

# Summary

## Project specifications and objectives

Turun Seudun Jätehuolto Ltd (TSJ) has started an environmental impact assessment procedure (EIA) of a waste-to-energy plant. Decisions concerning the Project implementer will be made later on. The objective set to this environmental impact assessment process by the Turun Seudun Jätehuolto Ltd (TSJ) is to create possibilities to continue the waste-to-energy production based on the proximity principle in the Turku region.

The role of the waste-to-energy plant is to serve as the base power station of the district heating network in Turku, and to provide power to the national power grid. The waste-to-energy plant is a Project aiming at reaching the objectives set by the National Waste Plan (VALTSU) and the waste policies of Southern and Western Finland by the year 2020. The Project also meets the waste policy objectives of the municipalities in the Turku region.

The Project assessed in the environmental impact assessment procedure covers the utilisation of waste-derived fuel to power a waste-to-energy plant. This enables exploiting the energy waste produced in the Turku region also in the long run. The waste-to-energy plant is a combined heat and power plant (CHP) with the necessary receiving and processing equipment and systems, a boiler, flue gas cleaning and a steam turbine.

The waste-to-energy plant will be fuelled by the annual 150 000 tonne of source-separated, non-recyclable municipal solid waste from private households and services, and possibly also by the solid waste produced in the commerce and industry. Small amounts of special waste, classified as hazardous waste, from health care as well as oily waste would also be used to fuel the waste-to-energy plant. The waste used as energy will be collected from the operating area of the Turun Seudun Jätehuolto Ltd (TSJ), as well as from the areas of southwest Finland.

The waste-to-energy plant is based on the fixed bed and fluidized bed combustion technology. In the fixed bed technology, the waste is fed onto the mechanically operated grate of the boiler where the incineration takes place. In the fluidized bed combustion, the waste is incinerated by the means of jets of air and hot sand being passed through the material in a fluid-like state, and the boiler consists of a combustion chamber, cyclone and heat transfer surfaces. In both of the two processes, the cleaning of the exhaust flue gas is carried out by using the so-called dry or semi-dry treatment. In this process, the acidic components react with the flue gas injected with lime and milk of lime. Activated carbon is fed into the flue gas in order to remove the metallic and organic contaminants. Before the exhaust flue gas is led into a chimney, the impurities are removed by fabric filtering.

### *Technical specifications of the waste-to-energy plant*

Specification	Unit and numerical value
Fuel capacity	150 000 t/a
Electric power output	15 MW
Heat power output	35 MW
Total efficiency	85 - 90 %
Average annual operating time	8 000 h
Average annual electricity output	100 GWh
Average annual heat energy output	280 GWh

Constructing the waste-to-energy plant, and its related processes, as presented in the Project require assessing the environmental impacts using an assessing procedure as imposed by the Act and Decree on the Environmental Impact Assessment (EIA) Procedure. In the EIA procedure the environmental impacts induced by the incineration plant, its operations and construction have been assessed to the extent required by the Act on the Environmental Impact Assessment Procedure.

The environmental impact assessment report and the statement of the coordinating authority concerning it shall be included into the application for the environmental permit of the Project. The environmental permit application concerning the Project, or some part of it, can be submitted in the course of the year 2013. Efforts are made to start the construction of the waste-to-energy plant in 2014 - 2015, and the plant is destined to be in operation in 2017–2018.

This Project is related to the joint waste-to-energy plant project of the waste treatment plants in

Southwest Finland. In this Project, the waste suppliers jointly invite tenders for the utilization of the energy waste. One more alternative location for the waste-to-energy plant, besides those mentioned in this Project, is the Salo Korvenmäki waste treatment centre. The Korvenmäki EIA Procedure has been carried out separately.

### The assessment of environmental impacts and alternatives assessed

The environmental impact assessment (EIA) procedure is based on the Act on Environmental Impact Assessment Procedure (268/1999) and its aim is to assess the significant environmental impacts induced by projects, to examine possibilities to prevent detrimental impacts on the environment, and to ensure citizens' participation opportunities in the planning and decision making of the project.

As to the waste-to-energy plant, two optional locations of the plant have been assessed: Topinoja VE1 and Palovuori VE2. In addition to them, also two so-called zero-alternatives have been assessed. The Alternative Oa implies that the Project will not be implemented and the current Oriketo waste incineration plant will continue operating. The Alternative Ob means that the Project will not be implemented, the current waste incineration plant will be closed down, and the energy waste will be transported somewhere else. During the environmental impact assessment procedure, the Supreme Administrative Court issued its decision concerning the environmental permit, and the environmental permit of the Oriketo plant will be valid until the end of the year 2014. Continuing the operation of the current plant, further than that, would require remarkable renovation measures and a new environmental impact assessment procedure.

This Project covers two optional locations and two 0-alternatives:

1. Topinoja waste management centre in the City of Turku area,
2. Palovuori in the City of Raisio area,
3. 0-alternative a: the present Oriketo waste incineration plant will continue operating,
4. 0-alternative b: the energy waste will be transported somewhere else for waste-to-energy production.

In the Topinoja Alternative, the power transmission would be carried out making use of the close-by power line through the transformer substation at the Topinoja waste management centre. The Palovuori Alternative requires constructing a somewhat longer power transmission line. In both alternatives, it is necessary to construct some new district heating pipeline and the Härkämäki pumping station can serve as a connection in both alternatives.

### Impacts on the traffic

The alternative locations of the waste-to-energy plant lie along major roads and the traffic to them is led via an interchange. The energy waste is mainly transported by compactor waste vehicles. However, outside the operating area of the Turun Seudun Jätehuolto Ltd, the waste is also trans-shipped by full trailer combination trucks. The total trafficking volume of the waste-to-energy plant is 120-125 daily vehicles, the share of heavy traffic being some 95 vehicles per day.

The daily volume of the heavy traffic to the Topinoja waste management centre is some 150 vehicles, and that of the passenger traffic some 300 vehicles. The heavy traffic increase to the Topinoja waste management centre due to the waste-to-energy plant is some 65 daily vehicles, and the corresponding figure for the passenger traffic 30 vehicles per day. In the *Topinoja Alternative VE1*, in comparison to the prevailing situation, the increase of the traffic volume in the Turku Bypass Road is 0.3 %, and in comparison to the estimated situation in 2035, the increase is 0.2%. The communications to the Topinoja waste management plant have been planned taking into account the heavy traffic which means that the impact induced by the increase of the heavy traffic remains minor. The increase of the traffic volume is relatively slight in relation to the general increase of the traffic volume, and to the traffic

volumes of the Turku Bypass Road, which implies that the impact remains minor.

At present, the traffic volume in the Palovuori area amounts to some 50 -100 heavy traffic vehicles per day. The *Palovuori Alternative VE2* generates a traffic volume increase of some 120 -125 daily vehicles. Most of the traffic (estimated 70%) will take the National Road 8 to Turku, the traffic volume of which will thus grow by + 0.4%. Anyway, the increase of the traffic volume remains very slight in relation to the general increase of the traffic volume and to the amount of traffic in the National Road 8 this implying that the impact on the traffic flow and safety is minor.

### Impacts on the air quality

The most significant factors impacting the air quality in the City of Turku area are traffic and energy production. The threshold values have not been exceeded in the City of Turku region in 2011. According to the air quality index, the quality of the air was classified 'mostly good' in Turku Oriketo and Kaarina, and 'mostly satisfactory' in the Turku city centre, Raisio, Naantali and Parainen.

In the *Topinoja Alternative VE1* and the *Palovuori Alternative VE2*, the ground level concentrations (at the height of 2 metres) due to the emissions of the waste-to-energy plant remained low in comparison to the air quality threshold values set by the European Union, by the national air quality guideline and target values, as well as by the other reference values used. The concentrations of the modelled impurities comparable to the highest guideline and threshold values are of equal magnitude in both location alternatives. Even at their highest, the values remain under 20 per cent of the air quality guideline value concentrations, which is the threshold value imposed by the Government Decree 445/2010 on the concentrations generated by individual energy generating units. Concentrations are higher than the concentrations due to the 89-metre high chimney of the present Oriketo waste incineration plant, but anyway, they remain so low that the 70-metre high chimney can be considered adequate for the waste-to-energy plant being planned.

Under normal operating, the ventilation air of the waste storage is used as combustion air which is why there will be no relevant odour emissions. Odour diffusion was modelled in a downtime situation in which

the gases are led into the chimney. The highest hourly odour concentrations remained clearly under the perceivable odour unit value of 1 OU/m<sup>3</sup>.

Also the traffic induced emissions of the waste-to-energy plant remained below the guideline and threshold values. Especially in Topinoja, the road to the waste-to-energy plant is so short that the traffic induced impact remains minor in comparison to the current traffic volume. In Palovuori, the NO<sub>2</sub> concentrations may occasionally rise close to the guideline value, this occurring only in the immediate vicinity of the road.

The concentrations of the chimney emissions are clearly lower than the maximum concentrations in most of the survey area. The traffic induced emissions will also remain minor in comparison to the present traffic volume in the area. Based on the modelling results, neither of the location alternatives will significantly lower the air quality in the area or cause significant human exposure.

### Impacts on the climate

The waste-to-energy production reduces greenhouse gas emissions by displacing fossil fuels in energy production, and by lowering the indirect greenhouse gas emissions, e.g. landfill gases. In the *Topinoja Alternative VE1* and the *Palovuori Alternative VE2*, the greenhouse gas emission from the waste-to-energy plant amounts to some 55 000 tonne annually. Replacing the energy derived from the waste-to-energy plant by the corresponding amount of fossil fuels (coal) causes some 135 000 tonne of greenhouse emissions per year. This implies that regionally the impact on the climate caused by the waste-to-energy plant is reasonably positive. In a landfill, the amount of the waste corresponding to the processing capacity of the planned waste-to-energy plant would produce methane equivalent to 210 000 tonne of carbon dioxide annually, which is four times the amount of carbon dioxide produced by the waste-to-energy production, provided the methane recovery grade of the landfill is 60 per cent. The carbon dioxide emissions caused by transport are estimated to decrease slightly as there will be no more need to transport the energy waste somewhere else to be processed and produced as energy.

## Impacts on the soil and groundwater

The soil in the *Topinoja Alternative VE1* consists mainly of silt/clay layers and, due to the variations in the rock surface level, the total thickness of the clay layer in the depression area varies greatly. Beside the Project area there is an overburden-covered rock hill. The Topinoja Alternative requires a moderate amount of earthwork, but the soil has already been worked which implies that the impact remains minor. No valuable groundwater areas lie close to the Topinoja area and, due to the high density of the soil in the area, the impact on the groundwater remains minor even in an emergency situation.

All the area in the *Palovuori Alternative VE2* is made up of broken rock and the groundwater formation is poor. The soil has been heavily worked which is why the impacts generated by the construction activities on the soil are insignificant. In the vicinity of the area there are no valuable groundwater areas and, basically, the planned activities do not cause emissions into the groundwater. In both alternatives, the area affected by possible leakages remains small due to the high density of the soil.

## Impacts on the surface waters

In the *Topinoja Alternative VE1*, depending on the observation point and the time when samples were taken, the water quality of the ditches varies from 'slightly' to 'highly contaminated'. It is possible that the surface waters from the Project area carry solid matter at the construction stage of the plant. However, considering the current state of the waterways down from the Project area, this is not estimated to have any impact on them. The waste waters generated at the operating stage of the waste-to-energy plant will be led into a waste water treatment plant and the rainwater of the yards into a storm sewer or onto the terrain. The quality of the rainwater in the yard area equals that of the rainwater in ordinary trafficked areas.

In the *Palovuori Alternative VE2*, the water in the ditches south from the area was contaminated by ammonium nitrogen and biological oxygen demand which refers to load from a closed landfill. It is possible that the surface waters from the Project area carry solid matter at the construction stage of the plant, but this impact is estimated to remain lower than that in the

Topinoja Alternative. Considering the current state of the waterways down from the Project area, constructing the waste-to-energy plant is estimated to have no impact on the present state of the water. The waste waters generated at the operating stage of the waste-to-energy plant will be led into a waste water treatment plant and the rainwater from the yards into a storm sewer or onto the terrain. At the operating stage, the waste-to-energy plant is not estimated to generate any impacts on the waterways.

## Impacts on the community structure and land use

In the *Topinoja Alternative VE1*, the waste-to-energy plant is situated as part of the built environment, south from the present landfill and reachable by the present road connections. At the construction stage, the impacts on the general land use and the community structure remain minor. Because of the industrial activity in the area, the Project does not cause significant changes in the land use and the area is already strongly characterized by waste management. As to the impacts on the landscape, those focused on the land use, e.g. on recreational areas, can be considered to be most significant. The Topinoja waste-to-energy plant is in accordance with the planned land use and the land use plan allows constructing a waste-to-energy power plant. Executing the land use in accordance with the real-time local detailed plan does not affect the execution of the planned land use.

In the *Palovuori Alternative VE2*, the construction of the waste-to-energy plant changes what the area looks like. At the construction stage, the impacts on the land use and the community structure outside the Project area are insignificant. Locating the waste-to-energy plant in the Palovuori project area does not cause significant changes in the land use of the surrounding areas. Constructing the Palovuori waste-to-energy plant changes the planned landscape area to become built environment. Implementing the Project in the Palovuori area requires an exemption of the regional plan and the local master plan, or changing them, as well as compiling a local detailed plan suited for the planned purpose of use.

## Impacts on the landscape

The *Topinojan Alternative VE1* lies in a built industrial environment surrounded by wide-spread open areas under cultivation, residential areas and forest-covered rocky hills. The plant would be clearly visible to the Bypass Road and it would be a new landmark in the landscape. In the near landscape, the impact is reduced by the existing power lines and by the fact that the power plant would be situated on the edge of the built area, as well as by the evident changes in the surroundings of the waste management centre. The impact on the landscape would be most significant into the direction of southwest from the Project where there is a far reaching, open valley space. In the distant landscape, the impact caused by the chimney of the waste-to-energy plant remains insignificant, as the construction mass of the chimney is small and in an urban landscape chimneys are not found to be disruptive. As to the visibility of the waste-to-energy plant in areas having special scenic or cultural historic value, the waste-to-energy plant may be visible to some very limited areas or from a very long distance, this implying that the impact is minor.

The *Palovuori Alternative VE2* is located in a ridge area bordered by higher-rising wooded hills, where the tree-growing hills close the visibility to the neighbourhood of the Project area. This makes the impact both on the close and distant landscape minor. If any impact were detectable, it would be from the direction of the National Road 8.

## Impacts on the flora and fauna

In the *Topinoja Alternative VE1* or the *Palovuori Alternative VE2*, no occurrences of endangered species, Directive species, natural habitats listed in the Nature Conservation Act, species or habitats subjected to the Forest or Water Act, nor endangered natural habitats were encountered. The Project areas are also located in conjunction with the existing community structure where the fauna is used to noise generating activities.

The particle, nitrogen or sulphur emissions at the construction stage of the Project are not estimated to have any impact on the health condition of the forests in the vicinity of Topinoja or Oriketo or on the natural state of the closest areas subjected to various na-

ture conservation programmes or strategies. In neither case does the 40 dB noise contour area extend to the closest nature conservation areas. In both of the Project alternatives, the total of the construction-stage-induced impacts of the Project on the natural diversity is estimated to remain minor.

It is estimated that at the operating stage of the Project the airborne emissions will remain below the set threshold values both in the Topinoja and Oriketo area which implies that no airborne impact is focused on the close-by natural environment. In the Topinoja and Palovuori Alternatives, the level of the operating noise exceeding 40 dB is limited to the distance of 300 metres around the plant, and in neither alternative are the species exposed to any harm greater than that due to their current exposure in the vicinity of the plant.

## Noise impacts

In the *Topinoja Alternative VE1* and the *Palovuori Alternative VE2*, the construction-stage-induced noise levels are at their highest when the rock is being quarried, the principal sources of noise being the drill rigs and heavy machinery. Quarrying may slightly raise the noise level at the closest residence, but anyhow it remains below the guideline value and the impact is short-term.

In the *Topinoja Alternative VE1*, the operating-stage noise levels both at day- and night-time stay under 40 dB, the guideline value for the closest sensitive receptor being 50 dB. In some special conditions, the operating sound of the waste-to-energy plant may be perceivable, especially at night time, when the general background noise level is relatively low.

In the *Palovuori Alternative VE2*, the operating-stage daytime noise level is some 45 dB at the closest sensitive receptor. The night-time noise level is slightly lower. The noise level stays below the daytime guideline value of 55 dB and below the guideline value of 50 dB set for old residential areas. It is likely that the operating sound of the waste-to-energy plant is occasionally detectable at the nearest residence, but the noise from the National Road 8 covers the sound generated by the power plant.

## Impacts on the human health, living conditions and pleasantness of the environment

Social impacts, e.g. residents' feelings of fear, hope and uncertainty concerning the future, may become evident as early as at the planning and assessing stages of a project. The residents in the Oriketo neighbourhood strongly opposed the intentions to build a new waste-to-energy plant replacing the current Oriketo plant. The present plan to build a new waste-to-energy plant in Topinoja or Palovuori has not aroused equal interest.

In the *Topinoja Alternative VE1*, the operating-stage contaminant concentrations are estimated to stay clearly under the guideline values, but their possible increase, and especially the concentrations in eventual emergency situations, cause worry and uncertainty among the residents of the neighbourhood. The noise generated by the waste-to-energy plant is likely to be limited so close to the plant that its increase disturbs the pleasantness of the environment only in some of the closest residents and the recreational use of the near-by forests. The visibility of the waste-to-energy plant and its chimney in the landscape is a relatively insignificant aesthetic inconvenience, but it anyway reminds the residents and the recreational users of the area of the possible harmful airborne emissions and thus increases the inconvenience related to the attractiveness of the environment. The new waste-to-energy plant is unlikely to have any great impact on the real estate values or the image of the area, as the area already has a waste management centre, several power stations and other inconvenience-arousing activities, e.g. a racing circuit.

In the *Palovuori Alternative VE2*, the operating-stage contaminant concentrations are estimated to stay clearly below the guideline values, especially as no other similar plants are located in Palovuori. However, the airborne emissions cause feelings of worry and uncertainty among the residents of the neighbourhood. The noise generated by the waste-to-energy plant is limited to the immediate vicinity of the plant and the increase of the noise disturbs the pleasantness of the near-by residential building and the recreational use of the close-by forests. The impact focused on the landscape due to the waste-to-energy plant and its

chimney is estimated to be minor. Nevertheless, the power plant and its chimney remind the residents and the recreational users of the area of the eventual detrimental airborne emissions which increases the inconvenience related to the attractiveness of the environment. The new waste-to-energy plant is not likely to have any impact on the real estate values or the image of the neighbourhood, as activities like rock excavation and crushing, a racing circuit and an earth fill are already located in the area.

In the *Topinoja Alternative VE1* and the *Palovuori Alternative VE2*, the concentrations induced by the airborne emissions have been compared to the national and international health related guideline and threshold values. The most central reference criteria of the health impacts are the air quality threshold and target values imposed by the European Union Air Quality Directive, the Government Decisions and Government Decrees. The modelled concentrations remain clearly under the reference values. The background concentrations for fine particles are available for the Oriketo area and those of the respiratory particles, sulphurdioxide and nitrogendioxide for the Turku area. Taking into account the above mentioned background concentrations, the concentrations at the ground surface level remain under the set reference values. Both of the alternatives lie along the main traffic routes and the increased traffic volume is not estimated to have any impact on the traffic safety and thereby on human health. In both alternatives, the waste-to-energy plant generates a slight increase of the noise level at the close-by residents, but the noise level remains clearly below the guideline values and the noise is not estimated to have any impact on human health. The close-by residents may be exposed to health impacts due to fire (flue gases) or chemicals leakage (ammonium) in case of an emergency at the waste-to-energy plant. However, good planning takes into account also emergency situations and the possible impacts can be limited within the plant area also in emergency cases.

## Impacts on the waste management and waste recycling

The waste-to-energy plant is fuelled by the waste not suitable for material recycling. The waste-to-energy plant increases the utilization of the energy content

of the waste and reduces the need to use fossil fuels. The Project supports the objectives set by the National Waste Plan (VALTSU) as regards the prohibition to dispose organic waste in landfills and the waste-to-energy production. The waste-fuelled incineration plant displaces a moderate amount of fossil fuels and the operations enable collecting a moderate amount of metals to be recycled.

### **The impacts of the implementation of the Project on the Oriketo area**

Constructing a new waste-to-energy plant implies closing down the present Oriketo waste incineration plant. The environmental permit of the waste incineration plant will be valid until the end of the year 2014 which means that the incineration plant will be closed down before the new waste-to-energy plant has been completed. The impacts due to the planned waste-to-energy plant on the area are greatly dependable on the possible conservation decisions concerning the existing incineration plant. If the constructions may not be demolished, many of the prevailing impacts in the Oriketo area, e.g. the impacts on soil, groundwater and landscape, will not undergo environmental remediation. The clearest change due to the closing-down of the current waste incineration plant is related to the decrease of the heavy traffic volume in Polttolaitoksenkatu-street. As to the social impacts, closing down the present waste incineration plant increases the attractiveness of the area, and specifically in the Palovuori Alternative VE2, this impact is moderate. Correspondingly, the Topinoja Alternative VE1 implies a moderate negative impact on the Oriketo area, the waste-to-energy plant being remarkably bigger in size and located close to the present incineration plant.

### **Zero alternatives**

The Project not being implemented, the environmental impacts generated by the planned waste-to-energy plant at the alternative locations will, of course, not be realized. The current situation in Oriketo will continue, this meaning that no changes will occur as regards the environmental impacts. Some of the energy waste of the Turku region will be transported somewhere else to be processed and produced as energy. However, it

is important to know that the environmental permit of the Oriketo waste incineration plant will expire at the end of the year 2014 and continuing the operations requires renovating measures and applying for a new environmental permit. Based on this, the Alternative 0a terminates at the end of the year 2014 after which the Alternative 0b will become valid.

According to the Alternative 0, the energy waste is transported somewhere else to be used as energy. Thus the environmental impacts will mainly occur somewhere else and most of the impacts due to the waste-to-energy plant in Topinoja or Palovuori will not be realized. Due to the trans-shipments, the traffic volumes in Topinoja will increase and the traffic will direct onto the main routes away from Turku. It will be necessary to process the energy waste somewhere, and the impact on the climate will depend on the type of energy that this process displaces. Considering the natural resources and the waste management, the Alternative 0b is negative due to the fact that in the Turku region the waste-to-energy plant displaces fossil fuels. It is also worth noticing that in the social impact assessment procedure, the Alternative 0b was considered by the residents to be the worst alternative.

In the Oriketo region, the impacts induced by the Alternative 0b are similar to those described above. In other words, if the constructions related to the current waste incineration plant remain at their current location, several impacts will stay as they are at present and the volume of the heavy traffic may slightly decrease.

### **The feasibility of the Project**

The waste-to-energy plant was assessed as technically feasible in the environmental impact assessment procedure concerning all Project alternatives. The waste-to-energy plant will be implemented using the best available technology (BAT). There is experience of similar plants also in Finland and the operations are well established.

The Project was found feasible as to its social aspects. The Project is in accordance with the land use plans, though in Palovuori some changes in the land use planning are necessary. Citizens' attitudes towards the Project are mainly positive and the optional areas already have other activities which mitigates the impacts due to the planned waste-to-energy plant.



Additionally, the Project supports reaching the social objectives set by the Waste Act and the National Waste Plan (VALTSU). The waste-to-energy plant Project, as a joint project of the waste management organisations in Southwest Finland, is valuable and worth noticing as it ascertains the sufficiency of the waste fuel required to fuel a power plant serving the region.

The Project was proven environmentally feasible and the differences between various alternatives are relatively small. The slight differences between the Topinoja and Palovuori are related to the land use. The Topinoja area already has waste management activities which is positive from the point of view of the planned waste-to-energy plant. The same applies also to the current land use planning in Topinoja. The negative impacts on the landscape in the Topinoja area are slightly higher than those in the Palovuori Alternative. The impacts induced by airborne emissions generated by the waste-to-energy plant remain minor in all alternatives.

The Project was assessed socially feasible as regards all Project alternatives. The general attitude towards the waste-to-energy usage in the Turku region was positive, though some negative opinions of the Project were also expressed. As to the social impacts, no great differences between the alternatives were found. The differences between the alternatives are focused mainly on the Oriketo area where people have opposed the current waste incineration plant. The Topinoja location alternative lies quite close to the present waste incineration plant which causes a more negative attitude towards the Oriketo area than towards the Palovuori Alternative. In spite of that, based on the survey, Topinoja is considered to be the best alternative for the waste-to-energy plant also by the residents of Turku.