

AFRY Management Consulting Oy

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Use of waste-based fuels in co-incineration in Finland – Potential impacts of EU Taxonomy on the fuel use

1 Background

The EU Taxonomy is setting a common classification system for sustainable economic activities. The delegated act draft published 21st April sets the technical criteria for activities qualifying as environmentally sustainable. The delegated act defines the use of biomass in heat and/or power generation as sustainable, but only when biomass is used exclusively in the energy production. Waste based fuels are not mentioned in the delegated act.

The heat and steam production and related CHP electricity production in Finland is quickly decarbonizing. Fossil fuels and peat are replaced with renewable fuels, largely with forest biomass. As a result, the demand for biomass from energy sector increases substantially. The development towards more sustainable energy production causes new challenges for the fuel sourcing to the heat producers, who need to ensure the availability of biomass with reasonable price. When peat and fossil fuels are no longer viable alternatives for energy production, waste based fuels are seen as interesting complementary fuel, making the fuel sourcing more flexible and reducing the risks related to fuel availability and prices.

According to the Taxonomy, co-incineration of waste and waste-based fuels are excluded from the sustainable activities. This can have impacts on the fuel choices especially for the plants which would use biomass together with waste. It may also impact the future investments in co-incineration capacity in Finland and other member countries.

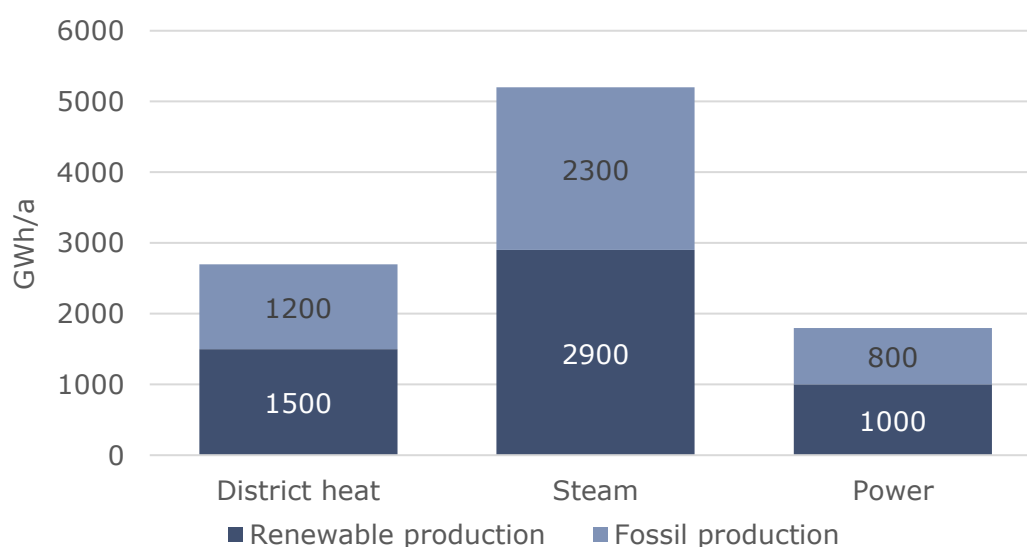
AFRY Management Consulting Oy has analyzed the current use of waste-based fuels in Finland in co-incineration plants. The analysis is based on the information collected from the environmental permits and reports of the co-incineration plants, statistics and AFRY's own databases. The information is collected mainly from 2019 actual fuel use, but if this data has not been available, 2018 or 2020 plant level data has been used. The aim of this paper is not to analyze the exact impacts of EU Taxonomy on co-incineration plants, as it is still highly uncertain, but rather to describe the capacity and fuel markets that might be impacted.

2 Co-incineration capacity and energy production in Finland

Unsorted waste, such as municipal waste, is utilized in 9 waste incineration plants currently in operation in Finland. In addition, 24 co-incineration plants utilize different waste-based fuels together with other fuels. The waste-based fuels used in these plants vary, but according to the environmental permits, the plants can use, for example solid recovered fuel (SRF), recycled wood, sludge, rejects from forest industry and other industrial processes and waste oils.

Co-incineration plants in Finland produce heat and steam for industries and district heating. Appr. half of the plants also produce electricity. In 2019, these plants produced 8 TWh of heat and steam, and 1.8 TWh of electricity. The district heat production with co-incineration capacity accounted for 7 % of the total district heat sourcing in Finland. 56 % of this energy was from renewable sources in 2019, assuming 40 % of the waste fuels as renewable. However, majority of the renewable energy from the plants comes from biomass. The co-incineration plants produced about 5.4 TWh of renewable energy in Finland. The heat and power production from the co-incineration plants in Finland is presented in Figure 1.

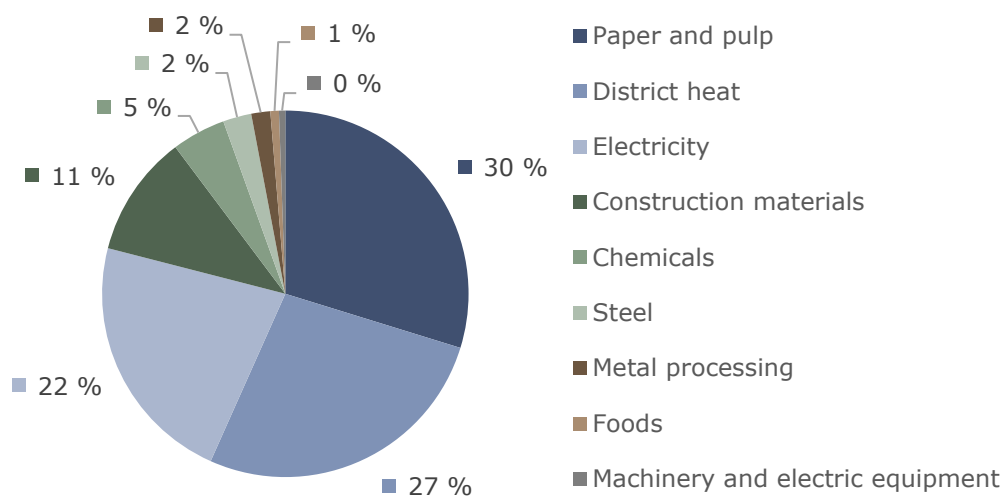
Figure 1 Energy production in the co-incineration plants in Finland in 2019¹ (GWh/a)



Co-incineration plants produce energy for different industrial companies and district heating companies. The largest sector using co-incineration plants is forest industry, which accounts for appr. 30 % of the total energy production with co-incineration capacity. Other main sectors using co-incineration include district heating, electricity production, construction materials, chemical and steel production sectors. Figure 2 presents the main sectors of the co-incineration capacity in Finland.

¹ Based on plant level data for 2019 whenever available. For some plants, also 2018 or 2020 data has been used

Figure 2 Fuel use in co-incineration plants in Finland by industry type in 2019



For most of the co-incineration plants, biomass is the main fuel used, and waste-based fuels are used in addition depending on the fuel market situation and availability. Based on the environmental permits, the co-incineration plants in Finland have a maximum permit to use more than 1 Mt of waste-based fuels. The fuel use statistics show that only some 40% of the permitted capacity has been used, which means that the use of waste-based fuels could be increased assuming the plants would not have technical restrictions.

The use of different fuels in the co-incineration plants is described below in Figure 3. Based on 2019 fuel use², about 5.8 TWh of biomass was used in these plants in Finland. Peat use in the plants was 2.6 TWh and the use of waste-based fuels accounted for 2.3 TWh³. Coal is currently used only in some plants, and accounted for appr. 1.1 TWh in 2019. The use of biomass in the co-incineration plants accounted for some 15 % of the total use of solid wood fuel use in Finland in 2019⁴ and 6 % of the total bioenergy use in the same year⁵.

In addition to the plants which were in operation in 2019, there are several large new plants recently commissioned or planned, which are permitted to use substantial amounts of waste-based fuels together with biomass. These plants are mainly in the district heating sector. According to the environmental permits, these plants could use 1.5 TWh of waste-based fuels and almost 5 TWh of biomass. The actual fuel use and impact of the plants to the total fuel use is, however, highly uncertain.

The share of waste-based fuels in the co-incineration plants varies between 3-99 %. A considerable number (17) of the plants, however, use less than 30 % waste-based fuels and there are only four plants which used more than 50 %. The average share of the waste-based fuels in the co-incineration plants was appr. 20 % in 2019. The environmental permits would have allowed them to use close to 50 % waste-based fuels in average.

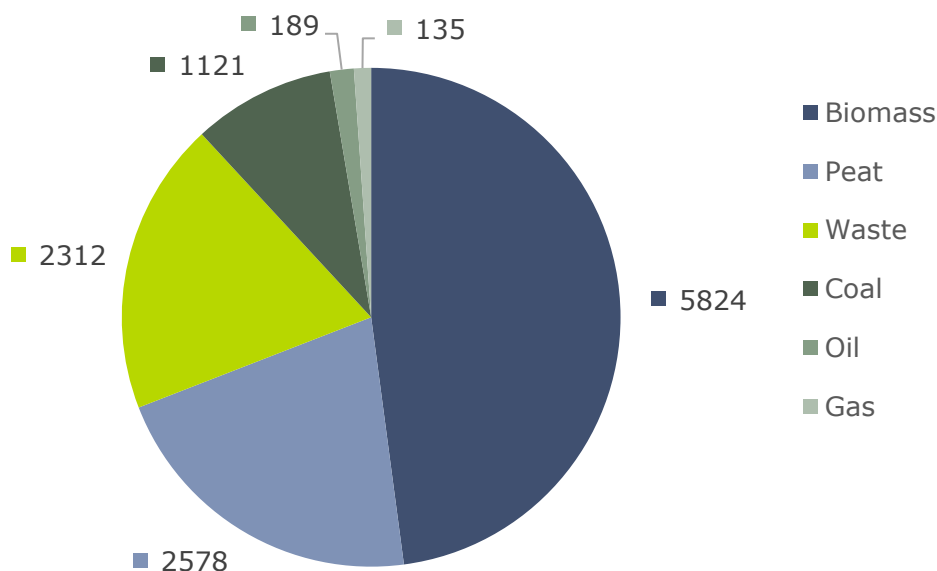
² 2019 data has been collected on plant level when available. For some plants, 2018 or 2020 data has been used if 2019 data was not available.

³ Rough estimation, exact information of the contents of the waste based fuels used has not been available for all plants, and the energy content of the waste used is therefore only an estimation

⁴ Natural Resources Institute Finland, Wood in energy generation 2019

⁵ Statistics Finland, Production of electricity and heat 2019

Figure 3 Fuel use in co-incineration plants in Finland in 2019 (GWh/a)



Co-incineration plants are included in the EU emissions trading scheme (EU ETS) which means that they have to submit emission allowances for the CO₂ emissions from peat, fossil fuels and for the fossil part of the waste-based fuels. As a result of the increased CO₂ prices and taxes for fossil fuels and peat, they have a clear economic incentive to replace peat and fossil fuels with biomass. This means that many of the plants will be reducing the peat and coal use (together 3.7 TWh in 2019) and replacing these with renewable fuels such as biomass, and possibly also waste-derived fuels.

3 Potential impacts of the EU Taxonomy on co-incineration plants

Based on the analysis of the current capacity and fuel use in the co-incineration plants in Finland, the impact of the co-incineration plants on the renewable energy production in Finland is considerable. These plants are needed to produce heat and steam for the local industries, which means they cannot easily be replaced with other type of capacity. Currently, the plants use biomass together with waste-based fuels and peat, and some of the plants have also used coal.

With the increasing CO₂ prices, fossil fuel and peat taxation, and gradual abandoning of the industrial energy tax refund system, it is likely that the plants would aim to replace peat and coal use with biomass due to economic reasons. As a result, the share of biomass is likely to increase quickly in these plants.

The EU Taxonomy may have impact especially on the plants that are already largely using biomass together with waste-based fuels. The exact and concrete impacts of the Taxonomy are still uncertain, and the impacts are likely to be different for different companies. However, if the companies aim for their energy production to be counted

sustainable according to the Taxonomy in the future, they might choose to switch to sole biomass use.

Based on the current fuel use, the replacement of waste based fuels with biomass would increase the demand of biomass by appr. 2.3 TWh. This comes in addition to the potential additional demand from replacing also peat and coal in the plants, which together accounted for 3.7 TWh in 2019. In addition, there are also several new co-incineration plants, which could increase the waste-based fuel use by appr. 1.5 TWh. However, it should be noted that these figures are only indicative, and in some cases the new capacity might also be replacing existing capacity. The total fuel use figures are estimations based on plant level data collected from the environmental permits and other publicly available data.

Based on AFRY's analysis of the overall development of the biomass energy use in Finland, the demand will increase by appr. 12 TWh in the coming years (by 2025) as a result of replacing peat and fossil fuels with biomass in the heat production capacity. In addition, the potential liquid biofuel plants would increase the demand by further 4 TWh. This means an increase of about 30 % from the current use. Although the supply of the biomass is also increasing, the increase in demand will result in scarcity in the biomass markets. It leads to increasing imports of biomass in some areas and increasing prices. The increasing competition may also impact other possible end uses of biomass in different sectors. From this perspective, the potential additional demand (2-4 TWh) from replacing also waste-based fuels with biomass in the co-incineration plants would be substantial and would impact the markets and other biomass users.

As the energy sector in Finland is quickly replacing fossil fuels and peat with biomass, the availability of the fuels and security of supply become more and more important questions. Waste-based fuels currently offer an alternative option for fuel sourcing, which can reduce the risks related to the biomass price increases and availability of the fuels.

The transition to waste-based fuels overall has happened during the last 10 years and has involved extensive investments into waste incineration and co-incineration plants. This has also led to rapidly falling landfilling rate, reaching a level of less than 1 % for municipal waste in Finland. Although also the utilisation of waste streams as materials has been increasing, some waste fuels cannot easily be used for other purposes than energy utilisation. The fuels used in co-incineration are typically already sorted and materials that can be re-used as a material are recycled. Reduced use of waste fuels in co-incineration plants may also lead to increased exports of waste-based fuels if capacity is not sufficient in Finland.