



Hydrogen Economy: Drivers and Barriers

Barrier – Power-to-Gas and CCU at a waste-to-energy plant



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Original Vantaa Energy plan

Vantaa Energy had planned to build a Power-to-Gas (P2G) plant, which would have been the first facility in Finland to produce carbon-neutral synthetic methane on a commercial scale, with a fuel capacity of 10 MW. Additionally, Vantaa Energy was exploring solutions for the recovery and utilization of carbon dioxide. Hydrogen played a major role in both projects.

Within the scope of the BalticSeaH2 project, Vantaa Energy was planning to establish a hydrogen production Use Case and demonstrate the hydrogen utilization in the Energy Sector. Originally, Vantaa Energy also planned to conduct a large-scale fuel cell demonstration including buildings and equipment for systems integration and testing.

After the submission of BalticSeaH2 project funding application, RFNBO regulation advanced with more specific calculations for GHG emission reductions and specifications on what components can be used for e-fuels.

E-fuel and CCU challenges

Bio-based carbon dioxide is currently viewed as a sustainable raw material for producing electricity-based fuels and chemicals. The incineration of municipal solid waste generates both bio-based as well as fossil-based carbon dioxide emissions, due to the waste composition. When producing new fuels or chemicals from carbon dioxide from a waste incineration plant, certain GHG emission reductions must be achieved to meet the sustainability requirements set by the EU.

Despite the CO₂ at Vantaa Energy coming from

the inevitable incineration of municipal waste, and all recycling processes being carefully planned, it will still be classified as fossil-based CO₂. Given the high fossil content of the waste, it is unlikely to meet the greenhouse gas emission reduction requirements.

Vantaa Energy Power-to-Gas plant was supposed to produce carbon-neutral synthetic methane from captured CO₂ and hydrogen, but without meeting the emission reduction requirements, it would be classified as fossil and could not be sold for a carbon neutral premium price. With other products besides e-fuels, the situation is similar: no matter what the end-product is, the GHG emission will still show in the balance of the incineration plant even if the CO₂ leaves the plant in the form of a product. Giving away the biogenic CO₂ will not reduce the GHG emissions of the plant either.

In countries where plastics are widely recycled, plastics made using CO₂ from waste incineration could circulate for quite long, so it could perhaps be considered a long-term storage of CO₂ in the future. This is currently not the case, and future regulation on CCU value chains is still uncertain.

Currently, the only storage considered to be “long-term” is storing CO₂ at the bottom of the ocean or deep within the ground. This method also requires huge investments into carbon capture equipment, as well as transporting the CO₂ to a suitable location, and a local service provider pushing it into the bottom. This method costs more than the emission allowances would cost, and it would mean also storing the biogenic CO₂.

According to Vantaa Energy interpretation of current regulation, it is nearly impossible to make CCU profitable at a waste incineration



plant. The waste that must be incinerated will include fossil-based material, even after all feasible recycling efforts. Given the significant investments needed to capture and process the CO₂, it might be more financially viable to pay the ETS costs for the greenhouse gas emissions rather than utilizing the CO₂ for short- or long-term products or synthetic fuels. The problem is that CCU is not recognized as an emission reduction action in waste-to-energy plants and produced district heat still remains to have high share of fossil CO₂.

Vantaa Energy now sees two options when considering emission reduction actions:

- 1) To invest in long-term storage in the bottom of the ocean or other geological storage locations.
- 2) To stop waste incineration altogether – including, for example, incineration of hazardous waste, which is necessary and recommended by the EU for recovering energy from it. This option also threatens the Nordic district heating network, which has made it possible to utilise waste heat from industrial processes instead of producing heat separately for households.

Neither of these options encourages the utilization of CO₂ in a waste-to-energy plant. Consequently, they fail to promote the circulation and effective use of CO₂ in situations where emissions cannot be avoided.

Policy suggestions

We recommend that the regulation of Carbon Capture and Utilization/Storage (CCU/S) should instead encourage long-term applications, such as recyclable plastics. This should be contingent upon ensuring that all recyclable materials have been processed before the waste is incinerated.

Sustainability of waste incineration should be supervised with clear criteria: not all waste incineration is sustainable, but regulation should determine what waste can and should be incinerated and what incineration is unsustainable. Carbon should circulate as long as possible rather than be stored in the ocean immediately after first round of use, when instead the carbon and the heat could have been utilised with hydrogen.

One possible solution would be the separate status for circulated carbon from unavoidable waste incineration. Waste incineration-based carbon should have a different status than coal burning-based carbon, with different sustainability criteria, similarly to the ones stated in biomass regulation.

Overall, waste incineration lies at the intersection of waste regulation and energy regulation. We recommend that the EU examines waste incineration comprehensively to establish functional rules and effective auditing for the industry.



References

¹European Court of Auditors: EU actions to address the increasing amount of hazardous waste:

https://www.eca.europa.eu/lists/ecadocuments/rw23_02/rw_hazardous_waste_en.pdf

The paper was written based on Vantaa Energy's description of the investment case and interpretation of regulation that resulted in revoking the investment case that was originally a part of the BalticSeaH2 project.

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