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CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

CPERI
Chemical Process and Energy Resources Institute

Achieving a Carbon-Neutral Europe: CCUS & Hydrogen

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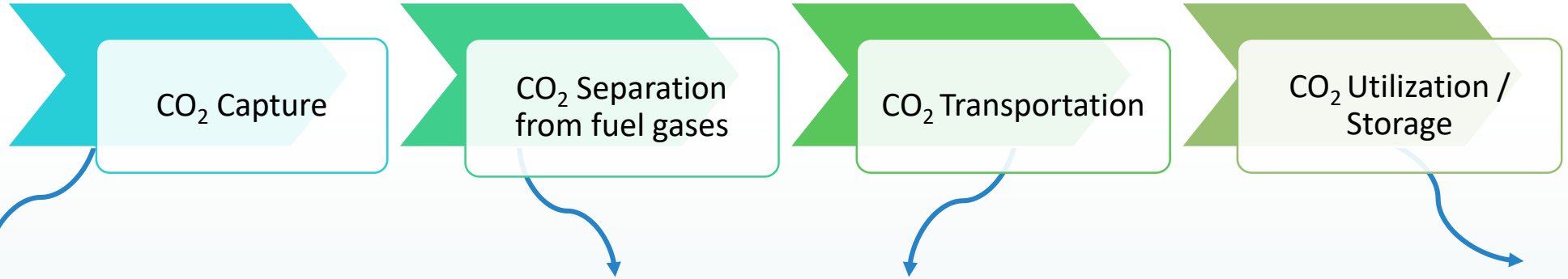
ΤΕΕ
ΤΕΧΝΙΚΟ ΕΠΙΜΕΛΗΤΗΡΙΟ ΕΛΛΑΔΑΣ

IENE

CCUS value chain

Carbon capture, utilization and storage (**CCUS**) ⇨ a suite of technologies that can play a diverse role in meeting global energy & climate goals.

CCUS ⇨ valuable tool for the decarbonisation of the industrial sector.



CO_2 along with other flue gases is captured via the deployment of capture technologies from industrial source points.

CO_2 is isolated from other flue gases.

CO_2 is collected and transported to areas of interest.

CO_2 is either utilized into new ways or is safely stored away from the atmosphere.

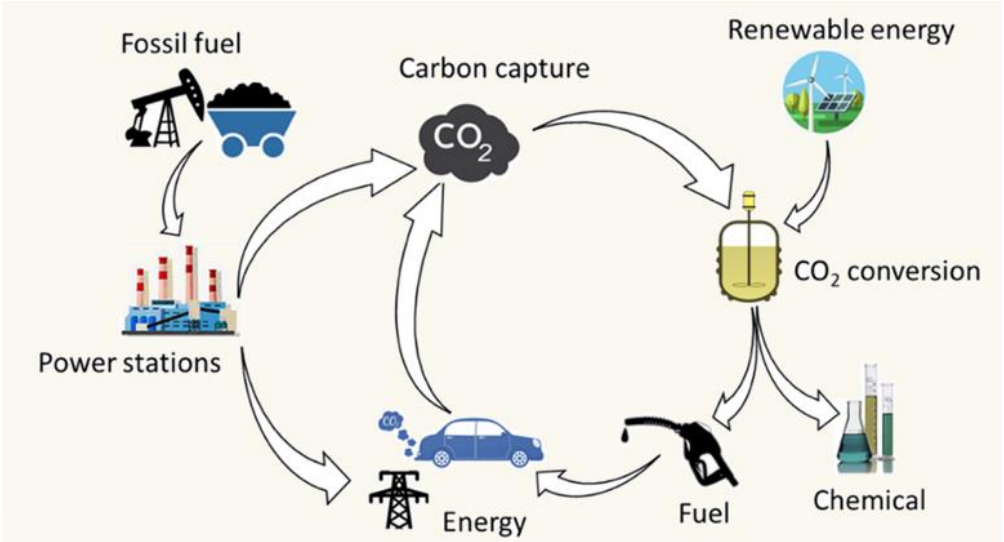
CCUS captures CO_2 from large point sources (power generation / industrial). If not being used on-site, CO_2 is compressed, transported & **injected into geological formations for CO_2 storage**.

CCUS value chain: CO_2 Utilisation

Carbon Capture & Utilisation (**CCU**)

is in line with the principals of **circular economy.**

CO_2 is a new **commodity**, not an industrial exhaust.



The different services the CCU can offer (Source: Adamu et al., 2020)

CO_2 is converted into at least 150 new products.

Valuable component to the production of fuels & chemicals.

Every year 180 Mton of CO_2 into **urea**, 60 Mton into **inorganic carbonates**, 15 Mton into **polyurethane** and 5 Mton into **polycarbonates.**

CCUS value chain: CO_2 Geological Storage

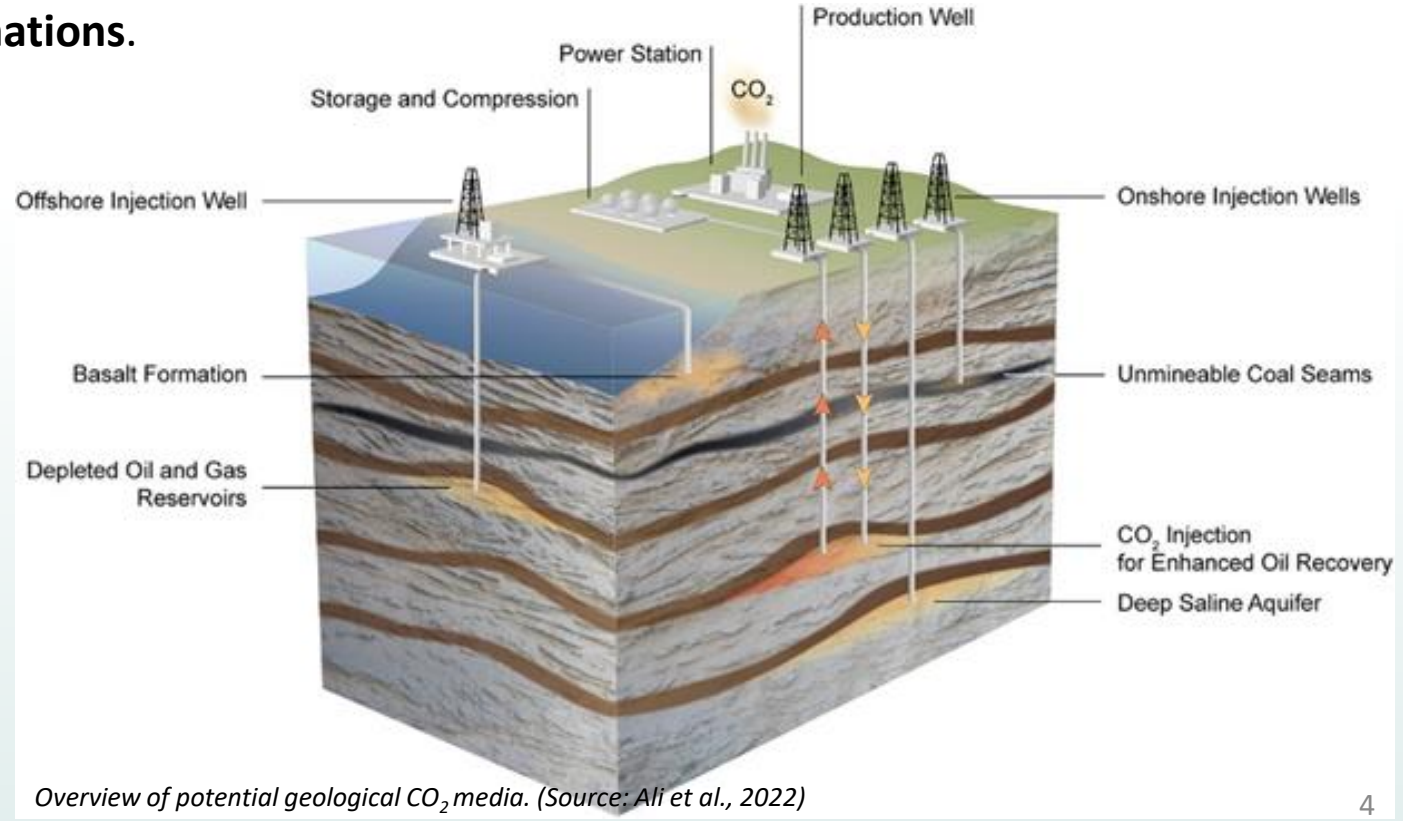
1. Storage above-ground: ⇨ in tanks
2. Underground storage: ⇨ in geological formations (permanent/long-term storage)
   ⇨ using CO_2 for EOR (Enhanced Oil Recovery)
3. Alternative CCS solution: ocean CO_2 storage or Bioenergy production with CCS (BECCS).

CO_2 reservoir prerequisites: **(1)** permeability, **(2)** thickness, **(3)** depth, **(4)** the occurrence of an overlying cap-rock.

CCS = sequestration of CO_2 into **geological formations**.

Underground geological formations suitable for CO_2 sequestration are:

- **Deep Saline Formations**
- **Abandoned Coal Mines/Salt Caverns**
- **Depleted Hydrocarbon Fields**
- **Coal Seams**
- **Basaltic, ultramafic rocks & sandstones (CO_2-mineralization)**



Overview of potential geological CO_2 media. (Source: Ali et al., 2022)

Hydrogen Value Chain (2)

H_2 Production

The H_2 production methods are codified by color.

- **Black/Grey H_2**: Generated via hydrocarbons. High CO_2 emissions.
- **Blue H_2**: Generated using hydrocarbons, combining CCUS.
- **Green H_2**: Produced by water electrolysis, using RES. Zero CO_2 emissions.
- **Purple H_2**: Produced by water electrolysis, using nuclear power.
- **Turquoise H_2**: Generated by fossil fuel pyrolysis.
  - **White H_2**: Naturally occurring in underground geological formations.

H_2 Transmission and Distribution

The transportation of H_2 can be accomplished via various transport routes.

Pipeline Network

Road network

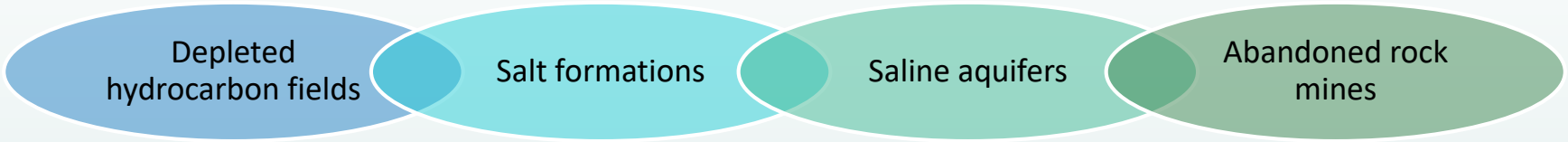
Railway network

Maritime transport

H_2 Storage

H_2 can be stored either **aboveground** in storage tanks, or **underground** in geological formations.

- **Geological settings** optimal for H_2 storage are:



H_2 Utilisation

The already generated and stored H_2 can be utilised to cover the energy needs.

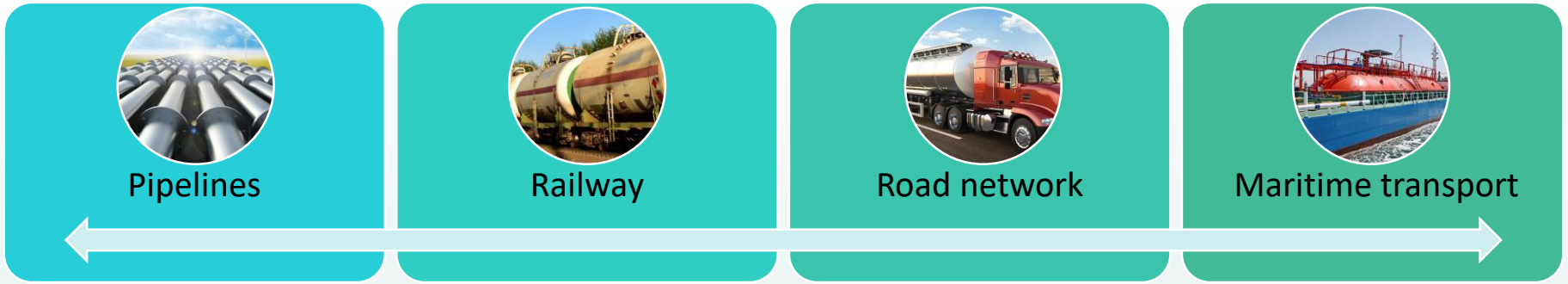
- H_2 is withdrawn from the storage site and properly processed to obtain a form that is suitable for use by consumers.
- H_2 can be utilised to **fuel vehicle**, **generate electricity** or **heat**.

H_2 value chain: Hydrogen Transportation

✓ In the hydrogen value chain, **transportation** is identified **at two key points**:

During periods of **low energy demand** → the **generated hydrogen** requires **transportation from** the **production facility to** the underground or aboveground **storage site**.

During periods of **high energy demand** → the **stored hydrogen** should be **transported from the storage** tank or reservoir **to the end users** to fulfil the increased energy needs.



A combination of the available transportation methods can be used

H_2 value chain: Hydrogen Storage

Two **categories** of H_2 storage:

Aboveground H_2 Storage

- Storage tanks (method Power-to-Gas (P2G))

Underground H_2 Storage

- Saline aquifers
- Depleted oil & gas fields
- Abandoned mines
- Salt formations

UHS in Abandoned mines

- **Existing cave** → no drilling is needed.
- **Possible availability** of **facilities** and **machinery** that can be used after necessary adaptation.

UHS in Saline aquifers

- **Experience** due to decades of **storing natural gas in aquifers.**
- **Requirements:**
  -> **porous formation** capable of retaining H_2
  -> **impermeable formation** to prevent migration

H_2 value chain: Hydrogen Storage

UHS in Salt formations

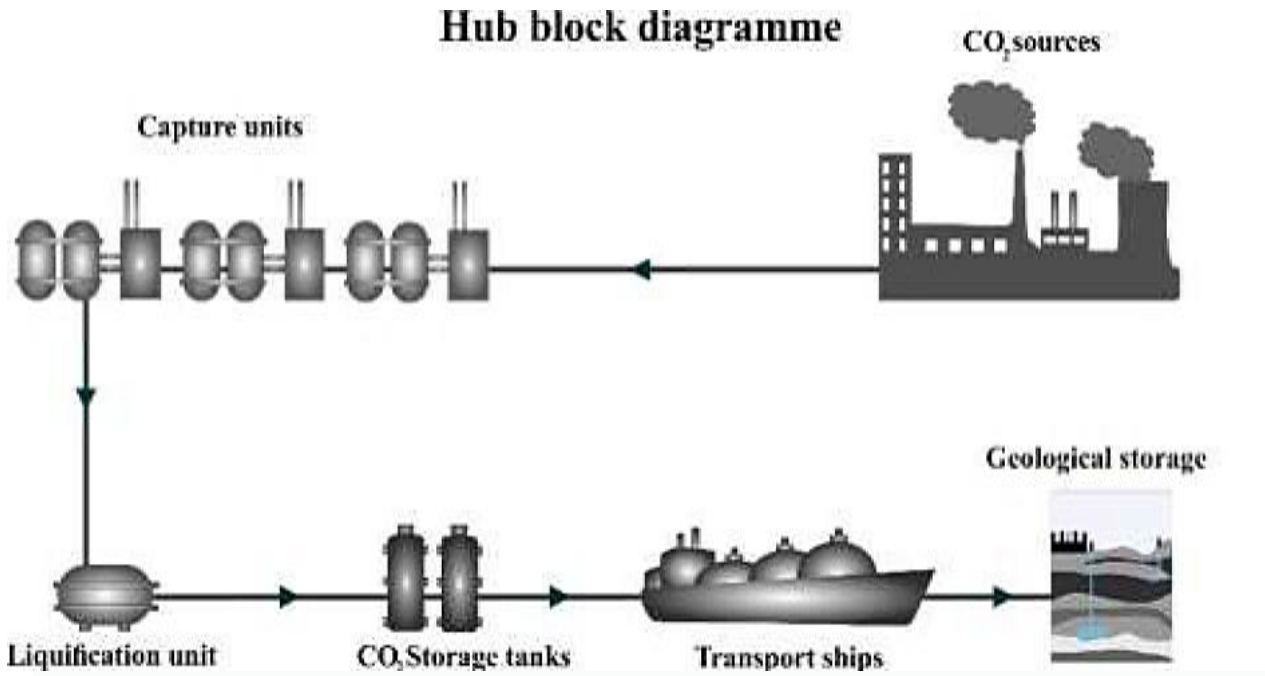
- **Large capacity and capable pressure conditions.**
- Relatively inexpensive excavation.
- **Higher rates of hydrogen storage and extraction** → **flexibility** to supply energy to the grid when required.

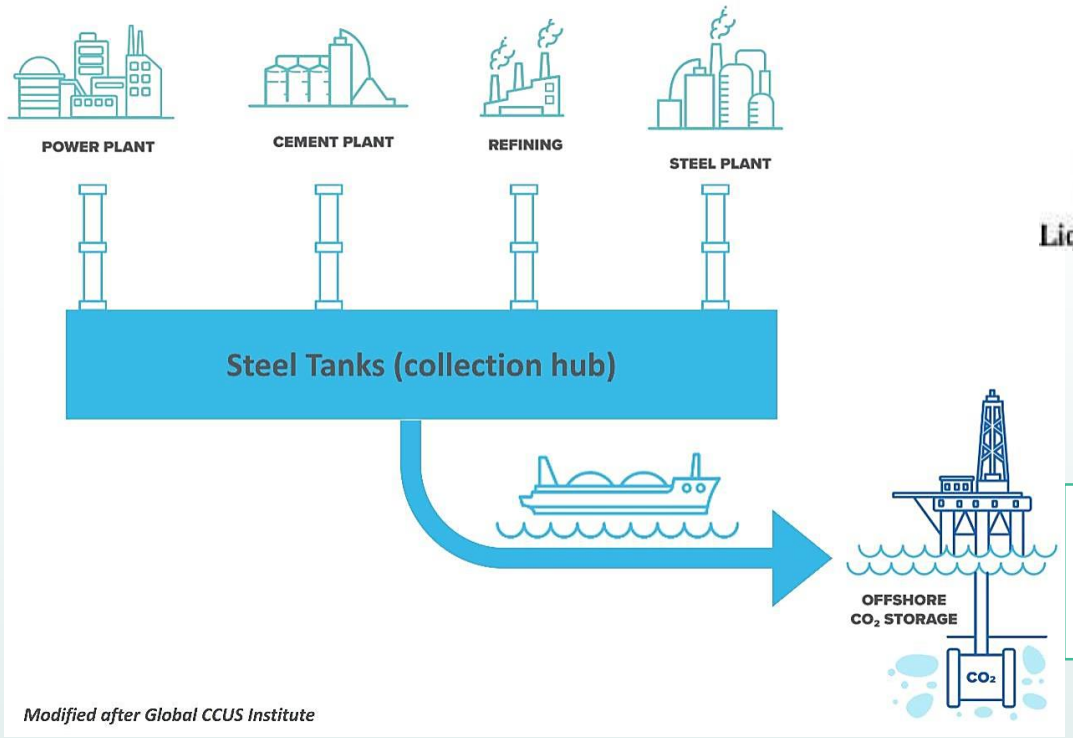
UHS in Depleted oil & gas fields

- **Optimum conditions** for gas storage.
- Years of **experience**, advanced **technological resources**, **existing facilities.**
- **Availability of** a residual gas quantity, which can be used as **cushion gas.**

CCUS & H_2 hub networks

Hub block diagram displaying the overall land-based hub architecture.





Modified after Global CCUS Institute

The envisaged CCUS hub and cluster network

Proposed CCUS hubs in Greece

- Proposed sites for **CCUS hubs** in Greece:
  1) **Thessaloniki port** → nearby CO_2 emission centers: (a) Western Macedonia industrial region, (b) Thessaloniki cement & oil industries. CO_2 transfer via ships in Greece/abroad.
  2) **Prinos** → promising storage sites.
  3) **Alexandroupolis port** → connects several local industries for CCU.
     Advantage: geopolitical significance (supply hub for NATO Alliance's defense).
  4) **Ptolemaida** → nearby CO_2 emission sources (coal power plants) & potential storage sites (Mesohellenic Trough). CO_2 transfer via pipelines/railway.
  5) **Corinth & Aspropyrgos** → major CO_2 sources (oil refineries). CO_2 transfer via ships in Greece/abroad.

Proposed sites for CCUS hubs in Greece

CO_2 Capture in Greece (1)

- CO_2 captured → CO_2 separated from other fuel gases via: (a) pre-combustion, (b) post-combustion, (c) oxy-fuel combustion.
- Major emission sources:
  a. **Sector of energy & industrial sector**: stationary sources, i.e., power plants & factories.
  b. **Sector of energy**: fossil fuel-powered power plants & refineries.
  c. **Industrial sector**: iron industry, steel industry & cement industry.

Ptolemaida V plant (source: https://energypress.gr)

▶ Potential CO_2 capture sources in Greece:

1. *Ptolemaida V power plant.*
2. *Cement industries (e.g., TITAN Cement)*
3. *Oil & gas refineries (e.g., Motor Oil, Energean)*

- Ptolemaida V: a **CO_2 capture-ready facility**, will contribute to the security of national energy supply.
- Started operating in 2022 → will convert to another fuel / technology by **2028**.
- **Potential storage**: Prinos basin, Middle East & North Africa for EOR (Red Sea, Egypt), Northern Europe (offshore storage).

CO_2 & H_2 Transportation in Greece – Available Infrastructure (1)

Ports (e.g., Piraeus port, Thessaloniki port) ➔ space for **industrial & commercial activity** ➔ can support numerous **ships & boats** (passengers / cargo) ➔ **CCUS hubs**

- Greek **railway network**:

Western Macedonia (standard gauge line)	• Polykastro – Idomeni variant (new layout) • Kommanos – Kozani (Public Power Corporation)
Peloponnese (standard gauge line)	• Rododafni – Rio, Isthmus – Loutraki • Isthmus – Ag. Theodoroi (connection with Motor Oil facilities)

- **Larger volumes** of CO_2 & H_2 and **longer distances than trucks**.
- Transportation **tanks**: **materials compatible with CO_2 and H_2 properties** to **prevent** any **leakage due to corrosion**.

Existing railway network of continental Greece (Source: www.ose.gr)

CO_2 & H_2 Transportation in Greece – Available Infrastructure (2)

CO_2 & H_2 transportation infrastructure → **pipeline networks**

- **CO_2 and H_2 transport by retrofitting existing gas pipes:**

I. **Existing NG pipeline network** → can be **adapted** to transport CO_2 and H_2 → **Reduces the costs** of constructing a new transport network.

II. **The adaptation** of the existing network for natural gas is **required due to the different properties of CO_2 and H_2 gases** compared to natural gas, which **may cause corrosion** of the existing pipes.

CO_2 & H_2 transportation infrastructure → **shipping** via Greek ports

Projected expansion of the European H2 pipeline network by 2040 (Source: EHB)

CO_2 Storage sites in Greece (1)

- Preferable types of CO_2 geological storage formations in Greece:

  - Saline formations
  - Oil and natural gas reservoirs
  - Un-mineable coal areas
  - Organic-rich shales

- Potential CO_2 geological storage sites in Greece with estimated storage capacity in Mt:

1. *Mesohellenic Trough (216-1,435 Mt)*
2. *West Thessaloniki – Epanomi field (640 Mt)*
3. *Prinos – South Kavala (35 Mt)*
4. *Volos basalts (2 Mt) – not preferrable*

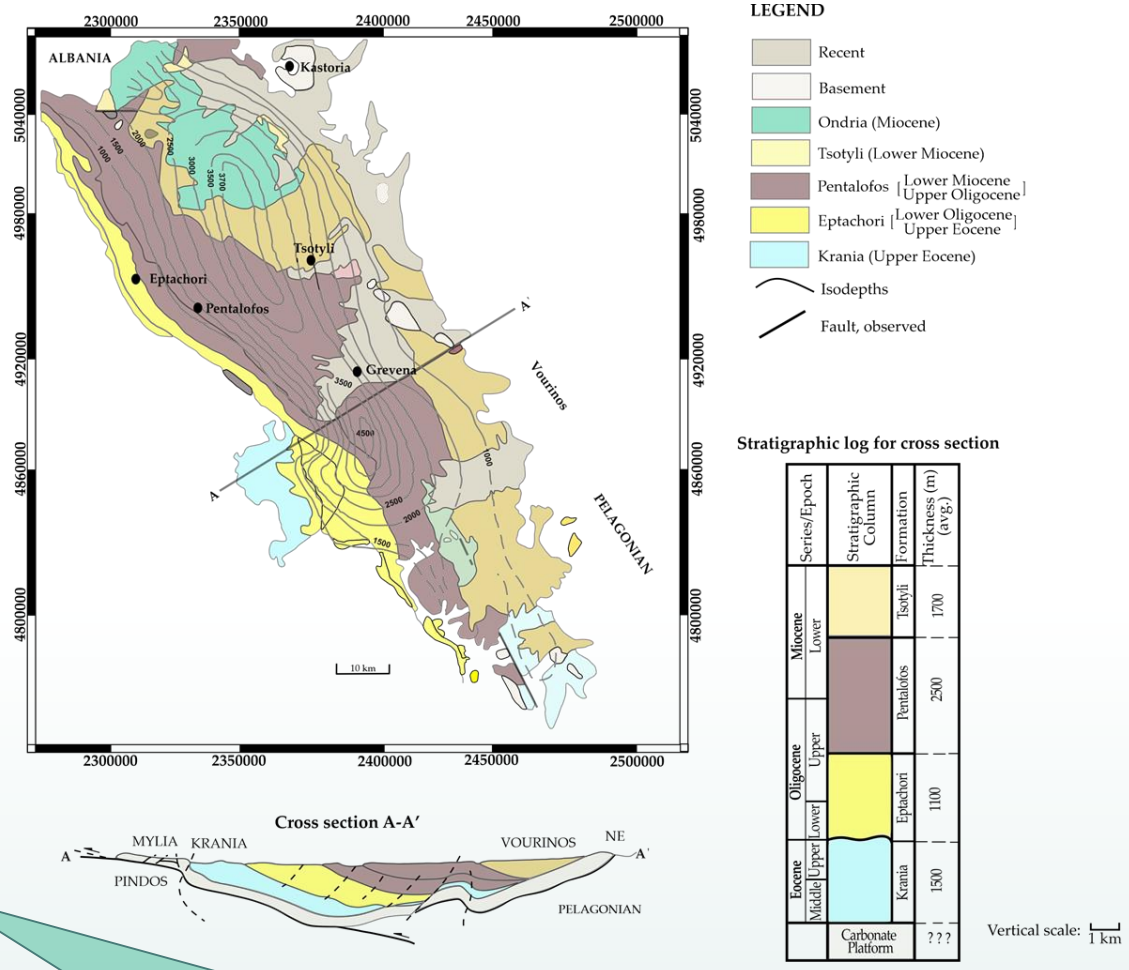
CO_2 Storage sites in Greece (2)

1. Mesohellenic trough sandsones

Acceptability criteria	Mesohellenic Trough
Storage Capacity (Mt)	216 – 1435 (Pentalofos + Eptachori formation)
Injectivity	Good (15% porosity)
Integrity	2 confining zones at depth
Depth (m)	2500

2. West Thessaloniki – Epanomi field

Acceptability criteria	West Thessaloniki	Epanomi Field
Storage Capacity (Mt)	640	2
Injectivity	Low porosity & permeability	Low porosity to tight
Integrity	1200	1600
Depth (m)	900 - 2400	2600



Estimated NG reserves in the **Epanomi field** ~ 500 million m^3 of:

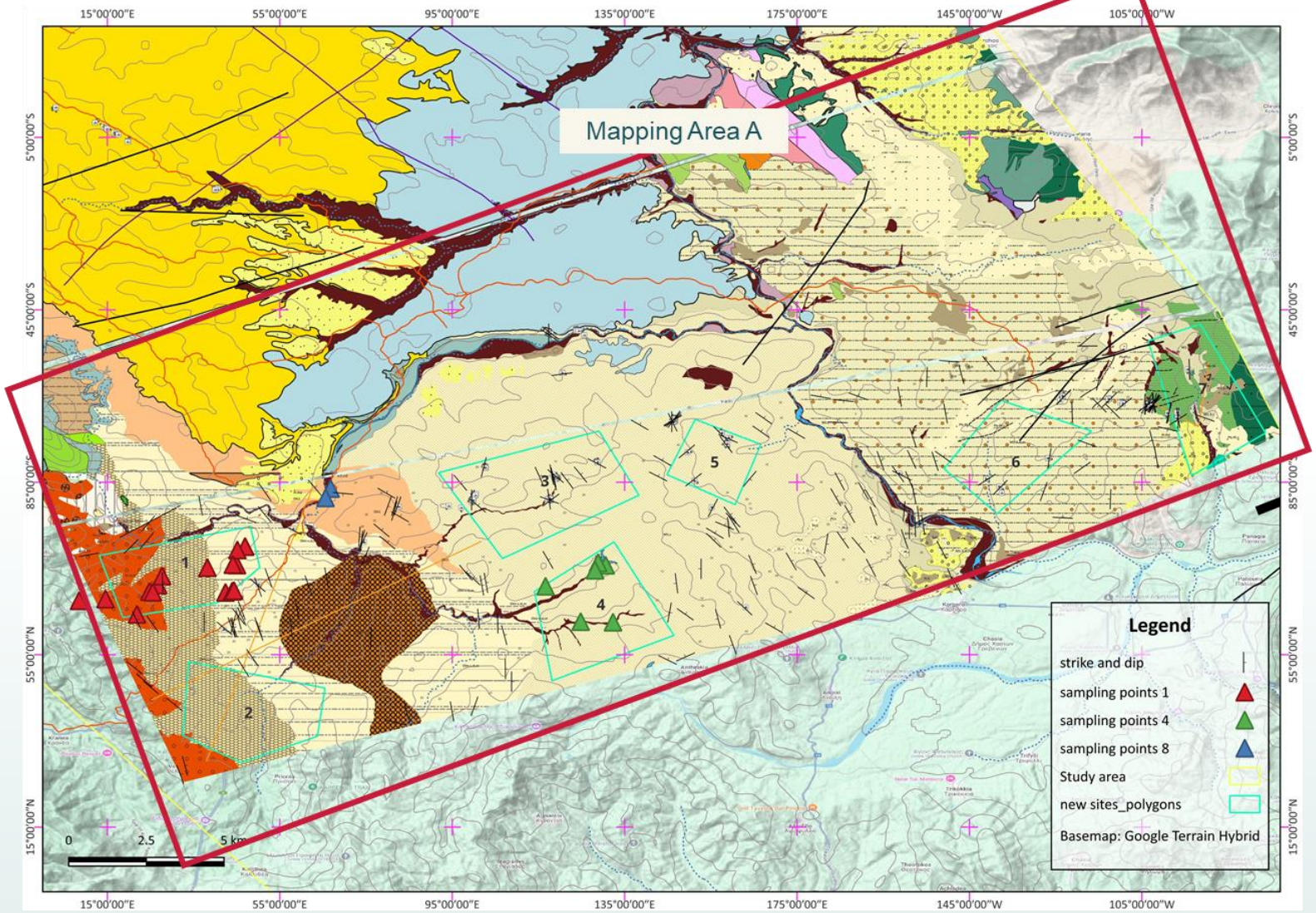
- 71.8% hydrocarbon gases
- 26.6% non-hydrocarbon gases (including 22.6% CO_2)

CO_2 Storage sites in Greece (3)

Mesohellenic trough sandsones ➔ The region is **studied** within the EU-funded **project PilotSTRATEGY** ➡ **CERTH is one of the participants**

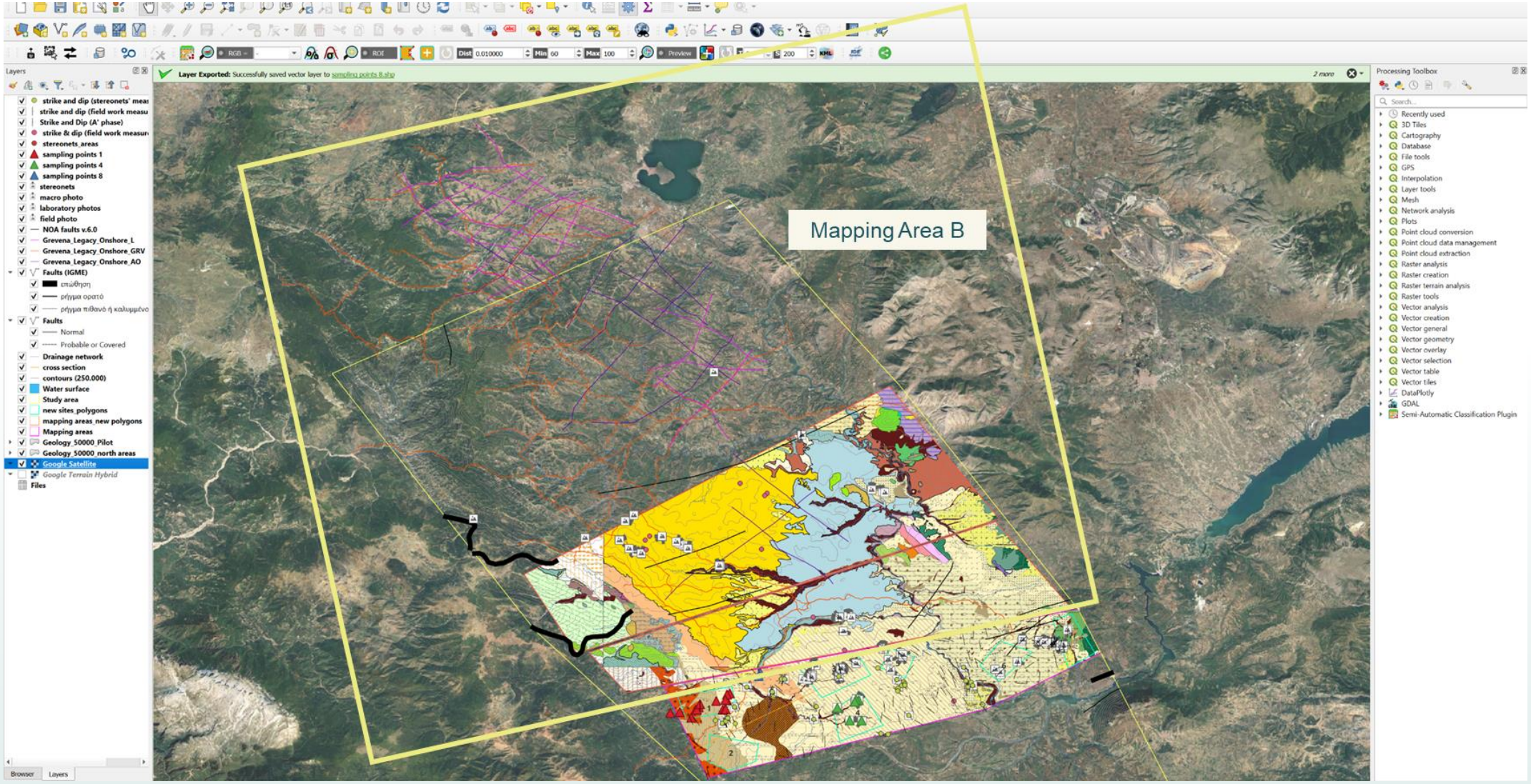
PilotSTRATEGY

- Data collected & organized in Geopackages for QGIS analysis:
  - Strike & dip measurements
  - Sampling points
  - Seismic Data
  - Visual material (sample photos, graphs, etc.)
- **Mapping Area A**: 90 % complete



CO_2 Storage sites in Greece (4)

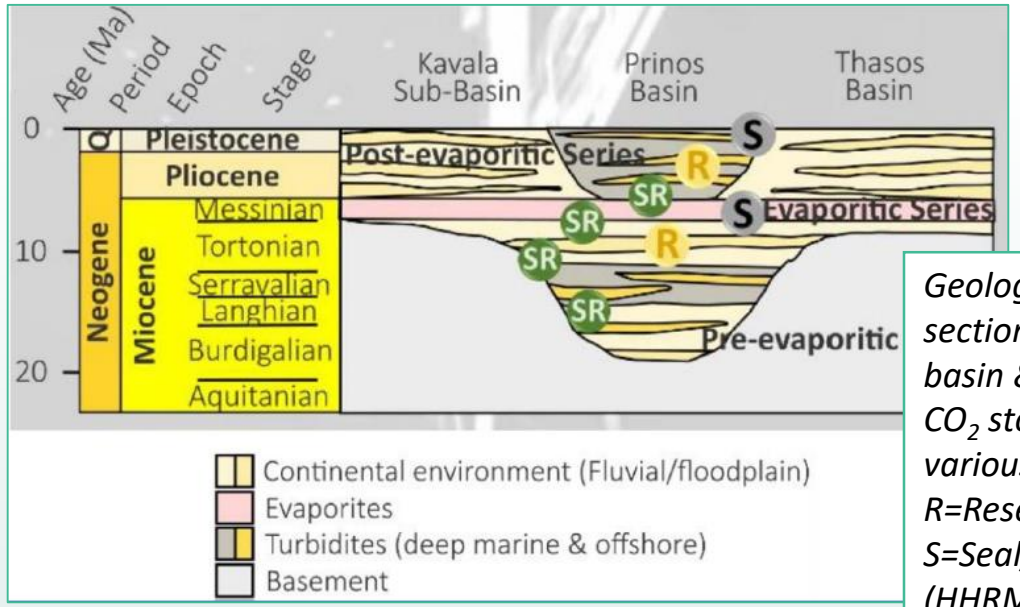
- **Mesohellenic trough Mapping Area B**: Currently mapping to cover the total area of Seismic data.



CO_2 Storage sites in Greece (5)

3. Prinos basin – South Kavala

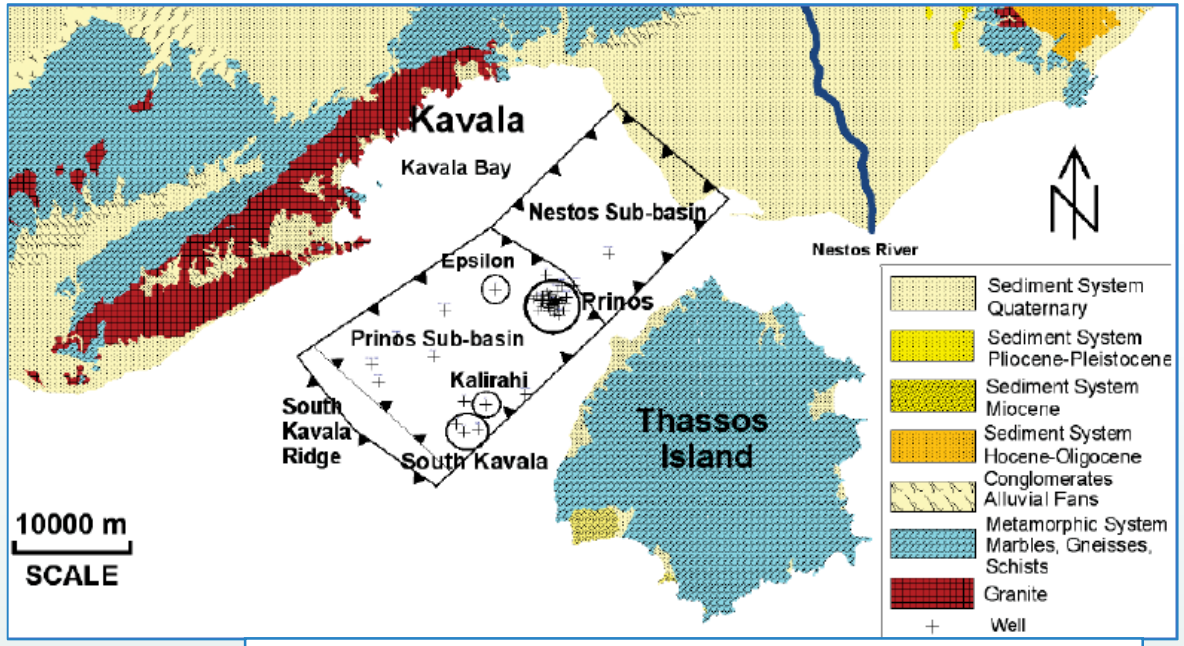
Acceptability criteria	South Kavala	Prinos Basin
Storage Capacity (Mt)	35	
Injectivity	Average to Good (15% porosity)	
Integrity	2500 - 2850	1600 - 1730
Depth (m)	1600	1600



Geological section of Prinos basin & possible CO_2 storage at various depths. R=Reservoir, S=Seal/Cap-rock (HHRM., 2020)

4. Volos basalts

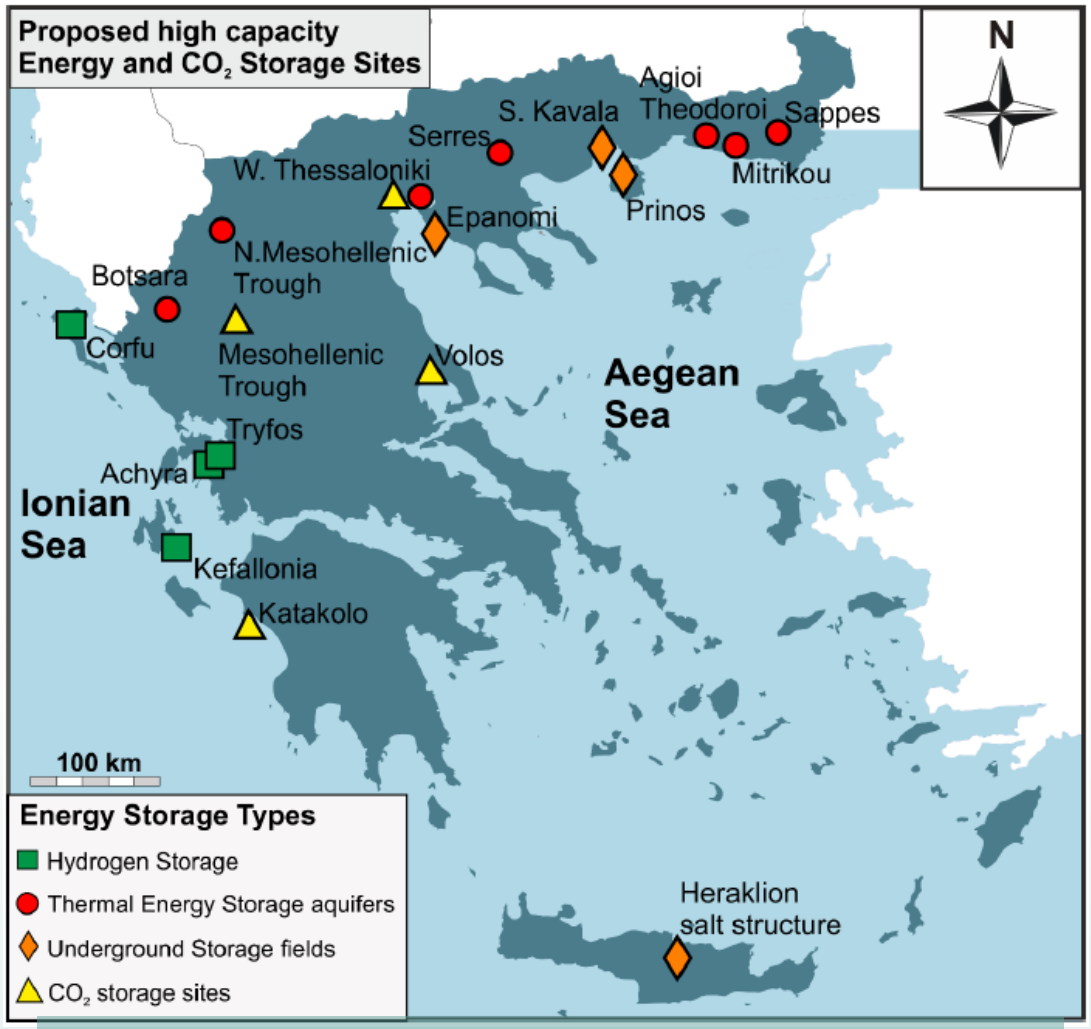
Geological Formations	Storage Capacity (tn)
Basalts	43,200



Map of the Prinos-Kavala sedimentary basin and the oil & gas reservoirs in the region (Kiomourtzi et al., 2008)

H_2 Storage sites in Greece

H_2 storage locations in Greece:	Capacity
1. Corfu	26.600 MWh(e) H_2
2. Achyra– Tryfos (Central Aitoloakarnania)	26.600 MWh(e) H_2
3. Kefallonia	26.600 MWh(e) H_2
4. Kavala (plans for underground gas storage facility)	1-2 TWh H_2



Potential H_2 & CCS storage sites in Greece
(Source: Arvanitis, Koukouzas, et al., 2020)

CERTH experience in European CCUS/CCS Projects (1)

Characteristic Examples of CCUS & CCS projects in Greece

Project Title	Start-End	Description
UCG & CO_2 STORAGE - Study of deep underground coal gasification & permanent CO_2 storage in affected areas	01/07/10-31/12/12	Evaluating the potential of deep coal seams for UCG & CO_2 storage via using the same boreholes after technical modifications. Study of technical, environmental, economic factors. Study areas: Dobrudzha Coal Deposit (Bulgaria), Florina Basin (Greece), El Tremedal (Spain).
RISCS - Research into Impacts and Safety in CO_2 Storage	01/01/10-31/12/13	Assessing environmental impacts of CO_2 leakage from geological storage sites on groundwater resources, onshore & offshore near-surface ecosystems. Informed policy makers, politicians & general public of the feasibility, long-term benefits & consequences of large-scale CCS.
R&Dialogue - Research and Civil Society Dialogue towards a low-carbon society	01/06/12-30/11/15	Promotion of collaboration between R&D organizations (RDOs) & civil society organizations (CSOs) for a shared vision on the development of renewable energies and CCS, to develop dialogue and joint learning.
ECCSEL - European Carbon Dioxide Capture and Storage Laboratory Infrastructure	01/09/15-31/08/17	Aim & Outcome: to make accessible ECCSEL as a distributed research infrastructure system for European CCUS. ECCSEL is a non-profit organization for the coordinated operation of multiple research facilities.
COALBYPRO - Innovative management of COAL BY-PROducts leading also to CO_2 emissions reduction	01/07/17-30/09/20	Study of CO_2 mineral sequestration in fly ash & zeolites. Assessment of possible utilization of post-sequestration products. Outcomes: environmental management of coal mines following their closure & minimizing the environmental impact of hard coal combustion processes.

CERTH experience in European CCUS/CCS Projects (2)

Characteristic Examples of CCUS & CCS projects in Greece

Project Title	Start-End	Description
STRATEGY CCUS - Strategic planning of regions and territories in Europe for low-carbon	01/05/19-30/04/22	Strategic plans for CCUS development at short (<3 years), medium (3-10 years) and long term (>10 years) in promising regions of SE Europe corresponding to 45% of EU CO_2 emissions from industry & energy sectors.
LEILAC2 - Low emissions intensity lime and cement 2: demonstration scale	01/04/20-31/03/25	A new technology for capturing CO_2 emissions of European cement & lime industries. A demonstration plant capturing 100ktpa of CO_2 will be integrated in an operational cement plant. Aim: to scale-up to ~20% of a typical cement plant's CO_2 emissions.
PilotSTRATEGY - CO_2 Geological Pilots in Strategic Territories	01/05/21-30/04/26	Understanding deep saline aquifers as means of CO_2 storage in 5 industrial regions of SE Europe, by acquiring new data (seismic, geochemical, etc.).
ConsenCUS - CarbOn Neutral cluSters through Electricity-based iNnovations in Capture, Utilisation and Storage	01/05/21-30/04/25	An industrial plan for a net-zero carbon EU via the utilization of 3 electricity-based innovations: carbon capture based on alkali absorption, conversion of CO_2 to formate & formic acids for market uses, and a safe cyclic loading system of CO_2 into salt formations & aquifers for storage.
CEEGS - CO_2-based electrothermal energy and geological storage system	01/11/22-31/10/25	Developing a multisector RES storage system including reversible trans-critical CO_2 cycles, geothermal heat extraction, and CO_2 geological storage. Aim: assess the techno-economic viability, cover the gaps between the technologies used, raising TRL from 2 to 4.

LEILAC 2 - Low emissions intensity lime and cement 2: demonstration scale

Proposed technology: Scalable & modular design, retrofitted to a **Heidelberg Materials cement plant** with a low-impact integration to its operations.

✓ Demonstration of **alternative & renewable** fuel sources use.

Leilac 2

Partners

- Currently working on:

  WP5 - Dissemination and stakeholder engagement

- Most recent updates:
  - **Task 5.1**: Social Impact Study → analyzing societal impacts of the **CO_2 storage/utilization solution of WP4**.
  - **Key Performance Indicators (KPIs)** → used to give detailed analysis in support of the **Task 4.5 Roadmap (D4.6: CO_2 storage or use roadmap)**.
  - Assessment of social & stakeholders' acceptance of the CCUS solution.

WP5 Partners:

PilotSTRATEGY - CO_2 Geological Pilots in Strategic Territories

Study **deep saline aquifers (DSA)** as means of geological **CO_2 storage** in five **European industrial regions**. New acquired data (seismic, geochemical, etc.) → increase the maturity level for **CCS applications in** DSA.

PilotSTRATEGY

Partners

ConsenCUS - CarbOn Neutral cluSters through Electricity-based iNnovations in Capture, Utilisation and Storage

Measures to make a system net-zero, e.g., CO_2 storage, direct air capture(DAC), biogenic carbon instead of fossils:

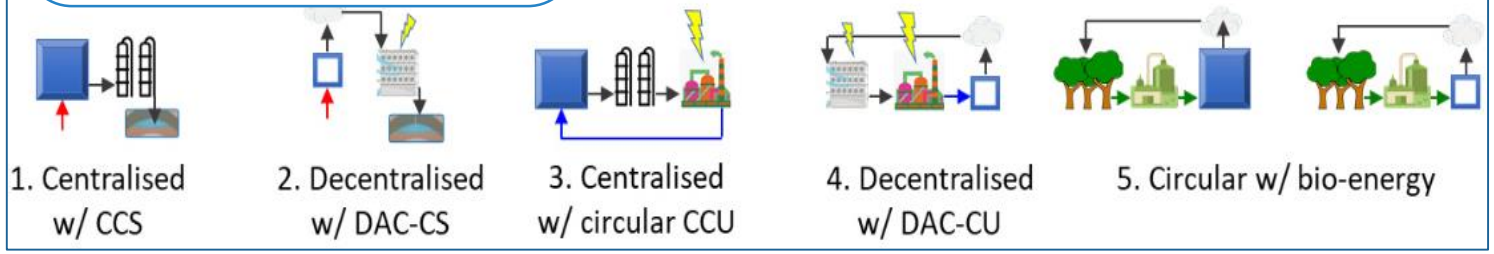
An industrial plan ➔ **3 electricity-based innovations**:

a) carbon capture based on alkali-absorption,

b) conversion of CO_2 to formate & formic acids for market uses,

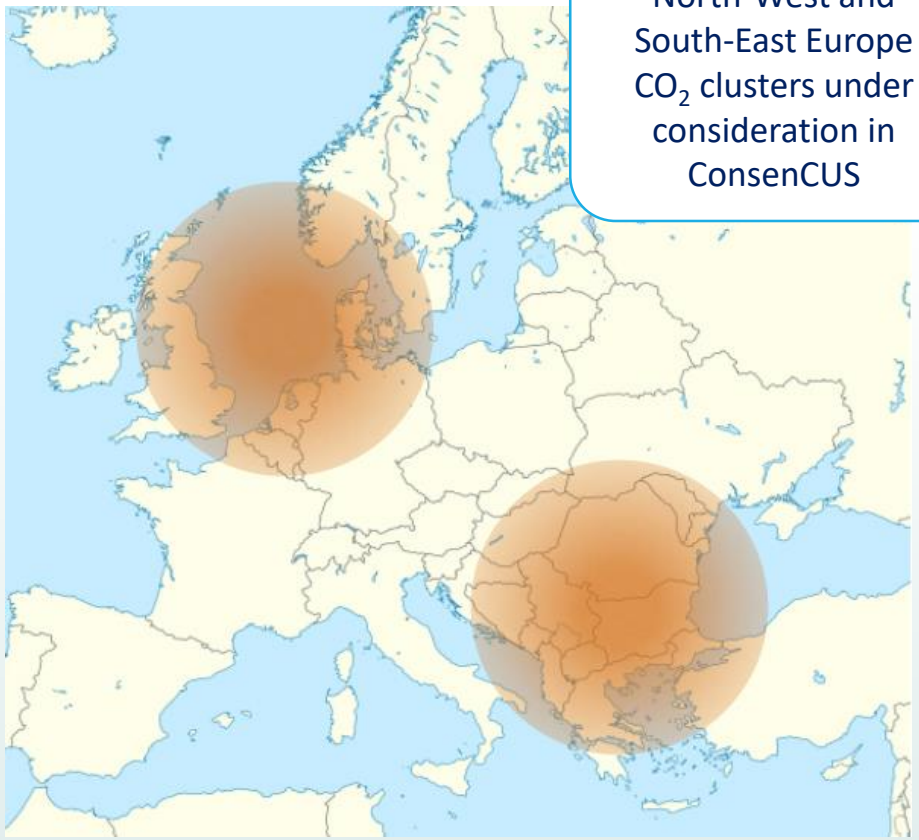
c) a cyclic loading system for CO_2 storage in salt formations & aquifers.

ConsenCUS



Partners

- **3 demonstration sites**:
  1. **Greece** (Yerakini Mine, Chalkidiki, Grecian Magnesite)
  2. **Romania** (Petrobrazi refinery, OMV Petrom)
  3. **Denmark** (Rørdal cement production site, Aalborg Portland)
- **End goal**: to **reach TRL7**, operating in actual industrial conditions.



North-West and South-East Europe CO_2 clusters under consideration in ConsenCUS

CEEGS - CO_2-based electrothermal energy and geological storage system

✓ A **multisector** renewable energy storage system → reversible trans-critical CO_2 cycles, geothermal heat extraction, and CO_2 geological storage.

Partners

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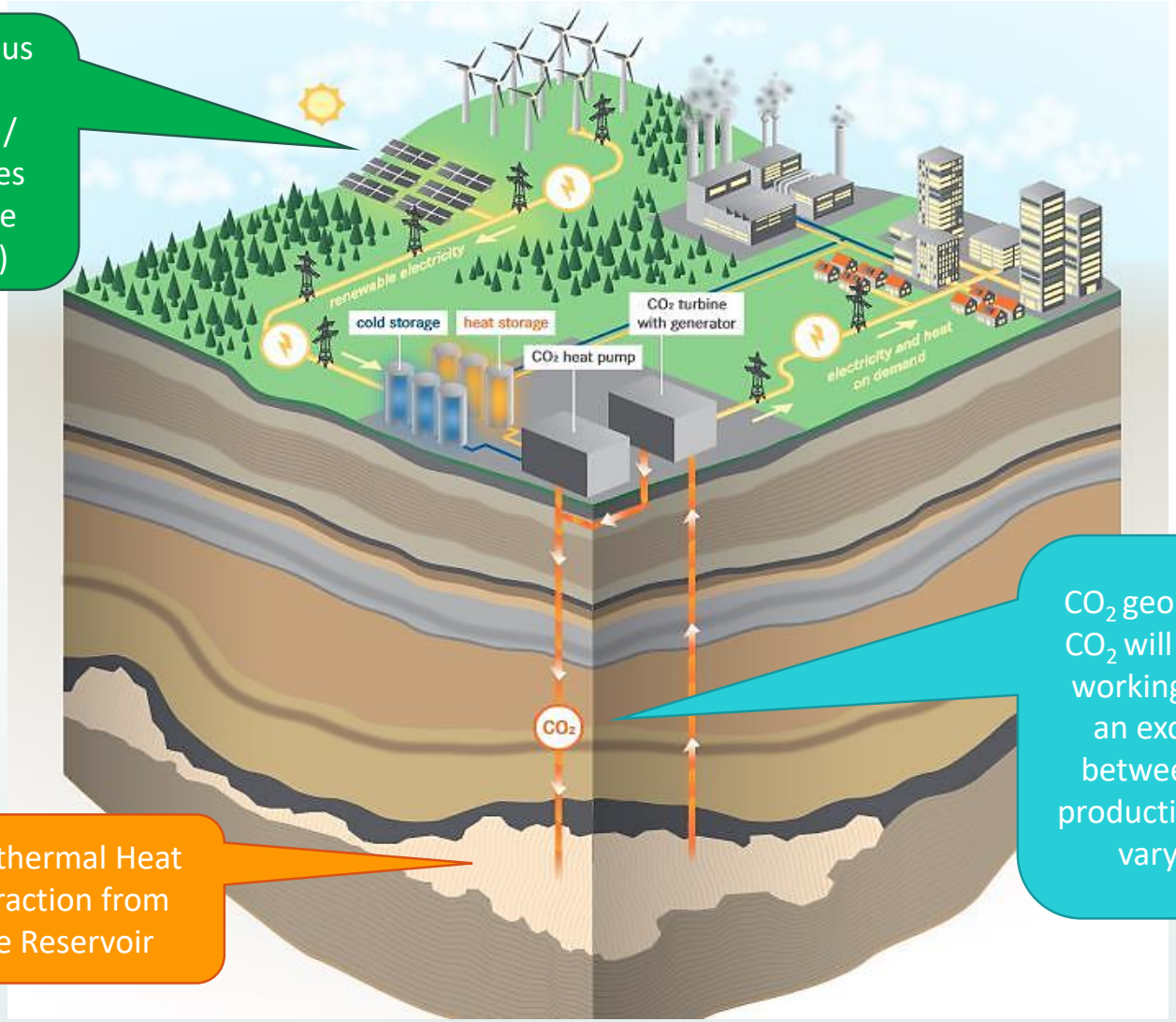
- **CEEGS concept**:

CEEGS

Use of surplus energy from wind / solar sources (Renewable electricity)



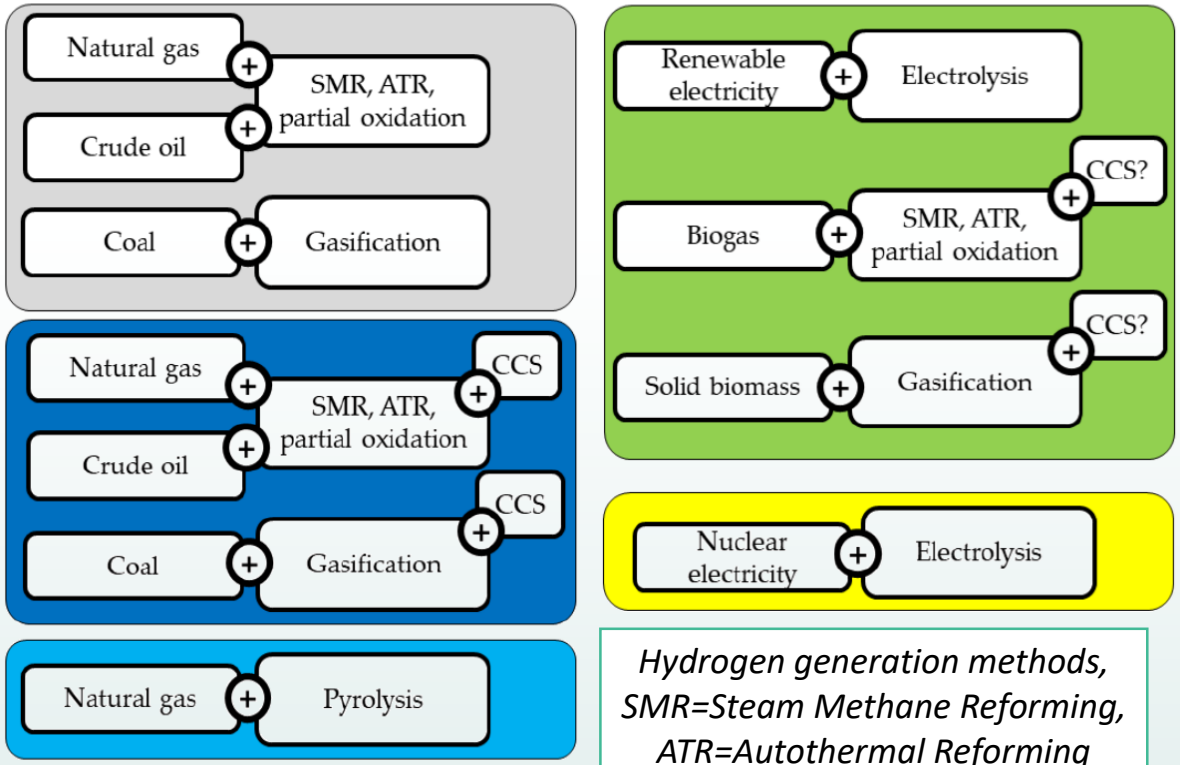
Geothermal Heat Extraction from the Reservoir

CO_2 geological storage, CO_2 will be used as the working fluid creating an excess pressure between injection & production wells due to varying density

Prospects for combined use of Hydrogen & CCUS technologies

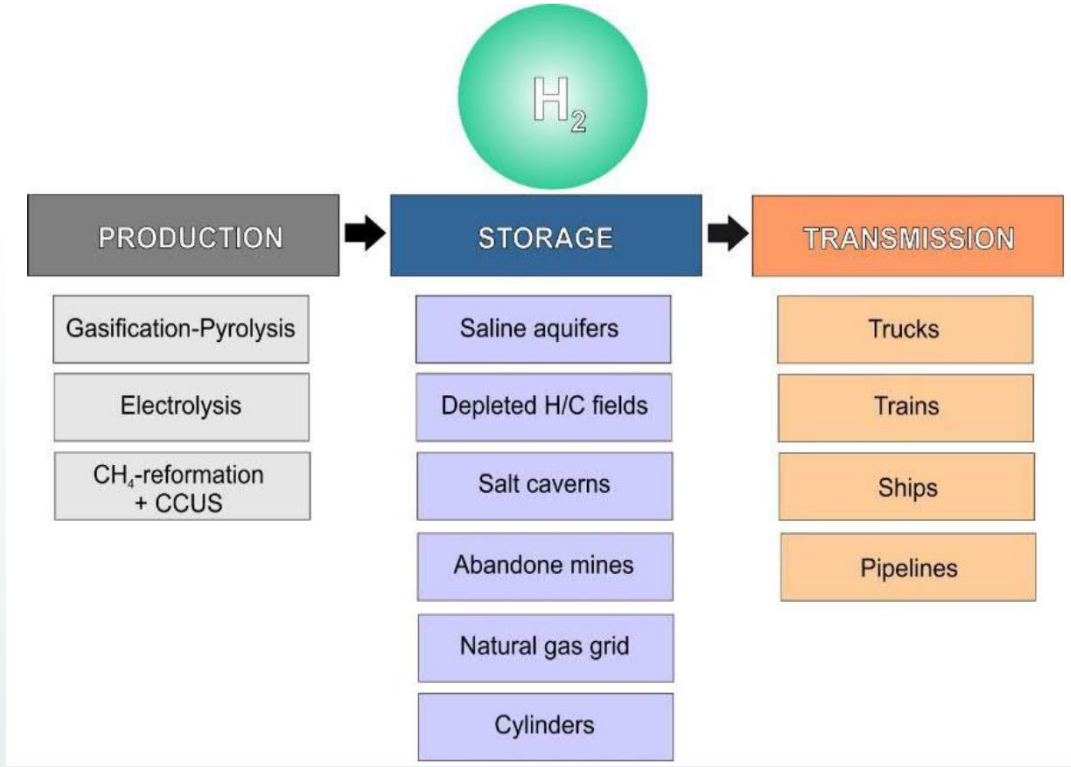
Synergies of CCUS and the H_2 value chain

- Potential synergies between CCUS & H_2 value chain → reduction of atmospheric CO_2 emissions → sustainable circular economy
- Hydrogen production methods → different colours depending on the generation source.



Hydrogen generation methods, SMR=Steam Methane Reforming, ATR=Autothermal Reforming (Noussan et al., 2021)

- Underground Hydrogen Storage (**UHS**) can be applied at:
  a) porous lithological formations
  b) abandoned rock mines
  c) salt formations



Schematic diagram of the H_2 value chain

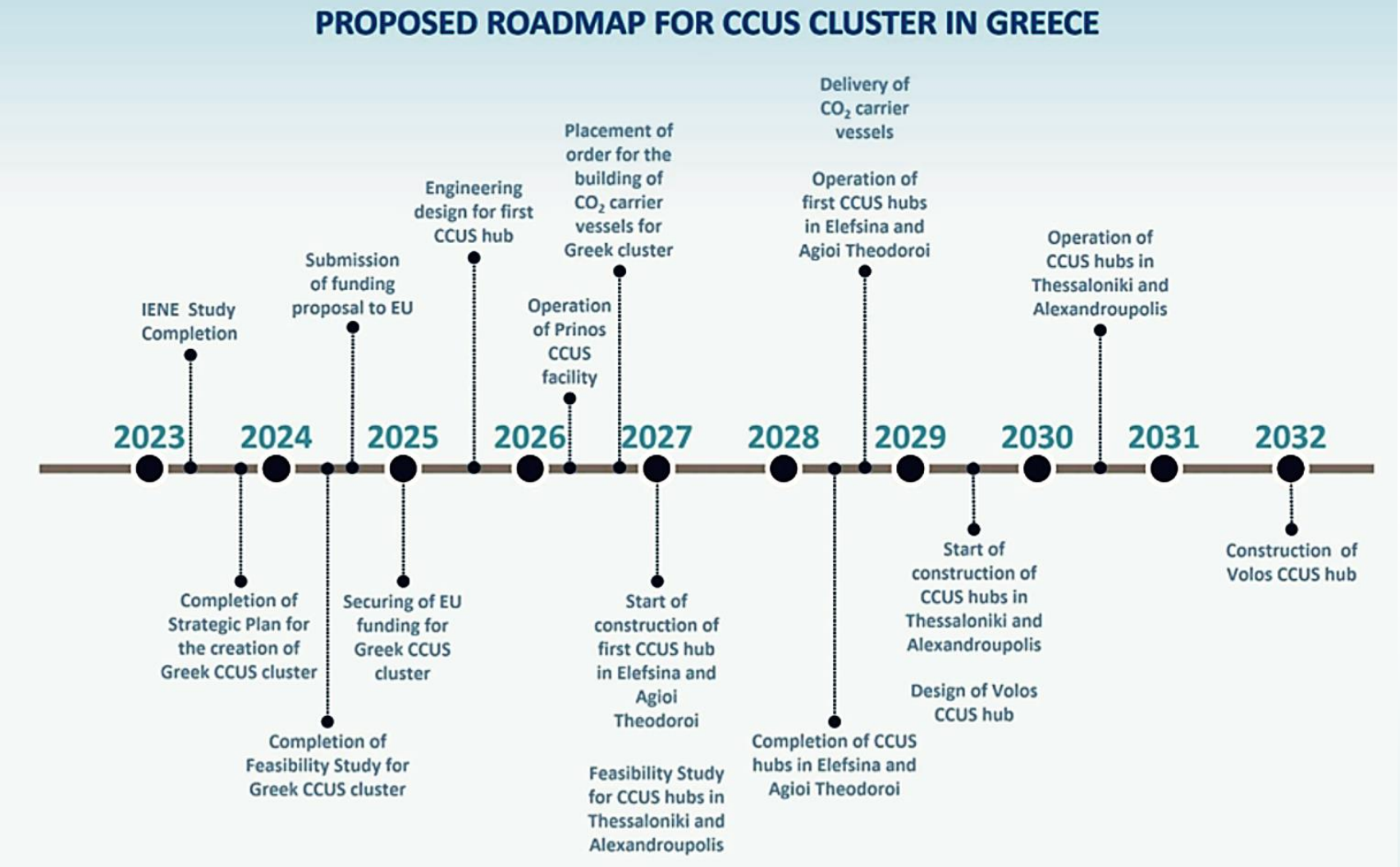
Synergies of CCUS and the H_2 value chain (2)

CO_2 & H_2 opportunities in Greece ⇨ Existing technologies & infrastructure

Existing technologies and infrastructure for the implementation of CCUS and H_2 technologies in Greece include:

- **Infrastructure for CO_2 capture** in industry (cement, iron and steel industries) and in lignite plants (e.g. Ptolemaida V plant).
- **Infrastructure for CO_2 and H_2 transportation**, e.g. gas pipeline systems, ports & railways.
- **Geological storage sites.**

Roadmap for CCUS implementation in Greece



Proposed roadmap for CCUS applications in Greece

Current trends in EU & Greece

What is going on in EU now:

- The promotion of decarbonization solutions for the EU & shift to RES* in order to achieve net-zero
- The increasing CCUS applications & projects
- The creation of CCUS hubs & networks in EU

**RES: Renewable Energy Sources*

CCUS in Greece:

- Encouragement of national government to set helping Regulations & Policies in line with the EU plan for net-zero
- Initiatives for CCUS applications & projects in Greece
- The integration of CCUS to the industrial & energy sectors

However, Greece:

- Needs to **update its Regulations & Policies** to align with the EU & actively participate in more CCUS activities & projects
- Need to **promote research & development** on CCUS
- Need to **improve the funding mechanisms** for CCUS projects

Projects relevant to CO_2- CCUS in Europe

Characteristic Examples of CCUS projects in Europe

Project	Leading Country	Description
Acorn	UK	Storage in Deep saline aquifer
AC2OCem*	Germany	CO_2 Capture
Athos	Netherlands	Full-chain CCUS
CarbFix	Iceland	CO_2 Storage
CEEGS *	Spain	CCS integration to renewable energy storage system
LEILAC *	Belgium Germany	CO_2 Capture
Northern Lights	Norway	CO_2 Transport and Storage
RISCS *	UK	Framework management of CCS sites
Strategy CCUS *	France	CCUS scenario development
SCARLET	Γερμανία	Δέσμευση CO_2

*Greek participation in the European projects mentioned.

Other CCUS/CCS Projects in Greece

Examples of CCUS, CCS and CO_2 capture projects in Greece involving industries of the energy & cement sector

Project	Location	Description
Prinos CCS project (RRF funding, involves Energean)	Greece	CCS application: CO_2 capture & storage in offshore Prinos semi-depleted oil field & saline aquifer (North Aegean Sea) from local emission sources. Capacity 60.0 Mt (total), Injectivity 1.0 $MtCO_2$/yr (Phase 1) → 3 $MtCO_2$/yr (Phase 2). Potential to include CO_2 emissions from nearby countries (e.g., Italy, Croatia).
Project IFESTOS (Innovation Fund EU funded, involves TITAN Cement)	Greece, Magoula cement plant	Large-scale carbon capture unit in Magoula (Greece, TITAN), zero-carbon cement → expected to avoid 98.5% GHG emissions during cement production. CO_2 capture via first- and second-generation Oxyfuel and post-combustion cryogenic capture technologies. Expected to reach TRL 8.
HERCCULES project (Horizon Europe funded, involves TITAN Cement & Energean)	Greece, Italy	CCUS in Italy & Greece: 2 main clusters of emitters → in Northern Italy (a cement and an EfW cluster) & in Greece (a cement cluster). Capturing via advanced oxy-combustion and post-combustion technologies. CO_2 utilization via mineralization → carbonation. Expected to reach TRL 8.
OLYMPUS project (Innovation Fund, involves Heracles GCC & HOLCIM TECH LTD)	Greece, Evia, Milaki cement plant	Large-scale CCS. CO_2 capture by: (a) OxyCalciner carbon capture, (b) Cryocap™ Oxy technology (by Air Liquide Hellas S.A.) → capture & purify CO_2 via oxy-fuel combustion. Expected CO_2 capture rate = 98%. Sequestration of up to 1 $MtCO_2$/yr in Prinos storage site & achieve avoiding 6.8 MT CO_2 during 10 years of cement plants operation.
Project IRIS (Innovation Fund, involves Motor Oil Hellas)	Greece, Corinth, Agioi Theodoroi MOH refinery	Incorporation of post-combustion carbon capture at an SMR unit → CO_2 capture & production of ultra-low emission H_2 , coupled with a small-scale CH_4 production unit. Expected CO_2 capture rate 95% (495 ktpa of 522 ktpa emitted). H_2 production: 55.2 ktpa (55,280 t/y) with carbon footprint less than 3.0 tCO_2/tH_2

H_2 projects & current trends: European Projects

- The interest of the **private sector** and **public bodies** has shifted towards **hydrogen** and the potential for the development of its value chain due to:
  - the **potential** of hydrogen as an **energy source**.
  - its **ability** to be **stored** in order to **satisfy energy requirements** during high-demand periods.

- In recent years, an increasing number of **partnerships** have been established to **develop the various stages of the hydrogen value chain** through the **implementation of projects**.

- **Indicatively**, some **H_2 projects** in Europe are mentioned:

hystories

H_2 geological storage in aquifers and depleted hydrocarbon fields

HyUnder

H_2 geological storage

HUSPRe — Hydrogen Underground Storage in Porous Reservoirs

H_2 geological storage in porous formations

hypster — Hydrogen Storage

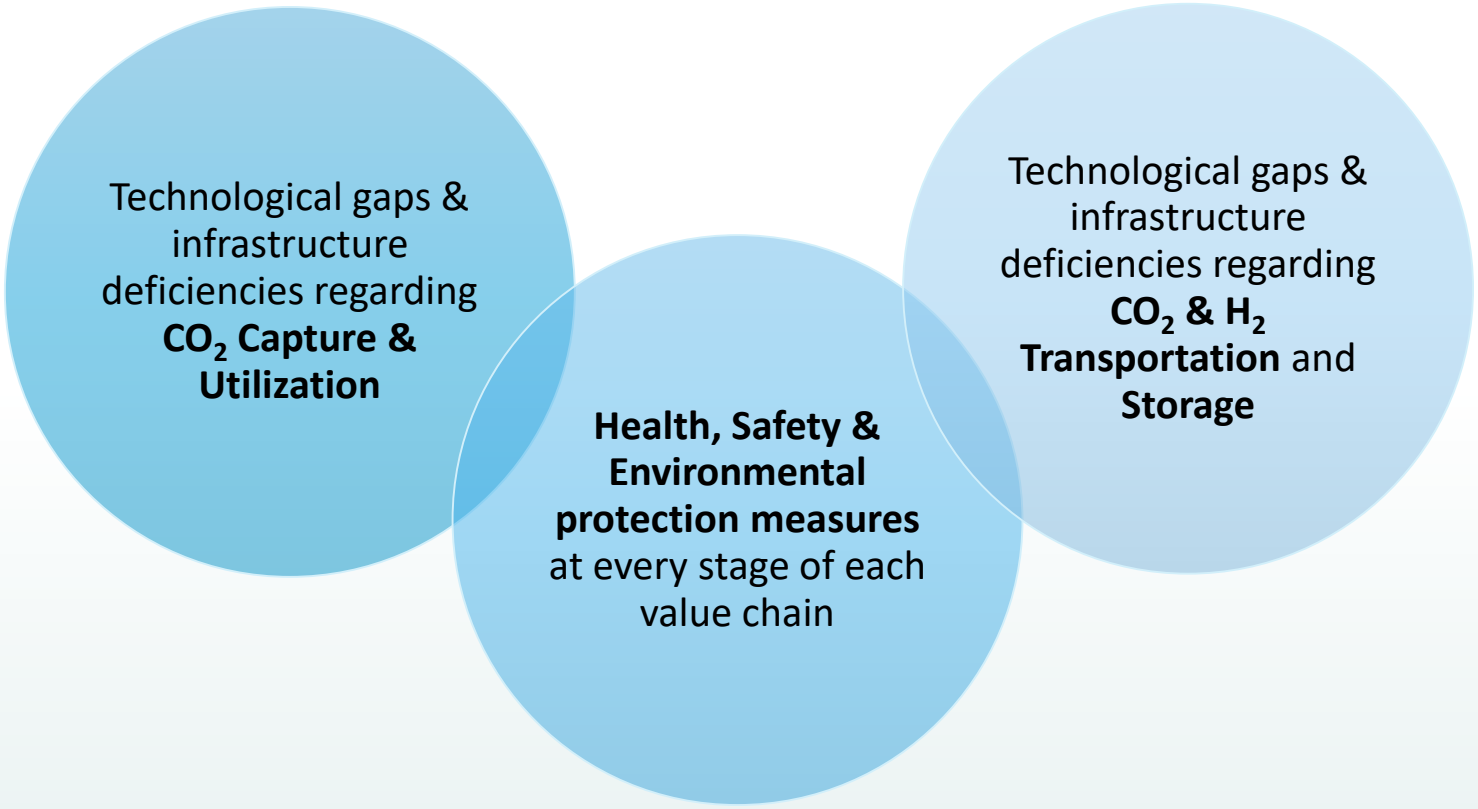
green H_2 geological storage in salt caverns

HyGreen Provence

green H_2 generation using solar power and storage in salt caverns

CO_2 & H_2 opportunities in Greece: Gaps & Requirements

- **Technological Gaps & Requirements:**



CO_2 & H_2 opportunities in Greece: Gaps & Requirements

- **Knowledge & Expertise Deficiencies:**

Institutions, Universities & Companies	Industrial sector employees	Students & junior employees related to the industrial sector	Universities & Research Institutes	Funding of R&I actions
Training programs for the workforce	Training & reskilling programs	Education & training to acquire the required knowledge & expertise	Promotion of Research & Innovation (R&I) actions	Obtain: • High TRL for every CCUS & H_2 value chain stage • High efficiency & durability • Low cost & risk

Thank you for your attention

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