



Sustainable Bioenergy  
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# Integration of torrefied biomass production plant with CHP plant

20.3.2014



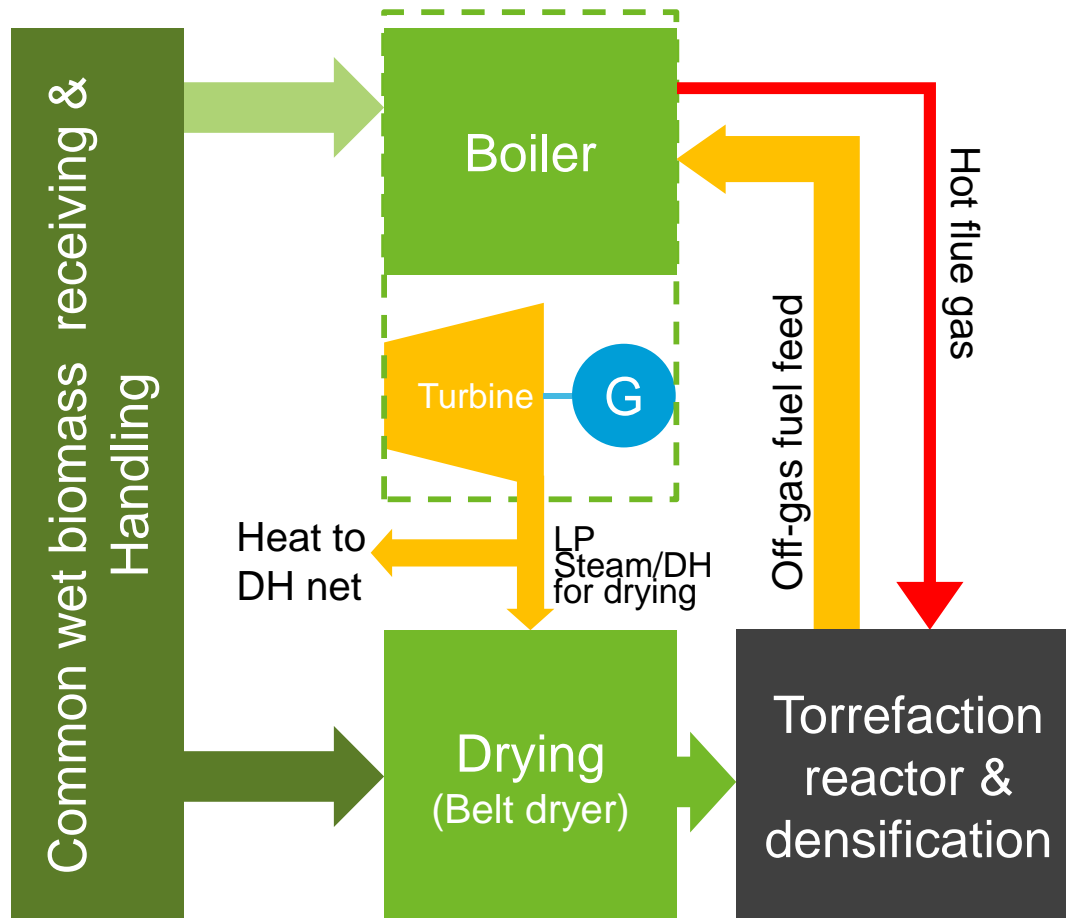
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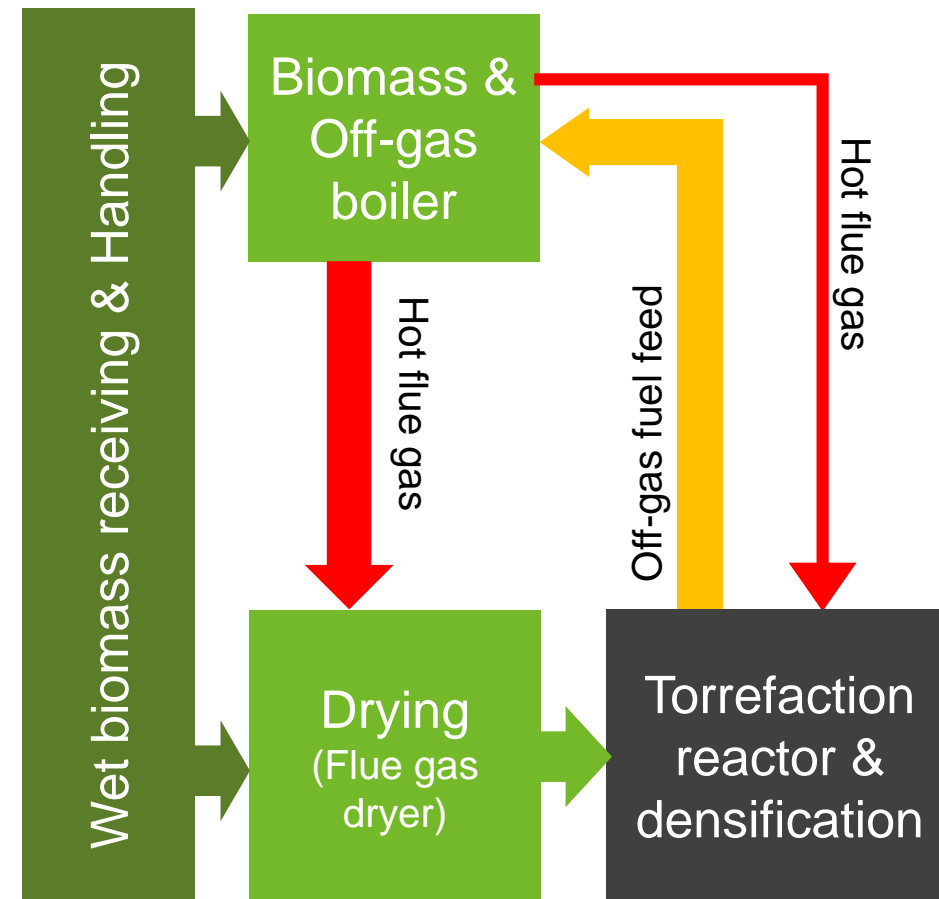


# Integrated torrefaction with CHP vs stand-alone

Integrated torrefaction and CHP plant



Stand-alone torrefaction plant





# Benefits of integration

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The benefit of the integration of torrefaction plant with CHP plant compared to stand-alone torrefaction plant derives from following areas:

## Investment cost savings:

- No need for a separate boiler to supply heat to drying and torrefaction reactor
- Possibility for a common fuel receiving

## Operation cost synergies

- Savings on staff costs
- Avoided electricity transmission costs for torrefaction plant due to direct feed from the CHP plant
- Lower cost of heat for biomass drying\*

\*) The cost of heat with CHP integration is very case specific and depends on following issues:

- The capacity of CHP plant compared to existing heat load
- Potential to increase CHP plant heat capacity e.g. by installing flue gas condenser
- The cost of heat production from other boilers connected to district heating network
- Electricity market price (high electricity price decreases the marginal cost of heat)
- The value of off-gas from torrefaction as a fuel for CHP-plant compared to CHP plant primary fuel



## Evaluation methods


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- The impact of integration on CHP plant performance was evaluated by Lappeeranta University of Technology (LUT) with process simulation software. The simulation was made for an existing CHP plant owned by Fortum. Andritz supplied process information on torrefaction plant.
- Investment cost synergies were evaluated by Andritz
- Fortum made investment cost analysis based on process simulation data from LUT and investment cost data from Andritz for evaluating integration benefits of a torrefaction plant at the site of an existing CHP plant.



# Results

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- Investment cost of integrated torrefaction unit appears to be 15-20% lower due to avoided investments in biomass/off-gas boiler, dryer vent gas treatment and fuel receiving
  - The case specific (CHP plant X, Fortum) variable and fixed production cost of integrated torrefied biomass production plant appears to be ~5% lower.
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- The total production cost of torrefied biomass including cost of capital appears to be roughly 10% lower compared to stand-alone production if the cost of feedstock is same for both plants.



# Discussion

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- The benefit of CHP-integrated torrefaction plant compared to stand-alone plant is case specific and depends on the location. In some cases stand-alone plant close to feedstock is more feasible than integrated unit further away from feedstock.
- Even building of a new CHP plant designated for supplying heat to torrefaction plant could be considered in certain market conditions.
- The competitiveness of torrefied biomass as a fuel is highly dependent on the market price of coal and CO<sub>2</sub>. Typically the market price of electricity is driven by the cost of fossil fuel based marginal production.
- The benefit integrated torrefied biomass production compared to stand-alone plant increases with higher electricity prices due to the fact that the integration boosts back-pressure electricity generation