

Distributed CHP with biomass gasification

International seminar on gasification

Malmö, October 2016



Biomass gasification CHP towards technology maturity

- Technology commercially available between 15 kWe to 5 MWe
- Around 80 suppliers, engineering companies and institutions form the European biomass gasification industry, a lot of them are organized in the industry association FEE, based in Berlin.
- In Europe around 400 installations of biomass gasification CHP, most of them small scale (> 45 kWe)
- Power production of over 8000 hours a year can be expected
- The earliest plants have delivered over 40 000 hours of operation
- An estimated 4- 5 million operational hours have been accumulated

FEE DAS INNOVATIONSNETZWERK
Fördergesellschaft
Erneuerbare Energien e.V.



Source: FEE, Spanner, Gammel, Meva Energy

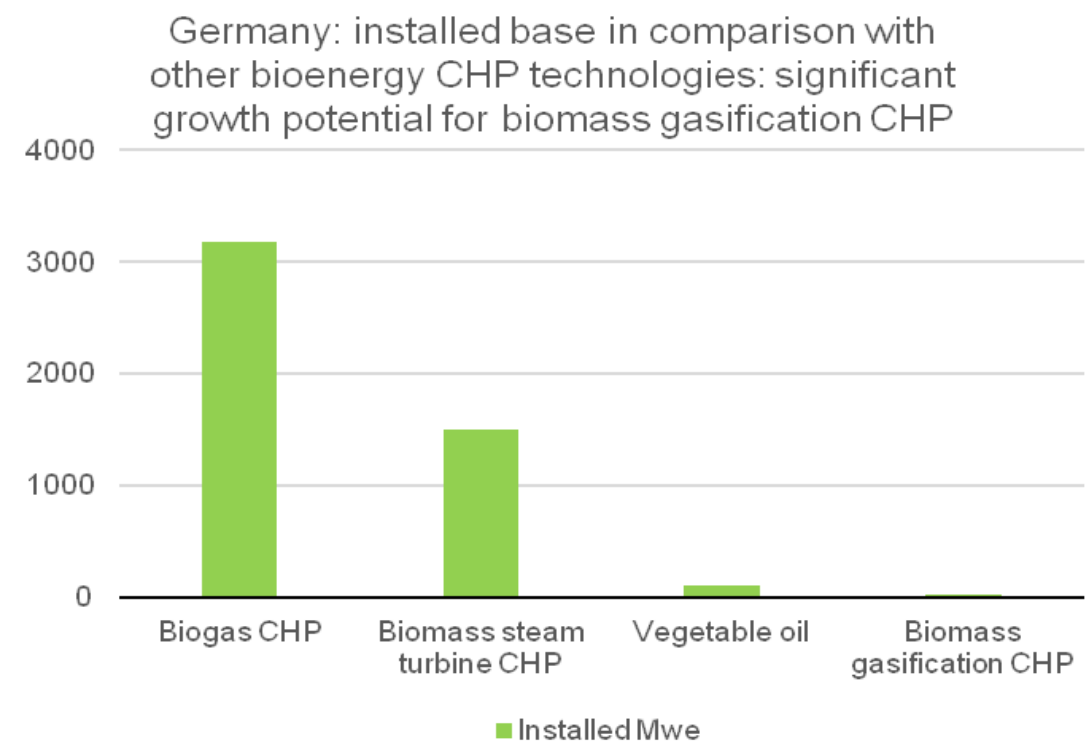
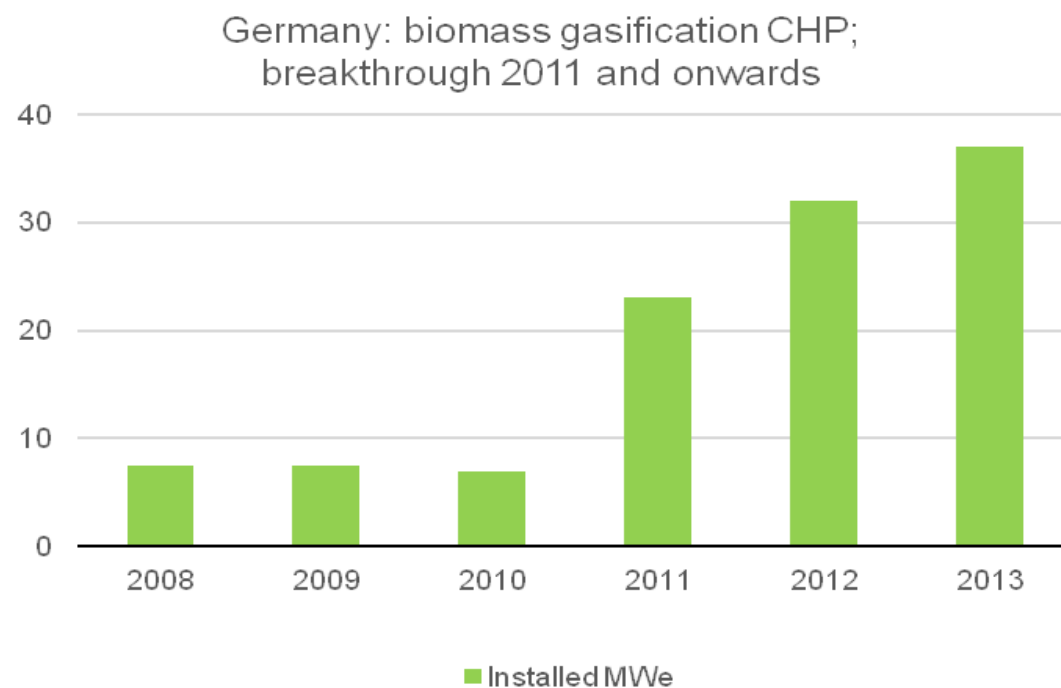
Very wide range of potential installations, replacing old boiler heating systems based on NG, oil or pellets/wood chips

- Industry: chemical plants, saw mills, wood manufacturing, laundries, food industry, plastic molding industry, farming and green houses
- Premises heating: office buildings, airports, shopping malls, schools, nursing homes, prisons, hospitals
- Basically all heat sinks between 0- 20 MWth may be potential biomass CHP installations



Market development: proved and here and now

- Market has started strong commercial growth since 2011 – Germany is leading the development
- The technology has proven its commercial ability (but is in the UK still considered as being on a R&D level)
- The growth potential is substantive: about 35 MWe biomass gasification compared to over 3,000 MWe biogas from anaerobic digestion (Germany)



District heating market potential

Global data not available but Germany and Sweden provides strong indications

Germany

According to the German district heating association (AG Fernwärme) there is a total of 19,900 MW of district heating being produced in heat boilers *without* simultaneous power production (CHP). Most of these plants do not have CHP since they are small (steam turbines are too expensive, see slide 8). This heat production is inefficient and there are strong advocates to increase the number of CHP plants (EU Cogeneration directive, German KWK- gesetz etc).



Sweden

Sweden has a low rate of CHP plants in contrast with old heat boilers. Only 40 % heat production have simultaneous power production (CHP). If Sweden would increase its share to 80% (suggested by the EU programme Code 2) by introducing small-scale biomass CHP instead of heat boilers it would represent an added 20 TWh.



Meva Energy in short

- Based on R&D at Lulea University of Technology and ETC Gasification Center
- Entrained flow gasification of biomass
- Targeting plant dimensions of 2-10 MWth and 1-5 MWe
- One commercial plant for local district heating/power production sold to local utility Pite Energi
- Ability to utilize **second generation biomass** such as wood dust, straw, husks as well as conventional fuels as pellets and wood chips
- Close development cooperation with genset producer Cummins



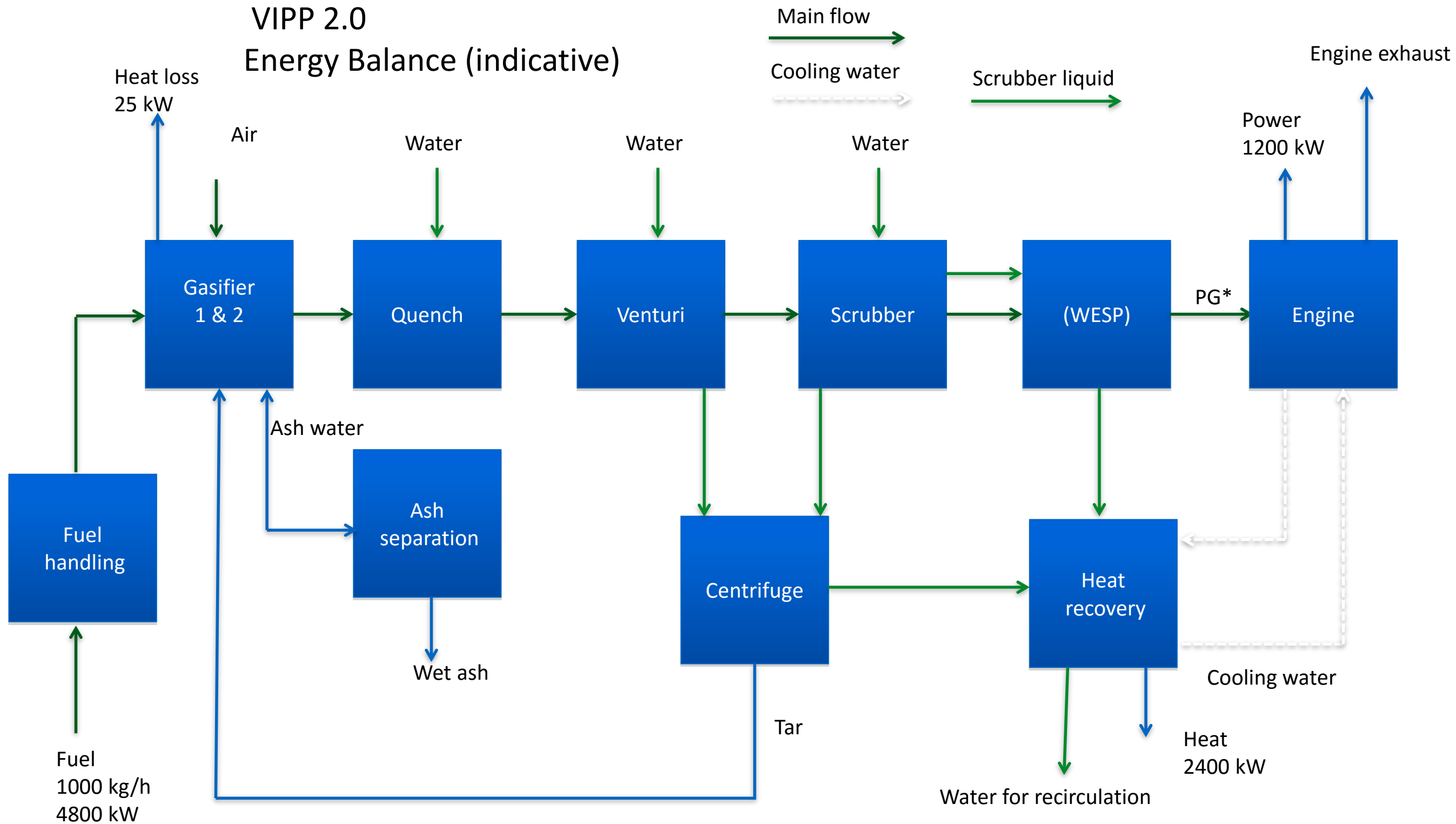
The Hortlax plant; heat delivery system



**Power
Generation**

VIPP 2.0

Energy Balance (indicative)



With higher CGE and decreased heat loss:

- > 75% cold gas efficiency
- 27% electrical efficiency (wood to power)
- 78% total efficiency

Key to profitability I: efficient technology

Very **even** gas flow and quality only small variations

- Why important? Necessary in order to function with advanced, lean burn* gas engines
- Cyclone gasifiers have very even temperatures and functionality. No batchwise loading or unloading of feedstock.

High quality gas meaning **heating value is high**, appr 30-40 % higher than comparable air blown bed gasifiers.

- Why important? Means more power from the engine and less losses from pressing inert gases such as N₂ and CO₂ through the gas cleaning system and the engine

Lean burn* = turbo charged engine with air/fuel ratio well above normal stoichometric conditions.



Cummins QSV91 lean burn gas engine.

Keys to profitable installations II: feedstocks

Top priority: find and use low -cost feedstocks:

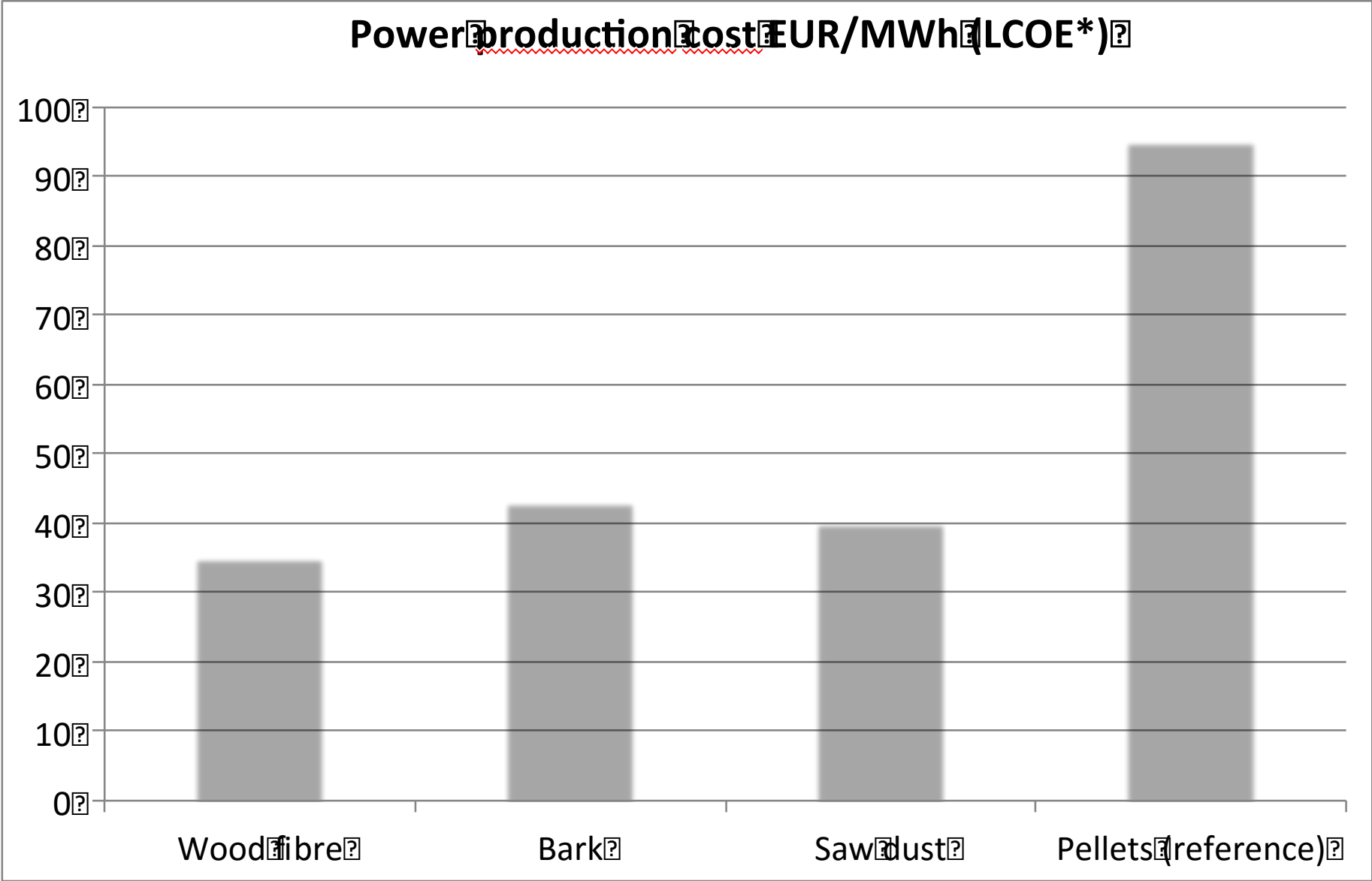
- with little alternative use
- technically difficult to use for competing technology
- constituting a waste problem
- being owned (produced) and controlled on-site- by CHP owner
- being smal-scale enables finding low cost feedstocks

Feedstock costs represents 60-90% of operational costs

Are there such feedstocks??!

- Wood fibre residue
- Saw dust
- Bark
- Straw
- Husks

Cheap feedstock → low cost power



Unique Meva acceptance

Other gasification technologies

**Levelized Cost of Electricity, CHP adaption*



Low cost power plants, despite small size

Power plant type	Small size steam turbine CHP	Meva Gasification CHP
Plant size	10 MWe	1.2 MWe
Investment cost	58 MEUR	4.5 MEUR
Investment cost/kWe	5,800 EUR	3,800 EUR
Electrical efficiency level	17%	28%

Source: IEA 2012 “Technology road map bio energy for heat and power” and Meva Energy AB. Average values.

Meva - a true bioenergy climate game changer according to WWF

Bioenergy: renewable energy (stored sunlight) from biological, renewable sources. It contrasts to fossil fuels such as coal and oil which are net adding CO2 to the atmosphere.

WWF: "If Meva would reach **20%** of its available world market, the world's emissions of green house gases can be cut with *17 million tons CO2- equivalents.*"



17 milion tons of CO2 is equivalent to...

The complete energy consumption of **1,795,000** private homes. As many as all private homes in Sweden.

or



225,000 tanker trucks of gasoline. Put them after each other and the queue will stretch from Stockholm to Rome.

or



Driving a car 66 billion km. That is equal to driving 1.6 million times around the earth's circumference.

or



91,000 railcars worth of coal burned.

17 million tons of CO2, how much is that?

Thank you!

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