



# ccsp

Carbon Capture and Storage Program

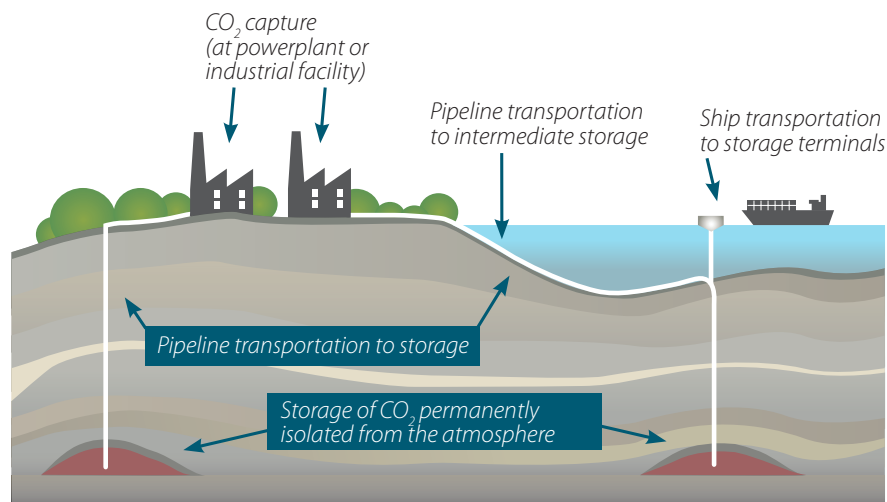
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## Carbon Capture and Storage Program

The program objective is to develop CCS-related technologies and concepts, leading to essential pilots and demonstrations by the end of the program 2014-2015. Commercial applications that promote Finnish CCS innovations will be available from 2020 onwards. A further objective is to create a strong scientific basis for the development of CCS components, concepts and frameworks, and to establish strong international networks that enable active international CCS co-operation.



## CCSP research areas

CCS is the only technology that can capture at least 90% of CO<sub>2</sub> emissions from power plants and other carbon intensive industries, transport it by pipeline or ship, and then store it permanently deep underground.

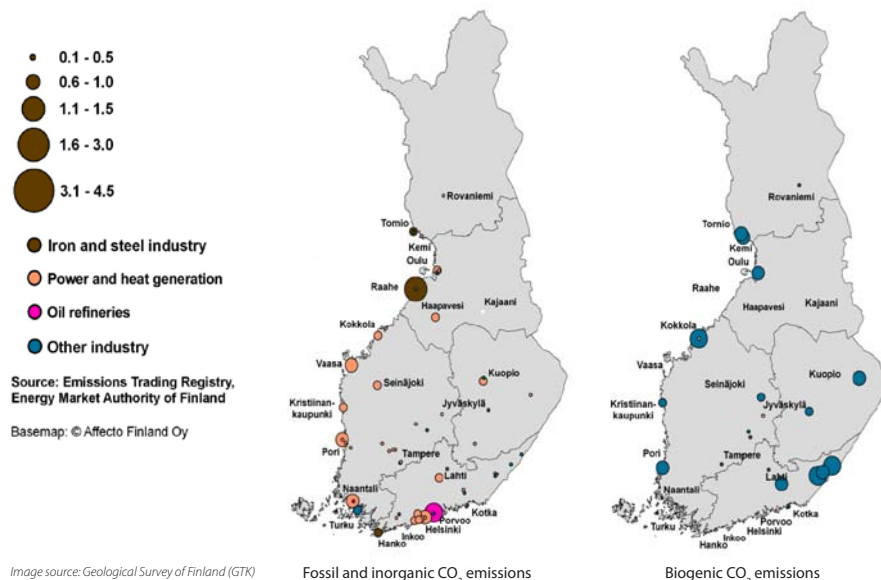
### The key technology focus areas

- CCS in CHP systems
- CCS technology related to multi-fuel and bioCCS
- CCS solutions for the oil and gas, and the iron and steel industries
- Acceptability of CCS

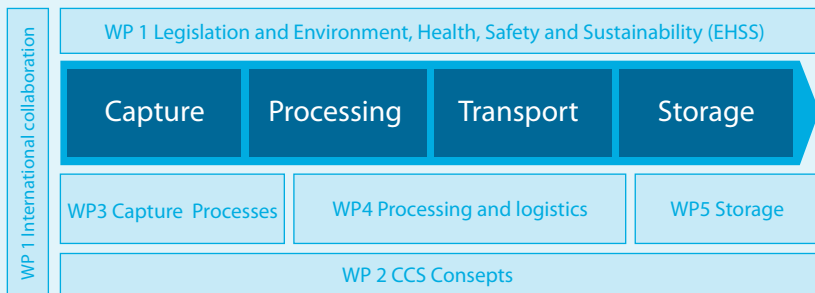
### Long term breakthrough technologies

- CLC (Chemical Looping Combustion)
- Mineral carbonation

## Largest CO<sub>2</sub> emission sources in Finland:



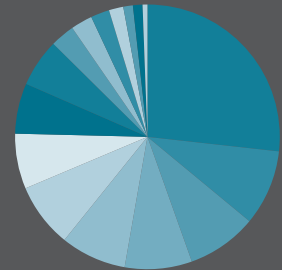
## Carbon Capture & Storage Program



CCSP Program volume:  
3 M€ / a 2011-2015

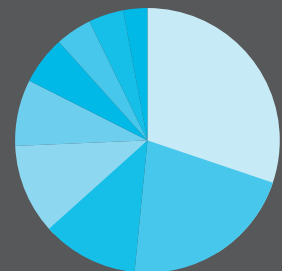
### CCSP consortium members

- 16 Industrial partners
- 9 Research partners



### Industrial partners 54,5%

Fortum Oyj 27%, Vibrometric Oy 9%, Ramboll Finland Oy 9%, Ruukki Metals Oy 8%, Helsingin Energia 8%, Neste Oil Oy 8%, Gasum Oy 7%, Stora Enso Oy 6%, Neste Jacobs Oy 6%, ÅF Consult 3%, Foster Wheeler Energia Oy 3%, Nordkalk Oy 2%, Oulun Energia 2%, Tapojärvi Oy 1%, Andritz Oy 1%, Outotec Oy 1%



### Research partners 45,5%

Technical Research Centre of Finland (VTT) 37%, Aalto University (TKK) 19%, Lappeenranta University of Technology 11%, Geological Survey of Finland (GTK) 10%, Tampere University of Technology 7%, University of Tampere 5%, University of Oulu 4%, Åbo Akademi University 4%, Finnish Environment Institute (SYKE) 3%

## About CLEEN

The CCSP consortium is managed by CLEEN, the strategic research centre for the Energy and Environment Cluster. CLEEN Ltd was founded in 2008. The 44 shareholders are all major actors in the sector, with 28 corporate shareholders and 16 research institution or university shareholders.

### WORK PACKAGE 1: CCS related regulation, legislation and EHSS questions

Creating and maintaining updated knowledge on the most essential legislation and regulations that set frames for the application of CCS will enable decision making for the future CCS framework, now under development. Aspects on Environment, Health, Safety & Sustainability questions and a further focus on understanding the factors and interactions influencing public acceptability of CCS will form basis for development of suitable CCS solutions.

### WORK PACKAGE 2: CCS concept studies

Creating and improving the combined ability of participating companies to define, evaluate and develop CCS concepts for power plants and industrial environments, as well as concepts for the sustainable utilisation of CO<sub>2</sub> in industrial applications. Special attention is given to the opportunities and requirements typical in Finland, such as CCS in combined heat and power production, oil refining, steel industry and other industrial solutions.

### WORK PACKAGE 3: Capture of CO<sub>2</sub> including advanced technologies

Developing and improving the technological ability of participating companies to develop advanced and case-specific technologies and solutions for the capture of CO<sub>2</sub> in power plants and industrial complexes. State of the art solutions are based on oxyfuel combustion and post combustion carbon capture with a special focus on biomass related solutions. The next generation capture technologies focus on Chemical Looping Combustion and other looping technologies.

### WORK PACKAGE 4: Processing and logistics of captured CO<sub>2</sub>

As a country with no significant geological storage capacity for CO<sub>2</sub>, defining and developing the most advantageous logistic solutions for Finnish CO<sub>2</sub> sources and storage locations is of importance. The development of technological solutions for conditioning and intermediate storage concepts for CO<sub>2</sub> plays a significant role in these logistic networks.

### WORK PACKAGE 5: Storage of CO<sub>2</sub>

Identifying the most feasible storage options from the Finnish point of view is essential for realization of CCS based CO<sub>2</sub> abatement options. Majority of solutions are based on geological storage and the focus of the program is on areas close to Finland. Development of technology for CO<sub>2</sub> fixation by mineral matter can bring advantages for certain industrial branches also in Finland.