



4,4 MWe gas engine CHP on natural gas - Case Study -

Technical and Performance Direction
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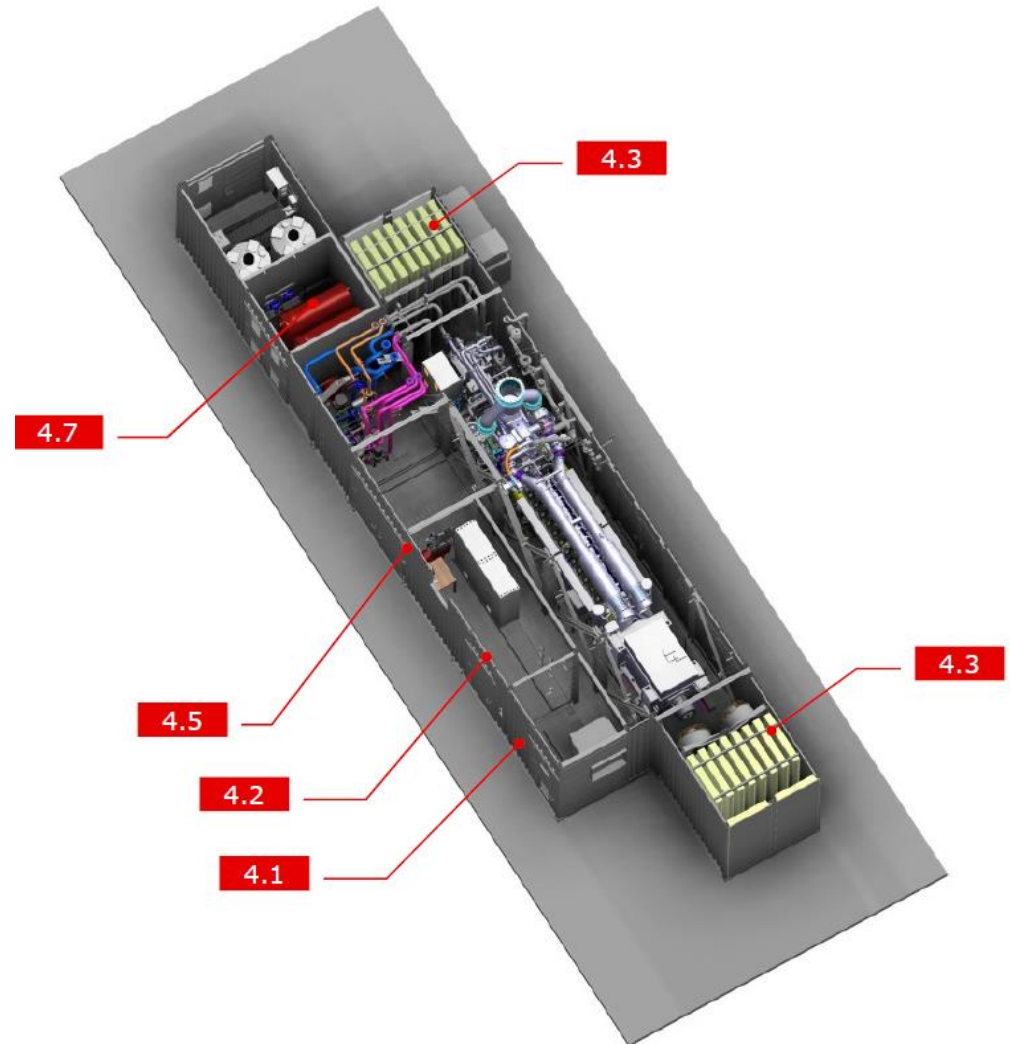
Summary of Iasi DHN

- Heat sales - **250 GWh/yr**
- Network length - **223 km**
- Number of substations: **376**
- Peak demand: **182 MWt**
- 2 x Heat Source:
 - ❖ CET I (summer operation)
 - ✓ Heat production only plant
 - ✓ Natural gas fired (distribution network)
 - ✓ 3 x HWB (116 + 116 + 58 MWt)
 - ✓ Annual average efficiency: 91,88%
 - ❖ CET II (winter operation)
 - ✓ Cogeneration power plant
 - ✓ Primary/secondary fuel: Coal / Heavy Fuel Oil
 - ✓ 2 x 420 t/h steam boilers + 2 x 50 MWe steam turbines
 - ✓ Annual average efficiency: 67,38%



Proposed solution

- 4,4 MWe internal combustion engine
- Natural gas fired
- High Efficiency Cogeneration
- Hot water thermal output
- Containerized solution
 - ❖ 6 containers
 - ❖ 11 trucks transport



Technical description

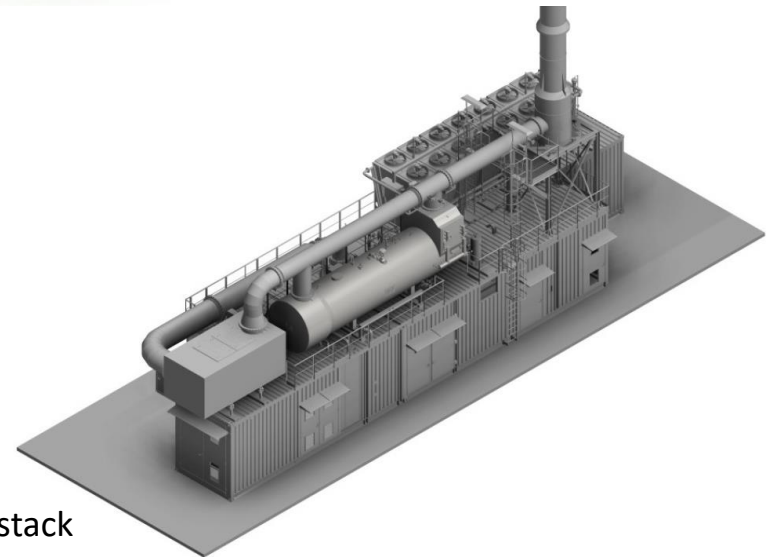
➤ JMS 624 GS-N.L, Version H, GE Jenbacher

- ❖ Natural gas fired, internal combustion engine (Otto)
- ❖ V60°, 4 stroke, 24 cylinders
- ❖ 1500 rpm
- ❖ 6,3 kV electric generator (Leroy-Somer)
- ❖ Genset weight - 30 tons

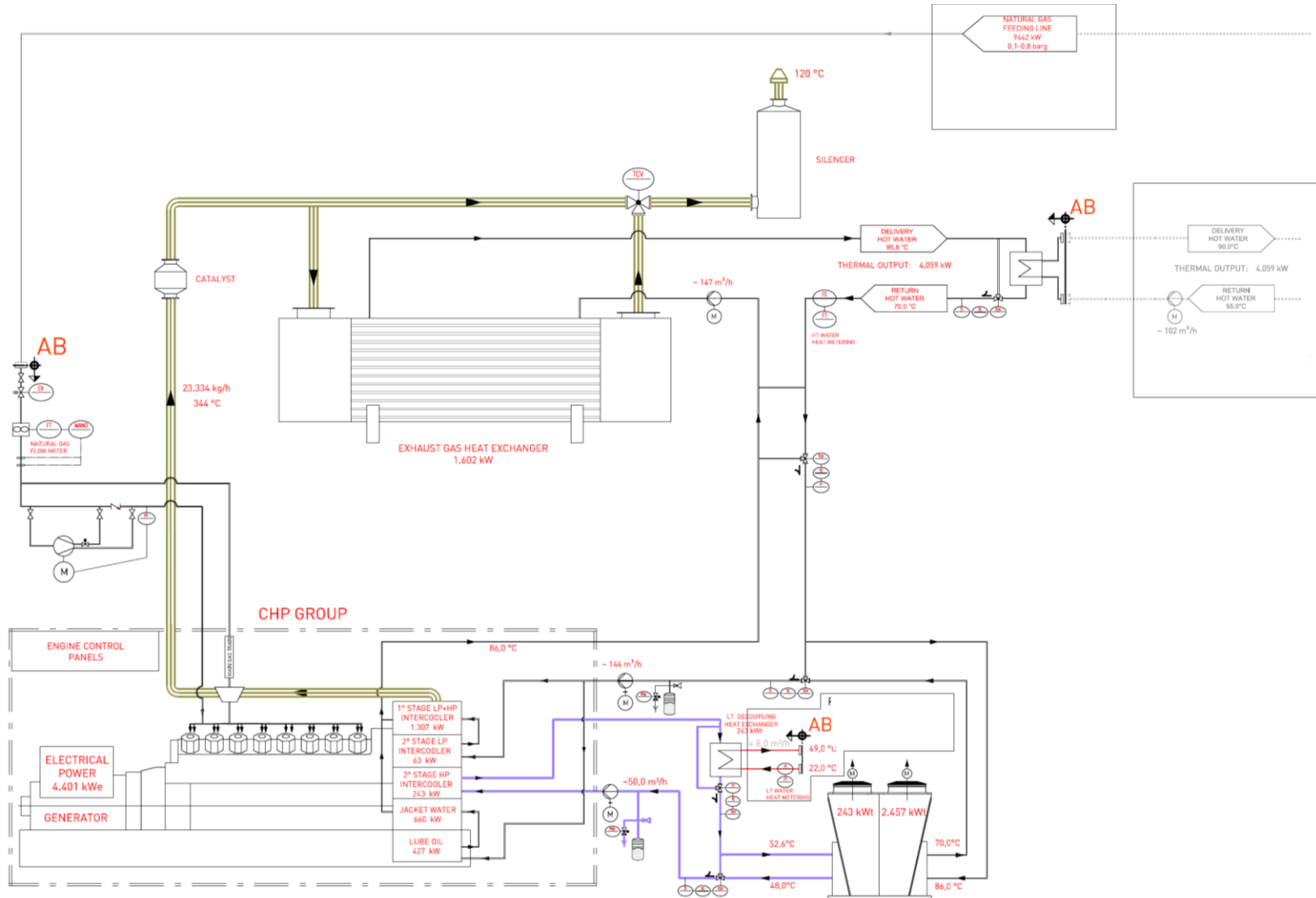


➤ ECOMAX 44 NGS (packager – AB Impianti, Italy)

- ❖ Containerized solution
- ❖ Carbon steel structure with noise insulation (rock wool)
- ❖ Ventilation system
- ❖ Gas compression system
- ❖ Heat recovery circuits
- ❖ Dissipation circuit (dry cooler)
- ❖ Lube oil system
- ❖ Stainless steel exhaust gas heat recovery, piping, silencer, stack
- ❖ Generator MV panels, LV panels, metering
- ❖ Unit control panel
- ❖ SCADA supervisory system

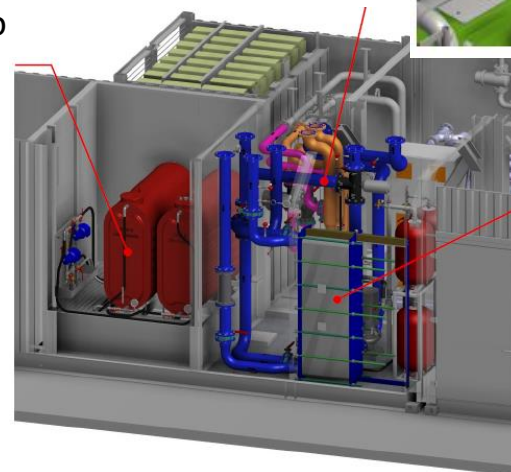
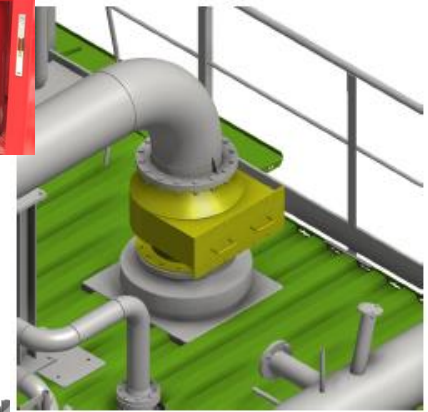


Functional diagram



Project highlights

- **First** JMS 624 (4,4 MWe) containerized engine installed
 - ❖ in Romania
 - ❖ in Veolia Worldwide
- **First** 2-stage turbocharged gas engine (JMS 624)
- Gas compression system
 - ❖ Max 5% of fuel is compressed
 - ❖ Used for engine pre-chambers
 - ❖ Increase electrical efficiency and reduce emissions
- Automatic fire fighting system with CO2
- Installation of Oxidation catalyst
 - ❖ No restrictions in environmental permit and legislatio
 - ❖ Environmental responsible
- Recovery of Low Temperature (50 °C) residual heat
 - ❖ From 2nd stage intercooler (234 kW)
 - ❖ Recovered using DHN make-up water
- Automatic, on-line, lube oil system
- 5 minute start-up (from 0% to 100%)

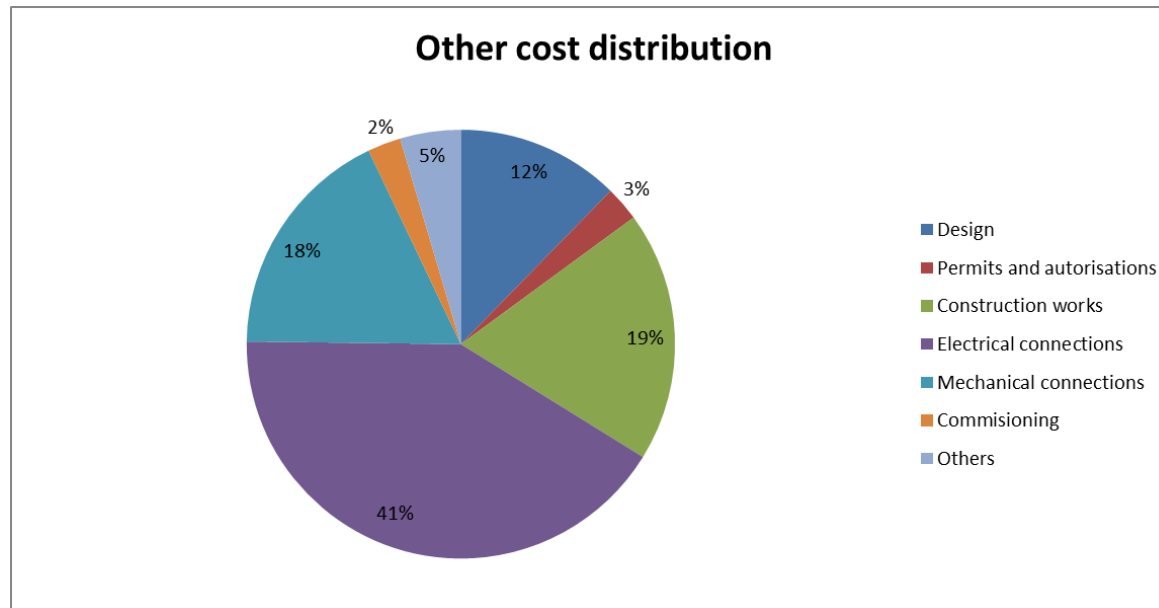


Expected Vs Real performances

Parameter	M.U.	Expected	Guaranteed	Real
Fuel input	[kW]	9442	9914	9894
Gross electrical output	[kW]	4401	4401	4401
Auxiliaries	[kW]	132	132	69,44
Net electrical output	[kW]	4269	4269	4331
Gross electrical efficiency	[%]	46,6	-	44,6
Net electrical efficiency	[%]	45,2	43,0	43,7
Thermal output	[kW]	4288	4131	4529
Thermal efficiency	[%]	45,4	41,7	45,9
Global efficiency	[%]	92,0	86,1	90,4
NOx	mg/Nm ³ @15% O ₂	190	190	181
CO	mg/Nm ³ @15% O ₂	113	113	17
Noise	db(A) – 10 m	65	65	60,8

Project management summary

- Internal GO decision: 14.12.2017
- Commercial operation date: 17.09.2018
- Total implementation time: **9 months**
- CAPEX: 2,8 Meuros (**635 Eur/kW - turnkey**)
 - ECOMAX 44 NGS and auxiliaries: 2,3 MEuros
 - Others: 0,5 MEuros



Project implementation phase



Project implementation phase



Project implementation phase

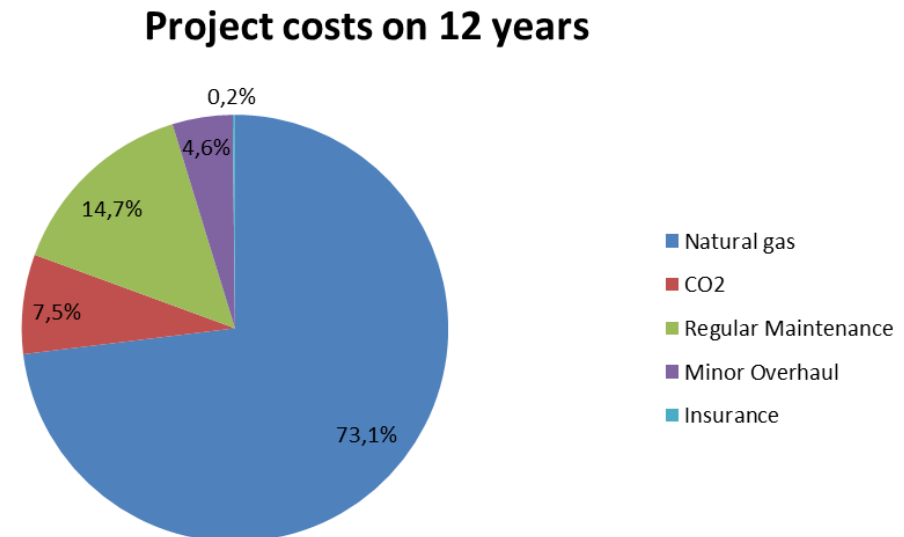


Project implementation phase



Project financial indicators

- 12 years BP period of analysis
- 4416 h/yr of operation (summer time only)
- Only Minor Overhaul in BP period, Major Overhaul occurs after 12 years
- Comparison reference: heat production only with HWB (CAF)
 - ❖ Constant thermal sales -> not included in the BP
 - ❖ HWB associated fuel and CO2 costs subtracted from Project scenario
- Project Revenues:
 - ❖ Electricity sales: 200 Lei/MWh
 - ❖ HE Cogen Bonus: 140 Lei/MWh
- Project costs:
 - ❖ Natural gas: 123 Lei/MWh_{PCS}
 - ❖ CO₂ : 55 Lei/t
 - ❖ Operation & Maintenance: ~9÷10 Eur/MWh
 - ❖ Insurance
- **Payback: ~6,5 years**



Contact details



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