IEA-ETSAP Workshop
7-9 November, 2011, CRES, Athens

The COMET methodology to analyse the most cost effective CO2 transport and storage infrastructure in TIMES

Gargiulo M., E4SMA, Italy
Kanudia A., KanOrs-EMR. India
Labriet M., ENERIS, Spain
Tosato G.C., ASATREM, Italy

Contents

1. The COMET project
2. Location and quantification of CO2 emissions from the sources
3. Locations and storage capacity of the sink regions
4. Analysis of the most cost effective CO2 transport and storage infrastructure within TIMES
COMET project introduction

• COMET - Integrated infrastructure for CO\textsubscript{2} transport and storage in the west Mediterranean (Spain, Portugal and Morocco) is an EU FP7 project.

• COMET aims at identifying and assessing the most cost effective infrastructure that will be able to serve the West Mediterranean area, considering:
  ➢ the time and spatial aspects of the development of the energy sector and other industrial activities in Spain, Portugal, Morocco
  ➢ the location, capacity and availability of potential CO\textsubscript{2} storage geological formations
  ➢ the transport modes matching the sources and sinks for a CCS network infrastructure as part of an international climate cooperation policy.

Location and quantification of CO\textsubscript{2} emissions from the sources

The project contributes to:

• **Identify and characterize the main current CO\textsubscript{2} sources (>100 kt/yr) in Portugal, Spain and Morocco**, including:
  ➢ Usual information needed for energy modelling (fuel consumption, lifetime, etc.)
  ➢ Useful data for GIS analysis

• **Assess future CO\textsubscript{2} sources**, based on:
  ➢ Current and future development plans of the countries
  ➢ Expected locations of the energy and industrial plants, if defined
  ➢ Different scenarios, represented by TIMES models

• **Example:**
  ➢ Spain: more than 230 sources, with 190 sources > 100 kt
  ➢ Portugal: 32 emission sources > 100 kt
Locations and storage capacity of the sink regions

- The project contributes to identify and evaluate capacities in a harmonized way for potential storage sites of the Iberian Peninsula and Morocco with a special focus on trans boundary off-shore sites.

- The sites are qualified through different criteria:
  - proximity to the sources,
  - geological settings (type of field, depth, permeability, porosity, cap rock, capacity, injection capacity, etc)
  - economic characteristics
• The proposed methodological framework uses a multi-regional model built with TIMES including:
  ➢ ES, PT, MA and
  ➢ COMET transport model (Cluster Regions model) to produce the most cost effective CO₂ transport and storage infrastructure from 2005-2050, based on different scenarios.

• The COMET model represents all the information:
  ➢ including localization, costs, efficiency, extra energy consumption etc.

related to CCS, in other words:
  ➢ emission sources (by cluster), capture, purification, transport (satellite lines and trunk lines), sinks.

Analysis of the most cost effective CO₂ transport and storage infrastructure within TIMES

Overview of COMET model.

Each emission cluster or storage site (itself possibly a cluster of storage sites) is a “region”. A region can have both as well.
Analysis of the most cost effective CO2 transport and storage infrastructure within TIMES

A typical region of COMET, including a cluster of emissions and storage site. A region of COMET could include only a cluster of emission, or only a storage site.

The approach is as follows:
- Regions: ES, PT, MA, 45 emission clusters and 40 sink regions
- Processes in the “COMET model”: capture, purify, transport and store
- Commodities: emissions by fuel and sector, captured and purified
Analysis of the most cost effective CO2 transport and storage infrastructure within TIMES

- Spain, Portugal and Morocco regions (3-Country Model) exchange energy with clusters and/or sinks in the COMET model. In the COMET model is possible to deliver CO2 from cluster to cluster or from cluster to sink.

- The 3-country model is generating CO2 commodities depending on sector and fuel. This commodity is:
  - captured in the COMET module
  - purified through technologies that combines the 35 emission streams into a few concentrations
  - suitable for transportation and storage

- Changes in The 3-country model:
  - Create CO2 <Sector><Fuel>;
  - Turn off original emissions for the covered sectors;
  - New emissions allocated to clusters;
  - Share controlled with base year information;
  - Emissions bounded to 0 in the 3-country model

- Emission clusters:
  - CO2<Sector><Fuel> arrives from the 3-country model PET regions;
  - Capture technologies described by fuel consumption, investment and variable costs;
Analysis of the most cost effective CO2 transport and storage infrastructure within TIMES

- Transportation and storage
  - Create links based on cut-off distances;
    - Cluster to cluster
    - Cluster to sink
  - "Placeholder" Costs (proportional to distance)

The 3-Country model + COMET module are running altogether producing the most effective CO$_2$ transport and storage infrastructure.
THANK YOU!

Maurizio Gargiulo
maurizio.gargiulo@e4sma.com