

A Commercial Prototype of a 35 kW Electricity Generator Based on a Really Tar Free Gasifier".

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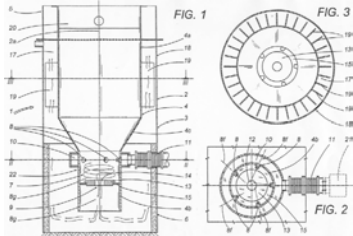
35 kW_e Commercial Prototype



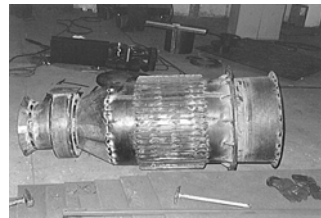
- Gasifier
- Cleaning system
- Electric Generator

Pat. EP 0955 350 A1

Features of the reactor



- Down-draft Imbert design
- High oxide-reduction temperatures in the throat area (up to 1500°C)
- Wall tuyeres opportunely oriented.
- Absence of cold veins in the oxide-reduction zone
- An efficient heat recovery by fins



Characteristics of the Gas Producer



- | | |
|---|-------------------------------|
| ● Rated fuel input (moisture 15%) | 1.3 kg/kWhe |
| ● Rated gas output | 3 Nm ³ /kWhe |
| ● Rated fuel-to-gas conversion efficiency | 75 - 80% |
| ● Gas heating value | 900-1300 Kcal/Nm ³ |
| ● Primary recommended biomass fuel | wood |
| ● Recommended fuel moisture | 15 - 25% |
| ● Recommended fuel size | 6 x 6 x 6 cm |

Analysis of the producer gas

		A	B	C	D	E
Methane (CH ₄)	%	0.15	0.19	0.31	0.14	0.19
Carbon dioxide (CO ₂)	%	20.3	19.7	18.4	20.6	21.3
Nitrogen (N ₂)	%	51.7	52.4	50.6	54.5	52.3
Oxygen (O ₂)	%	1.3	1.7	0.2	0.4	0.7
Carbon monoxide (CO)	%	13.2	14.7	16.6	14.2	13.7
Hydrogen (H ₂)	%	13.2	11.2	14.7	10.0	11.7

Tars and ashes in producer gases

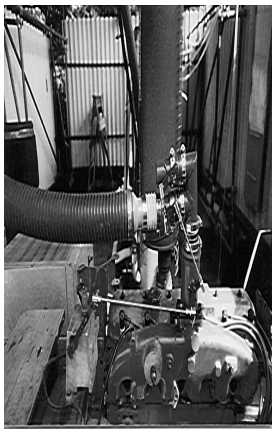
Gasifier	Tars + dust (mg/Nm³)
Traditional wood gasifier	30
Present gasifier	< 2
Specifications for engines	< 10

Gas Cooling/Cleaning System



- **COOLING UNIT:** a cylindrical tank filled with a unhomogeneous cheap material. The gas is purified counter-current from dust and cooled by water. The used water is cooled and recycled.
- **DEMISTER:** a cylindrical tank filled with the same unhomogeneous material
- **FINAL FILTER:** a steel cylinder filled by wood chips or sawdust. Flowing bottom to top, the gas releases all remaining particles and water

Internal Combustion Engine



- Engine type 4 stroke
- Original design full-diesel engine
- Displacement 4,000 cm³
- Cogeneration (calc.) up to 2 kWt / kW_e
- Conversion from diesel to producer gas:
 - The compression ratio is decreased from 17:1 to 11:1
 - Spark plugs are installed instead of the injectors
 - A distributor is applied instead of the injection pump
 - A special carburettor is installed on the intake manifold
 - Heat exchangers to collect energy from exhaust gas, cooling water and lubricating oil were added

Performance

- Hours on operation 1,200 h
- Electricity 25,700 kWh_e
- Average power 21.4 kW
- Emissions in accordance with italian laws

- Technical problems:
 - Frequent blockages of semiautomatic feeder
 - Minor problems with gas composition
 - Minor problems with engine

Economic analysis: 40 kW_e Generator

Input (Biomass H ₂ O 20%)	t/y	260
Plant utilisation	h/y	5,000
Output (Electricity)	kWh/y	200,000
Fixed investment	€	82,000
Yearly cost of production	€ / y	21,050
Electricity value (0.18 €/kWh)	€ / y	36,000
Net saving	€ / y	14,959
Pay-out time	years	5.3

Main uses



- Sawmills
- Joineries
- Forest activities
- Small factories
- Farms
- Hotels, campsites and residences

The Company



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