out of the planned 36 million gallons of annual fuel production) and were expecting to scale up significantly.⁴⁴ This did not happen: when the plant closed in early 2024, Enerkem stated that the total amount of fuel produced over the whole period, nearly a decade, was (still) 5 million litres.⁴⁵ Clearly, they did not deliver on the promises that had led to them attract tens of millions of Canadian dollars in subsidies.

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