

# E-Crude-Production in Norway

## Blue oil

*Synthetic crude oil from sustainable hydropower: In Norway this venture should have a good chance of success. In the industrial heart of the country, the Nordic Blue Crude start-up plans to set up its first production facility using CO2 emissions from industrial processes.*

*Text: Laurin Paschek | Pictures: Dirk Lässig*

Strongly rugged mountain ranges cut by fjords: This makes Norway's west coast a natural wonder. Behind the coastline, mountains covered by glaciers of the Ice Age rise to 2,000 metres above sea level, some even to almost 2,500 metres. But while the highest mountain ranges of Scandinavia drop steeply to the northwest, they form vast upland plateaus to the southeast, which the Norwegians call „Fjells“. The draining water pools there in long fjord lakes until it flows on through rivers and canals into lower plains. Here it gathers again and finally reaches the Skagerrak coast of southern Norway: simply ideal natural conditions for generating electricity from hydropower. The hydroelectric power plants distributed throughout the country meanwhile generate 99 percent of the national electricity demand.

At the end of 2015 the telephone rang for Gunnar Holen in Oslo. The caller was his friend Rolf Bruknapp,

who had been building hydroelectric power plants of all sizes in Norway for two decades. Bruknapp had heard from the media about the „miraculous diesel oil“, synthetic diesel fuel, which is produced from water and carbon dioxide with the help of electric power. At that time, he was keen to start a company that produced the e-fuel and was looking for a CEO. Holen, actually an investment banker, saw a chance to start something completely new. „From the outset, it was clear to us that the production of synthetic fuels only makes sense if there is sufficient renewable energy available,“ says Holen today. „And for Norway, this is perfectly true.“ The potential far exceeds the demand, because in addition to hydropower, the country provides almost ideal conditions for wind turbines, especially along the shoreline from the North to the Norwegian Sea. Gunnar Holen agreed with his student friend. They founded Nordic Blue Crude to produce synthetic crude oil on a large scale.

Gunnar Holen takes us to the Herøya Industrial Park, which was built in 1929 on an island in the small town of Porsgrunn - in the industrial heart of Norway around the Frierfjord, 150 kilometres south-west of Oslo. He points to an area of around 5,000 square meters on which the first Nordic Blue Crude production plant is to be built from mid-2020. „We looked at many locations in Norway, but this one is ideal,“ says Holen. „Because



*Norway generates almost one hundred percent of its electricity needs from hydropower. The picture shows the Ulefoss power plant.*

here in Herøya we may use existing infrastructure.“ In particular, the raw materials for e-fuel are easily available: Water by pipeline from a nearby lake and electricity generated from renewable sources over a powerful hydroelectric grid connection from the outback. The carbon dioxide required is provided by a fertiliser factory rich in tradition, which is also located in the industrial park, directly on a neighbouring site. Last but not least, a large industrial port is located nearby for direct shipping of the crude oil products produced - in particular fuels, waxes and raw materials for the plastics industry.

Gunnar Holen and Rolf Bruknapp are pursuing ambitious plans for the start-up, which currently employs just a handful of staff and is still based in Oslo. „Over

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the past three and a half years, we have defined the business model and the technical concept," reports Holen. „We also demonstrated the technical feasibility together with the Trondheim Technical and Scientific University of Norway and the engineering service provider Aker Solutions. By the end of 2021, Nordic Blue Crude in Herøya intends to produce ten million litres of synthetic crude oil and to increase its production volume by a factor of twenty to 200 million litres (1.258 million barrels) per year within five years. In comparison, Norway's oil production in 2018 amounted to around 1.84 million barrels - per day. Holen is planning to build a total of ten such factories in Norway. In this way he wants to achieve the desired economies of scale. The selling price of e-fuel is initially expected to be around two euros per litre and will gradually fall.

The costs also play a role in the construction of the pilot plant. Nordic Blue Crude will therefore initially make use of existing technologies and raw materials. Such as CO<sub>2</sub>, which is to be extracted directly from the air in the longer term - for example with technology from Climeworks, a spin-off of ETH Zurich. However, the neighbouring fertilizer factory sells the carbon dioxide for 30 euros a tonne, while extraction from the air currently costs around 600 euros a tonne. However, a low single-digit CO<sub>2</sub> share from the ambient air right from the start. „We also have to pilot this tech-



*Herøya Industrial Park is situated by the Frierfjord and has a direct access to the Skagerrak.*

nology to be independent," Holen emphasises. „ After all, CO<sub>2</sub> from existing sources is not everywhere as readily available as it is in Herøya.“

**»We'll make it, I'm a hundred percent sure we will.«**

Nordic Blue Crude is also relying on proven alkaline electrolyzers for the initial splitting of water into hydrogen and oxygen. The hydrogen obtained is blended

with the purchased CO<sub>2</sub> at temperatures of up to 1,000 °C to produce carbon monoxide (CO): In the so-called RWGS reaction (reverse water-gas shift reaction), CO<sub>2</sub> and hydrogen (H<sub>2</sub>) combine to form CO and H<sub>2</sub>O, i.e. water. The carbon monoxide (CO) is then processed with other hydrogen atoms (H<sub>2</sub>) to form a synthesis gas, which is then liquefied in the Fischer-Tropsch process and by removing the oxygen formed into long hydrocarbon chains.

There are still a few challenges to be met on the industrial island of Herøya before the „blue crude oil“

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will be gushing from hydropower. „Although we are using existing stand-alone technologies, we have to bring them together on an industrial scale,“ summarises Holen. The biggest task, however, lies in financing the pilot factory. „That will keep us busy over the next few months,“ says the investment banker. But no one can be more confident than he is: „We'll make it, I'm a hundred percent sure we will.“



*Nordic Blue Crude CEO Gunnar Holen plans an annual production volume of 200 million litres of synthetic crude oil within the next five years.*

#### **About | Gunnar Holen (CEO Nordic Blue Crude)**

31 years of experience in Investment Banking. Vast experiences within Corporate Finance work including fundraising and M & A activity. Originated and participated in a number of national and International private placements and IPOs.

Founded and developed CAR ASA which developed from 2 persons in 2003 to 55 and from 0 to 80 million NOK in revenues in 2007. Previously top rated Investment analyst both internationally and domestically.

Master of Business and Economics

*Nordic Blue Crude AS will produce high-quality, carbon-neutral, synthetic fuels and other fossile replacement products, based on water, carbon dioxide and renewable power. Nordic Blue Crude will build the worlds first commercial Power-to-Liquid jetfuel plant at Herøya, Porsgrunn, Norway.*

FVV | Blue Oil

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