Chemical-looping combustion of gaseous fuels
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In January 2006 the EU-project "Chemical Looping Combustion CO2-Ready Gas Power" (CLC GAS POWER) was started under contract no 19800. The project is 30 months and is funded on the achievements in the previous GRACE projects, which involved the study of more than 300 different oxygen-carrier particles, as well as 100 h of successful operation in a 10 kW chemical-looping combustor. (see e.g. *Greenhouse Gas Issues,* No 73, July 2004) The project partners include:
- Chalmers University of Technology (Chalmers), Sweden
- Consejo Superior de Investigaciones Cientificas (CSIC), Spain
- Vienna University of Technology (TUV), Austria
- ALSTOM Power Boilers (APB), France
- Shell Global Solutions International BV, Netherlands
- Tallinn University of Technology (TUT), Estonia

The project is also part of phase II of CCP (CO2 Capture Project).

Critical issues for an up-scaling of CLC to a demonstration phase of 20-50 MWe have been identified and it is the objective of the project to establish and validate solutions to these. Thus, the following topics will be addressed:
1) Identify process suitability of raw materials commercially available at competitive prices.
2) Establish best commercial particle production technique for up-scaling from laboratory freeze-granulation method so far applied.
3) Adapt alternate particle production paths with potentially lower production costs.
4) Investigate possible effects of gas impurities on particles, primarily sulphur.
5) Long term testing in an existing 10 kW_{th} CLC prototype unit to confirm mechanical and chemical integrity of particles.
6) Testing and intermediate CLC demonstration at 120 kW_{th} scale.
7) Extend and verify modelling capability for process performance optimisation and scale-up.
8) Process and technology scale-up to prepare for industrial 20-50 MW_e demonstration unit.

The following achievements have been accomplished during year one:
- It has been verified that there is a market with raw materials available at competitive prices, which are suitable for the production of oxygen-carrier particles. Suitable nickel raw materials can be found at prices, although

somewhat above the world market price for nickel, still much below those of the “pro-analysi” materials used in the first phase of the research.

- The up-scaling of particle production from freeze-granulation, to large-size spray-drier has been initiated and it appears that spray-drying can produce particles to the specifications derived from the earlier successful powders produced by freeze-granulation.
- An alternate route for particle production based on impregnation, has also been investigated with good results, and the production of a 30 kg batch is well underway.
- A cold model of an attrition rig to confirm long term durability of oxygen carrier particles under representative industrial conditions has been designed and built.
- The 10-kW chemical-looping combustor at Chalmers has been improved and adapted for long term testing with new oxygen-carrier particles.
- An intermediate chemical-looping combustor demonstration unit of 120 kW_{th} has been designed, and the construction of the unit at TUV has been started.
- The modelling capabilities have been developed within a process simulation environment. The new model library contains the relevant solids for oxygen carrier description and the unit models of the fluidised bed reactors.