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Potential of Biomass CHP in the WBP production

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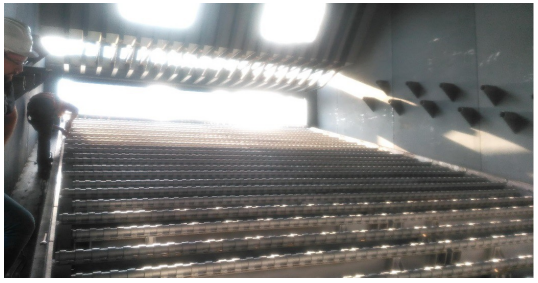
ITI Engineering is a Company established in 1985 with the aim of designing and manufacturing Biomass plant to the Wood Industry.
ITI Engineering has experience in Biomass fired CHP plants with Steam Rankine Cycle and Organic Rankine Cycle.
Since 1985 ITI Engineering has delivered 26 Biomass fired plants in Particle Boards and MDF production.



Object of presentation:

- Implementation of CHP in Biomass fired systems

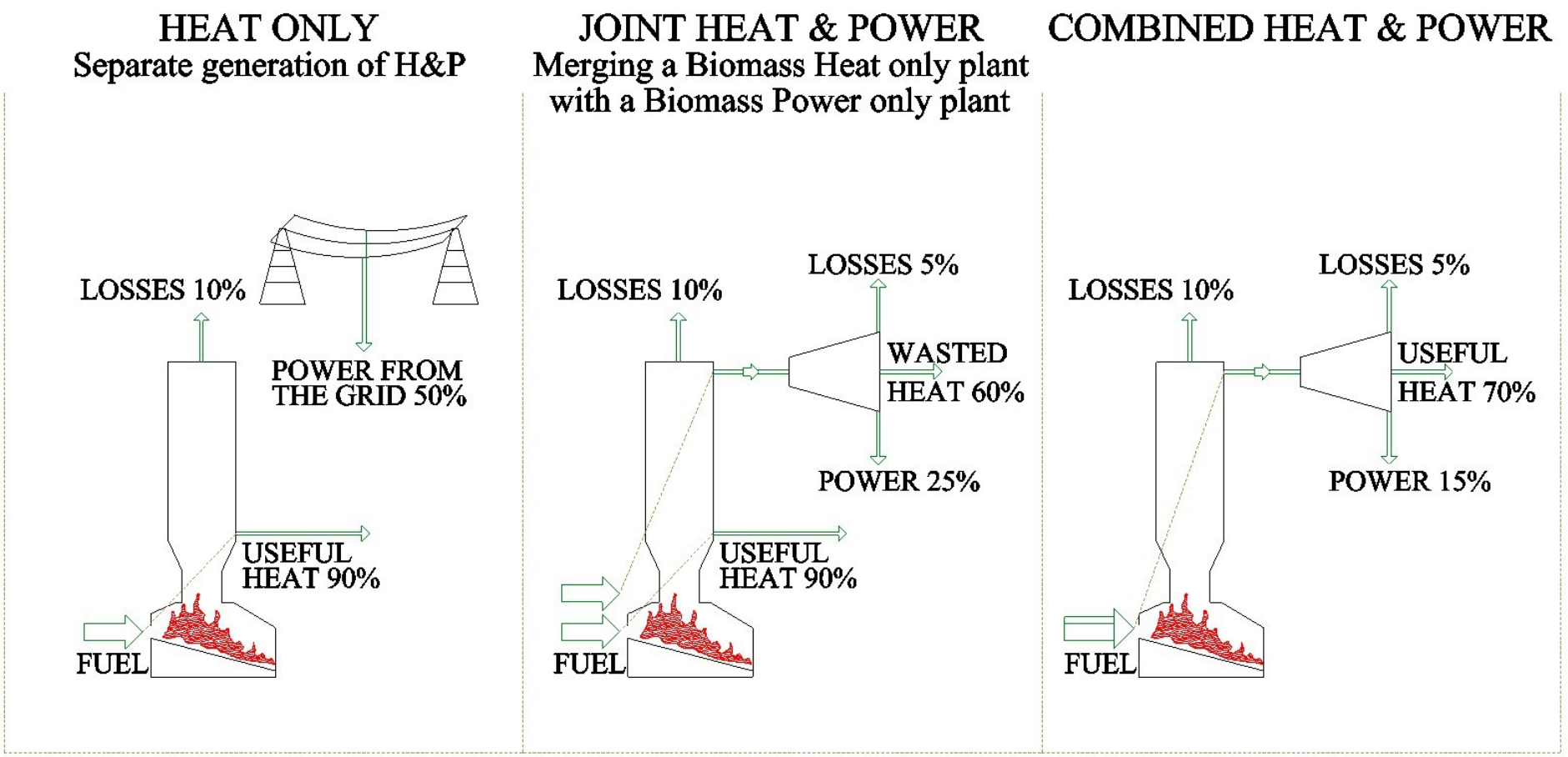
Assumptions:

- Biomass fired plants for heat only production are the reference background
- Only Energy aspects about drying technologies have been taken into consideration

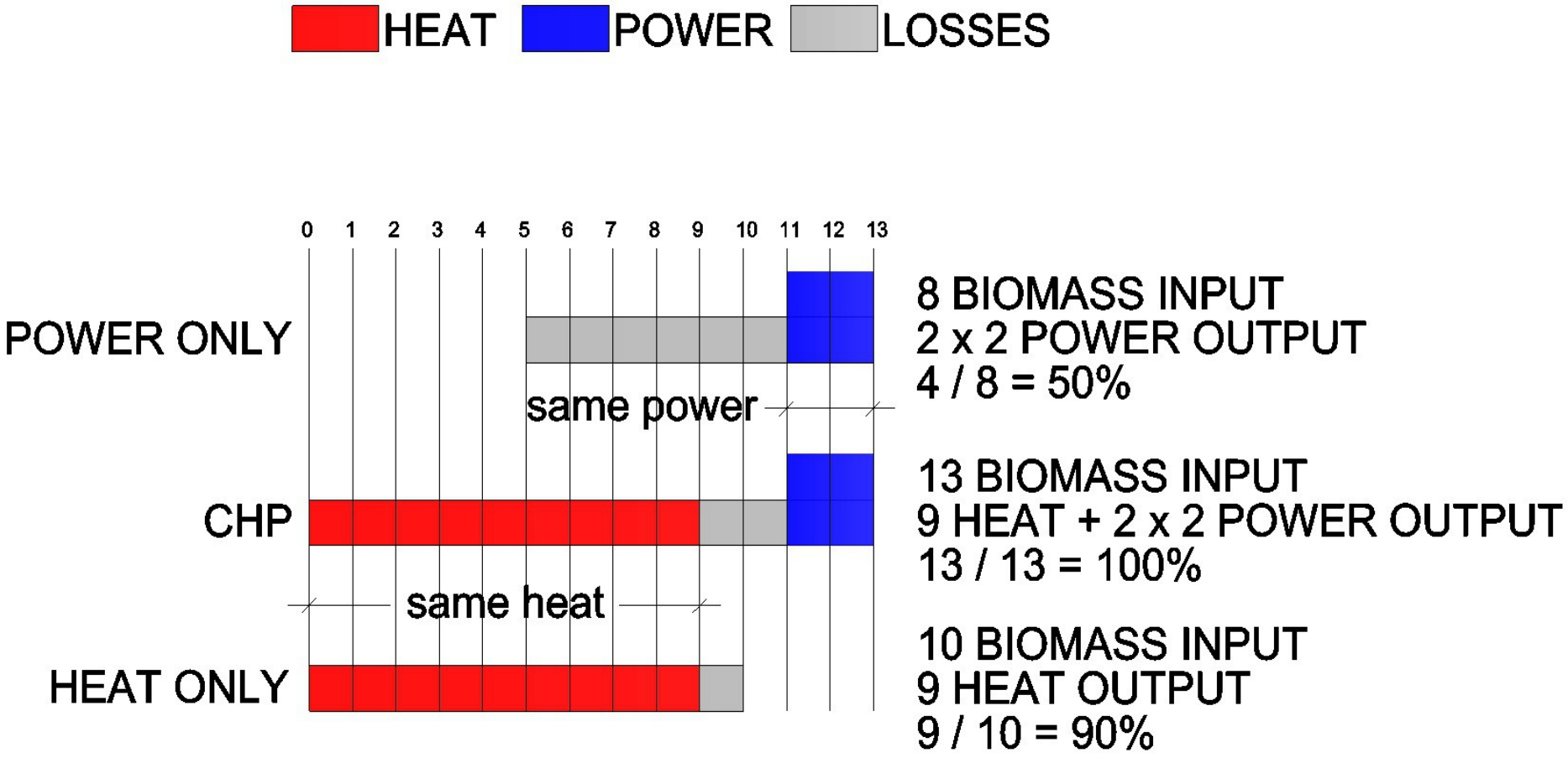
Structure of presentation:

- Basis of Biomass CHP Thermodynamics
- Biomass-Fired CHP Technologies
- Implementation of Biomass-Fired CHP in PB, OSB, MDF

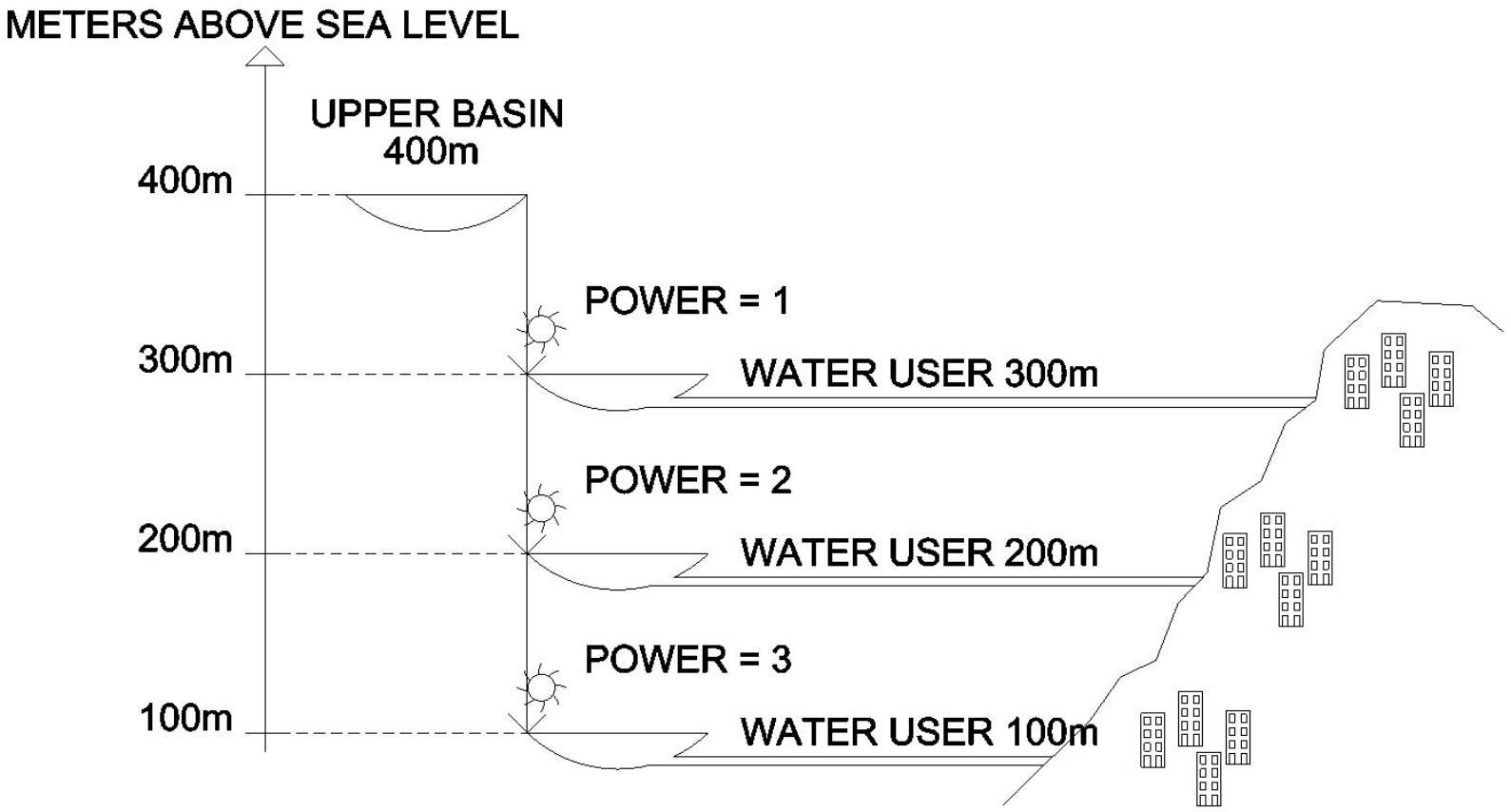
How Heat and Power can be supplied to the production process



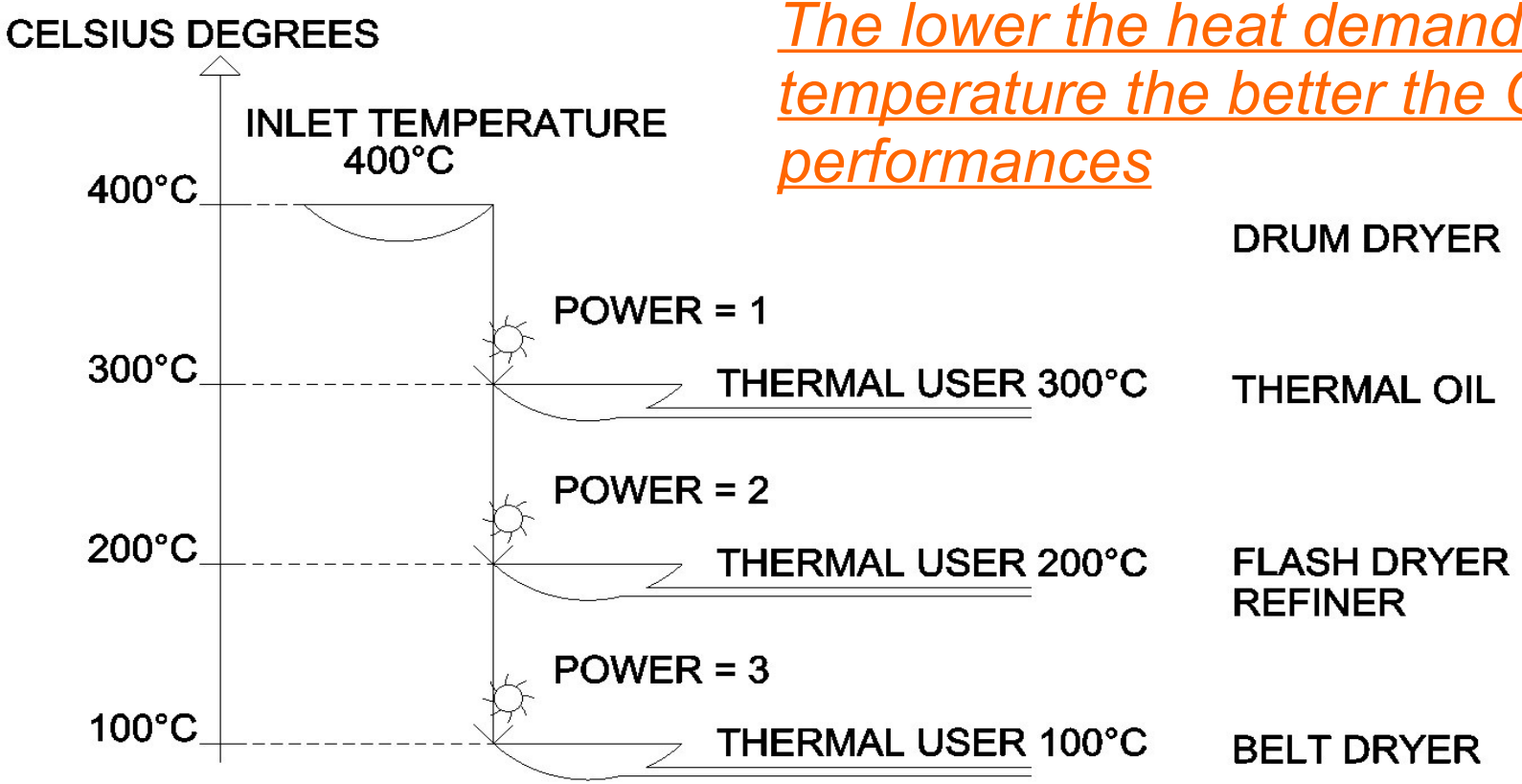
CHP is the clever way to convert Biomass into useful energy



Hydropower
Power = water flow x Dh x η



Thermodynamics
Power = heat flow x Dt x η



The lower the heat demand temperature the better the CHP performances

Suitable Biomass fired CHP technologies to WBP production

Mature technologies

Steam Rankine Cycle (SRC)

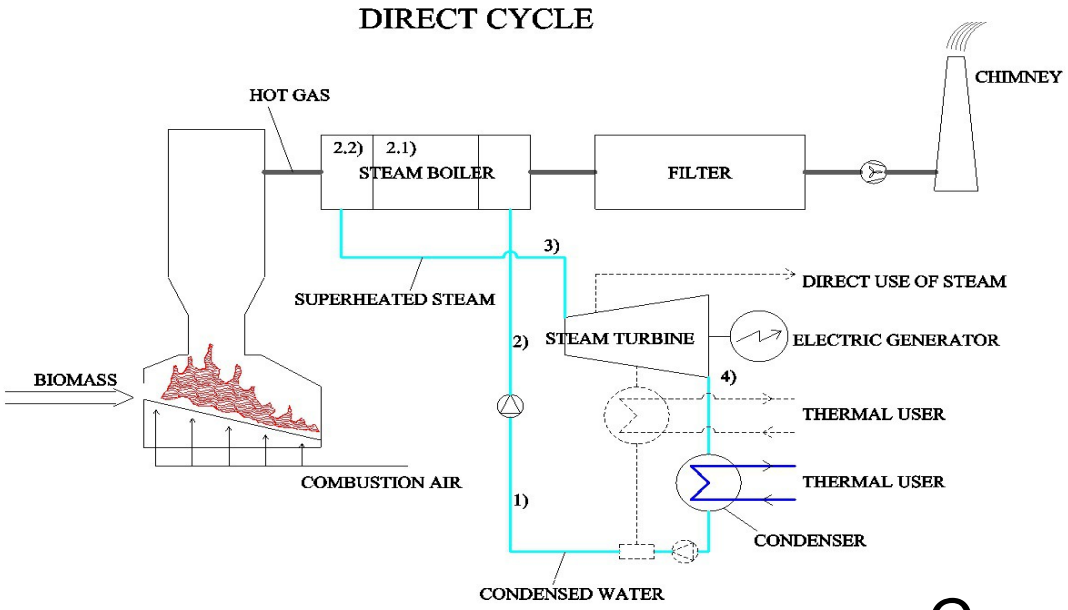
Organic Rankine Cycle (ORC)

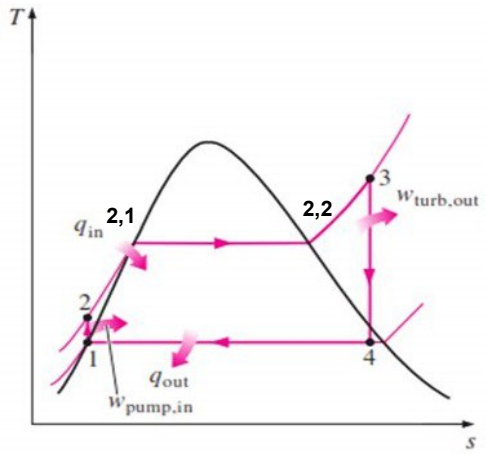
Prospective developments

Externally Fired Gas Turbine (EFGT)

High Temperature Organic Rankine Cycle

Steam Rankine Cycle





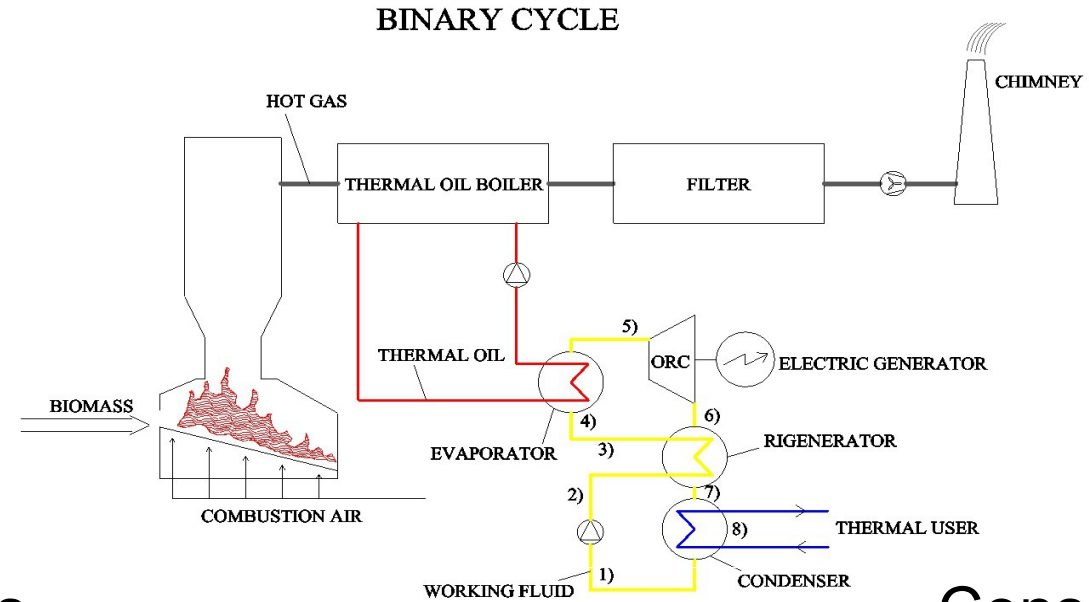
Pros

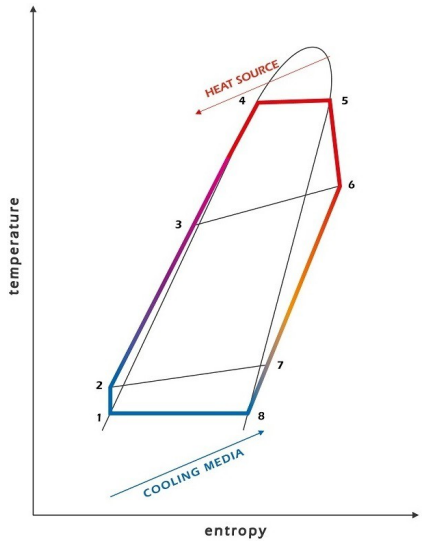
- Very mature technology
- High efficiency
- Many levels of cogenerated heat temperature are possible

Cons

- High pressure superheated steam boiler needed
- Qualified operators needed
- Water treatment and consumption

Organic Rankine Cycle





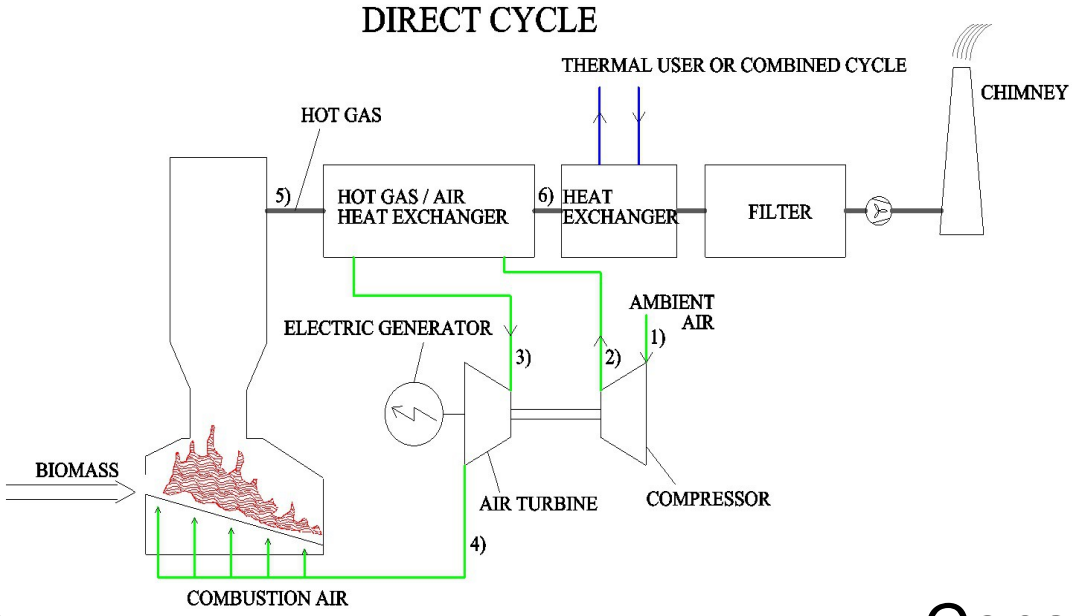
Pros

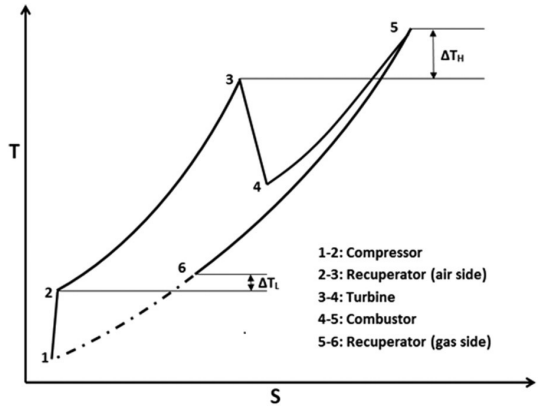
- Thermal oil as heat medium
- No water consumption
- Easy to operate

Cons

- Low temperature cogenerated (unless HT ORC are used)
- High aux consumption

Externally Fired Gas Turbine





Pros

- High performances with high temperature heat demand
- Feasible to combined cycle

Cons

- Critical high temperature heat exchanger
- Only few references
- Sensitivity to biomass quality

Biomass fired CHP in WBP production

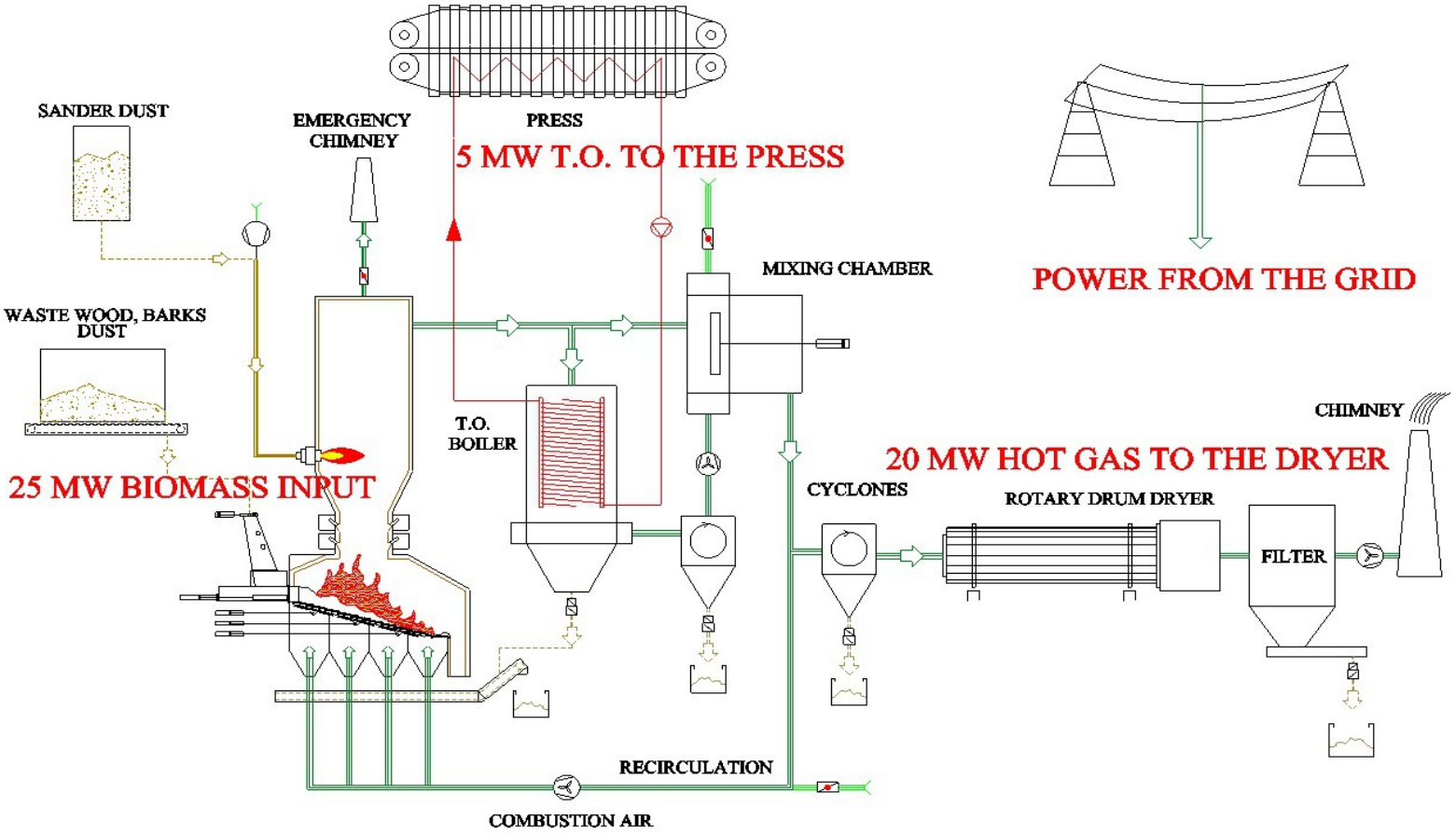
PB and OSB:

- Biomass fired Joint Heat & Power (Rotary Dryer)
- Biomass fired Combined Heat & Power (Belt Dryer)
- Economic Feasibility Study

MDF:

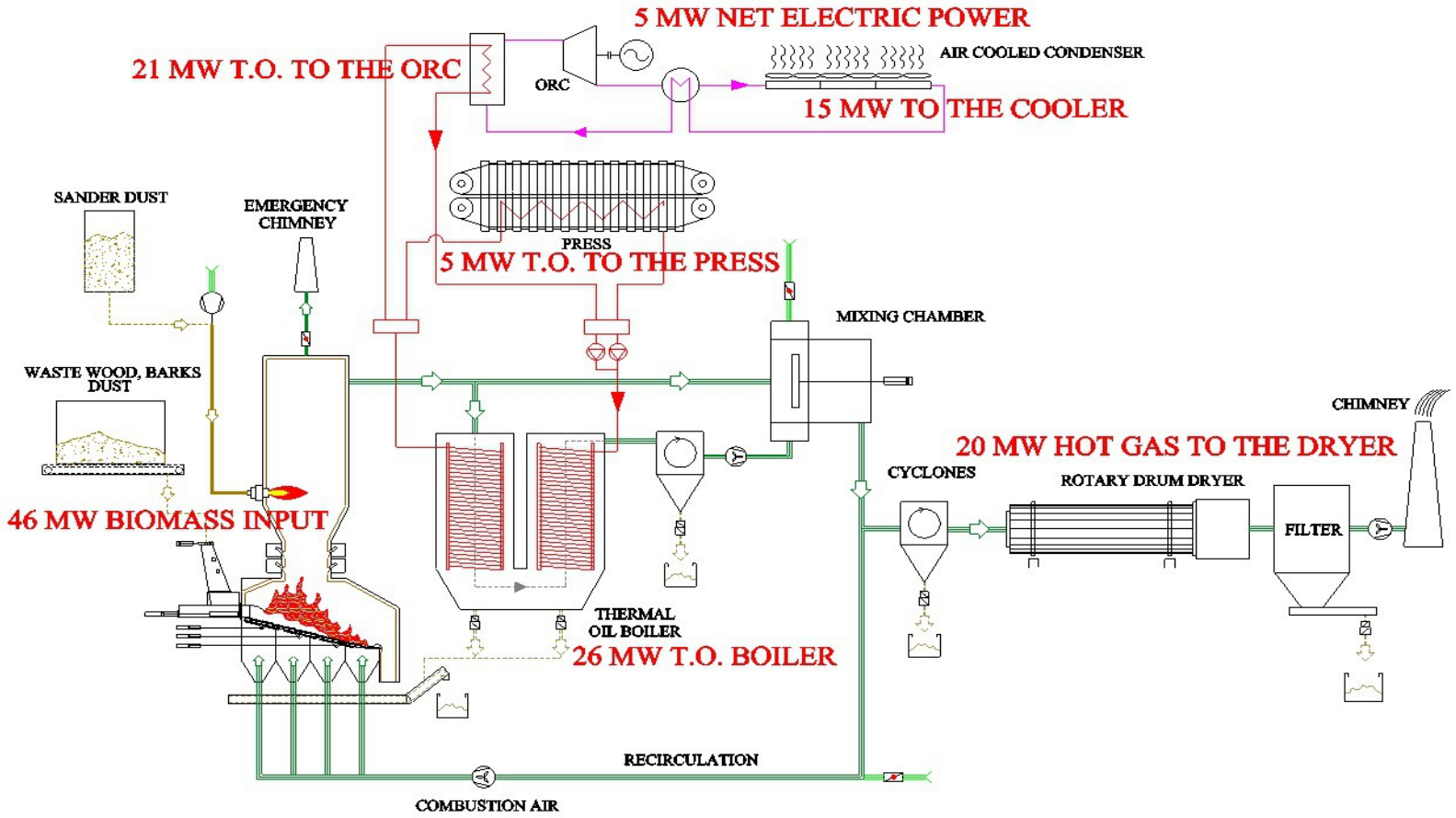
- Biomass fired Combined Heat & Power scenarios

Conventional Heat only Energy System in PB or OSB



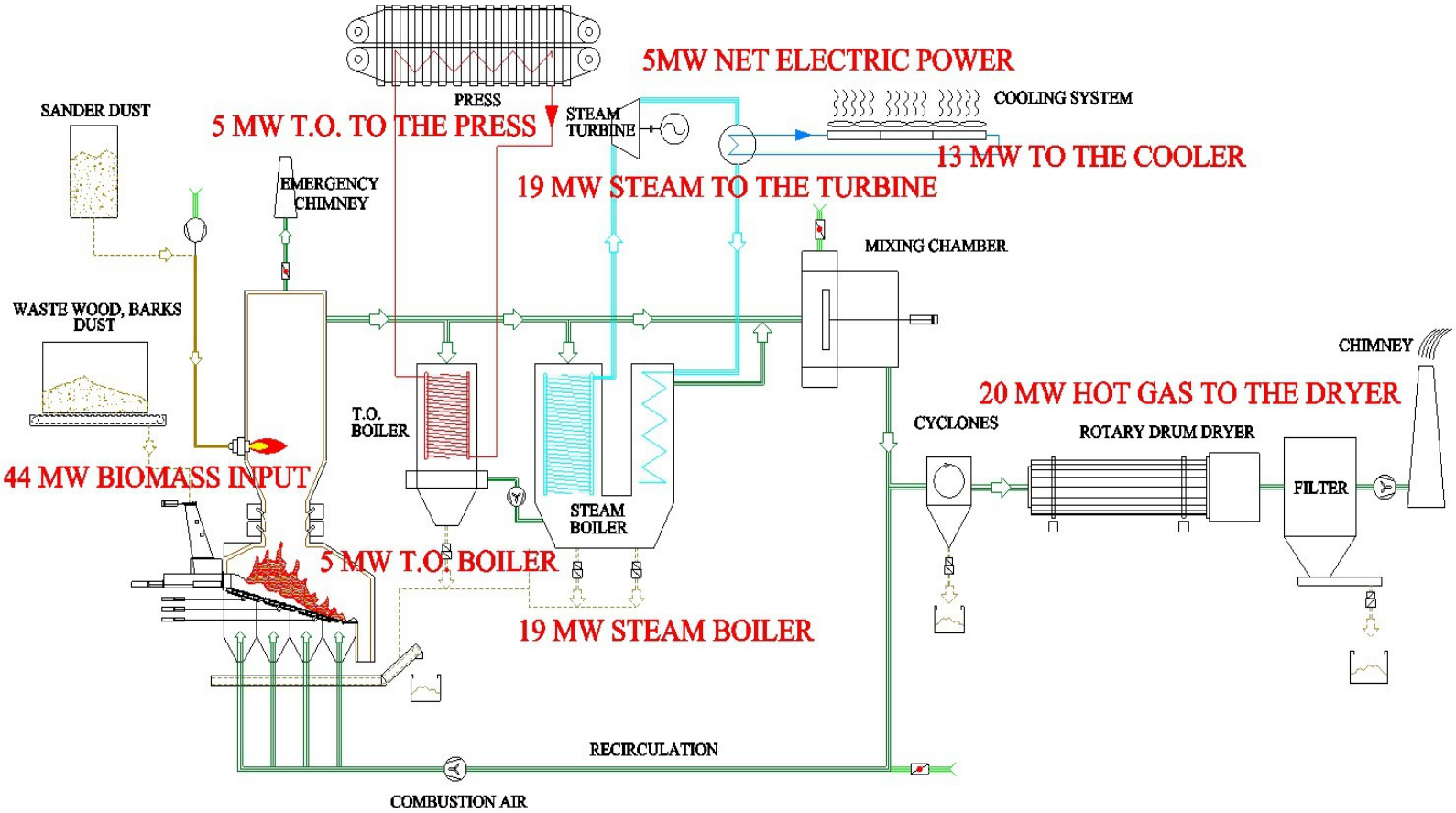
Joint Heat and Power with ORC in PB or OSB

No changes in the drying process



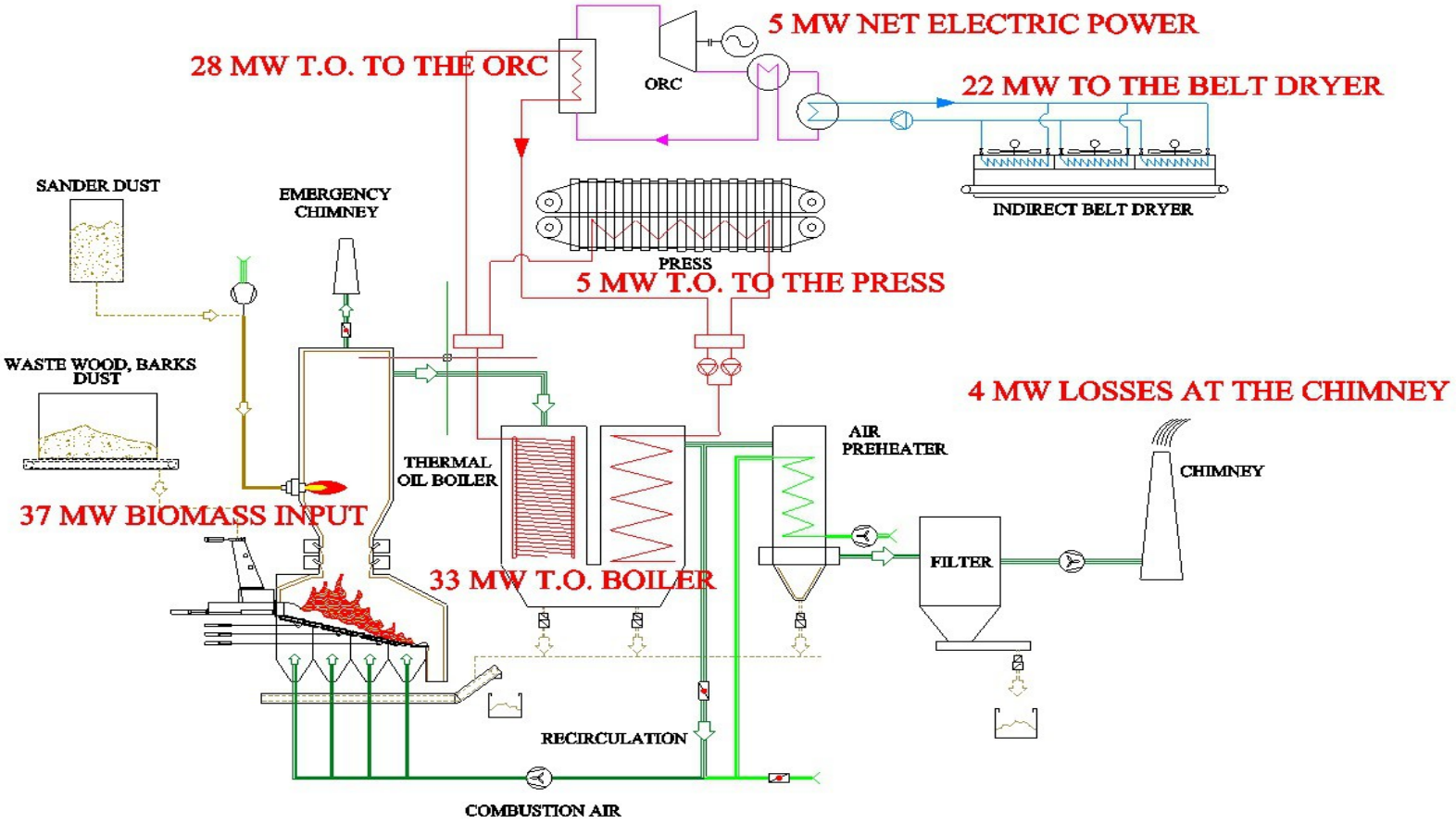
Joint Heat and Power with SRC in PB or OSB

No changes in the drying process



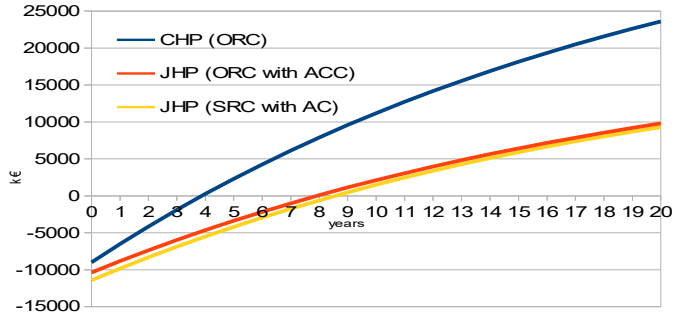
Combined Heat & Power with ORC in PB or OSB

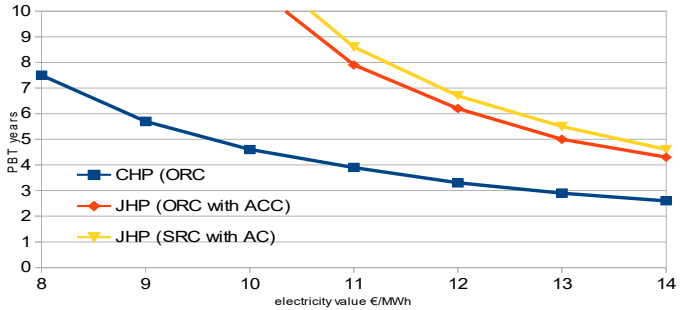
The Rotary Dryer is replaced with a low temp Belt Dryer

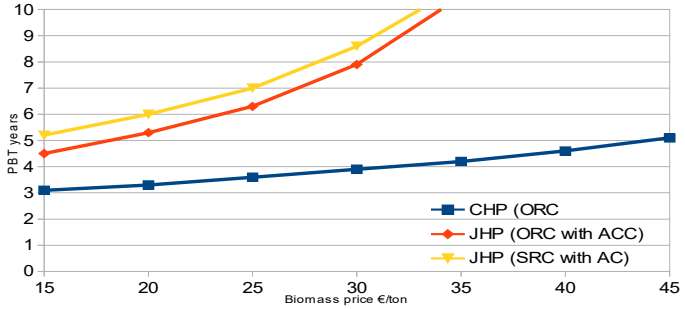


Economic feasibility study

Compared to a 5MW T.O. + 20 MW hot gas plant to PB production				
CAPEX		CHP (ORC)	JHP (ORC with ACC)	JHP (SRC with AC)
TOTAL CAPEX	€	9.460.000	10.890.000	11.990.000
OPEX				
Service, maintenance, other costs	€/a	220.000	260.000	290.000
Total cost for personnel	€/a	90.000	90.000	270.000
TOTAL COSTS O&M	€/a	310.000	350.000	560.000
EFFICIENCY/PERFORMANCE				
Overall combustion size	kW	37.338	46.608	44.160
Upgrading combustion size	kW	12.338	21.608	19.160
Additional biomass consumption	kg/h	4.935	8.643	7.664
Gross electric efficiency	kW	19%	26%	28%
Net power	kW	5.000	5.000	5.000
ECONOMIC RESULTS				
Operating hours	h/a	8.000		
Interest rate	%	5,0%		
Biomass price	€/ton	30		
Ashes disposal	€/ton	100		
Electricity value	€/kWh	0,110		
Biomass cost	€/a	-1.184.439	-2.074.330	-1.839.362
Ashes disposal cost	€/a	-157.925	-276.577	-245.248
O&M	€/a	-310.000	-350.000	-560.000
Annual saving of electricity	€/a	4.400.000	4.400.000	4.400.000
Cash Flow	€/a	2.747.635	1.699.092	1.755.389
IRR 15 years	%	28,4%	13,2%	11,9%
NPV 15 years	€	18.152	6.425	5.934
PBT	year	3,9	7,9	8,6

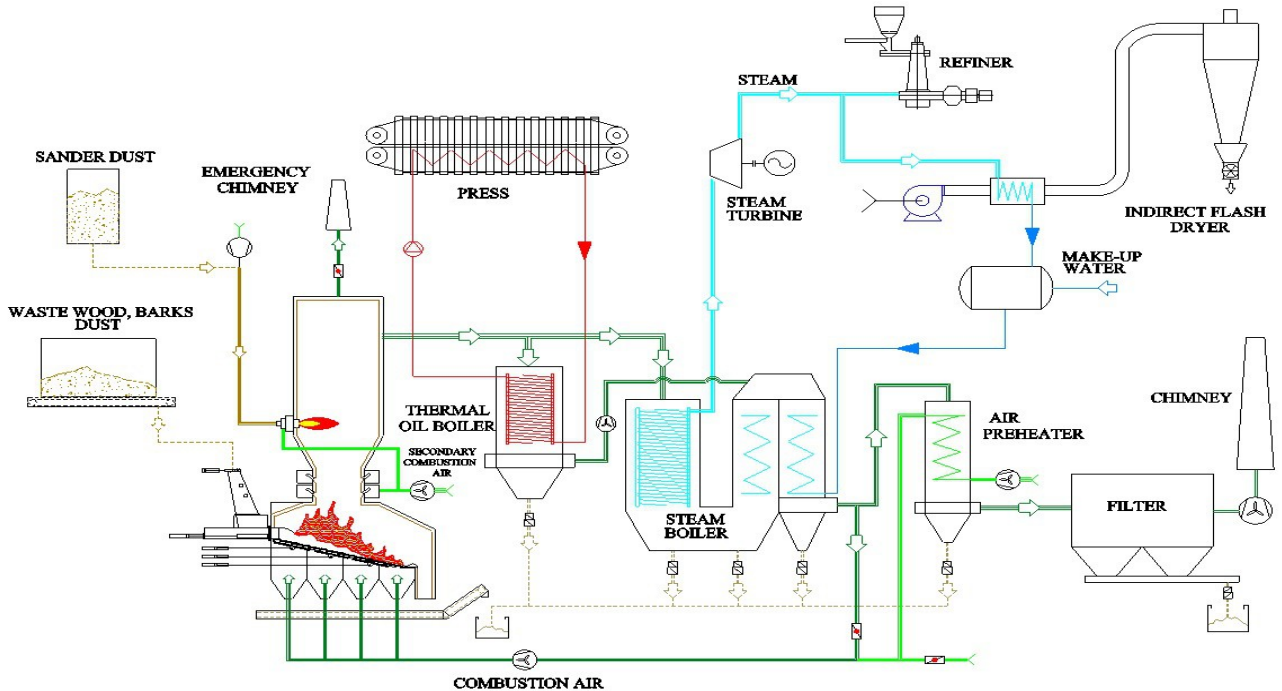






Biomass fired CHP scenarios in MDF production

- CHP is possible with no modification in the Drying process using SRC
- Lower heat demand temperature for drying increases the CHP performances and enable ORC
- Both SRC and ORC are suitable for Joint H&P



Conclusions

- WBPI has favorable conditions to Biomass CHP.
- In PB and OSB the Biomass CHP can be implemented replacing the drum dryers with low temperature belt dryers. Otherwise a Joint H&P is possible.
- In MDF the Biomass CHP can be implemented without modifications in the process, although a lowering of the heat demand temperature is desirable.
- The Steam Rankine Cycle and the Organic Rankine Cycle are suitable and reliable mature technologies.
- The production cost of electricity (LCOE) in CHP mode is competitive with grid price, in Joint H&P mode it depends on Biomass price.
- A wide implementation of biomass CHP in WBPI is technically possible and economically sustainable.

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Thanks for your attention!

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