

# Mild Oxy Combustion for Climate and Air



MOCCOA<sub>2</sub>

# *Background*

Norwegian Financial Mechanism and the European Economic Area Financial Mechanism, i.e. EEA and Norway Grants, are a form of foreign aid granted by Norway, Iceland and Liechtenstein to new UE Member States.

The total amount of the second edition of the Norway and EEA Grants amounts to EUR 1.798 billion. Allocation for Poland amounts to **EUR 578.1 million**, including management costs incurred by the Donors and the Polish side.

**The main objectives** of the Norway Grants are: to contribute to the reduction of economic and social disparities in the European Economic Area and strengthening the bilateral relations between the donor and the beneficiary states.

## **BENEFICIARY STATES**

The recipients of EEA and Norway Grants are 16 EU countries: 12 countries that joined the common market in 2004 and 2007, as well as Spain, Portugal, Greece and Croatia.

## Norwegian-Polish Research Programme

**Operator:** National Centre for Research and Development

**Partnership at programme level:** Research Council of Norway

**Value of the programme from the EEA Grants:** EUR 62 830 000

**The programme will support research and development in the following areas:**

- environment,
- climate change, including polar research,
- health,
- social sciences, including the issues of migration,
- mainstreaming gender equality and promoting work-life balance.

## *Project overview*



## Consortium

Institute of Thermal Technology (ITT)

SINTEF

## Project Budget

6 278 888 zł

## Duration of the Project

01.05.2014- 30.04.2017

## Steering Committee



Advisory Board  
Tauron  
PEC Gliwice  
Fortum  
P.Rokke

WP1

WP2

WP3

WP4

WP5





## *Partners*

## Institute of Thermal Technology

ITT is affiliated with the Faculty of Energy and Environmental Engineering of the Silesian University of Technology. This defines the main directions of the activities being as follows:

Education, Research, Cooperation with the industry, Cooperation with the local community.

Members of the ITT staff have served as reviewers for over 80 international journals. They also participate in the process of reviewing Polish and international research projects, including the EU Framework Programme ones.

## Institute of Thermal Technology

- experimental investigation of solid fuels combustion, especially fuel characterization,
- one of the first research institutions in Europe working on MILD Combustion,
- experience in oxy-combustion by participating in the national strategic project on this technology.

## SINTEF

**SINTEF** - A contract research organization based in Trondheim, Oslo, Bergen, Stavanger and Tromsø

**SINTEF** is one of the largest independent research organizations in Europe.

### **Social perspective**

SINTEF wishes to contribute to the creation of value and to a society in healthy sustainable development.

### **Business concept**

SINTEF sell research-based knowledge and related services to Norwegian and International clients.

### **Fundamental values**

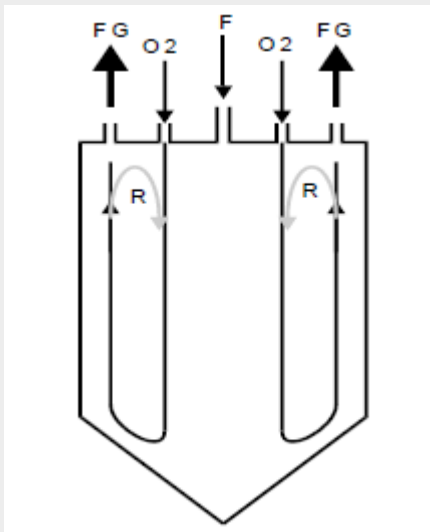
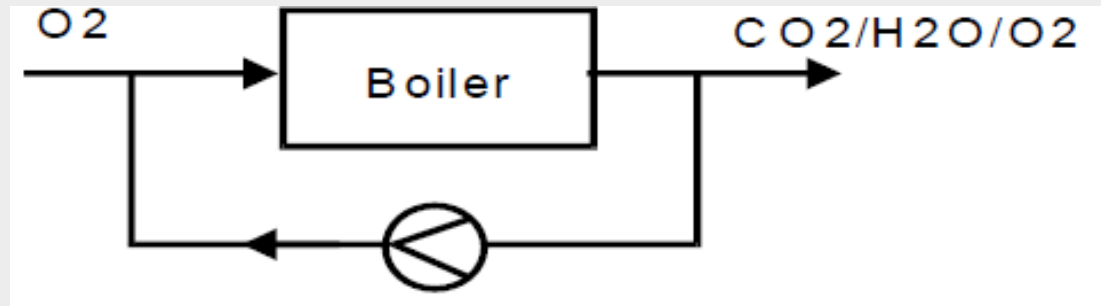
Honesty, Generosity, Courage and Unity SINTEF has 2145 employees, 1600 situated in Trondheim and 430 in Oslo.

## SINTEF

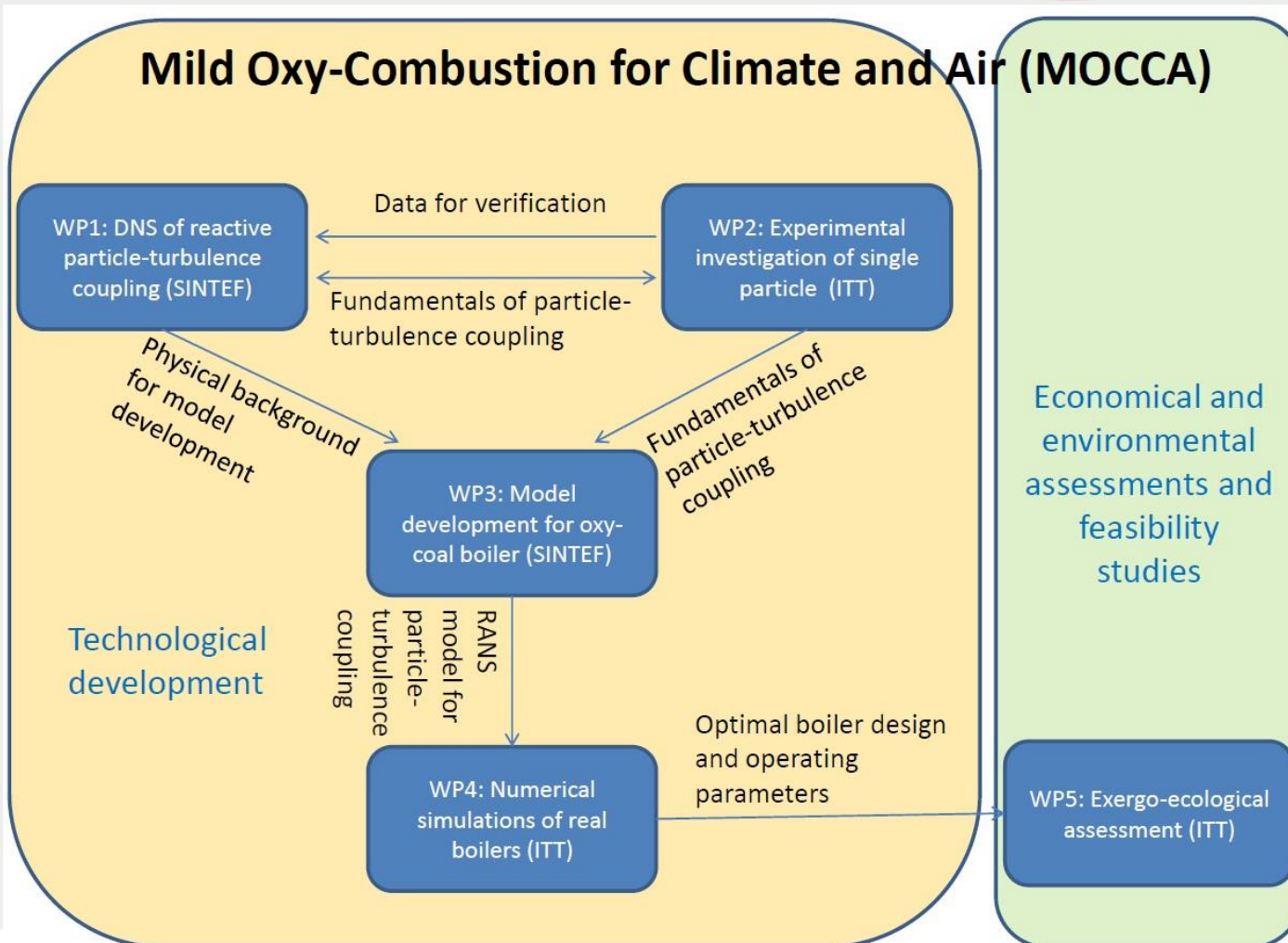
### Activity areas

- Power production with CO<sub>2</sub> capture CCS
  - Hydrogen combustion
  - Oxy-fuel combustion
  - Chemical Looping Combustion (CLC)
- Emissions and thermal impact from flames/flares
- Low-NO<sub>x</sub> burners (boilers and gas turbines)
- Soot emissions from biomass combustion (woodstoves)

## *Idea of the project*



- elimination of external flue gas recirculation
- fuel flexibility
- increased radiation boiler
- better burn out of fuel
- lower NO emission
- lower air excess ration
- applicable for small boilers





# *Organization of the project*

## WP1

WP 1 leader: Nils Erland L. Haugen/PhD

### Tasks

- 1.1 .DNS implementation of reactive particles
- 1.2 .Theoretical investigation of reactive particle-turbulence coupling
- 1.3 .DNS simulations of reactive particle-turbulence coupling

## WP2

WP 2 leader: Wojciech Adamczyk/PhD

### Tasks

- 2.1. **Upgrading existing test stand and make it usable for investigation of fine particle combustion**
- 2.2. **Developing procedure of measurement and procedure of experimental data processing**
- 2.3. **Performing a series of experiments for selected fuel in different temperatures and atmospheres**
- 2.4. **Performing a series of experiments for different fuels**
- 2.5. **Attempt to use infrared camera (IR) for measuring temperature of a particle**

## WP3

WP 3 leader: Øyvind Langørgen/MSc

### Tasks

3.1 .CFD model development

3.2 .CFD model implementation

3.3 .Comparison with available literature data

## WP4

WP 4 leader: Gabriel Węcel/PhD

### Tasks

- 4.1. Preliminary optimization of the Mild Oxy combustion boiler
- 4.2. Implementation of the new RANS model into CFD code
- 4.3. Selection of the final geometry of the boiler
- 4.4. Optimization of the fuel and oxidizer supply in Mild Oxy combustion boiler
- 4.5. Assessment of fuel flexibility CFD study in Mild Oxy combustion
- 4.6. Calculation of specific emissions and thermal efficiency of the Mild Oxy  
Combustion Boiler
- 4.7. Simulation of the small scale boiler Mild Oxy combustion

## WP5

WP 5 leader: Wojciech Stanek/DSc

### Tasks

- 5.1. Direct Exergy Analysis of boiler configuration and behaviour
- 5.2. Thermo-Economic Analysis of power plant system behaviour
- 5.3. Thermo-ecology and LCA for environmental analysis

*Thank you for your attention*