Intelligent energy production out of renewable energy sources

Alexander Schmid, GE Gas Engines
Using gas fueled Otto-engines for electricity, hot-water, chilled water or steam production

Configured as cogeneration, trigeneration or greenhouse application with CO₂ fertilization

Achieving over 90% of total efficiency

Using an organic rankine cycle power-skid converting waste heat into electricity with no additional fuel or emissions

No energy losses

Modular, containerized concepts
Gas Engines fueled with RES

*Bio gas*

- More than 2,400 of GE’s biogas engines* with an electrical output of about 1,300 MW worldwide
- Anaerobic digestion produces fuel gas
- Renewable—from organic and animal waste
- 5,000 cows can power 1 MW plant
Gas Engines fueled with RES

**Bio gas**

- Using corn, wheat, grass, agricultural waste, biological waste or waste from slaughter houses as row materials for biological digestion

- Typical gas composition: 65% CH4, 35% CO2

- Closed circle: electricity will be fed into the local grid, thermal energy will be used for digester heating and row material drying, slurry will be used as fertilizer developing the growth of the crops

5,2MWele plants in SLO and GER
Gas Engines fueled with RES

*Landfill gas*

- More than 1,800 of GE’s landfill gas engines* with an electrical output of about 1,900 MW worldwide
- Organic decomposition produces fuel gas
- Waste from U.S. city of one million can power 8 MW plant
Gas Engines fueled with RES

**Landfill gas**

- Drilling holes into the deposited waste hills
- Sucking out the gas
- Compressing the gas, cleaning it and using it as fuel for the gas engine
- Landfill gases are made out of ~45% CH$_4$, rest CO$_2$ + N$_2$ and SOx (Siloxanes)

1,4MWele plant in AUT
4 Mwele plant in NZ
Gas Engines fueled with RES

**Sewage gas**

- More than 870 of GE’s sewage gas engines* with an electrical output of more than 550 MW worldwide
- Sewage fermentation produces fuel gas
- Wastewater from city of half a million powers 1 MW plant
- Covers 100% of energy needed for sewage plant
Gas Engines fueled with RES

Sewage gas

- Waste water treatment plants are using the filtered waste for producing the bacteria and the sewage gas
- Electrical energy can be used for the waste water treatment process
- Thermal energy can be used for heating up the digester and supplying the local buildings with hot water (~90°C forward temperature)

1MWele plant in AUT
1,7 Mwele plant in the US
Gas Engines fueled with RES

*Wood gas*

- Synthetic gases from gasification
  - Highly efficient power generation with biomass and waste gasification
  - Waste materials out of the wood production are used as fuel
  - No rest materials out of the gasification process except biological ash
Gas Engines fueled with RES

*Wood gas*

- Using pyrolysis processes for gasifying woodchips to gain synthetic gas using as fuel for the cogeneration unit
- Gas washers and cleaners are mandatory to enable the functionality of the gas engine
- GE is the single supplier of customized special gas engines having a unique engine design optimized on the appropriate gas composition!
Organic Rankine Cycle

GE’s Heat Recovery Solution®

- One Clean Cycle™ system
  - can generate 1 million kWh of electricity per year from waste heat
  - avoids more than 350 metric tons of CO₂ per year
Organic Rankine Cycle

How it works

Evaporative Condenser

Heat Source
3.34 MBTU/hr (980 kW)

Evaporator

Vapor
251°F (121.8°C)
225 psia (15.5 bar)

Vapor
144°F (62.2°C)
29.9 psia (2.1 bar)

Integrated Power Module

Generate 125 kW

Economizer

Receiver

Vapor
97°F (36.1°C)
25.2 psia (1.7 bar)

Liquid
70°F (21.1°C)
22.3 psia (1.5 bar)

Ambient Air
ISO Conditions
59°F (15°C) 60% RH

Pump

Liquid
72.5°F (22.5°C)
230 psia (15.9 bar)

R245fa

Liquid
105°F (40.3°C)
229 psia (15.8 bar)

Liquid
70°F (21.1°C)
22.3 psia (1.5 bar)
Thank you for your attention!
For more information regarding intelligent power generating solutions, please contact our Romanian distributor TOTAL ENERGY BUSINESS (TEB) adrian.marin@teb.com.ro