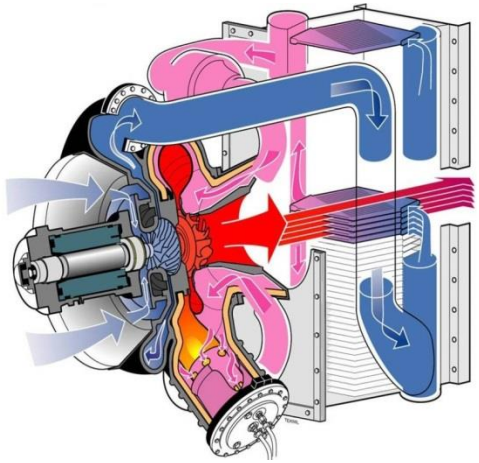
ETN MGT Meeting



ETN MGT activities: progress and results

31 March 2017

EUSEW 2016

Micro-Gas Turbines put a new spin on green energy production

Objective

To highlight and discuss how MGT technology can contribute to the decarbonisation of the energy system.

Programme

Technology advancements in the EU 2030 climate and energy policies
Andreea Strachinescu – European Commission

Technology challenges for deployment of MGT in distributed generation applications
Andreas Huber - DLR

End User Perspective, heat and power integration challenges from the policy
Sébastien Farinotti – Vanparijs Engineers

Biomass small scale CHP
Ludwig Van Wonterghem - ÖkoFEN

SUSTAINABLE ENERGY WEEK 13-17 June 2016

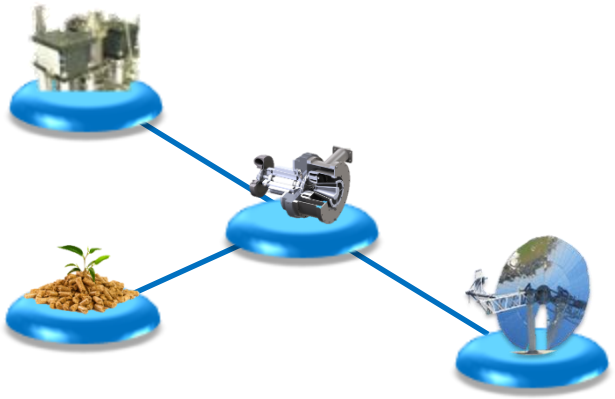
BUILDING THE ENERGY UNION TOGETHER

EUSEW 2016

Micro-Gas Turbines put a new spin on green energy production

Topics

- How the MGT systems could contribute in reaching the 2030 targets by using CHP with RES.



- The challenges in developing the technology further in terms of system optimisation, material selection, reduction of production costs, reduction of maintenance, life extension and hence reducing the environmental impact from system and part manufacture.

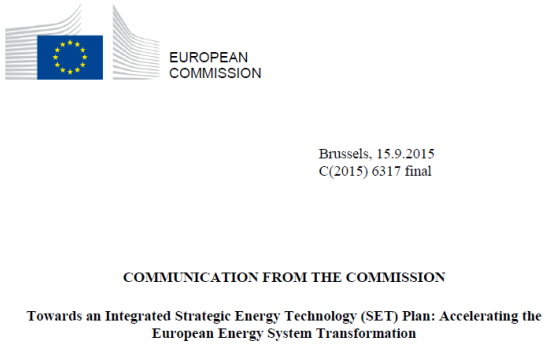
- The feasibility of the MGT technology using CHP with a high integration of RES.

- Techno-economic challenges in a discussion with both manufacturers and end-users in order to get a clear view of the costs and benefits of various system solutions in actual economic scenario.

EU
Strategic Energy Technology Plan

The **technology pillar of the EU Energy and Climate policy** since it was established in 2007

Objectives


EUROPEAN COMMISSION

Brussels, 15.9.2015
C(2015) 6317 final

COMMUNICATION FROM THE COMMISSION

Towards an Integrated Strategic Energy Technology (SET) Plan: Accelerating the European Energy System Transformation

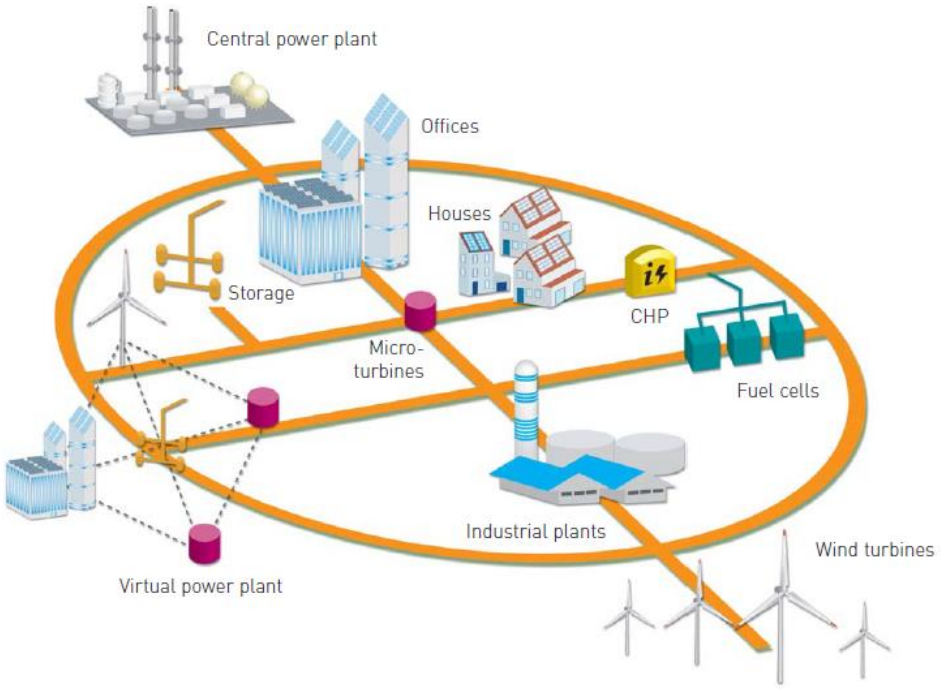
- To accelerate the development of low-carbon technologies
- To promote research and innovation efforts across Europe
- To promotes cooperation amongst EU countries, companies, research institutions.

SET Plan Action 4

Energy Systems

(Increase the resilience, security, smartness of the energy system)

Target → **45% RES** by 2030 in the EU electricity system



Flexibility options

- Energy grids, systems and integration
- Storage
- Demand-response
- Flexible backup and generation

SET Plan Action 4

ETN comments to the SET Plan Action 4 Issue Paper

ETN believes that for **decentralised power generation**, there is a need to make innovative solutions regarding the hybridisation of existing technologies with RES, accessible to the consumers in order to enable power generation, heating and cooling production, aiming at the same time to increase the energy efficiency in the buildings. **MGT with micro-CHP** can play a substantial role in supporting renewables and meeting the challenges of the modern electricity grid. **MGT technology is able to support renewables at the system level in Europe and can realise multiple benefits as a form of demand response.**

ETIP
Smart Networks for Energy Transition

Final 10-year ETIP SNET R&I roadmap covering 2017-2026

Transmission Systems
22 Functional Objectives

New → T22 - Flexible thermal power generation

Distribution Systems
14 Functional Objectives

New → D14 - Integration of flexible decentralised thermal power generation

ETIP
Smart Networks for Energy Transition

Final 10-year ETIP SNET R&I roadmap covering 2017-2026

D14 - Integration of flexible decentralised thermal power generation

Specific tasks - *Power system flexibility*

- To further increase the rate at which a thermal generation unit can increase or decrease its output (load following capability).
- To improve start-up/shut-down time and ramp rates.
- To further reduce the minimum load at which a thermal generation unit can reliably operate.
- To improve performances (efficiency and emissions) at partial loads.
- To increase the clean fuel flexibility of thermal power plants, to be able to use different sources of fuels (mixing and switching).
- To adapt waste heat recovery solutions (ORC, etc.) to the flexibility challenge so that energy efficiency improvements do not lead to a reduced flexibility.
- To decouple the use of heat and power (e.g. via buffers, storage, power-to-heat, power-to-gas, power-to-fuel).
- To better integrate existing and future units in the grid/energy system.
- To demonstrate integration of technologies with high electrical efficiency that can use hydrogen, biomass and biofuels.
- To optimise the connection, control and management of the units, including those coordinated as "virtual power plants", and providing flexibility to the power system.
- To demonstrate contribution of small and micro-CHP to “virtual power plant” configurations.
- To integrate small-scale and micro-CHPs, energy storage and demand response for optimal balancing of supply and demand, while maintaining high efficiency operation of the CHP system.
- To demonstrate the complementarity between small- and micro-CHP installations and heat pumps at the district level.

ETIP
Smart Networks for Energy Transition

WG1 – Reliable, economic and efficient smart grid system

It focus on system aspects, addressing the main functionalities, quality and efficiency of the electricity system as such and consider the benefits of its integration with the other energy vectors.

WG2 – Storage technologies and sector interfaces

It addresses the technological and market developments related to energy storage solutions to ensure the required level of flexibility for the transmission and distribution of electricity.

WG3 – Flexible Generation

It addresses the business and technology trends considering the centralised and decentralised thermal power generation and RES.

WG4 – Digitisation of the electricity system and Customer participation

It addresses the use and impact of the Information and Communication Technologies as a pervasive tool along the entire value chain of the power generation, transportation and use.

WG5 – Innovation implementation in the business environment

It adopts a helicopter view of the activities carried out in the projects within the perimeter of the ETIP about the energy transition.

SET Plan Action 5

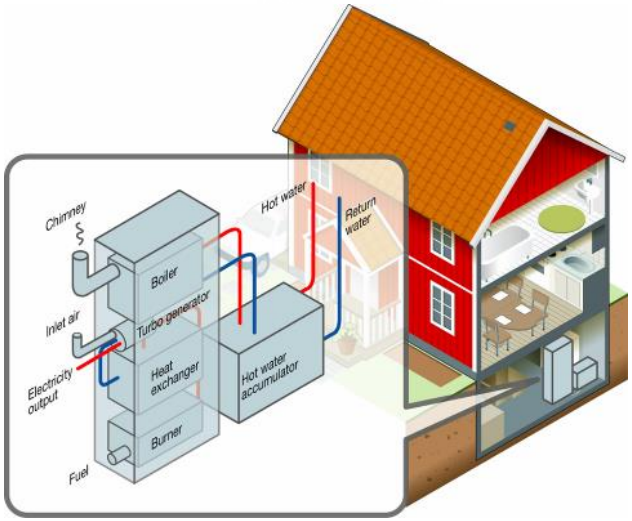
Develop new materials and technologies for energy efficiency solutions for buildings

Target → **10%** gap reduction by 2025 between the predicted and the actual energy performance

"The role of micro-CHP in future energy sector - A focus on energy efficiency and emission reduction"

Energy Equipment/Systems

Efficient and smart cogeneration (CHP) for buildings (e.g. micro gas turbine with micro CHP)



SET Plan Action 5

ETN comments to the SET Plan Action 5 Issue Paper

"Develop new materials and technologies for energy efficiency solutions for buildings"
CROSS CUTTING HEATING AND COOLING TECHNOLOGIES FOR BUILDINGS

- **Micro Combined Heat and Power/Combined Cooling Heat and Power (CHP/CCHP) – Chapter**

- **Micro CHP/CCHP Targets by 2025:**

  - ✓ Reduction by 50% of the equipment and installation costs compared to present levels.

  - ✓ Increase of the energy efficiency of Micro CHP/CCHP by 20% compared to present levels: increase high operational electrical efficiency, close to nominal and maintain thermal efficiency of the entire operating range of micro and small scale CHP/CCHP.

  - ✓ Increase the fuel flexibility of micro CHP/CCHP by increasing the share of use low cost, low quality and more complex biomass fuels (e.g. agrobiomass, waste recovered fuels/sludges and biogas) by 30 % in biomass based cost-competitive poly/cogeneration units which can interact with other RES in an integrated hybrid system.

SET Plan Action 6

Continue efforts to make EU industry less energy intensive and more competitive

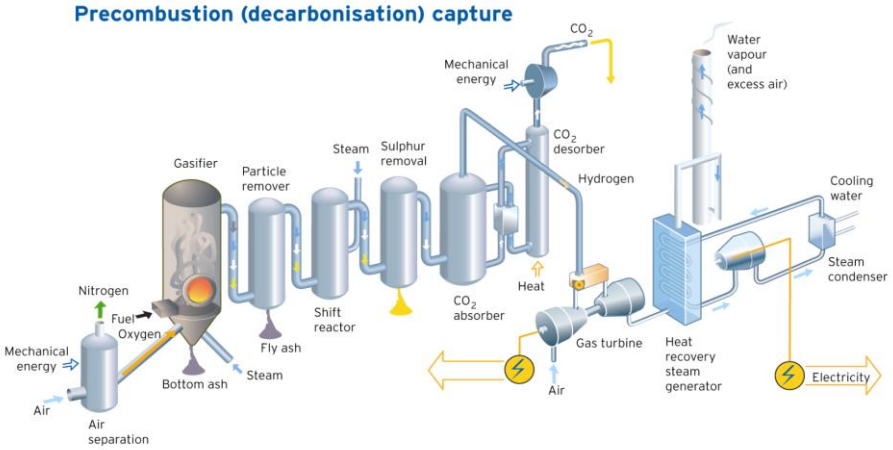
EUROPEAN TURBINE NETWORK

"Turbines are key components for energy efficiency in the industry"

EUTurbines

Emerging Technologies

- Integrated Gasification Combined Cycle (IGCC)
- Organic Rankine Cycle
- Supercritical Rankine Cycle



SET Plan Action 6

ETN comments to the SET Plan Action 6 Issue Paper

Continue efforts to make EU industry less energy intensive and more competitive

Turbines are key components for energy efficiency in the industry

The issues paper identifies two emerging technologies based on turbines that could have a high energy-savings - and thus cost reduction - potential in the future:

- sector-specific technology for the chemical industry as well as petroleum refineries

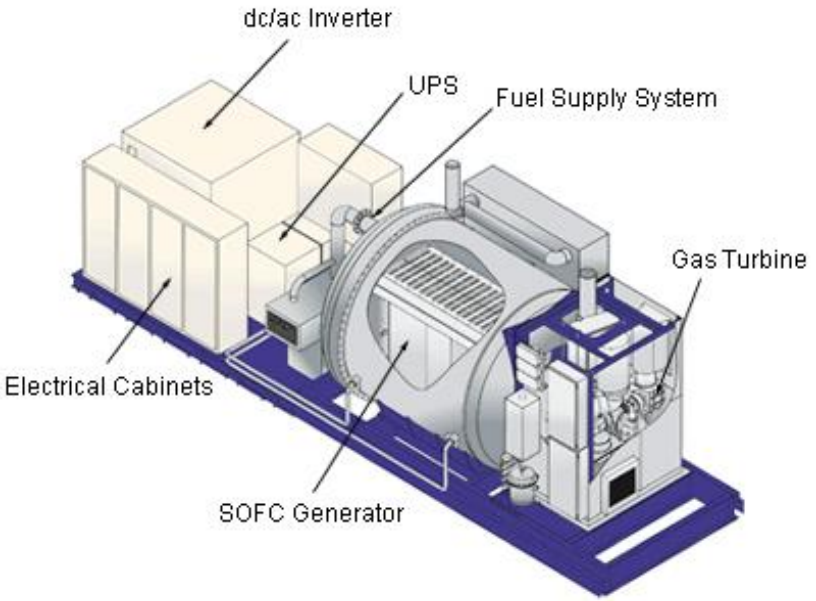
- cross-cutting technology for waste heat recovery

SET Plan Action 6

Temporary Working Group Action 6

Three Priorities

- **Iron & Steel**
- **Chemical & Pharmaceutical**
- **Cross-cutting**
  - ✓ Polygeneration – hybrid plants



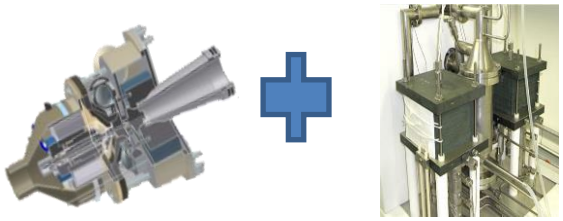
MGT & SOFC

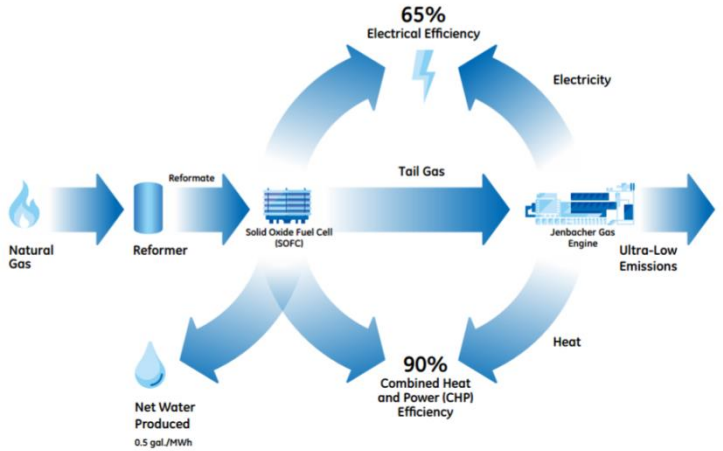
SET Plan Action 6

Advanced Hybrid Plant – SOFC and MGT/Gas Engine in CHP mode

Main objective

to demonstrate the technology in a relevant environment increasing TRL level towards more effective applications from current TRL 5.





Diagrams for illustrative purposes
Source: https://www.ge.com/sites/default/files/GE_FuelCells.pdf

Target

- Fully renewable of combined heat and power system for the industrial environment;
- high electrical efficiency of more than 65% and total thermal efficiencies of more than 90%.
- Wide operational flexibility ranging from 25% to 100% electric power;
- Wide operating range of ambient conditions;
- Very low emission levels with single digit ppm NOx (at 15% vol. residual oxygen);
- A pay back period competitive with conventional technologies should be achieved within next 20 years.

SET Plan Action 6

Advanced Hybrid Plant – SOFC and MGT/Gas Engine in CHP mode

- Primary energy saving potential in percentage and in ktoe/a (assuming full deployment in the EU28)

280 Tbtu/year => 7000 ktoe/a
Total Consumption of Energy in Industry 2015 EU28 = 272.5 Mtoe/a
Iron and steel energy consumption = 50.8 Mtoe/a
Reduction related to the steel industry sector = - 13.8%

- GHG emission saving potential in percentage and in ktCO2eq/a (assuming full deployment in the EU28)

18.3 MtCO2/year
Total Production EU28 = 4400 MtCO2/year
Reduction = -0.4%
8.5 % related to Industrial processes.
Reduction related to the industry sector = -4.8%

http://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics

ETIP
Renewable Heating and Cooling

The RHC Platform aims at playing a decisive role in maximising synergies and strengthening efforts towards research, development and technological innovation which will consolidate Europe's leading position in the sector.

Solar Thermal Technology Panel	• The development of solar compact hybrid systems (SCOHYS) • Technological improvements in Solar-Active-Houses (SAH) • The development of systems supplying solar heat for industrial processes
Biomass Technology Panel	• Biomass fuels (whole supply chain) • Technologies for residential heating • Technologies for industries and district heating • Non technological issues (markets, policies, communication, training)
Geothermal Technology Panel	• Shallow geothermal heat pump systems • Deep geothermal • Non technical issues
Cross-Cutting Technology Panel	Strategic research priorities in technological areas which would allow a higher integration and take-up of renewable energy sources into the heating and cooling systems.
Heat Pump Technology Panel	The main target will be to create the conditions to further boost the research, development and technological innovation of all existing and new heat pump applications.

ETIP
Renewable Heating and Cooling

Biomass Technology Panel

RHC-ETIP Input to H2020 Energy Work Programme 2018-2020

R&D topic – BIO 3: Cost and energy efficient, environmentally friendly micro and small scale CHP

Specific challenge: The development in the sector has been difficult due to different competing technologies. The research funding received by micro and small CHP is rather low.
Scope: Small and micro-scale CHP constitute a high energy efficient solution providing reliable and decentralised renewable energy production for residential sector, small scale industries and service sector.

Type of actions:

- Reduce conversion system costs
- Increase the load flexibility and fuel flexibility
- Development of efficient storage systems (electricity, heat) to avoid grid losses
- Emissions reductions

ETIP
Renewable Heating and Cooling

Biomass Technology Panel

D1.1 Report status of the implementation of the RHC Roadmaps

The research funding identified so far for micro and small scale CHP is rather low in the SET plan integrated roadmap as compared to the amount suggested in RHC biomass technology roadmap. With 30M€ (50:50 share for public and private) for material research and 125M€ (50:50 share for public and private) in development of the technology, the funding is much lower than 500M€ until 2020 suggested in the RHC biomass technology roadmap.

The development in the sector has been difficult to identify due to different competing technologies and scarcity of publicly available data. Additionally, several figures for KPIs were missing in the RHC biomass technology roadmap which makes it difficult to estimate the progress of the KPI since 2013. In the next update, a large work is needed to assemble better fitted KPI values in order to give a representative weighted average value in the end. More targeted KPIs should be defined, being technology specific and country and support schemes independent.