



- Cost effective
- Reliable
- Low maintenance



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# MTT Introduction

- MTT is an innovative company, active since 2008 on the development and commercialization of micro CHP systems based on its in-house developed micro gas turbine;
- MTT is located in Eindhoven Netherlands, and currently employs 18 highly qualified staff;
- To develop and commercialize its CHP products, MTT has risk sharing contracts with various relevant industrial partners and with knowledge institutes;
- Together with its partners,  $\pm$  45 skilled engineers work on the optimization of the micro CHP system.







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### Delivering the most cost effective micro CHP

#### Market assessment:

High investment - and maintenance cost are obstructing fast market introduction of micro CHP

# EnerTwin is aiming to be the most cost effective micro CHP system:

- Allowing acceptable pricing at relatively low volumes
- Customer pay back target between 2 and 5 years

### MTT's strategy:

- Use Commercial Off The Shelf (COTS) components (automotive)
- Involve business partners and installation companies during development
- Outsource component development & manufacturing to keep costs low and development speed high
- Improve product efficiency once volumes are realized







### Technologies compared on relevant aspects for micro CHP:

	Cost	Maintenance cost	Pay back time	Fuel flexibility	Reliability	Electrical efficiency	Power 2 weight ratio	Overall score
Stirling engine	high	medium	very long	medium	low	low	very poor	-/-
Rankine cycle (ORC)	high	medium	long	medium	medium	medium	very poor	+/-
PEM fuel cell	high	low	long	low	high	good	medium (reformer)	+
SOFC fuel cell	very high	low	long	low	high	very good	reasonable	++
Gas engine	medium	medium to high	reasonable	medium	medium	medium	reasonable	+++
Micro gas turbine	low	low	short	very good	high	medium	excellent	++++

# Low cost (investment + maintenance) are essential for the success of micro CHP !

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### Technology: micro gas turbine





- Gas turbines have been used since 1930:
  - Very reliable & long life: only 1 moving part, moves in only 1 direction
  - Low maintenance costs
  - Highest power to weight ratio / power density  $\rightarrow$  relative low weight
  - High frequency noise: can easily be damped
- Multi fuel: Natural Gas, Bio Gas, LPG, Heating Oil
- Turbochargers are produced in millions  $\rightarrow$  low costs, very reliable

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### **EnerTwin target specifications**

#### Specifications for the EnerTwin micro CHP system:

- Power (natural gas) input:
- Thermal power:
- Electrical power:
- Power to Heat ratio:
- Total efficiency:
- Weight:
- Clean combustion:
- Substantial CO2 reductions:
- Low noise:

#### Additional specifications:

- Able to modulate to ~ 50%
- Maintenance: > 5.000 hrs (± 2 years, similar to condensing boilers)
- Lifetime : > 30.000 hrs +
- Remote control / smart grid ready

\* At ISA conditions and 30/50: can be improved by adding a condensing unit

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21 % 87 % \* ± 225 kg < 40 ppm NOx 3 - 6 tons per year < 55 dB(A)

20 kW

14,4 kW

3.0 kW

Modulation range: Heat : 7,5 – 14,4 kW Electricity : 1,0 – 3,0 kW





### Target maintenance cost EnerTwin

- 5.000 hrs (small service):
  - Replacement of CAP seal, air intake filter, oil filter
  - Check oil level
  - Visual inspection of system + computer read out
  - Total cost: material Euro 45,- plus ~ 1 hour labor
- 10.000 hrs (large service):
  - Similar as 5.000 hrs service, plus:
  - Change fuel compressor head, replacement of UPS battery
  - Replacement of oil (4 liters)
  - Total cost: material Euro 245,- plus ~ 1,5 hour labor
- 30.000 hrs (overhaul service):
  - Similar as 10.000 service, plus:
  - Replacement of micro turbine (~ Euro 750,-)
  - Total cost: Euro 995,- plus ~ 3 hours labor
  - Life extension to 45.000 50.000 hrs
- Maintenance cost Σ 30.000 hrs: ~ Euro 625 + 6 hrs labor (@ Euro 80) = Euro 1.105,-
- Per kWh electricity: 1,3 Eurocent (@ 85.000 kWh)





### Best use cases EnerTwin



- EnerTwin can best be used in situations where many running hours are possible;
- Aiming at annual heat demand of > ~3.500 m3 of natural gas;
- Combination with a heat buffer is advised to enable long running periods;
- Systems can be placed in cascade when higher heat demand is required;
- Examples: large houses, houses with pool, family hotels, fitness centers, schools, elderly homes, multi family homes, restoration projects, municipality buildings etc.



### **EnerTwin in Field Test**



- Certification for field test Q1 2013;
- Field tests started July 2013 (Phase 1):
  - Initially 12 systems
  - Lab endurance testing partly in parallel
  - Main objective: reliability
- Field Test Phase 2:
  - Planned to start Q2, 2014
  - Up to 50 systems
  - Main objective: use cases
- Commercialization planned for mid 2015

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### Field test locations in NL and DE (phase 1)







### Remote monitoring FT units



- Continuous on-line monitoring on key parameters by MTT team (PC and mobile phone)
- FT units are equipped with local PC for detailed data logging
- Data is transferred to MTT database every minute for analyses, extra loggings in case of errors (1 sec)
- Weekly update report to partners
- FT units for supporting R&D (DLR, KIC-Eifer, KIC-IREC, FH Soest) are locally monitored, independent test results are shared with MTT

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### USP's

- Pay back of investment 2 5 years;
- Low investment cost (3 kWe micro CHP system);
- High reliability low maintenance costs;
- Able to modulate while retaining high electrical efficiency;
- Substantial CO2 reduction (3 6 tons per unit per year);
- Multi fuel: Natural Gas, Bio Gas, LPG, Heating Oil;
- Low weight, low noise and easy installation plug & play;
- Allows new business models for energy distribution companies & -utilities.





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