HEAT & POWER OVERVIEW

This overview gives a composite list of Research & Technology Development (RTD) activities identified in the technology modules, presented by technology:

Pulverized Combustion (PC)

- Further improvements by increasing live steam temperature to 620°C-650°C using recently developed ferritic steels.
- Further improvements by increasing live steam temperature to 700°C achieving more than 50 % efficiency using superalloy materials.
- Further increase of live steam pressure to 330 – 365 bar (application of ultra-supercritical cycles)
- Full exploitation of primary NOx reduction potential.
- Co-firing of solid fuels together with wastes and residues.

Fluidized Bed Combustion (FBC)

- Handling of solid fuel and of ashes and residues (AFBC & PFBC).
- Further scale-up of maximum unit size to 500 MWel.
- Optimization of FBC design and operation to improve economic and environmental performance.
- Dedicated demonstration of FBC for decentralized production of heat and power from locally available low-quality fuel.

Natural Gas based Combined Cycle Gas Turbine (CCGT)

- Reduction of emissions (NOx) via development of new burner concepts.
- Increase of gas turbine efficiency (increase of inlet temperature & Pressure and minimization of aerodynamic losses).
- Application of new, improved gas turbine blade cooling technologies.

Integrated Gasification Combined Cycle (IGCC)

- Lower costs (higher specific power output, standardization, modular systems, etc).
- Higher efficiency of up to 55 % (further gas turbine development, hot gas cleaning, etc.)

- Improved availability.
- Long-time operation experience.
- Use of wastes as feedstock.
- Demonstration of other types of IGCC i.e. air-blown gasifier IGCC.

Gas turbines (GT)

- Increase of gas turbine inlet temperatures, from 1200°C to 1300-1400°C and above.
- Reduce aerodynamic losses.
- Lower NOx emissions.

For these goals RTD is necessary in the following areas:

  - Performance of materials for blades and vanes.
  - Application and improvement of thermal barrier coating.
  - Application of advanced cooling techniques (e.g. steam cooling).
  - Further low NOx burner developments.

Pressurized Fluidized Bed Combustion (PFBC)

- Further scale-up of maximum unit size to 200-500 MWel.
- Application of hot gas filtration.
- Improved of gas turbine blade & vane coatings.
- Use of advanced (supercritical) steam conditions.
- Improved process by increasing the flue gas temperature.
- Co-firing of biomass and wastes.
- Reduced bed erosion (activities to be carried out on research level and later to be demonstrated

Pressurized Pulverized Combustion (PPC)

- Improved slag separation in the boiler.
- Improved slag separation from hot flue gas.
- On-line measurement of flue gas contamination.
- Optimization of liquid-ash-resistant ceramics.
- Successful operation of demonstration plant.

Fuel Cells (FC)

Phosphoric Acid Fuel Cell (PAFC)

- Improvement of lifetime operation.
- Improvement the sensitivity to the catalyst poison carbon monoxide

Proton Exchange Membrane Fuel Cell (PEMFC)

- Further development of inexpensive components and manufacturing methods (minimizing the platinum content).
- Improve the sensitiveness to fuel impurities.
- Making the catalyst layers more CO resistant

Molten Carbonate Fuel Cell (MCFC)

- Further material research and improvement is needed to decrease the corrosion and increase the current density.

Solid Oxide Fuel Cell (SOFC)

- Increase of power output at reduced operating temperatures.
- Achieve high robustness under tough operating conditions.
- Improve performance and lifetime.
- Further development of internal reforming and scale up
- Intensive RTD activities for auxiliary parts such as the heat exchanger, piping and pumps due to the high operation temperature.