



CCUS RESEARCH IN EUROPE

CATO easter drink 2016. | Sven van der Gijp

TNO innovation
for life

WARNING

- › *Since the following information could be considered boring, there will be a quiz during the presentation.*



QUIZ, HOW IT WORKS

1 choose URL: **b.socrative.com**
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- › Open explorer
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-
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Question 1




CATO GOES EUROPE


- › Demonstrations
 - › ROAD seems only feasibly with funding from other nations
 - › Trending topic: Multiple capture sources combined with an integrated cross border transport chain and limited number of sinks

- › Research and Innovation
 - › More and more combined member state initiatives in order to defragmentize R&I
 - › National R&D Funds can be multiplied by EU funding
 - › H2020 collaborative efforts ongoing

- › The European Strategic Energy Technology Plan (SET-Plan) aims to accelerate the development and deployment of low-carbon technologies
- › In particular, the Integrated SET-Plan Identifies 10 key actions for research and innovation
- › The SET-Plan includes a.o. the European Energy Research Alliance



2015 - Energy union – R&I pillar



Towards an
#EnergyUnion

Four core priorities:

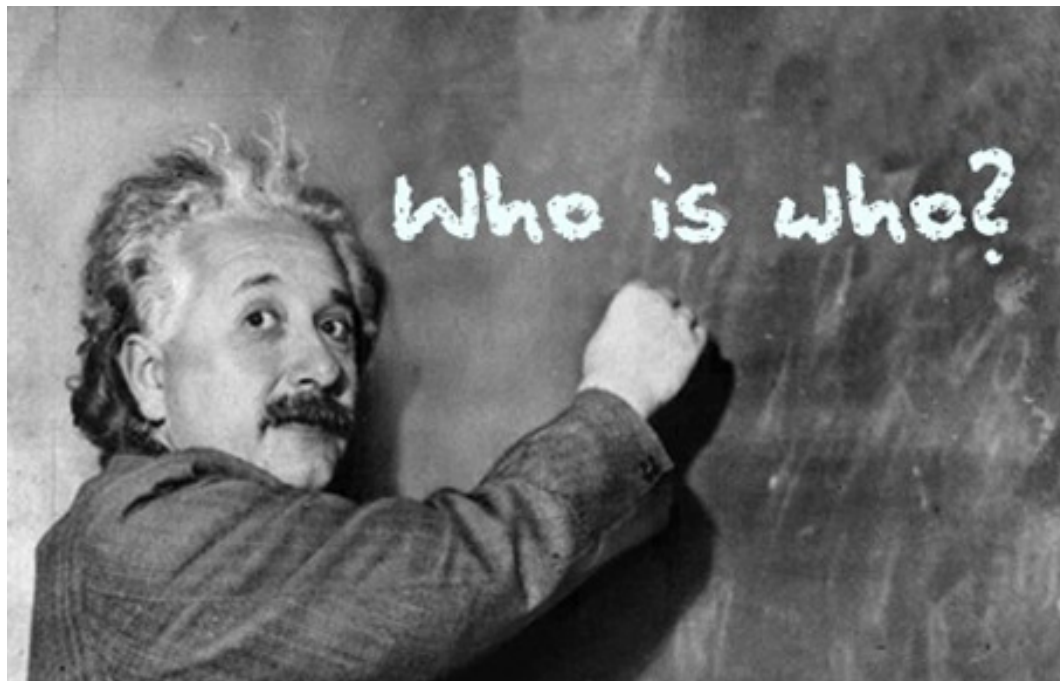
- World leader in **RES**, together with energy storage;
- **Consumer** – smart grids, smart home appliances, smart cities, and home automation systems;
- **Efficient energy systems**
- More **sustainable transport systems** – innovation for increase energy efficiency and reduce greenhouse gas emissions.

Two additional research priorities:

- A forward-looking approach to **CCS** and **CCU** for the power and industrial sectors
- **Nuclear energy** – the use of the highest standards of safety, security, waste management and non-proliferation; technological leadership to be maintained

Question 2

BUT WHO IS WHO IN EUROPE



Carbon Capture, Transport and Storage (CCS) in Europe

MAIN CCS STAKEHOLDER GROUPS

The European Commission's Directorate-General (DG) for Research, Energy and for Climate



DG Research
DG Energy
and DG Climate

The EERA CCS Joint Programme (JP)



EERA
CCS JP

Zero Emissions Platform



ZEP

CO₂ Capture, Transport and Storage in the Netherlands



CATO

UKCCS Research Centre



UKCCSRC

COLOUR KEY

- IN OPERATION
- IN PLANNING
- PILOT

The European Network of Excellence on the Geological Storage of CO₂



CO2GeoNet

NORDIC CCS Competence Centre



NORDICCS

BIGCCS International CCS Research Centre



BIGCCS

European Carbon Dioxide Capture and Storage Laboratory Infrastructure



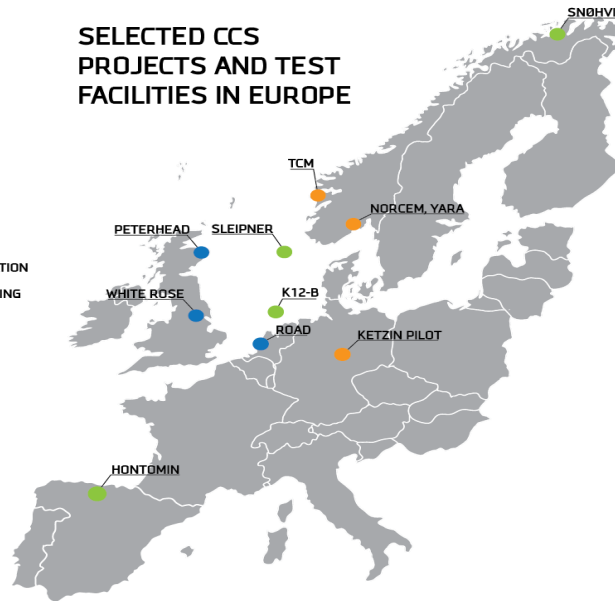
ECCSEL

Bellona Environmental CCS Team



BELLONA

SELECTED CCS PROJECTS AND TEST FACILITIES IN EUROPE



CCS NETWORK

The European CCS Demonstration Project Network



CLIMIT



CCS*

Carbon Capture & Storage Association



SCCS

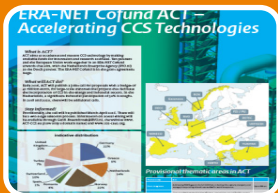
Scottish Carbon Capture & Storage





Technology Roadmap

- EERA, ZEP and CO2Geonet
- ECRIA on CCS Integration



Programming

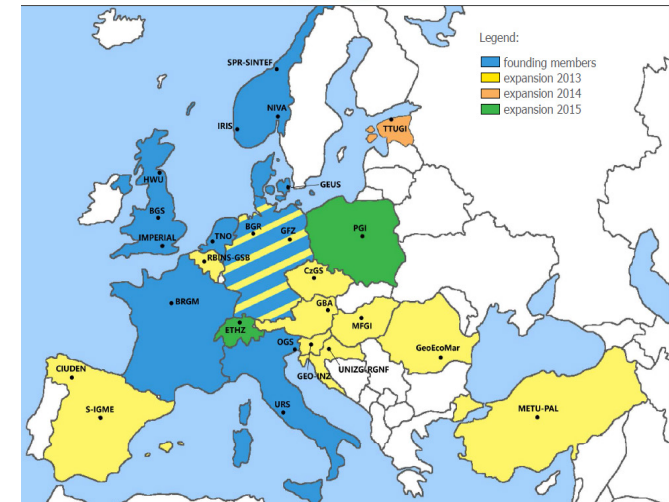
- Jointed National: ERA-NET ACT/ROAD; CATO-CLIMIT
- H2020 projects like e.g. Cemcap and ENOS
- National Programs: CATO, CLIMIT, UKCCSRC



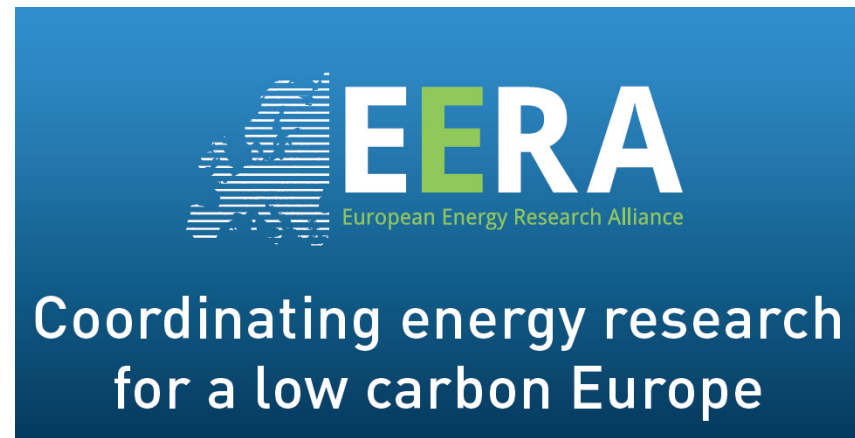
Infrastructure

- ECCSEL
- Gateway on transport infrastructure

- › What:
 - › Association
 - › Independent scientific body on CO2 geological storage
- › WHO:
 - › Geoscientific research institutes and academia
- › Goals
 - › Joint research
 - › Scientific advice
 - › Training
 - › Information and communication
- › Useful for:
 - › R&I
 - › Training and dissemination activities
 - › Access to a scientific network
- › Contact: Ton Wildenberg

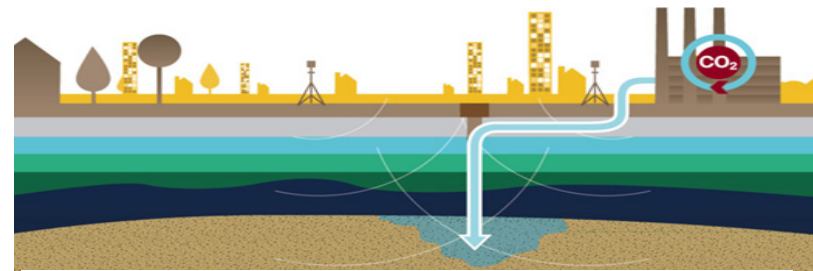


- › What:
 - › Part of the SET-Plan
 - › Key energy research institutions in Europe
- › WHO:
 - › Research institutes and academia
- › Goals
 - › Strengthen, expand and optimise research capabilities
 - › Accelerate the development of energy technologies to the point where they can be embedded
- › Useful for:
 - › R&I
 - › Access to a scientific network
- › Contact: Sven van der Gijp



ZERO EMISSION PLATFORM

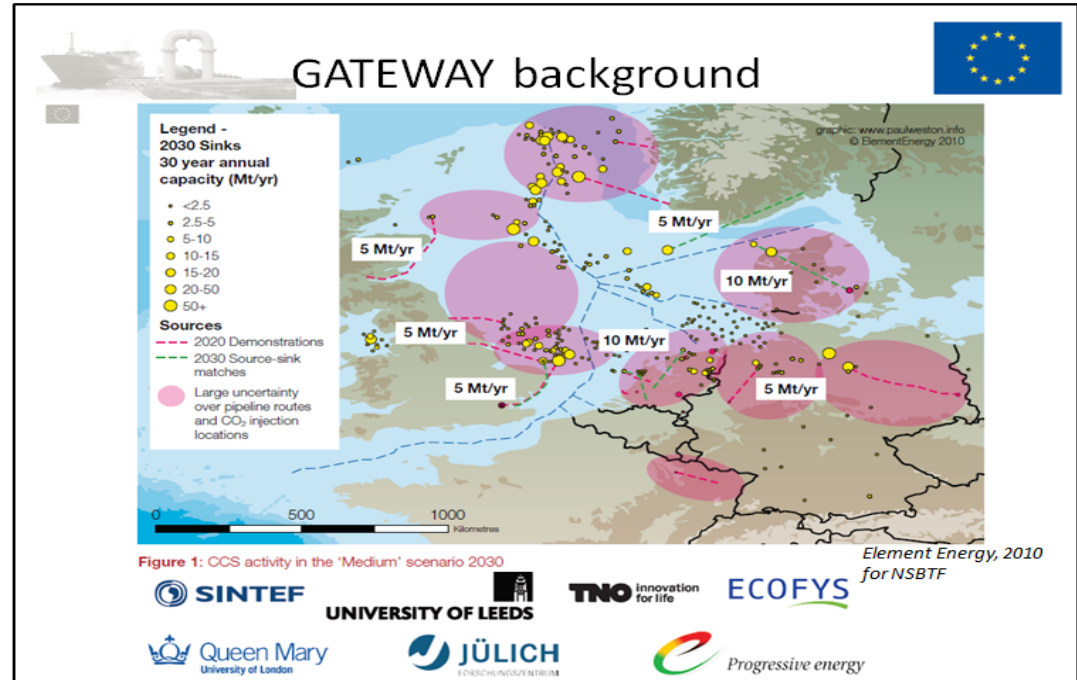
- › What:
 - › Coalition of stakeholders
- › WHO:
 - › Petroleum companies, equipment suppliers, scientists, energy intensive industries, NGO
- › Goals
 - › Make CCS commercially viable by 2020 via a demonstration programme.
 - › Accelerate R&D into next-generation CCS technology and its wide deployment
- › Useful for:
 - › Creating demo's
 - › Access to industrial CCS network
- › Contact: Filip Neele



Question 3

PROJECTS WITH (POSSIBLE) MS PARTICIPATION

- › ERA-NET
 - › ACT
 - › ROAD
- › GATEWAY
- › ECCSEL



Main objectives

- › Operate a pan-European research infrastructure
- › Integrate and upgrade existing research facilities and supplement with new ones
- › Enhance European science, technology development, innovation and education

Societal impact

- › Enable spin-off activities and generation of new business
- › Investment ~€250 Million, Transitional operation started 6/2015

Contact

- › Robert de Kler



Question 4

EU FP6, FP7, H2020 PROJECTS (NOT EXHAUSTIVE)

Post combustion



Pre-combustion



Oxy-Fuel



Transport & Storage

CCUS Research in Europe



RUNNING PROJECT IN 2016 WITH TNO AND ECN



- › Running
 - › CEMCAP (TNO)
 - › HIPERCAP (TNO)
 - › MIRECOL (TNO)
 - › STEPWISE (ECN)
 - › Leilac (ECN)
 - › Ascent (ECN)
 - › FASTCARD (ECN)
- › New
 - › ENOS (TNO)

COALITIONS ON CAPTURE

| partner | | TNO | ECN | VITO | LUT | PdMilano | Sintef | DTU | Uni Edinburgh | Vtt | CSIC | IFP | CNRS |
|---------------|-------------|-------------|-------------|---------|---------|----------|--------|---------|---------------|---------|-------|--------|--------|
| | country | Netherlands | Netherlands | Belgium | Finland | Italy | Norway | Denmark | UK | Finland | Spain | France | France |
| TNO | Netherlands | | | | | | | | | | | | |
| ECN | Netherlands | 0 | | | | | | | | | | | |
| VITO | Netherlands | 0 | 1 | | | | | | | | | | |
| LUT | Finland | 0 | 0 | 0 | | | | | | | | | |
| PdMilano | Italy | 1 | 5 | 1 | 0 | | | | | | | | |
| Sintef | Norway | 4 | 4 | 3 | 0 | 6 | | | | | | | |
| DTU | Denmark | 2 | 0 | 1 | 0 | 0 | 3 | | | | | | |
| Uni Edinburgh | UK | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | |
| VTT | Finland | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | | | | |
| CSIC | Spain | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | | | |
| IFP | France | 4 | 0 | 1 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | | |
| CNRS | France | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| NTNU | Norway | 5 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 1 | 4 | 2 |

NEW CALLS

April 2016

- › ECRIA, LCE-33-2016

Jan 2017

- › Large scale test site, LCE 27-2017
- › CCS in industry; LCE-29-2017
- › CO2 Storage; LCE-30-2017
- › New low TRL technology (CCU, algae), LCE 6-2017
- › Flex power, LCE 28-2017

- › ACT

Question 5

› **THANK YOU FOR YOUR ATTENTION**

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TNO innovation
for life

cato
CO₂ CATCHER