



clean energy ahead  
**TURBODEN**

**HRS HIGH ELECTRICAL EFFICIENCY UNITS**

TURBODEN European leader in ORC technology for distributed Energy generation

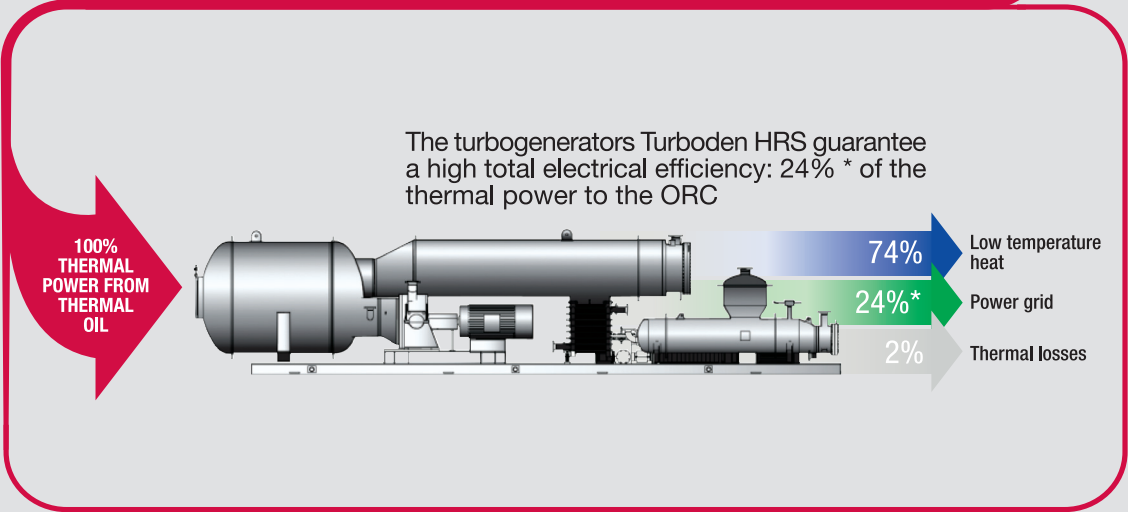
# HRS for electricity generation and cogeneration from biomass

Turboden developed new models of turbogenerators "HRS" capable of ensuring high performance in terms of electrical efficiency in contexts with a strong pre-

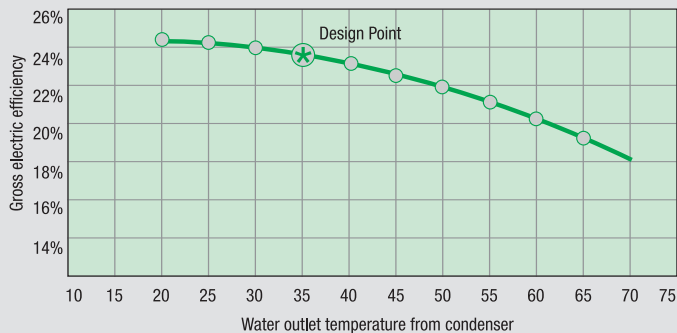
sence of agricultural and forest biomass, but with discontinuous ability to allocate the heat.

HRS models can operate both in dissipative regime, maximizing the electrical output, and in cogeneration, with the opportunity to provide heat to any seasonal thermal load and making the most of the biomass.

pruning of branches, marc, husk and forest chips

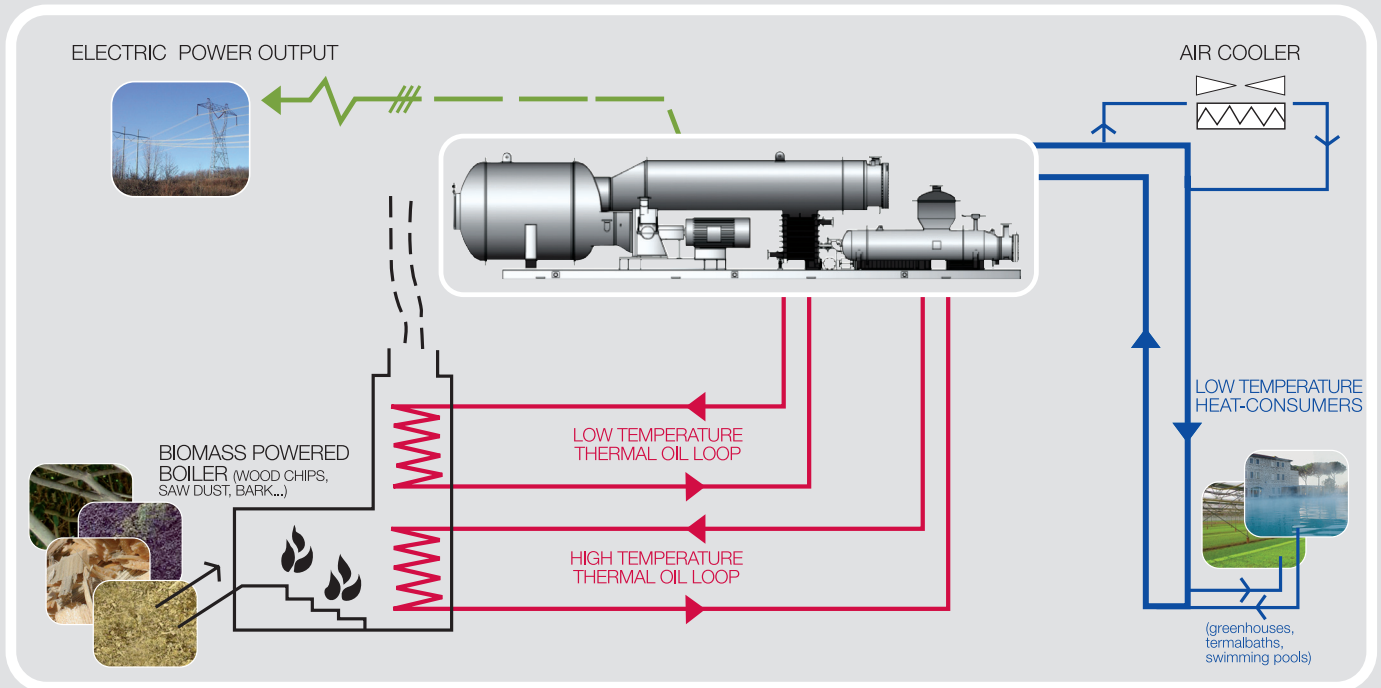


Gross performance of the Turboden HRS modules at various condensation water temperatures



\* Value of gross electrical efficiency calculated as the ratio of electric power output at generator terminals and thermal power input to the ORC in the design point.

# TURBODEN 12 and 24 HRS for BIOMASS application



## HRS for biomass application - Standard Sizes and typical performances

		TURBODEN 12 HRS split*			TURBODEN 24 HRS split*
		Pel=1000 kW standard conditions	Pel=1000 kW cogeneration mode with 60°C	Pel=1156 kW standard conditions	Pel=2312 kW standard conditions
<b>INPUT - Thermal oil</b>					
Nominal temperature "HT" loop (in/out)	°C	315/220	315/225	315/220	315/220
Thermal power input "HT" loop	kW	3840	4405	4425	8850
Nominal temperature "LT" loop (in/out)	°C	220/95	225/95	220/95	220/95
Thermal power input "LT" loop	kW	340	390	390	785
Overall thermal power input	kW	4180	4795	4815	9635
<b>OUTPUT - Cooling water</b>					
Cooling water temperature (in/out)	°C	25/35	50/60	25/35	24/37
Thermal power to the cooling water	kW	3115	3735	3585	7175
<b>PERFORMANCES</b>					
Gross electric power	kW	1000	1000	1156	2312
Gross electric efficiency		23,9%	20,8%	24,0%	24,0%
Captive power consumption	kW	34	53	44	88
Net active electric power output	kW	966	947	1112	2224
Net electric efficiency		23,1%	19,7%	23,1%	23,0%
Electrical generator		asynchronous triphase L.V.	asynchronous triphase L.V.	asynchronous triphase M.V.	asynchronous triphase M.V.
Plant size		single skid	single skid	single skid	multiple skid
Biomass consumption**	kg/h	1827	2096	2105	4211

\* The Turboden split system allows maximizing power production for a given biomass consumption

\*\* Assuming a low heat value of biomass=2,6 kWh/kg and boiler efficiency=0,88. The thermal oil boiler is not included in the Turboden scope of supply.