



## Summary

### The planned project

Kanteleen Voima Oy is investigating the construction of a biorefinery producing bioethanol or alternatively bio-oil, in connection with the existing Haapavesi condensing power plant.

The project area is on the shore area of Lake Haapajärvi, in the Eskolanniemi district of Haapavesi. The project area is about 2.5 km from Haapavesi town centre. The area reserved for the new biorefinery is about 5 hectares in area, and is located between the existing operations of Kanteleen Voima Oy Haapavesi power plant area and the Haapavesi biofuel terminal.

The annual running time of the planned biorefinery will be about 8,000 hours. The raw materials that will be used at the refinery are primarily wood-based, such as sawmilling by-products and forestry raw materials. These raw materials for the biorefinery will be delivered to the plant by road in the amounts needed. The delivery radius for raw materials is around 150 km.

Haapavesi is an excellent location for the biorefinery, both for the availability of raw material and on account of its good logistical connections. The power plant is also capable to efficiently use the secondary material flows from the refinery and produce the power and the thermal energy needed in the biorefinery. The project also allows the fuel base of the Haapavesi power plant to be converted from fuel mixture based predominantly on peat to a predominantly wood-based fuel mixture.

Kanteleen Voima Oy began designing the biorefinery (concept) in 2014, and biorefinery production is projected to begin in 2020.

### The EIA procedure

Environmental impact assessment (EIA) process is carried out in accordance with the new Finnish law (252/2017) on environmental impact assessments. These assessments are aimed at identifying and evaluating the effects of planned projects on the environment. The procedure promotes the assessment of the likely environmental impacts of the planned project. It gives residents and other actors involved in the project better access to information and opportunities for participation. EIA procedures do not involve making decisions related to the project in question. Rather, the purpose of these procedures is to provide information on which such decisions can be based.

This EIA report presents the results of the environmental impact assessment of the planned biorefinery project. Amongst the main contents of the report are a description of the environmental impacts of the various options for implementing the planned project, the methods for mitigating the foreseeable adverse effects of the planned operations, and the conclusions on the feasibility of the project. Local residents and others have the opportunity to present their opinions and statements on the implementation and results of the assessment. The report provides a public information and discussion forum for presenting the project and the results of the assessment. The contact authority for the EIA procedure is the North Ostrobothnia Centre for Economic Development, Transport and the Environment (ELY Centre). This ELY centre compiles the opinions and opinions given in the report, and based on these will provide its own opinion.

The environmental impact assessment programme was launched in July 2016, and the aim is to complete the EIA -procedure in autumn 2017. The EIA procedure will end when the contact authority provides Kanteleen Voima with its statement on the EIA report.



## The options under assessment

The EIA process of the planned project examined three different options:

- Option 0 (VE0) – The biorefinery will not be implemented. Kanteleen Voima Oy will continue to operate the Haapavesi power plant.
- Option 1 (VE1) – A bioethanol plant will be built and will be connected to Kanteleen Voima Oy's Haapavesi power plant.
- Option 2 (VE2) – A bio-oil refinery will be built and will be connected to Kanteleen Voima Oy's Haapavesi power plant.
  - Option VE2a – Bio-oil production will be based on the pyrolysis process. In addition, a solid-fuel gasification plant will be built in connection with the power plant.
  - Option VE2b – Bio-oil production will be based on gasification and on a chemical process of synthesis.

## The impacts of the plan

### Land use, land use planning and the built environment

The new biorefinery will be built in the area between the existing industrial activities of the power plant and the biofuel terminal. Locating the planned project in this corresponds to all the main uses (industrial uses and warehousing) that are marked in the current land use plans. The project is not expected to cause any need to change these land use / zoning plans. Neither does the project require any changes to the public road network or electricity grid.

The planned biorefinery project will realise and promote nationwide land use objectives by using existing structures and diversifying the range of business operations in the area. The raw material used by the biorefinery is renewable. The planned refinery will use the electricity produced by the Haapavesi power plant, which is generated partly from renewable fuels.

### Traffic

The increase in heavy traffic brought about by the project would be significant during the first year of construction. However, because of the short duration of this phase, the estimated impact on the environment is small.

When operational, the fuels for the power plant and the raw materials for the biorefinery will be delivered to the plant by road in the amounts needed. In option VE0, the average amount of road transportation will be approximately 90 lorries per day, with a maximum of 125 lorries per day (one way). Of all the options for implementing the biorefinery, the average amount of road transportation will be largest in option VE1, at approximately 105 lorries per day, with a maximum of 190 lorries per day (one way).

The increase in total traffic in VE1 compared to the zero option (VE0) is moderate provided that the traffic is distributed evenly on all the main roads to Haapavesi. The proportional increase is highest in the volume of heavy traffic. However, the increase in heavy traffic on most of the road sections would be clearly less than 50 % (calculated according to the maximum number of road deliveries).

The impact of increased traffic on Turvetie road is estimated to be significant. For other nearby sections of road, the effects are estimated to be moderate in some cases, and slight in others. The impact on trunk roads and main connecting roads would be limited.



On traffic lanes that already in poor condition, even a small increase in the amount of heavy traffic poses a risk to road safety. The additional traffic would also cause significant harm to those road sections of the project area that are not provided with routes for light traffic. Without taking measures to improve road safety, the project is expected to reduce road safety in Haapavesi.

### Noise

The noise that would be generated by the planned project (from traffic, the operation of the power plant, and from the biorefinery) has been evaluated based on mathematical modelling of noise levels.

Based on the results of this noise modelling, the amount and effects of the noise created by the biorefinery when in operation would be very similar to the noise level of the option VE0. During the daytime, the dominant noise source is estimated to be the chipping taking place in the biofuel terminal area. In the residential areas of Eskolanniemi that are closest to the terminal area, it is possible that the noise levels may slightly exceed the guideline values during the day. At the two holiday properties beside the Pyhäjoki river, it is possible that the noise levels may slightly exceed the guideline values during the night. In order to avoid exceeding the guideline noise levels near residential properties, it is advisable for chipping to be carried out indoors, or to place noise barriers around the chipping operations. To minimise night-time noise, it is important that the plant be designed in such a way that the total noise of the biorefinery does not exceed 105 dBA. By selecting and positioning the equipment it is possible to stay within the permissible noise levels. It has therefore been estimated that the noise impact of the plant will remain low.

For sensitive objects (schools, hospitals, etc.) considered in the impact assessment, the noise guidance values were not found to be exceeded.

As far as traffic is concerned, noise affects an area that is broader than the site area. In cases where there are residential areas within a distance of less than 50 m from the central line of busy roads, and where the guidance noise values are already at present slightly exceeded with the current traffic volumes—and without the power plant and biorefinery traffic—the traffic noise zone will expand due to the increase in traffic. To reduce the impact of traffic noise, it may in future be necessary to look for new solutions by the town council and the road authority.

Noise pollution due to construction may occur from time to time in the area near the project, and occasionally the noise limit may be exceeded. However, because of the short duration of this phase, the estimated noise impact is small.

### Air quality and climate

The annual sulfur dioxide, nitrogen oxide, particulate and carbon dioxide emissions of options VE1, VE2a and VE2b for the biorefinery are less than the emissions for the option VE0. As a result of the increase in the volume of transport and the length of transport distances, road traffic emissions will increase compared to the option VE0. However, the emissions from transport are quite small compared to the emissions from the power plant. The overall impact of the project on air quality has been evaluated as slightly positive.

The effects of all the biorefinery implementation options on climate have been assessed as positive. Implementation of the project will reduce the use of fossil fuels at the power plant. The most significant CO<sub>2</sub> emission reduction is provided by option VE2a. All the alternatives will also have a significant positive effect when the biorefinery products are used.



Based on the existing information, the biorefinery emissions to air will not be significant. The biorefinery will not generate significant amounts of process-related airborne emissions. Gases that are separated from the production processes will be primarily channelled for incineration at the power plant. In the case of a disturbance situation at the biorefinery, there may be some smells from the resulting gaseous emissions. However, the likelihood of disturbances is estimated to be low, and in the event of disturbances efforts will be made to keep the duration of the emissions short.

Handling raw material and fuel will cause dust emissions, as will storage. However, the impact of dust is estimated to be restricted mainly to the plant site. Of all the implementation options of the project, wood raw material is dealt with to the largest extent in option VE2a, in which a gasification plant is used in addition to the biorefinery. However, there is no significant difference between the alternatives for dust-related harm, since the minimisation of the amount of dust released into the environment is being taken into account in the design of functions and equipment in all of the options.

The effects of building the biorefinery are comparable to conventional industrial construction. Effects on air quality may be caused in particular by excavation of the bedrock during the construction phase, and by land transport during the construction phase. Compared to the operational effects of the refinery, the impacts during the construction phase are estimated to be only local in nature. The transport impacts do not significantly differ from impacts of traffic during the operation phase.

#### Land, bedrock and groundwater

The normal operation of the biorefinery and of the power plant will have no impact on the soil, bedrock or groundwater. The area of the planned project is not within a classified groundwater area. The plant area is paved, and rainwater is collected in such a way that soil contamination will not occur.

During construction and operation of the biorefinery, the most significant environmental risks are related to the handling and storage of fuels, and chemicals and waste. These could cause the risk of soil and groundwater pollution as a result of leakage or damage.

#### Waterways

All the options in the project generate waste water, as well as cooling water and drainage water.

The waste water from the power plant is handled by allowing the solid materials to settle out of suspension in delay pools (part of these water streams will first be neutralised). From there they are led along the discharge channel to Lake Haapajärvi. Grey waters from the power plant and the storm water from the area will be directed, depending on the source, through an oil sludge / sludge separation pool and a delay pool to Lake Haapajärvi. Also, the drainage waters of the biorefinery area will be managed by the same system in all the project options.

The starting point for the impact assessment of the biorefinery in relation to water resources has been that no significant additional burden on the water system will be generated from the wastewater from the refinery. Option VE2a does not generate actual process water; it only generates wash water from the various items of process equipment. These waters will be treated in the same way as water from the power plant. In options VE1 and VE2b, process effluents are pretreated at the plant before being directed for purification at the town's wastewater treatment plant. Consequently, the project does not considerably increase the impact on the quality of waterways lower down.



In all the project options, cooling water for the biorefinery is intended to be taken from an existing cooling water system, and also to be returned to the water system using the existing system. Cooling water will not be contaminated in the process, and its effects on the waterways are mainly due to the thermal load. The magnitude of the thermal load from cooling water will depend on the choices of process technologies. According to provisional estimates, the thermal load from the running power plant, option VE0, and due to options VE1 and VE2a, is of the same order of magnitude, and the effects on the water system do not change with respect to the previous situation. Due to the management of cooling waters, the ice situation in Lake Haapajärvi and in Lake Pyhäjoki below it will be weakened.

In project option VE2b, the thermal load on the waterways will be doubled with respect to the option VE0. Thus, the impact on the ice situation is estimated to be very high. In this alternative, Lake Haapajärvi is estimated to remain mostly unfrozen throughout the winter. During further planning of the project, there will be further investigation of the use of cooling water heat at the plants (e.g. drying of raw material) or at other potential sites.

#### Vegetation, fauna, biodiversity and nature conservation

The project area is located on a man-made industrial site, so its impact on vegetation and animals is assumed to remain negligible. The impacts of construction and subsequent operation on vegetation and fauna through soil, surface water and air or traffic or noise are manageable, and can be minimised.

#### Natural resources

As a whole, the project will have a rather positive effect on the exploitation of natural resources. The most significant positive impact on natural resources will be due to the replacement of fossil fuels by forest raw materials, and by fuels produced from sawmill by-products.

Minor harmful effects of harvesting forest raw material will be mainly on water, soil, and biodiversity.

The project is not expected to have any significant impact on the use of natural resources at the construction stage.

#### Landscape and cultural heritage

The project is located in the existing power plant area, so it will not make any significant changes to the landscape; no completely different structural elements will be added. The change in the near landscape caused by the project may be significant depending on the vantage point, but this impact affects only small areas. Considering the situation as a whole, the biorefinery plant will not cause significant landscape change in the Haapajärvi area, so its impact on the landscape can be considered reasonable.

The impact of the project on the cultural landscape, as well as on the nationally and provincially valuable cultural-historical sites, is considered to be small overall.

A Stone Age habitation area is situated within the project area. The local ELY centre has granted Kanteleen Voima Oy permission to operate on the site. However, in the process of the planning work that continues on the project alongside the EIA procedure, it has occurred that the biorefinery can be implemented on the plant site of Kanteleen Voima Oy without need for disturbing the historical remains. Consequently, the area of the site of the cultural history of this particular ancient monument has been temporarily excluded



from the project area reservation, and construction of the biorefinery has no effect on the site.

#### The human impact of the planned project

The project's human impact will be mainly due to increasing traffic, noise, air and water emissions, and landscape change.

The project is not expected to have any health effects on humans.

The overall impact of the project on people's living conditions and comfort with regard to all the areas of influence is considered to be moderate. The most significant operational impacts on people's living conditions and comfort are caused by traffic increases and noise emissions.

The biorefinery is not expected to cause any bad smells to be emitted into the environment during normal operation. Landscape change is not expected to cause significant harm to the pleasantness of the area.

The operation of the biorefinery and the power plant is estimated to have a significantly harmful effect on the recreational use of waterways during the winter. In other ways the project will not have any significant impact on the recreational use of the Haapavesi area.

The project will have a significant positive impact on local employment and the region's tax revenue. The biorefinery will directly employ approximately 20-25 people. About 100-200 jobs will also be generated through the procurement of raw materials. With the completion of the biorefinery project, the total increase of jobs compared to the option VE0 is about 60, and over 300 for the current situation (the power plant during the reserve period). In addition, the plant will indirectly employ more people through the other functions that serve production at the plant. In addition to employment impacts, the project is expected to significantly increase the attractiveness of the area, and thereby to enhance the image of the region.

#### Accidents and disturbances

The design, construction and use of the biorefinery take into account the risks associated with the materials to be handled and stored, and comply with the applicable legislation and regulatory requirements. The required protection zones and hazard distances in the site will only be evaluated more precisely when the design is sufficiently advanced, and when the more accurate positioning of the plant functions is known. In planning the facility, preparations are being made for possible incidents and for the prevention of problems arising from them. Instructions will be developed and training will be provided to the parties concerned. Possible accidents and disturbances will be discussed in more detail when applying for permission from the Finnish Safety and Chemicals Agency TUKES.

The most likely environmental harm is estimated to be a flare-up occurring in process interference, which may cause more severe noise, smell, and light disturbance than normal. The flare-up range will have harmful effects on pleasantness that extend beyond the plant area, but these are short-lived.

Chemical leaks and emissions could cause soil and groundwater contamination. Harmful substances can also end up in waterways through chemical leaks and emissions. Large-scale liquid leaks or gas leaks are extremely unlikely. Accidents involving chemical transport equipment are very rare, but still possible, in relation to the volume of transport. In order to ensure safety, the technical requirements for the transport of dangerous chemicals and the driver's qualifications are regulated by law.



Fires and explosions are extremely unlikely, but are possible in the plant area. In the event of such an occurrence, some harmful substances may be released into the environment. Any uncontrolled spread of fire outside the site is unlikely.

Most of the potential risks to the environment are assessed to be contained within the boundary of the site and do not have any impact on water, soil, groundwater or harm to humans, animals or vegetation.

#### Effects of termination of the operations

The usage life of the biorefinery is expected to be about 30 years. The effects of ending the refinery's operation are similar to those of the construction phase, though smaller in scale. If the operation of the biorefinery is discontinued, the plant may be completely disassembled or utilised for other purposes. The demolition work will generate noise and dust, as well as traffic that deviates from the normal traffic flow. At the end of the plant's life cycle, there will no longer be any emissions into the water or air, and no further waste will be generated by the plant. Traffic from refinery and refinery will cease.

Closure of the plants would have a negative impact on employment through the reduction of jobs, both at the plant and in the procurement of raw materials.

#### Summary and conclusions

The environmental impacts of the biorefinery project have been assessed on the basis of project pre-designing materials, modelling and queries developed in connection with impact assessment, environmental monitoring reports of the power plant, publicly available materials, and other similar projects.

The most significant positive impacts of the project relate to employment and livelihoods, land use, resource use, and the reduction of fossil emissions. The negative impacts arise from increasing traffic and noise, and from the thermal load of cooling water to the waterway. The risks of accidents and disturbances related to the operation of the plant also increase through the project.

The environmental impacts of the project have been analysed by comparing the changes caused by the implementation of the biorefinery to the option VE0, whereby the refinery is not built and the operation of the power plant will continue as a regulating base load plant.

Impacts	VE1	VE2a	VE2b
Land use, land use planning and the built environment	Moderate --	Moderate --	Moderate --
Traffic	Moderate --	Moderate --	Moderate --
Noise	Slight -	Slight -	Slight -
Air quality	Slight +	Slight +	Slight +
Climate	Moderate --	Moderate --	Slight +
Land, bedrock and groundwater	No impact	No impact	No impact
Waterways	Slight -	Slight -	Moderate --
Vegetation, fauna, and nature conservation areas	Slight -	Slight -	Slight -
Natural resources	Slight +	Slight +	Slight +
Landscape and cultural heritage	Slight -	Slight -	Slight -
Health	No impact	No impact	No impact
Living conditions and pleasantness	Slight -	Slight -	Slight -
Recreation	Slight -	Slight -	Significant ---
Employment and the economy	Significant +++	Significant +++	Significant +++
Accident and disturbance situations	Moderate --	Moderate --	Moderate --



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YVA-selostus  
3.7.2017

All of the project implementation options (VE1, VE2a and VE2b) considered in this EIA can be considered environmentally feasible. As a result of the evaluation, the project was not found to cause any adverse environmental impacts that could not be accepted, prevented or alleviated to an acceptable level.

Following the technological selection of the biorefinery, a more detailed design phase can take into account the issues raised in the impact assessment such as the necessary noise control measures and energy efficiency and heat recovery methods. The planned mitigation measures and their impacts are described in the environmental permit application for the project, in which impact assessment in these areas is specified.