TRUST

High resolution monitoring, real time visualization and reliable modeling of highly controlled, intermediate and up-scalable size pilot injection tests of underground storage of CO_2

Contract #309067

Deliverable Number	**D9.1**
Title	**Educational material for Heletz visitors' program**
Work-Package	**9**
Lead Participant	**IIT**
Contributors	EWRE
Version:	**1**
Revision level:	**02**
Due Date:	
Reviewed by:	
Status:	
Dissemination level	**PU**

Executive summary

This deliverable suggests a plan for using the Heletz site for educational purposes and suggest materials that could be used to this end. We plan to use materials to be developed in the frame of TRUST as wells as documents, knowledge and information generated by other projects (such as MUSTANG and PANACEA). A visitor's center, though modest, will be established at Heletz.

Keywords	Training, visitor center

Table of Contents

1. Objective 3
2. Why is this important 3
3. Outline of proposed center 4
3.1 Ideas presentation methods 4
3.2 Subjects to be presented 4
3.3 Advertisement 5
3.4 Location 6
3.5 Steering committee 6
4. List of materials 7
4.1 Posters (a) 8
4.2 Video clips (b) 8
4.3 Presentations (c) 9

1. Objective

One of the key obstacles to public acceptance of CO_2 storage in deep geological formations is the lack of public confidence by many environmental stakeholders, in a number of aspects of this technology, especially its reliability, the integrity of the storage, and risks associated with the impact of possible failure (in the reservoir and above ground). It is our opinion, shared by many experts, that the strong skepticism with regard to this technology resides in a lack of information by the public concerning the purpose of the storage, the technology implemented and the associated risks. Within the framework of the TRUST project, special attention is devoted to this issue of dissemination of information to concerned stakeholders. The establishment of a Visitors Center at an experimental CO_2 injection site would contribute significantly to disseminate information on the technology, the benefits and the risks and to familiarization with this technology. It is our belief that understanding the technology and the risks involved is a key element in its acceptance.

The objective of the Center is to serve as a place where visitors, from all over Europe, as well as visitors from around the world, primarily non-professional ones, will be exposed to the concepts, the technology of CO_2 sequestration in deep geological formations and its contribution to the prevention of CO_2 from augmenting the greenhouse effect, thus slowing down the trend of climate change. They will also be exposed to the technology itself, to the measures undertaken to make the technology safe, and to the risks. They will be exposed to educational materials on the subject and receive explanations on the concepts underlying this technique. They will also be exposed to on-going examples of actual CCS projects - experimental and full scale implementation ones.

2. Why is this important

Eventually, the approval of implementation of any project depends on decisions by national and regional and local authorities. These, in turn, depend on the public's attitude concerning such projects. Public ignorance, and often disinformation, as to the pros and cons of any project, will prohibit the approval of proposed projects, even if scientists and engineers will present tons of proofs that a considered project is beneficial to the environment and is absolutely safe from any considered point of view. Hence, educating the public as to the benefits as well as potential dangers is essential. It is the duty of scientist not only to investigate the problems and the difficulties involved and to discover methods to overcome difficulties and ensure efficient and economic projects, but also to make sure that projects are safe as far as the public and the environment are concerned.

However, it is not enough that the scientists and engineers, who investigate and plan CCS projects, are convinced that the latter are efficient and safe. The public must be convinced, feel comfortable with the project, and support it. This goal can be achieved only when the public and its representatives in decision making bodies, is exposed to reliable information not only on the proposed projects, but also on potential dangers and means of overcoming them. Only if the public will be convinced that a proposed project is safe, there is a chance of approving it for implementation.

The advantage of disseminating information at the Heletz site, where actual injection experiments have been conducted is obvious.

3. Outline of proposed center

The idea is to establish at a certain location, preferably at a CCS site, a place where the public can visit comfortably in order to be exposed to specially prepared material about the problem of CO_2 sequestration in deep geological formations, from "why do we need it", up to "how can we do it safely and efficiently".

3.1 Ideas presentation methods

The ideas underlying CCS projects will be presented in a variety of forms.

To the public at large:

a. Posters that expose and explain concepts, ideas and research conclusions.
b. Video clips that expose ideas, including videos that present guided visits to existing sites and laboratories. Videos of laboratory experiments, as well as of existing i\sites around the world.
c. PowerPoint presentations of concept, research, etc.
d. Tour to the actual well where experiments have been conducted, with explanations, description now experiments, results and conclusions.
e. Tour to the instrumentation and measuring equipment, with emphasis on safety devices.
f. A large sand box (or more than one to show various aspects) with glass sides that will represent an area underlain by several geological porous formations: an upper phreatic aquifer from which water is being pumped and a deeper confined layer into which CO_2 is injected and one can see the spreading of a simulated plume in a confined layer. Injection into a depleted petroleum reservoir (e.g., anticlinal) can also be demonstrated in the same way.
g. One or two Hele-Shaw models will be used to exhibit the spreading of the injected CO_2 in a confined formation.
h. Exhibition of literature on the subject---books and publications, general and by country.
i. Printed and other material (including material that visitors can download to a disk-on-key).
j. Material that a visitor may download and take home.
k. If possible, e.g., if located within the premises or close by to a university, the CENTER may also serve as a location for meetings, symposia and conferences on CCS and related subjects.

To professionals and students.

In addition to the above, the Heletz experimental site can be used to demonstrate to engineers, geologists and graduate students the actual detailed injection and pumping wells as well as the equipment, the measuring instrumentation and the safety devices.

Courses to professional and students can be conducted on the site.

3.2 Subjects to be presented

Pedagogical visits by the scientific/technical community as well as by the general public, during which the public visiting the center will be exposed to the following subjects.

1. Promotional/education material.

    a) What is carbon dioxide (CO_2)?
    b) Global warming and the role of carbon dioxide in promoting it.
    c) Who contributes CO_2 to the atmosphere?

d) The idea of sequestration in depleted oil/gas reservoirs and in deep saline-water containing formations.
e) The fate of the injected CO_2 in the formation.
f) Why is it safe?
g) The risks involved and how can we minimize them.
h) The roles of the public and decision makers.
i) The future of CO_2 sequestration as part of the efforts to combat global warming.

2. Overview and/or in-depth tutoring to the functioning of a CO_2 storage facility in general and Heletz facility in particular.

3. Audiovisual and written material clarifying the functioning of CO_2 storage operation.

a) The idea of CO_2 sequestration in deep geological formations.
b) Safety considerations.
c) Economic considerations.
d) Investigations leading to a proposal to construct a CCS project.

4. Structures and routines for guided visits.

3.3 Advertisement

Information about the center will be distributed throughout Europe.

3.4 Location

The proposed Center may be located at several optional facilities.

a. In, or adjacent to an active injection site. This is the best location choice, as visitors can actually see that CO_2 is being injected and the earth does not shake, and no excess CO_2 is in the atmosphere or in the drinking water.
b. On the campus of a university. Advantage: imposes a scientific atmosphere, and students can be employed to act as guides to visitors.
c. On the premises of an industry (also an oil/gas company), but the public may be suspicious that the industry is biased.
d. Anywhere in Europe. However, because the HELETZ site is an interesting site of injection experiments, it is a good candidate for the location of the proposed Center. However, for Europeans, visiting the CENTER at Heletz will require much more travelling.

3.5 Steering committee

To plan the Center and its operations, as it is envisaged that the center will be continuously updated as more information is being gathered from experimental and operational sites around the world,

a. A steering Committee (5 members of the TRUST consortium) will be appointed by the Coordinator of TRUST to approve all proposals and materials prepared in connection with the proposed CENTER.
b. All members of the TRUST consortium will be informed about developments in planning the CENTER and their comments and contributions will be solicited.

4. List of materials

This section will include a summary of the materials for the variety of visit guide methods, and its intended goals.

Table 1. List of materials to be presented at the center.

Index	Material	Goal	Remark
a	Posters	1(a)(b)(c)(d), 2, 3(a)	
b	Video clips	1, 2, 3, 4	
c	PowerPoint presentations	1, 2, 3, 4	
d	A large sand box with glass sides	2, 3(a)	Budget dependent
e	Hele-Shaw model	3(a)	Budget dependent, can be represented by (b)
f	Exhibition of literature - books and publications	1(a)(b)(c)(d), 2, 3(a)	
g+h	Printed and digital material	1(a)(b)(c)(d), 2, 3(a), 4	

4.1 Posters (a)

a. What is CO_2.
b. Global warming
c. Heletz site experiment – processes and tools.
d. CO_2 sequestration in deep geological formations.
e. PANACEA project insights summary.

4.2 Video clips (b)

a. CO_2 fingering phenomena: "6c. Fingers.mp4 ", "6d. Migrating CO_2.mp4" from "Numerical Modeling of Geological Storage part 2" by Jesus Carrera CSIS on the TRUST advanced course on CO_2 sequestration in deep geological formations.

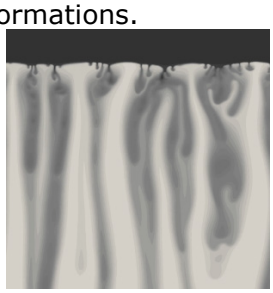

Figure 1. Fingers.

Figure 2. Migrating CO_2.

b. Guided visit video for instructors: we have already started producing educational/informative movies on the technologies installed at Heletz and we plan to produce a number of short movies explaining the experiments that will be carried out.

4.3 Presentations (c)

a. What is CO_2 and S.C. CO_2.
b. Global warming and what is CO_2.
c. Heletz site experiment – processes and tools.
d. Heletz site experiment – main ideas.

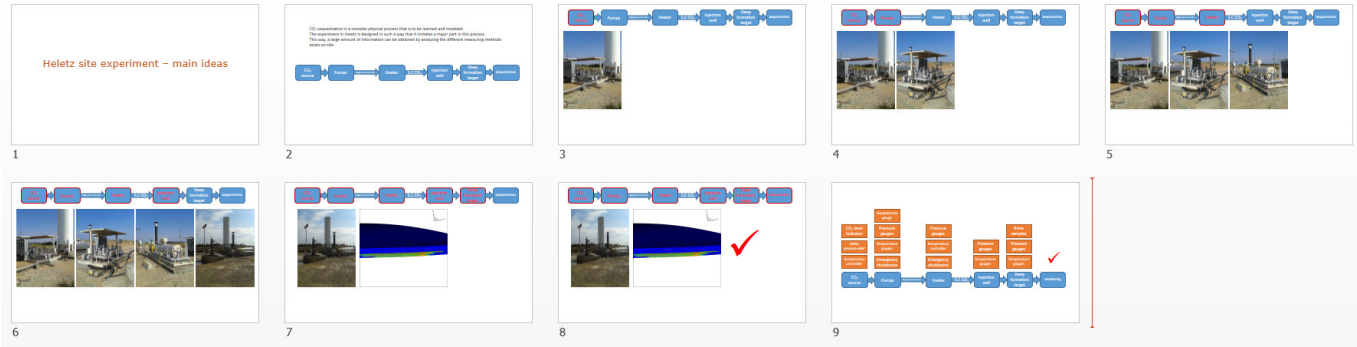

Figure 3. Heletz site experiment – main ideas.

e. PANACEA project insights summary.
f. "Introduction to geological storage of CO_2 and examples of field projects" by Auli Niemi Uppsala University on the TRUST advanced course on CO_2 sequestration in deep geological formations.

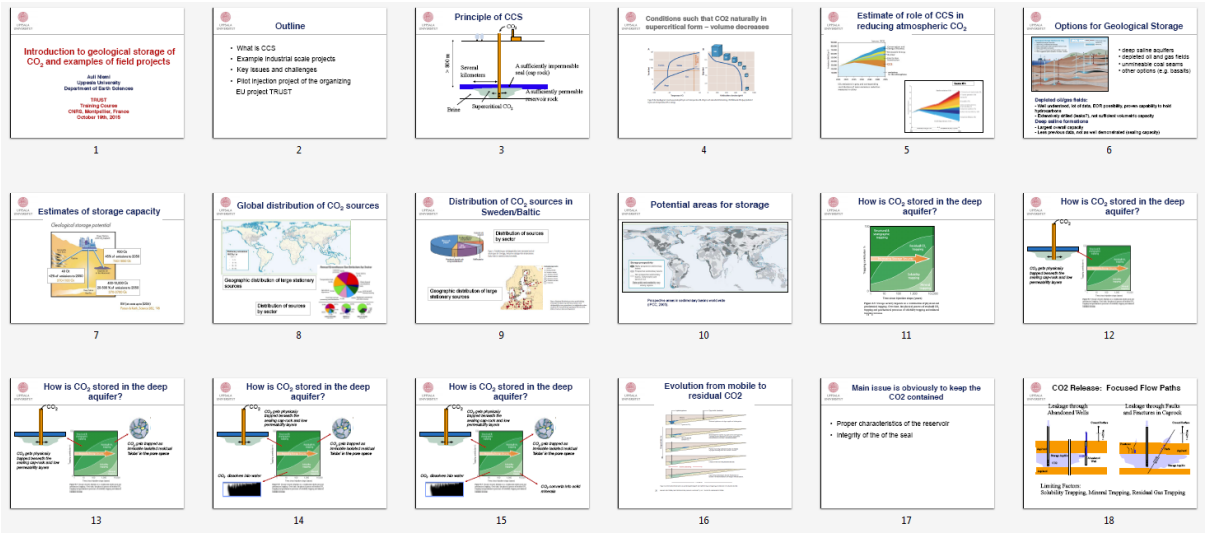

Figure 4. Introduction to geological storage of CO_2 and examples of field projects.