Good locations for the production and storage of hydrogen in the Raahe area

The Raahe area contains areas suitable for the production and storage of hydrogen in terms of good location and sufficient area size. A number of suitable areas were found, of which the areas of Mitti, Someronkangas and Paharäme have been examined in more detail.

The Someronkangas and Paharäme areas are suitable for both hydrogen production and storage. The Mitti area is particularly suitable for hydrogen production because of its good location, for example in relation to the international hydrogen network. The use of the Mitti area for hydrogen storage may require more extensive tillage measures. The selected areas were examined, taking into account the operating conditions of hydrogen production, such as an assessment of the availability of water and the current state and use of nature in the area.

The areas have good opportunities for the placement of hydrogen production and storage, even though safety requirements must be taken into account in the planning. In addition, safety distances to sites in the area, such as residential buildings, must be examined when the location is selected.

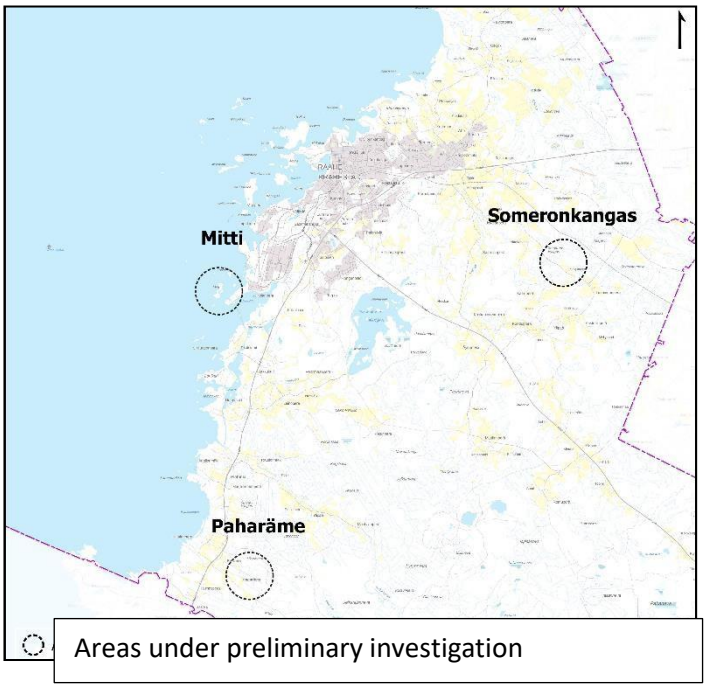

Image 1. Areas selected for a more detailed examination, the suitability of which for hydrogen production and storage was assessed.

Raahe offers opportunities for hydrogen production and new uses of hydrogen

For the purpose of finding suitable areas, a sufficient distance was determined to various sites, such as residential buildings, large transport routes, the built environment and nature conservation areas. In determining the distances, accident and explosion modelling and similar distance definitions and surveys made elsewhere were utilised. Based on the determination of distances, it was possible to view on the map the locations where hydrogen production and storage cannot be located (so-called NO areas) and in which areas they could be located (YES areas).

The YES areas were examined in more detail in order to examine the possibilities of using the areas. The use of the areas for the production and storage of hydrogen requires some more detailed clarifications and other further measures concerning planning and licensing of activities, such as applying for an environmental permit.

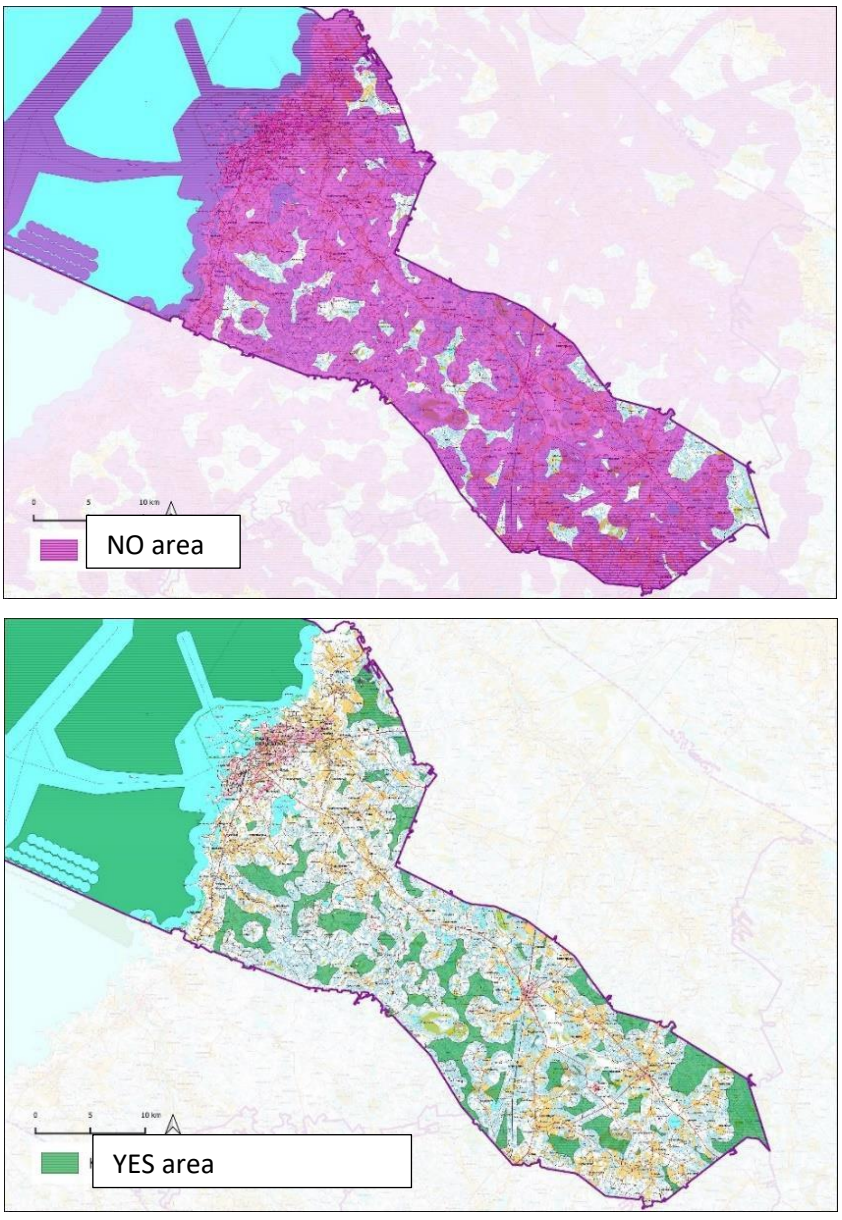

Image 2. Site analysis of areas.

Many uses of hydrogen as part of a carbon-neutral society

Hydrogen is an odourless, colourless and highly flammable gas. Hydrogen itself is not toxic and has not been found to have adverse effects on the environment. The carbon neutrality of hydrogen is classified according to its production form. Fully emission-free hydrogen can be produced by electrolysis, in which the water molecule is electrically decomposed into oxygen and hydrogen. In addition to oxygen, heat is also produced as a by-product. Hydrogen produced with electrolysis is green hydrogen if the electricity used is produced from renewable energy sources, such as wind and solar power. If nuclear power is used as the source of electricity for electrolysis, the hydrogen produced is commonly referred to as purple or pink hydrogen. A storage area for hydrogen and oxygen and a water purification plant are required in connection with or in the vicinity of a hydrogen production plant.

With regard to hydrogen production and, in particular, storage, it is necessary to take into account the required level of safety for operations that guarantee the safety of users and residents in neighbouring areas. The fulfilment of the safety level and the measures required for it can be assessed using various risk assessments and accident scenarios, which are implemented during the planning of the activities.

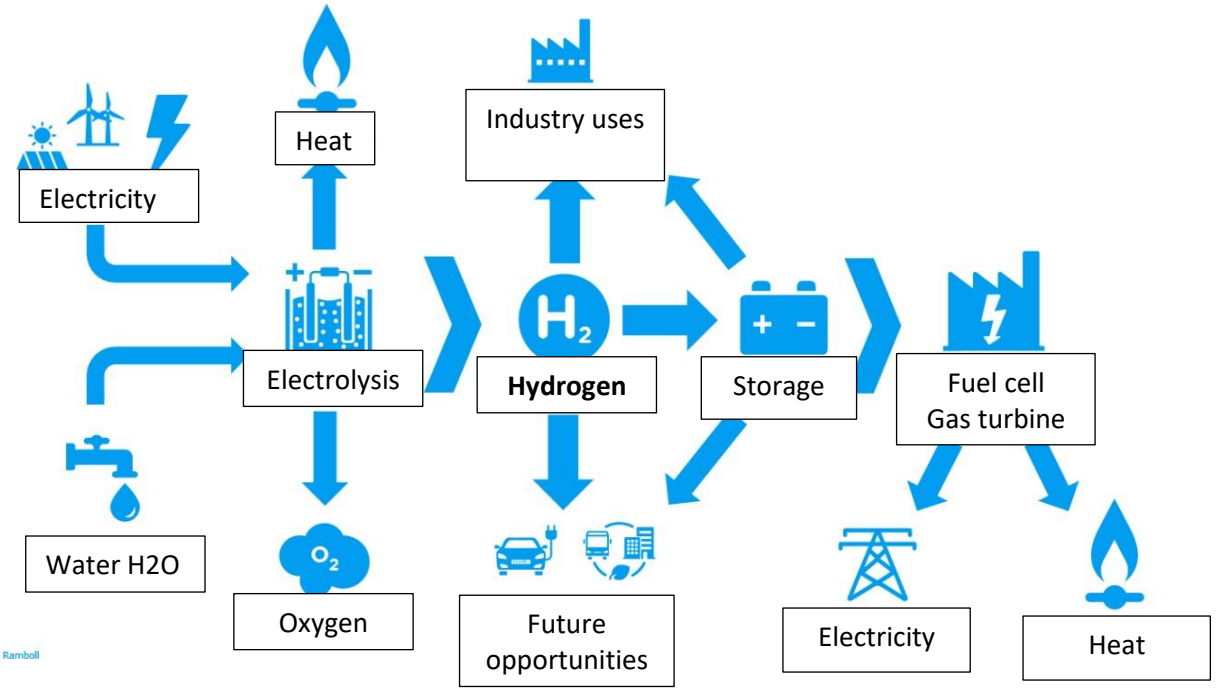

Image 3. The circulation of hydrogen in society from manufacturing to use when the hydrogen is produced with electrolysis.

Hydrogen is already commonly used as a raw material in, for example, the chemical industry and oil refining. At the moment, more than 99% of hydrogen is produced globally using fossil raw materials. Approximately 100,000 tonnes of hydrogen is currently produced in Finland, which corresponds to approximately 3.3 terawatt hours. One terawatt hour is estimated to correspond to the annual electricity consumption of households in Helsinki. However, an effort will be made to increase the global production of hydrogen in a carbon-neutral manner, as hydrogen has potential for significantly reducing greenhouse gas emissions in the transport sector and industry.

In the future, hydrogen can be utilised, for example, in the steel industry in iron reduction and as a fuel for low-emission transport. Hydrogen can also be used in energy storage to balance energy consumption and production.

Raahe has projects supporting hydrogen production and a connection to the international hydrogen network

The objective of the European Union's hydrogen strategy is to significantly increase the production of global hydrogen from the production level in 2019, which was 200 megawatts to 40 gigawatts by 2030. Increasing the use of green hydrogen is one way of achieving Finland's carbon neutrality target by 2035. In addition, hydrogen plays an important role in the green transition of energy production.

Several projects are underway in the Raahe area to produce carbon-free electricity and to strengthen the region's electricity network, which contributes to the location of hydrogen production in the area.

Wind power operator OX2 is planning an offshore wind power project in the Finnish exclusive economic zone of Oulu and Raahe. A maximum of 160 wind turbines are planned in the area. The estimated annual production of the wind farm would be approximately 12 terawatt hours, and according to the preliminary schedule of the project, the production of the wind farm would begin early in 2030.

Image 4. Offshore wind farm. Illustration.

One of the key objectives of Finland's Sustainable Growth Programme is to make Finland one of the world's leading countries in the hydrogen and circular economy. For this reason, the development of the Raahe region has launched the National Hydrogen Network project, the aim of which is to enable this objective by collecting and sharing information and expertise on local hydrogen projects between different regions. The project supports the business opportunities of various areas of hydrogen economy nationally and initiates local preparedness for the promotion of the hydrogen ecosystem.

Hydrogen plays an important role in achieving carbon neutrality. The Europe Hydrogen Backbone (EHB) analysis deals with the construction of an international hydrogen network in ten European countries, including Finland. The analysis assesses the development of the hydrogen transmission network by 2030, 2035 and 2040. The transmission network is an essential factor in the creation of the hydrogen market. It is estimated that the network will be located in the southern part of Finland and along the west coast all the way to the Bay of Bothnia and on the mainland. According to the estimate, less than a third of the demand for hydrogen would be directed at electricity production in terms of energy storage. It is estimated that the amount of hydrogen corresponding to demand could be produced using renewable energy sources in a carbon-neutral manner.

As part of Raahe's strategic land use plan, the location and operating conditions of the hydrogen production plant and storage in the Raahe area were examined. The aim was to enable the hydrogen production plant and the carbon-neutral industry in the city of Raahe. The work was carried out by Ramboll Finland Ltd and commissioned by the City of Raahe.

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