Fundación Ciudad de la Energía

Hontomín TDP
Features, facilities and experiences

ECCSEL Training Course on monitoring large scale CCS pilots R&D facilities
J. Carlos de Dios, Low Carbon Technologies Director at CIUDEN
Hontomín, Feb 24th 2016
# Index

<table>
<thead>
<tr>
<th>Hontomín TDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The origin. Main goals</td>
</tr>
<tr>
<td>2. Decision making</td>
</tr>
<tr>
<td>3. Features of the seal and reservoir complex</td>
</tr>
<tr>
<td>4. Engineering, construction and commissioning</td>
</tr>
<tr>
<td>5. Starting the operation</td>
</tr>
<tr>
<td>6. Future challenges</td>
</tr>
<tr>
<td>7. Collaboration</td>
</tr>
</tbody>
</table>
HONTOMÍN TECHNOLOGY DEVELOPMENT PLANT FOR CO$_2$ GEOLOGICAL STORAGE
Hontomín TDP. The origin. Main goals

Project OXYCFB300 “Compostilla”

Storage main goals

- Refine CO₂ storage technologies in “on-shore” deep saline aquifer conditions (fractured carbonates)
- Identification of cost reduction action for the whole of the process
- Potential risk assessment and corrective measures proposal
- Support for developing alternative geophysical technologies to characterize the seal-reservoir complex
- Tools development for dynamic modelling (hydraulic, hydrodinamic and chemical scope)

European Energy Programme for Recovery

Objectives Phase I
Technology development for CO₂ oxy capture, inland transport and storage in saline aquifers supporting a future demo 300 MW CCS oxyCFB Power Station

Technology upscaling development from pilot to industrial size in “Real Life Conditions”
OXYCFB300 “Compostilla Project”
The origin

TDP for CO$_2$ Geological Storage (Hontomín)
Why Hontomín?

1. Regarding the **project goals**:
   - Deep saline aquifer
   - Fractured carbonates
   - Enough capacity for upscaling (2-4 Mt)

2. **High knowledge level on the geological formations**
   and especially related with the seal and reservoir complex.

3. The **populations** are located in small villages around the site with implantation of traditional oil sector activities in the area.
Decision making
Geological characterization

Geophysical campaigns

- **Induced seismicity 2D-3D**
  Determine geometry, tectonic structure, top allocation, formation thickness, petrophysical properties and the rest of the data needed to develop the geological static model (Project OXYCFB300)

- **Electromagnetic Techniques CSEM, Magnetotelluric**
  Define the base lines needed for tracking CO₂ plume evolution and developing future works to control de injection evolution. Different techniques have been conducted according this goal (LEMAM, ERT, Magnetotelluric, etc) in the project OXYCFB300

- **Microgravimetry**
  Determine the base line and an alternative technique for the CO₂ plume tracking. (Project OXYCFB300)

- **DIN SAR and GB SAR**
  Use of satelital images and ground radar technique to analyze the surface subsidences produced by the injection. (Project OXYCFB300)
Hontomín TDP. Features of the seal and reservoir complex

1. **Site**: on-shore deep saline aquifer storage (1.600 m depth)

2. **Location**: Hontomín (Burgos), Castilla y León Region, Spain

3. **Nature of the cap rock**: carbonates (Marly Lias 150 m width)

4. **Nature of the store rock**: carbonates (limestones and dolomites)

5. **Capacity of the site**: 100.000 T CO₂ (administrative requirement, Spanish Law 40/2010 CO₂ Geological Storage)

6. **CO₂ injection strategies**: liquid, supercritical and alternative

7. **Safe storage operation**: irregularities and leakage control

8. **Public acceptance**: positive
Hontomín TDP. Engineering, construction & commissioning. Pilot plant layout
Pilot technical characteristics. Wells and deep monitoring

HI Injection well

HA Observation well
Operating parameters
P up to 120 Bar
T -20 to 40º C
FR 0,2 to 2 Kg/sec
Hontomín TDP. Engineering, construction & commissioning. Water conditioning facility

Operating parameters
P up to 120 Bar
FR up to 10 Kg/sec
Brine (up to 40,000 ppm salinity)
Hontomín TDP. Engineering, construction & commissioning. Seismic and hydrogeological control networks

- 30 passive seismic stations
- 20 sensors SARA SS 45 (4.5 Hz)
- 10 sensors Lennarzt LE 3D (20 seconds period)
- 1 accelerometer
- Specific software (control room)
Hontomín TDP. Engineering, construction & commissioning. Light drilling technique

Cost efficiency up to 60% regarding traditional methods
Hontomín TDP. Engineering, construction & commissioning. Well-connectivity tests and VSP campaign

Both wells are in the same reservoir block
Hontomín TDP. Engineering, construction & commissioning. Hydraulic characterization

14,000 m³ of brine and 1,5 Kt of CO₂ have been injected in the reservoir following the modes: “pressure control”, “flow control” and “injection-production” to determine the safe and efficient operation parameters (pressure, flow rate, temperature, etc).

Tests in “Pressure Control” mode (Well HI)
CO₂ injection
Liquid injection strategy

Injection conducted according transport conditions “OXYCFB300 Project”

1st Stage. Well pressurization with brine

2nd Stage. CO₂ conditioning to be injected

3rd Stage. CO₂ injection

4th Stage. Tubing cleaning

Control

Tubing choke installed 1,000m depth for avoiding high bottom hole overpressure with unadmissible seismic effects on surface
Future challenges

- **Low cost drilling techniques** (light equipment) as an efficient tool for exploration and construction activities. Except the EHR cases, CO₂ storage is an industrial process for waste treating in geological formations.

- **Cost-effective injection strategies** in fractured rock massifs with poor porosity and high anisotropy. Cold injection (avoiding the hydrates effects), solved with brine (regarding the mixture acidification), etc.

- Go further with the existing projects and studies to improve the **alternative geophysical techniques** (CSEM, Gravimetry, DIN SAR, GB SAR, etc).

- **Deep monitoring tools** to control the reservoir behaviour for the whole of the project life.

- **Innovative dynamic modelling** for a realistic capacity and plume evolution assessment.

- Advanced tools for the **interpretation of the seismic response** related with the injection operations.

- New abandonment **well techniques**

- **Good practice guidelines** regarding the different project stages (exploration, construction-commissioning, operation, abandonment and the liability transfer) as the first step for developing an updated European Legal Framework for CGS.
Value the knowledge gained during the project OXYCFB300 development in the form of the provision of high technological value services which permit the commercial deployment of CO2 geological storage technology.
Lines of cooperation

Project ENOS- ENabling Onshore CO₂ Storage in Europe Call H2020 LCE 2014-15

Proposal endorsed by:

Hontomin- Batelle site in Michigan Basin (USA)-Otway(Australia) / LBrl-Kansas Wellington Field.

ECCSEL framework

European Research Area (ERA)
SET-PLAN → EII-CCS
ESFRI
European Strategy Forum on Research Infrastructures
EERA
European Energy Research Alliance
Zep
Zero emissions platform
ERA-Net ACT Cofund

International collaboration

Carbon Capture & Storage Association
GLOBAL CCS INSTITUTE
POWER-GEN EUROPE
Thank you for your attention

Further information:
Carlos de Dios, jc.dedios@ciudan.es