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Cogeneration using Biomass

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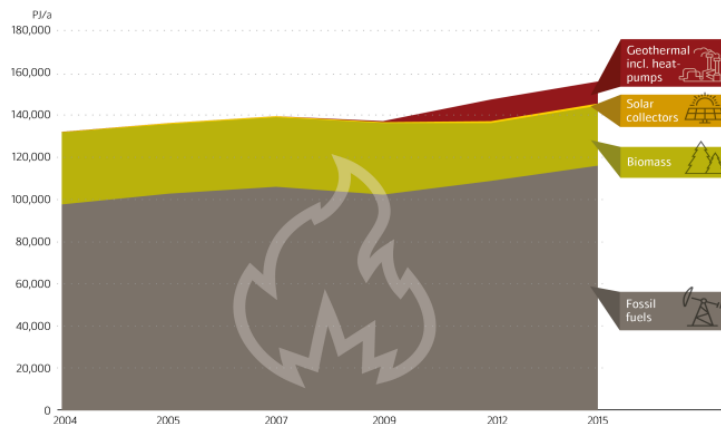
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In 2016, global biomass installed PG capacity increased by 6% with investment volume of US\$6.8 bn¹

Development of global heat supply

- Bioenergy accounts for almost 90% of renewable direct heat use, solar thermal represents around 8%, and geothermal accounts for 2%
- Bioenergy accounts for around 7% of global industrial heat consumption

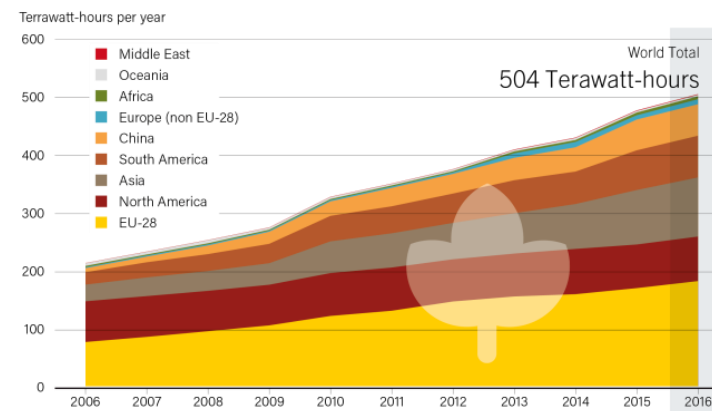


¹ Incl. WtE investments

Source "Renewables 2017 Global Status Report", REN21, 2017

Global biomass electricity supply

- Global bio-power capacity increased at 6% in 2016; total installed capacity: 112 GW. Generation also rose 6% to 504 TWh
- In 2016, leading countries for electricity generation from biomass are 1) United States (68 TWh), 2) China (54 TWh), 3) Germany (52 TWh), 4) Brazil (51 TWh), 5) Japan (38 TWh)

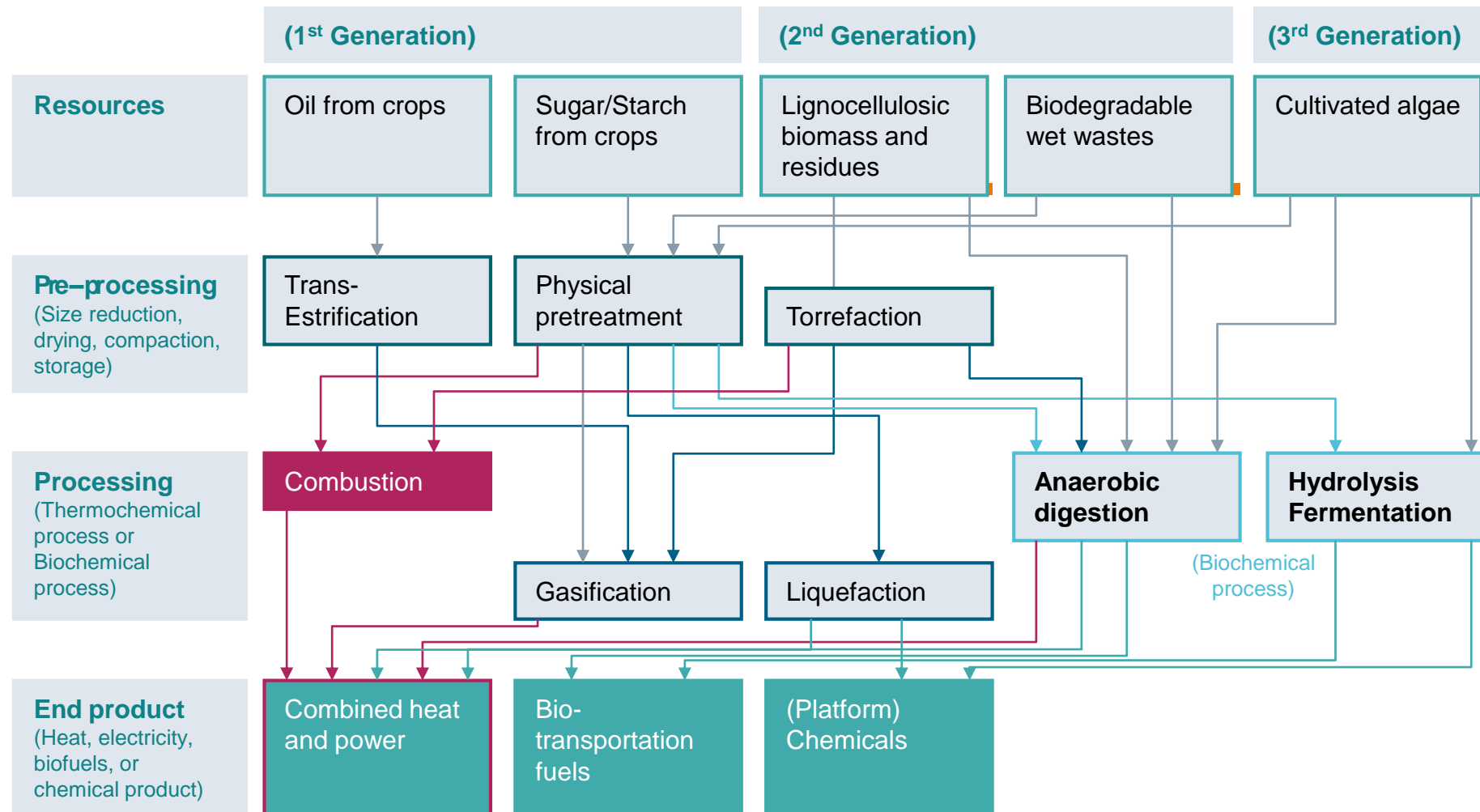


Key facts

- Biomass power plants provide 7% of global industrial heat demand, 2.8% of global residential heat demand, and 2.4% of the global electricity demand
- Biomass is one of the most capital-efficient transitions from coal to renewables

Increasing trend toward using biomass power plant to deliver a baseload power

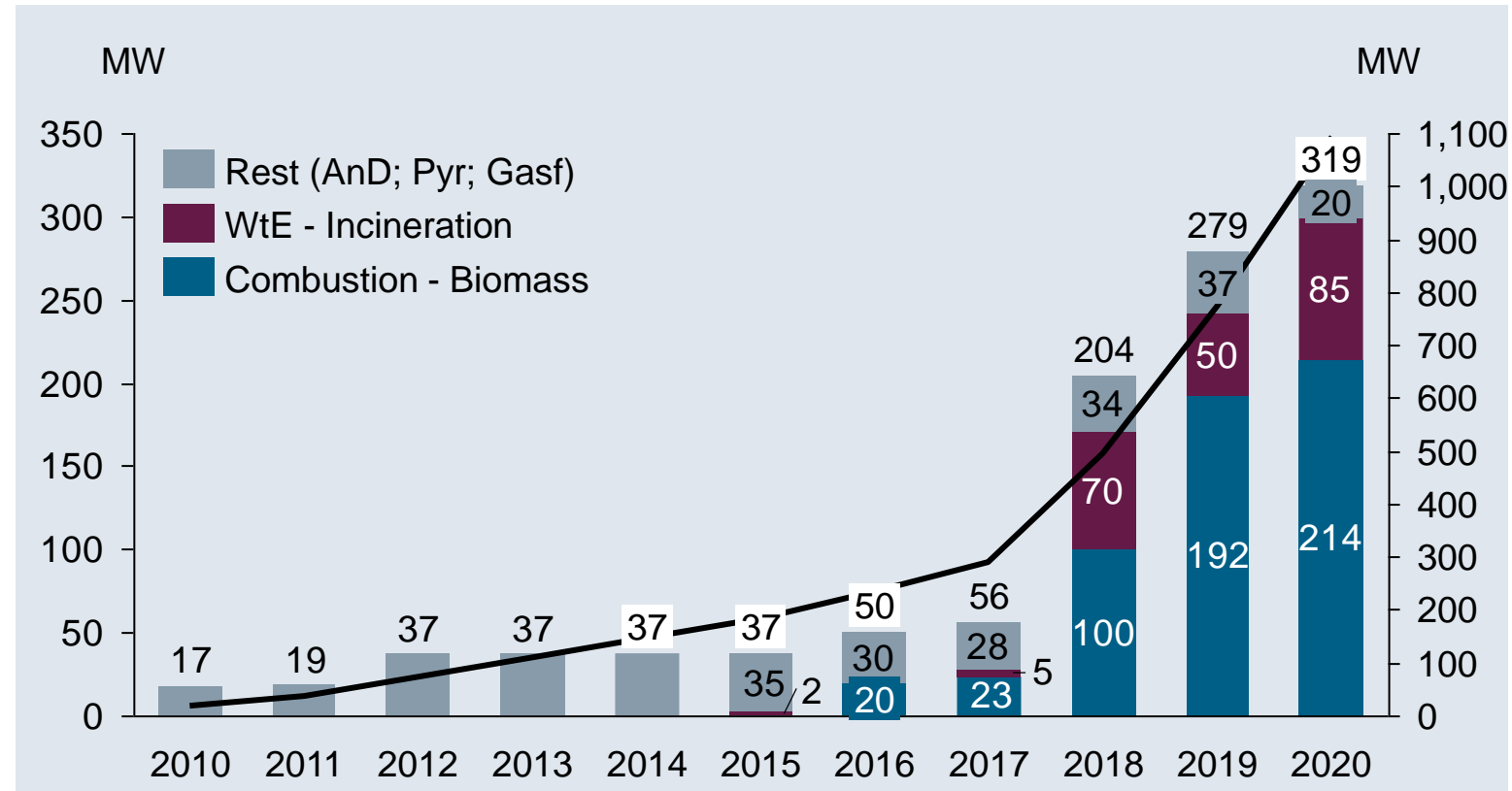
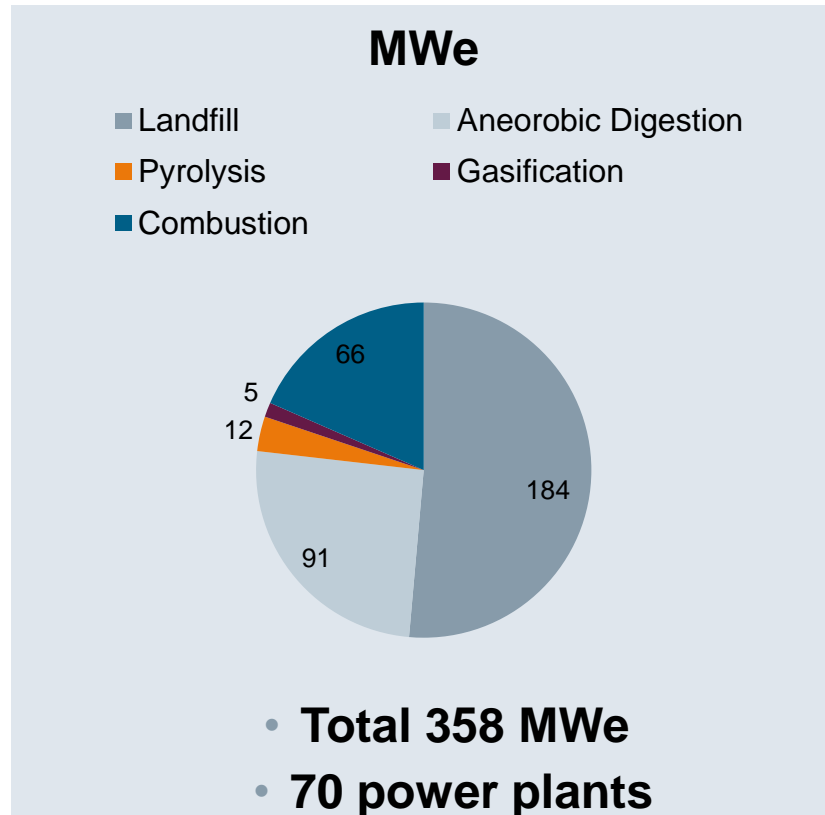
Many pathways by which biomass feedstocks can be converted into useful energy – Focus is on producing CHP



Many technologies and conversion processes are now well-established and fully commercial

Biomass (incl. WtE) in Turkey

So far 358 MW installed, expected to reach 1000 MW till 2020



>90% of the power plants have been built to generate electricity only

Feedstock

Forest:

- Forest Residues
- Forest Industry Residues
- Energy Forest
- Residues from Cities
- Black Liquor

Agriculture:

- Agriculture residues
- Cotton
- Corn
- Wheat
- Barley

Installed Base & Potential

- 10% of installed biomass/WtE PP (~40 MW) with Forest Res.
- A few examples available in Turkey using also **heat & hot water** in their process but **no DH** yet
- High potential in specific regions i.e. Karadeniz, Marmara, Ege & Akdeniz
- **1,5% of Turkey's demand** can be met (1,5 MTEP)

Challenges

- **Transportation** → < 50 km
- **Potential conflict** with forest industry (pulp & paper, furniture, etc)
- **Import:** Shall it be free?? Affects on to the business
- **Classification** of forest residues by Ministry
- **No incentive on heat** production

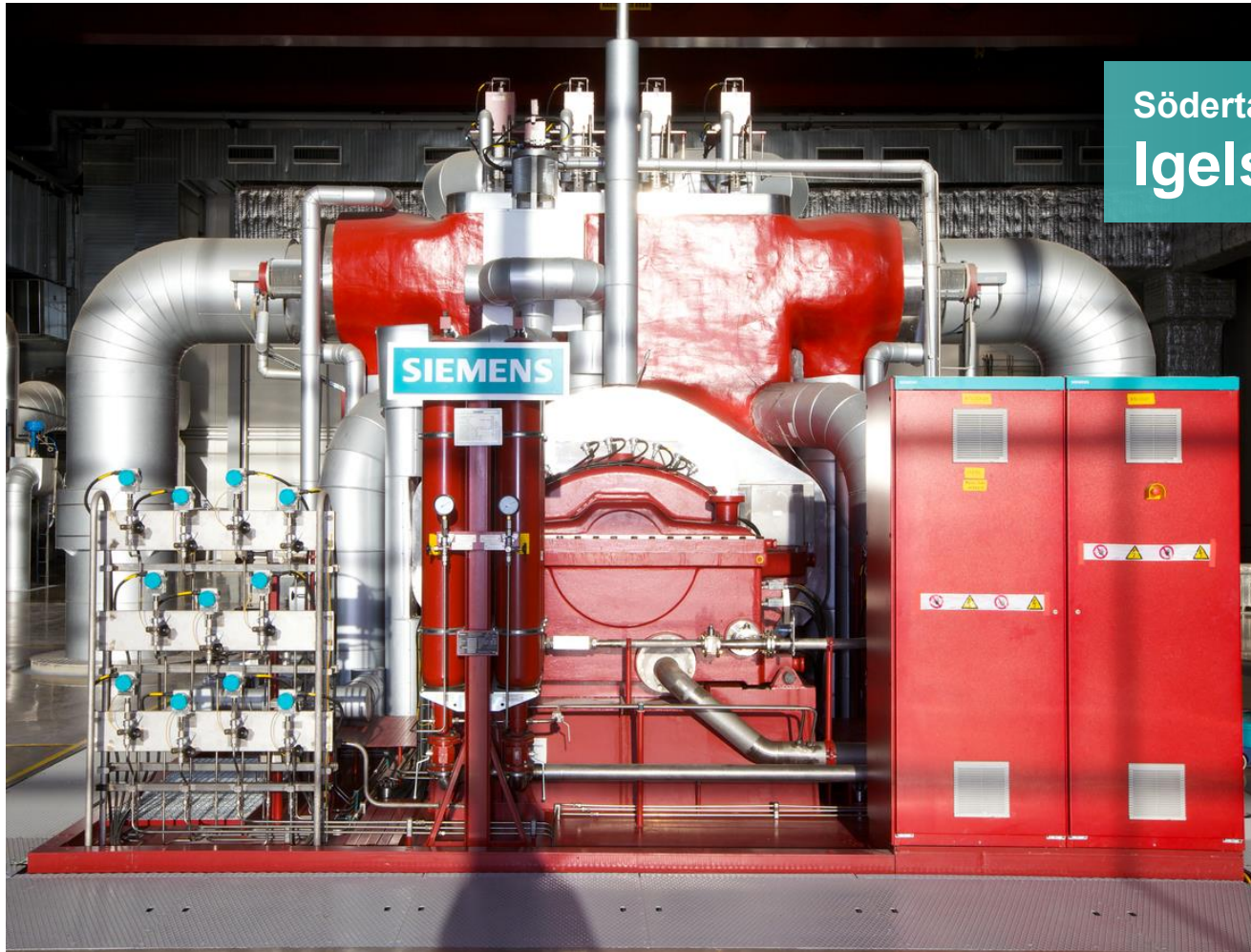
Biomass in Turkey vs. Sweden (2013 key facts)

	Turkey	Sweden
Elec Generation from Biomass	3.010 TOE	780.482 TOE
Heat Production from Biomass	---	2.353.469 TOE

- 1 Tonnes of Oil Equivalent = 11,63 MWh
- World Energy Resources Bioenergy | 2016
- https://www.worldenergy.org/wp-content/uploads/2017/03/WEResources_Bioenergy_2016.pdf

SST-800 – Sweden's largest biomass plant

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Södertälje, Sweden
Igelsta

SST-800: Biomass District Heating Plant

Inaugurated in March 2010, the plant uses a biomass fuel mix consisting of about 90% renewable fuels like forest refuse, wood chips, tree bark, and 10% non-recyclable waste paper and plastic. It produces 200 MW heat and 85 MW electricity, the equivalent of heating 50,000 households and generating electricity for 100,000 residences

- **Steam turbine:** SST-800
- **Power output:** 90 MW
- **Inlet pressure:** 85 bara/1,305 psi
- **Inlet temperature:** 540 °C/1,004 °F
- **Fuel:** 90% renewable fuels, 10% non-recyclable waste

SST-800 – Pulp and Paper plant Finland

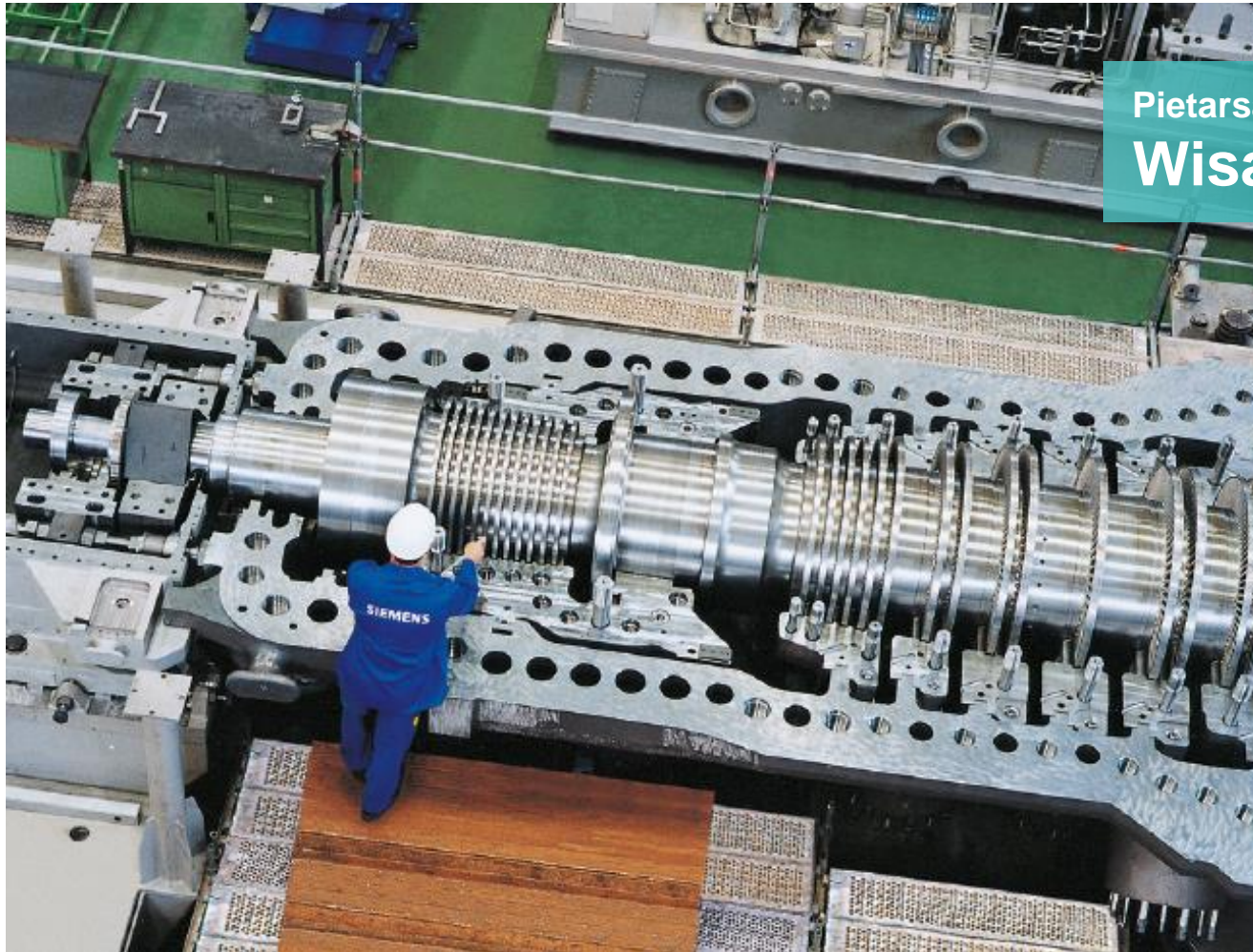
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Pietarsaari, Finland

Wisaforest Pulp and Paper Mill

The Wisaforest Mill's biomass generator is one of the largest 100% biomass-fired power plant in the world. In addition to supplying electricity and process steam to the mill's operations, it also provides district heating to the surrounding town of Pietarsaari

- **Steam turbine:** SST-800
- **Power output:** 143 MW
- **Inlet pressure:** 100 bara/1,450 psi
- **Inlet temperature:** 505 °C/941 °F
- **Fuel:** Pulp and paper mill by-products



Conclusion

- **Incentives on heat** production and usage
 - **District Heating**
 - DH to be considered by Municipalities in new Urbanization areas
 - Biomass plants to be located near in cooperation with Municipalities through different models: BOO, BOT, PPP
 - **Cogeneration in Industries**
- **Incentives on high efficiency** in biomass power plants – Performance evaluation annually checked

Contact

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