

Energy from Solid Biomass – Basic Informations, Profitability and Best Practise Examples in the Sector of Industry

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Who is C.A.R.M.E.N. e.V.



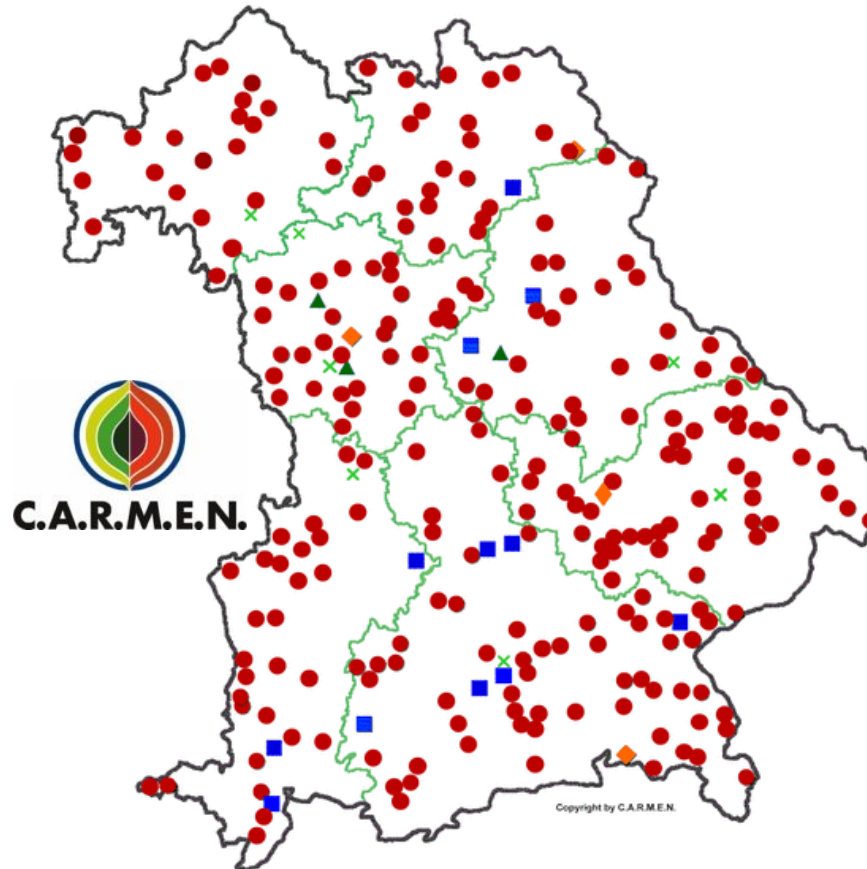
Central Agricultural Raw materials Marketing and
Energy Network, a registered non profit association

- ▶ Coordination office for renewable resources in Bavaria
- ▶ Founded in 1992, 70 members, 40 employees
- ▶ Consulting, public relations and project management with main regard to energetically use of biomass, bank reports
- ▶ Project assessment and project evaluation for the Bavarian Ministry of Economy, Energy and Development
- ▶ Further information: www.carmen-ev.de
- ▶ Christian Letalik, cl@carmen-ev.de Mobile: *49.160.8575069



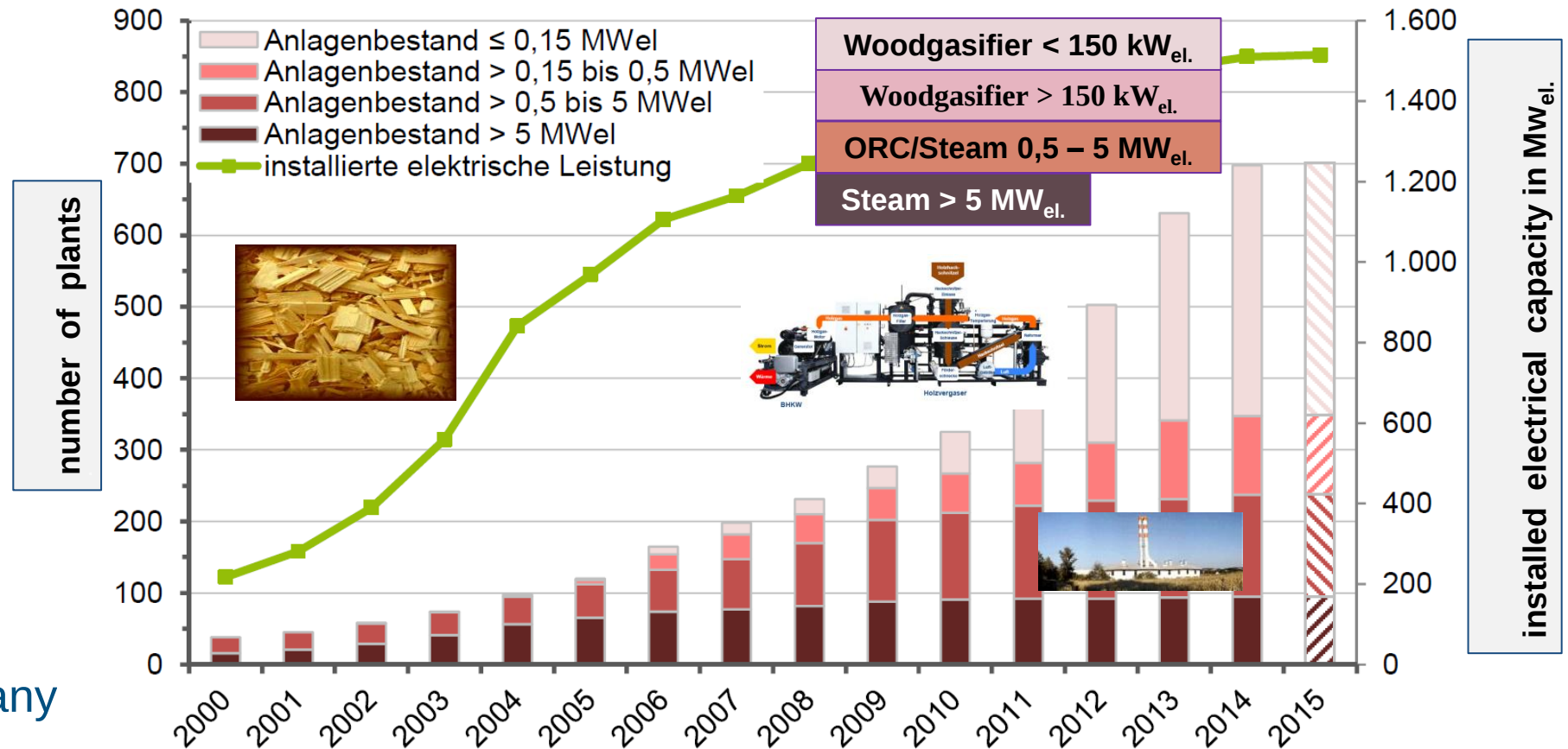
Evaluated Biomass Heat Plants in Bavaria

- More than ● 400 biomass heat plants (0,1 MWth. – 5 MWth.) (with/without heat grid)
- and 15 CHP woodgasifiers
- ➔ supported with investment subsidies by the Bavarian Government and evaluated over 7 to 12 years
- ➔ sources for long term technical and economical data
- 30 CHP plants (0,5-10 MWe.)
- and 50 CHP woodgasifiers ➔ no investment subsidies but fixed electricity feed in tariff (EEG)



Number of CHP Solid Biomass Plants in Germany— small Wood Gasification Systems included

2014: new EEG
Legislation with
→
much lower feed
in tariffs
→
no more new
CHP plants
run by wood chips
were taken into
operation in Germany



Heat Supply from Renewables-based sources in Germany 2018

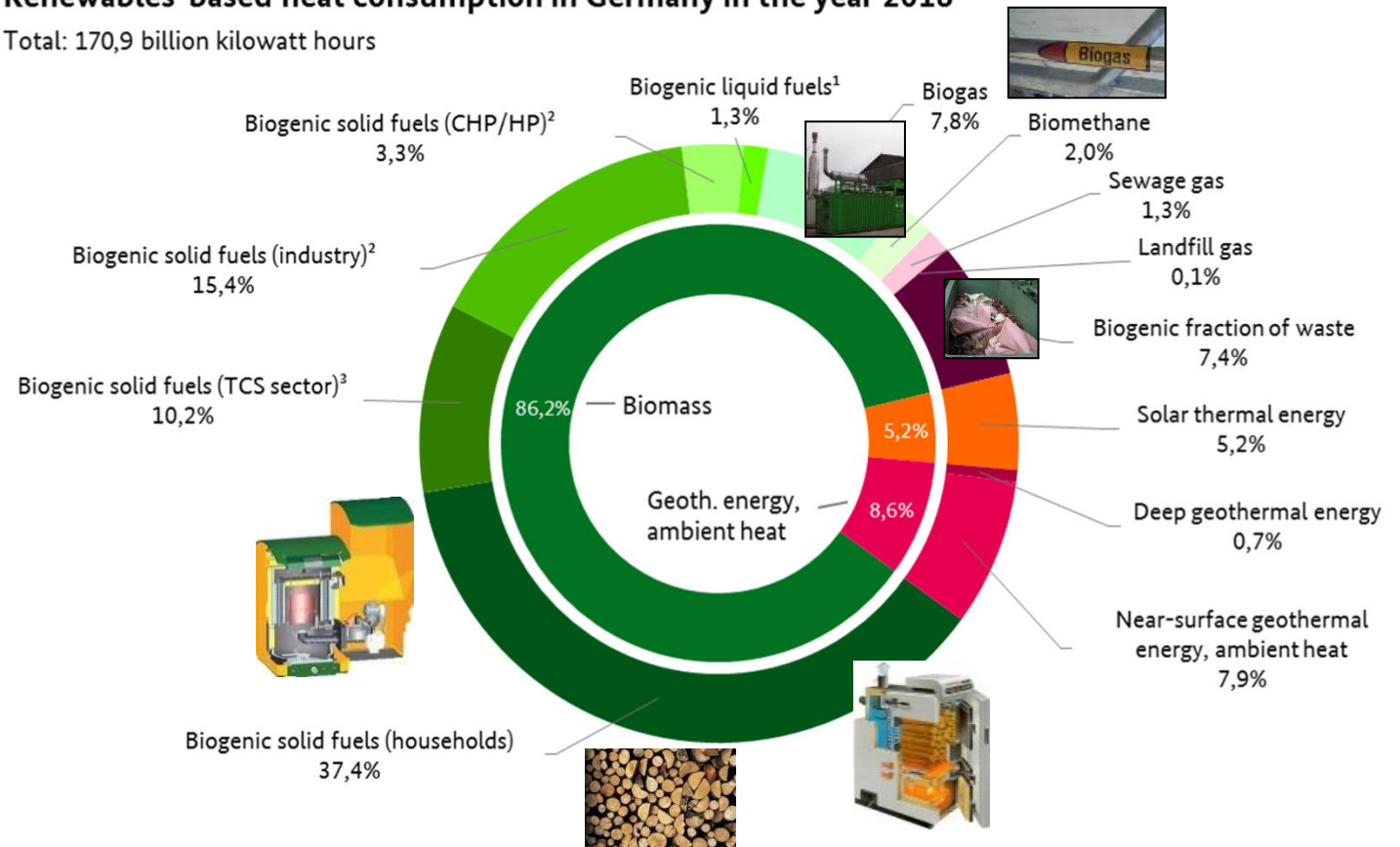
86 % bioenergy share on renewable heat supply → means **12 % of total heat demand in 2018**

~ **8%** from geothermics

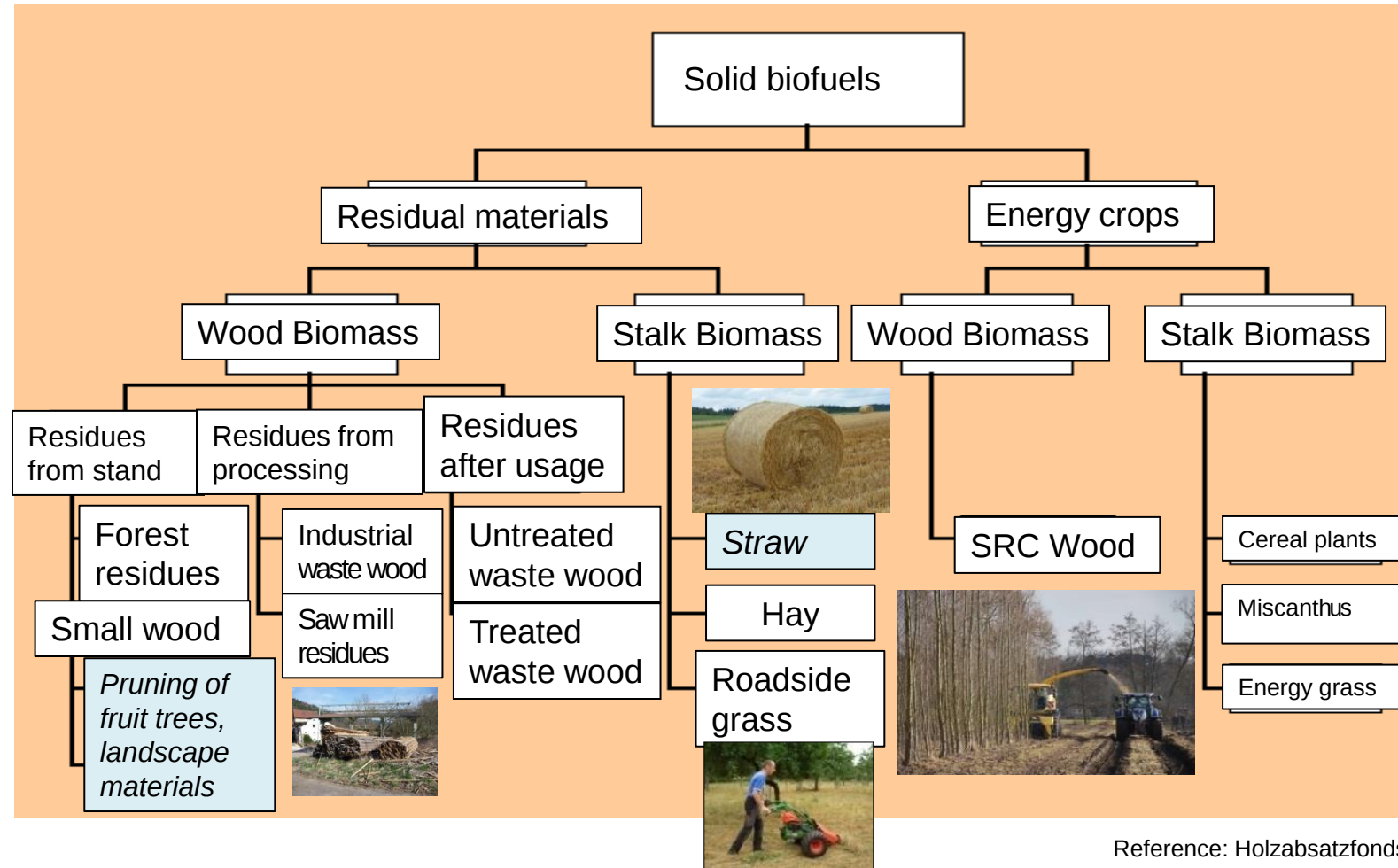
~ **5%** from solarthermics

Renewables-based heat consumption in Germany in the year 2018

Total: 170,9 billion kilowatt hours

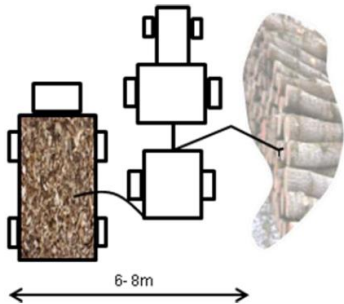


Overview on Solid Biofuels: most important: Forest Residues



Reference: Holzabsatzfonds

Efficient Wood Chipping along the Forest road



- Allocation as decoupled process step with large mobile wood chipper
- On-site chipping can be approved if the truck can approach properly (driveway should be 8-10 m wide, flat and not steep)
- Raw material should be stored consistently with the thicker end horizontally right angled to the forest road
- Feeding of chippers often is organized on the right!
- Highest productivity for round timber is $\varnothing 100 \text{ m}^3/\text{h}$, for forest residues (crown and branches) $\varnothing 75 \text{ m}^3/\text{h}$
- The stronger the chipper's gear the higher the output
- Output/h for softwood > hardwood - knife sharpness is very important!
- Overall efficiency is dependent on adjusting the logistics to the chipper's efficiency – to avoid waiting time!
- Avoid input of soil, stones etc.

Solid Fuels from Tree Cuttings and Landscape Materials in one Efficient Working Step

Transport



Storage



Drying in a
biogas plant



Chipping
and sieving

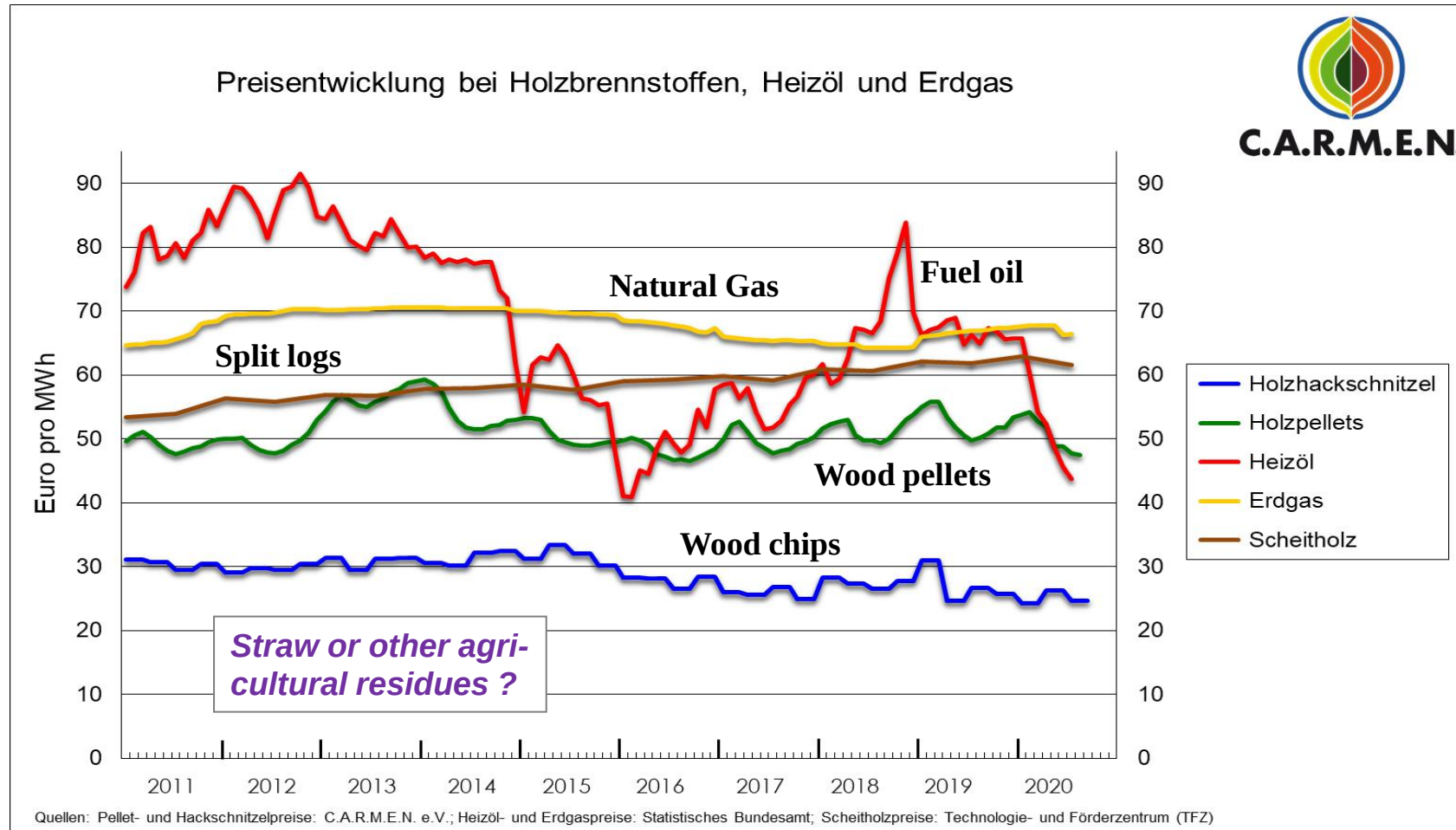
Prices of Solid Biofuels and Fossil Fuels in €-Cent per kWh

Prices for wood chips, wood pellets, split logs and other solid biomass fuels in Germany

									
	Fuel oil	Wood chips (35% H₂O)	Split logs 33 cm	Wood-pellets	corn	Straw	Straw - pellets	Miscanthus	Olive residues (nuclei) in Spain
Current price	0,45 €/l	75 €/t	60 €/m ³	220 €/t	200 €/t	80 €/t	150 €/t	80 €/t	150 €/t
Costs per kWh in €-cent	4,5	2,5	4,0	5,0	4,0	2,0	3,5	2,0	3,5

Price for natural gas: 3 €-Cent up to 8 €-Cent per kWh !!

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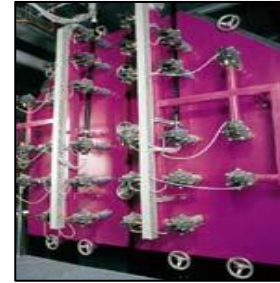


50,000 clicks
per year by
*private clients,
*farmers and
other biomass
*traders, forest
rangers,
*municipalities,
*Engineering
offices ==>
price check
and market
transparency
are essential !!

Structure of Costs of a Biomass Heat Plant (*CHP*) Project

▶ **Capital Investment (amount of annuity) – Overhead costs**

- ▶ Investment for building (heating house, bunker, chimney) and heat pipe
- ▶ wood chip fired boiler; fossil boiler for peak load
- ▶ hydraulic systems, control technology
- ▶ *CHP*: turbine, generator etc.
- ▶ pumps, compressor and other components
- ▶ installation and commissioning
- ▶ technical planning and design, building permission



▶ **Consumption bound costs – variable costs**

- ▶ wood chips, heat oil or natural gas for peak load boiler
- ▶ electricity, waste (ash) management



▶ **Operating and other costs**

- ▶ manpower costs for maintenance and repair, cleaning
- ▶ management, insurances, measurement of fume etc.



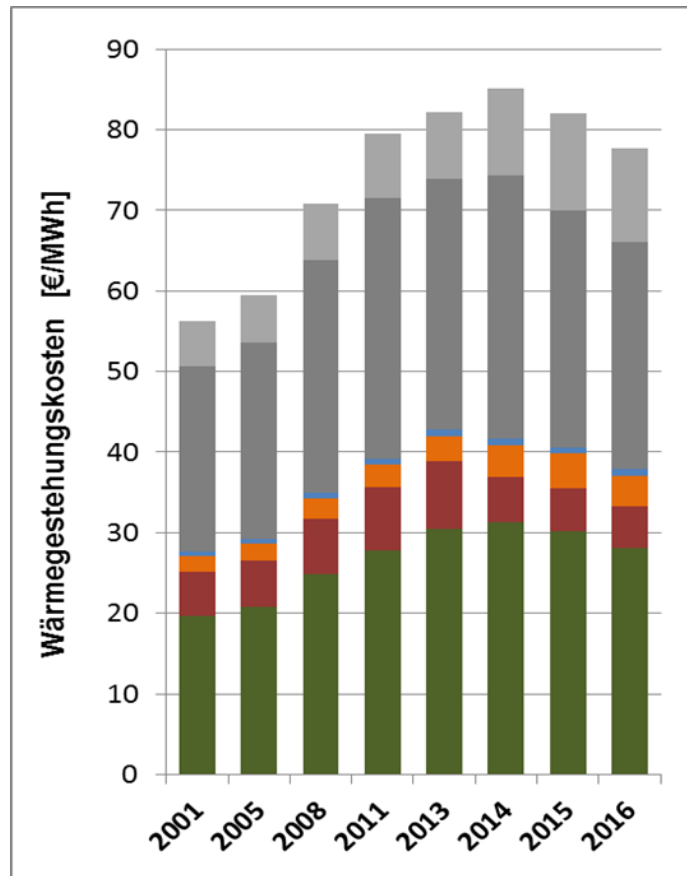
Federal Ministry
for Economic Affairs
and Energy



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Structure of Costs of a Biomass Heat Plant Project (no Heat Pipe)



2019/20: same structure; average full costs 7-8ct/kWh

Structure of costs in %, on the left in €/MWh

- Fuel costs for biomass: ~ 25 - 35 %
 - Fuel costs for gas or fuel oil (peak load) : ~ 5 - 10 %
 - Costs for electricity: ~ 3 - 5 %
 - Capital costs: ~ 30 - 45 %
 - Operating costs: ~ 15 - 20%
 - Costs for waste disposal (wood ashes): 3-5 %
- Fuel costs for (*natural*) biomass with about 25 -35 % of total costs – about the same dimension of share than capital costs (principal and interest costs)
 - → No waste wood or landscape material as biomass fuel calculated! Price for wood chips from forestry in Germany = 2,5 ct/kWh = 75 €/to

Reference Projects no.1: Process Heat in Industry: *Meat Processing*

Lechner GmbH & Co. Höhenrainer KG, Großhöhenrain

Initial Operation	2013
Boiler Output / Steampower	850 kW / 1.300 kg/h
Nominal Pressure	12,5 bar (ü), saturated steam
Heat Supply per Year	3.172 MWh from biomass
Biomass Fuel Requirement	670 tons/a wood pellets
Substitution of Fuel Oil	350.000 l/a
CO ₂ -Avoidance per year	950.000 kg/a



Reference Projects no.2: Process Heat in Industry: *Industrial Laundry*

TopClean Wäscherei GmbH, Lohberg

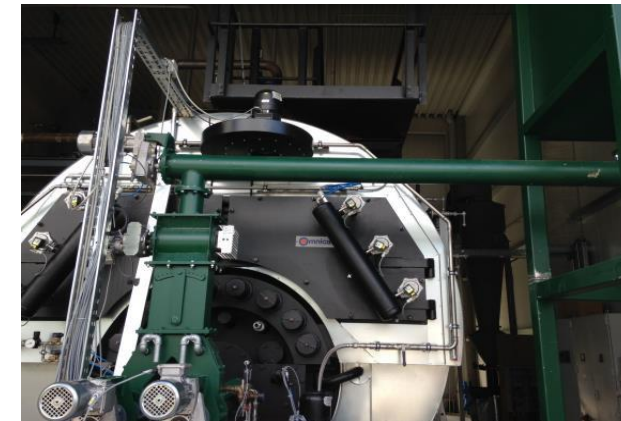
Initial Operation	2014
Boiler Output / Steampower	2,000 kW / 3,000 kg/h
Nominal Pressure	12 bar (ü), saturated steam
Heat Supply per Year	4,108 MWh from biomass
Biomass Fuel Requirement	1,000 tons/a wood pellets
Substitution of Fuel Oil	500,000 l/a
CO ₂ -Avoidance per year	1,350,000 kg/a



Reference Projects no.3: Process Heat in Industry: *Fruit Juice Industry*

Güldenchron Fruchtsaft, Nistertal

Initial Operation	2015
Boiler Output / Steampower	2,000 kW / 3,000 kg/h
Nominal Pressure	12 bar (ü), saturated steam
Heat Supply per Year	4,468 MWh from biomass
Biomass Fuel Requirement	1,000 tons/a wood pellets
Substitution of Fuel Oil	500,000 l/a
CO ₂ -Avoidance per year	1,340,000 kg/a + District Heating



Reference Projects no.4: Process Heat in Industry: *Whiskey Distillery*

Ncn'ean Distillery, Drimnin, Scotland

Initial Operation	2017
Boiler Output / Steampower	800 kW / 1,300 kg/h
Nominal Pressure	13 bar (ü), saturated steam
Heat Supply per Year	2,000 MWh from biomass
Biomass Fuel Requirement	500 tons/a wood chips
Substitution of Fuel Oil	220,000 l/a
CO ₂ -Avoidance per year	600,000 kg/a



Reference Projects no.5: Process Heat in Industry: *Powder Coating*

Multicolor GmbH, Lauffen a. Neckar

Initial Operation	2018
Boiler Output / Steampower	3,200 kW / 4,200 kg/h
Nominal Pressure	28 bar (ü), overheated steam 300°C
Heat Supply per Year, CHP	13,400 MWh biomass, 300 kWel.
Biomass Fuel Requirement	5,000 tons/a „used wood“ AI/AII
Substitution of Fuel Oil	2,100,000 l/a
CO ₂ -Avoidance per year	3,990,000 kg/a



Reference Projects no.6: CHP in the City of Landshut: *Conversion of a Waste Incinerating Plant to Solid Biomass (Landscape Material)*

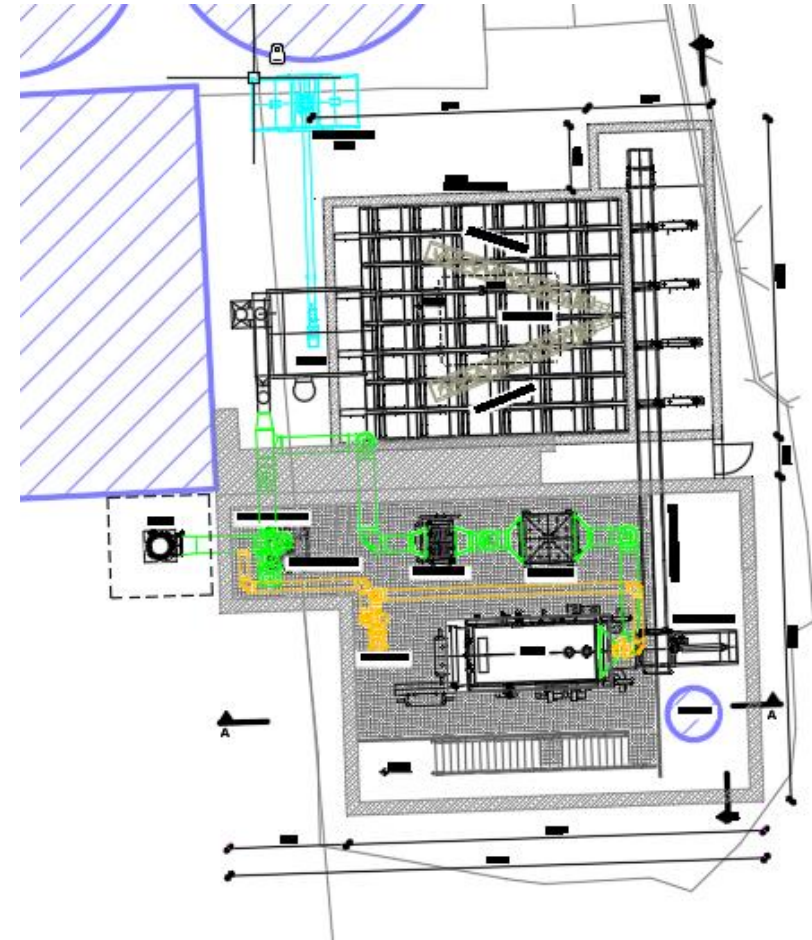
Initial Operation	2012/13
Furnace Thermal Capacity	17,500 MW
Heat Supply per Year	61,000 MWh from biomass
Heat Supply per Year for	➔ 4,000 Households
Electrical Output of Turbine	4 MW ➔ 19,000 MWh
Electricity Supply per Year for	➔ 5,800 Households
Biomass Fuel Requirement	66,000 tons/a wood chips from landscape material
CO ₂ -Avoidance per year	24,000,000 kg/a



<https://eta-energieberatung.de/projekte/umnutzung-mva/>

Reference Projects in progress nr.1: *Malthouse*

Initial Operation	Project in progress
Boiler Output	2,500 kW
Nominal Pressure	Hot water, no steam
Heat Supply per Year	Est. 10,000 MWh from biomass
Biomass Fuel Requirement	2,500 tons/a wood chips
Substitution of Fuel Oil	2,100,000 l/a
CO ₂ -Avoidance per year	1,000,000 kg/a



Reference Projects in progress nr.2: *Canning Factory*

Initial Operation

Boiler Output

Nominal Pressure

Heat Supply per Year, KWK

Biomass Fuel Requirement

Substitution of Fuel Oil

CO₂-Avoidance per year

Permission in progress

3,000 kW, 250 kWel.

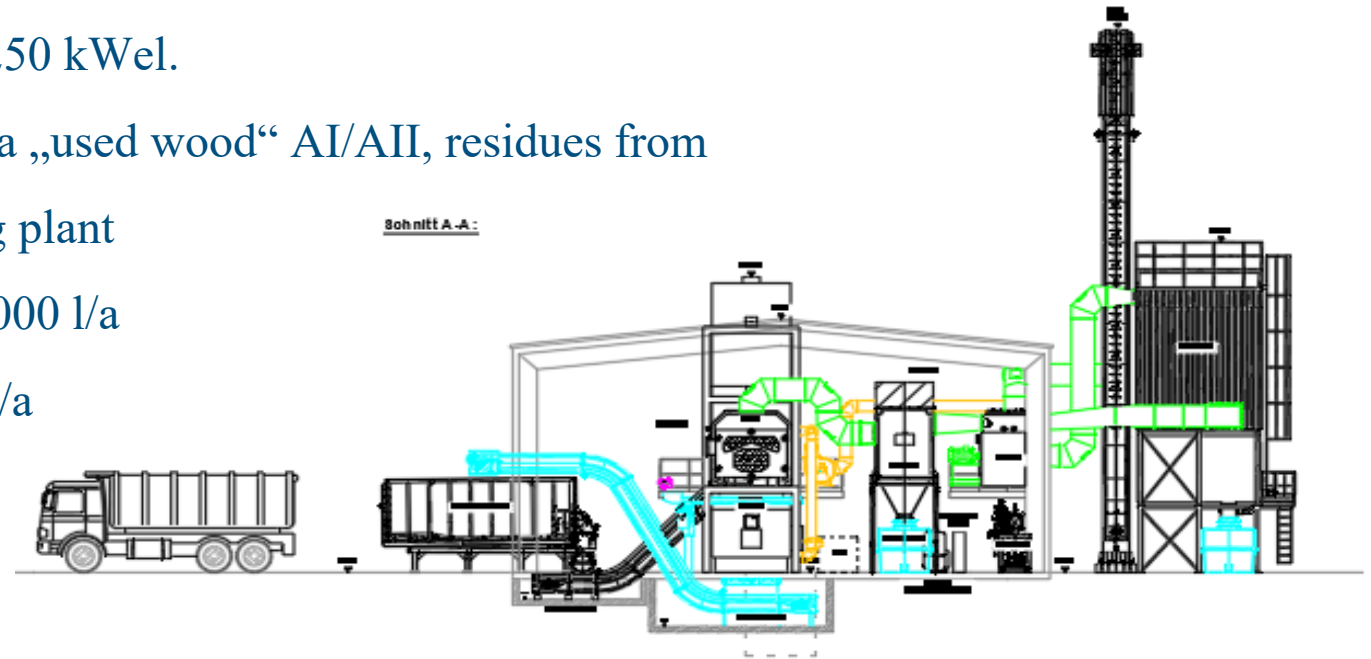
Saturated steam 12 bar (ü)

3 MWth., 250 kWel.

7,000 tons/a „used wood“ AI/AII, residues from
composting plant

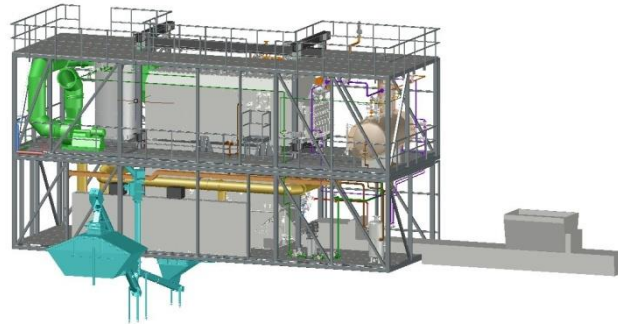
Est. 2,000,000 l/a

810,000 kg/a



Reference Projects in progress nr.3: *Distillery, Scotland*

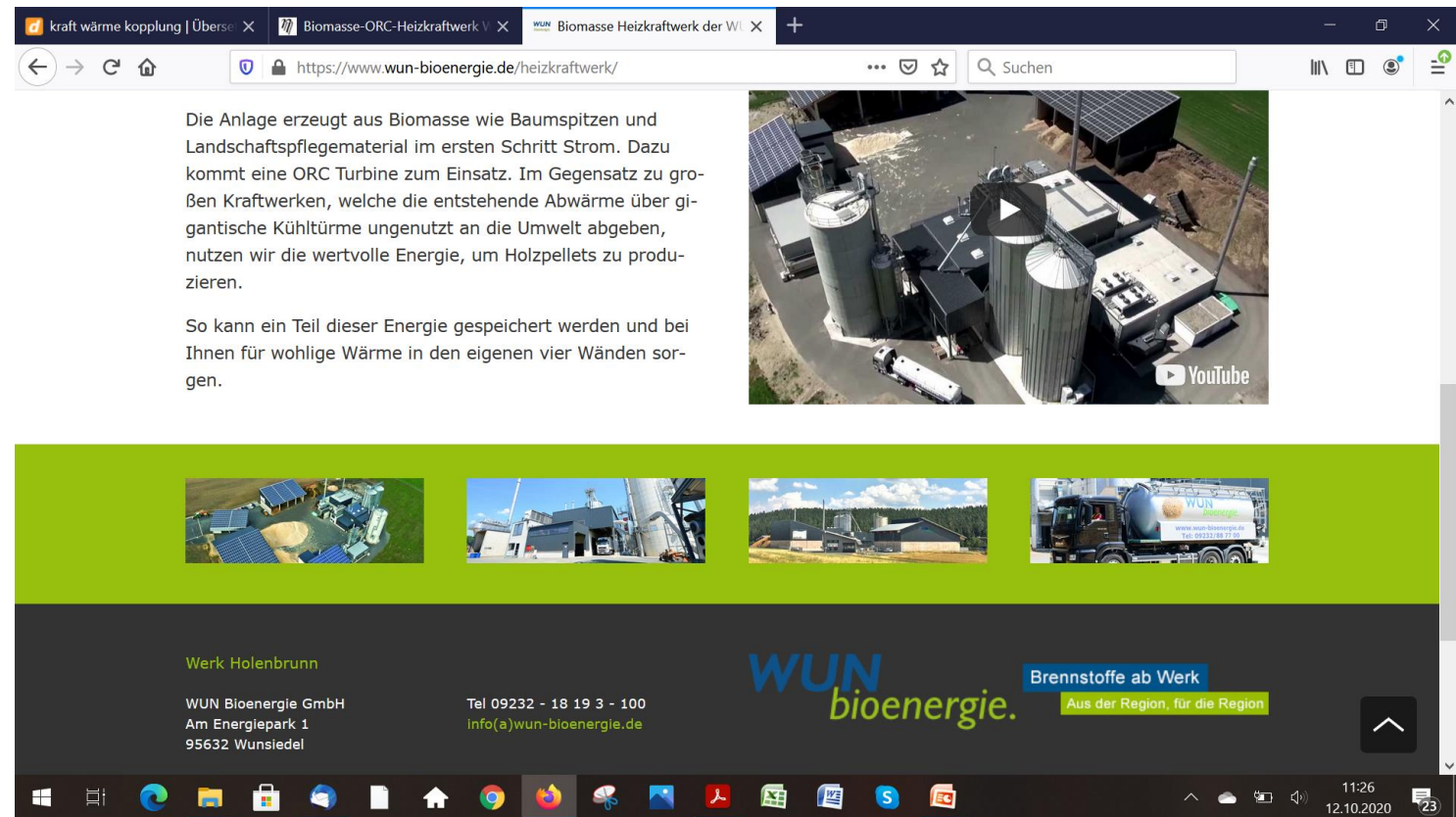
Initial Operation	Est.: 4. Quarter in 2020
Boiler Output / Steampower	3,000 kW / 4,400 kg/h
Nominal Pressure	13 bar (ü), saturated steam
Heat Supply per Year	13,500 MWh from biomass
Biomass Fuel Requirement	5,500 tons/a wood chips
Substitution of Fuel Oil	Est.: ca. 2.000,000 l/a
CO ₂ -Avoidance per year	3,990,000 kg/a



Reference Projects no.5: Process Heat in Industry: *Wood Pellet Plant*

WUN Bioenergie GmbH, Wunsiedel → <https://www.wun-bioenergie.de/heizkraftwerk/>

- Lighthouse Project for a Circular Economy Concept
- Pellet Production from Local Sawmill Residues
- CHP by ORC-Turbine – Biomass from local Forestry
- Electricity in Public Grid
- Heat Supply for Drying of Pellet Feedstock (Sawdust)
- Pellets sold to end-users
- Pellets used in local CHP Wood Gasification Systems with local District Heating
- <https://eta-energieberatung.de/referenzen/>





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Bioenergy from Solid Biomass in Industry- an Common and Reliable Strategy!

Thank you for your attention!

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13th of November 2020

