The *Building momentum for the long-term CCS deployment in the CEE region* project is funded by Iceland, Liechtenstein and Norway through the EEA and Norway Grants Fund for Regional Cooperation.

BUILDING MOMENTUM
FOR THE LONG-TERM CCS DEPLOYMENT
IN THE CEE REGION

Summary of CCS4CEE project

Hungary

Implemented by: WiseEuropa, BELLONA EUROPA, EPG ENERGY POLICY GROUP, CIVITTA, Institute for European Integration
Supported by: EUROPEUM INSTITUT PRO EVROPSKOU POLITIKU INSTITUTE FOR EUROPEAN POLICY
Co-financed by: NIW
Sfinansowano przez Narodowy Instytut Wolności - Centrum Rozwoju Społeczeństwa Obywatelskiego ze środków Programu Rozwoju Organizacji Obywatelskich na lata 2018 – 2030
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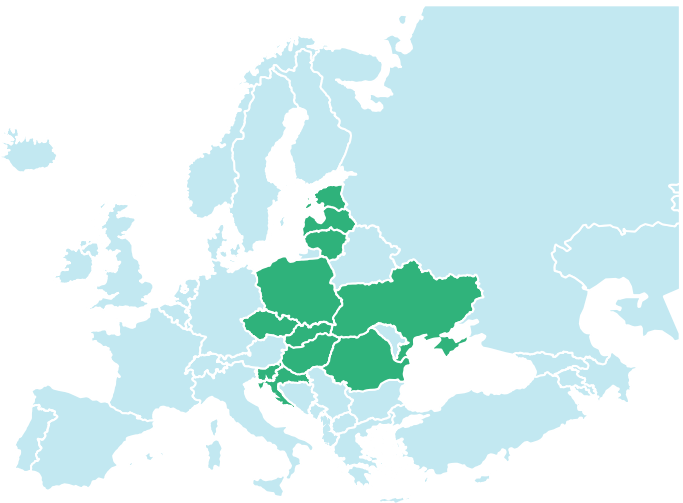
CCS4CEE project

PROJECT CONTEXT | Recent advances in several key areas (e.g., renewable energy sources, energy storage, electric vehicles) enable significant greenhouse gas (GHG) emission cuts but are not sufficient to reach deep decarbonisation consistent with Paris Agreement. This is recognised by International Energy Agency in its technology assessments and various modelling studies by both European Union institutions and independent researchers. Carbon capture and storage (CCS)[1] deployment may reduce industrial emissions, provide low-carbon industrial heat and improve energy security by allowing dispatchable power sources to continue operating with low emissions. However, its large-scale implementation requires a long-term policy framework. At the moment, the topic of CCS is not present in the mainstream debate on climate policy in the Central and Eastern European (CEE) countries. This may lead to uneven progress in CCS deployment across Europe, resulting in increased catching-up costs as well as missed opportunities for national development and regional cooperation. This project is designed to counteract this scenario.

PROJECT GOAL | The project aims to renew the discussion on the long-term deployment of CCS in the CEE region, leading to new policies and joint projects. It is expected that building evidence-based consensus among key stakeholders will pave the way to implement concrete policies and ventures. This will be achieved through combining analytical work, in the form of national and regional publications, with outreach, communication and capacity-building activities focused on the importance of timely CCS deployment and associated international cooperation.

SCOPE AND PHASES | The project covers Poland, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Romania, Lithuania, Latvia, Estonia and Ukraine.



[1] CCS refers to "the capture of CO_2 from industrial installations, its transport to a storage site and its injection into a suitable underground geological formation for the purposes of permanent storage", as defined by the European Commission. On the other hand, in carbon capture and utilization (hereinafter – CCU), the captured CO_2 is transported to a facility in which it is utilized. CCU exhibits fundamental differences stemming from the fate of the captured and transported CO_2 – in CCU, it is embodied into products, whereas in CCS it is permanently stored in underground geological formations. The main focus of the CCS4CEE project is CCS.

The project is implemented by four stakeholders from the region of CEE in cooperation with the expert partner from Norway:

WiseEuropa is an independent think-tank institute located in Warsaw. Lead partner of the project and coordinator of the work in Poland, Croatia and Slovenia.

Institute for European Integration is a non-profit, non-partisan, and independent think tank focusing on European integration and cohesion. Coordinator of the work in the Czech Republic and Slovakia.

CIVITTA is a leading management consultancy from CEE. Coordinator of the work in Lithuania, Latvia, Estonia and Ukraine.

Energy Policy Groups is a non-profit, non-partisan independent think-tank located in Bucharest. Coordinator of the work in Romania and Hungary.

The Bellona Foundation (expertise partner) is an independent non-profit organization that aims to provide expertise regarding the climate change issue by identifying and implementing sustainable environmental solutions.

The three phases of the project are as follows:

1. Determination of the starting point: assessment of the current state and potential of technological options, as well as European policy landscape and national contexts (Work Package 3, 2021);
2. Development of national roadmaps as well as regional cooperation roadmap for CCS deployment in the CEE region (Work Package 4, 2022);
3. Supporting implementation of the roadmaps through networking and capacity-building events (Work Package 5, 2023).

The project targets national and local policymakers, the business sector, research institutions and civil society. This will support the emergence of a socially accepted mix of appropriate policies, R&D and deployment activities. The project will ultimately benefit the CEE societies by supporting the timely implementation of CCS technologies which will ensure a smooth low-carbon transition.

PROJECT FUNDING | The project is funded by EEA and Norway Grants Fund for Regional Cooperation (project contract number 2018-1-1141).

ADDITIONAL INFORMATION ON THE PROJECT | Additional information about the project, including national and regional reports and deliverables can be accessed on the project website: ccs4cee.eu

Opportunities and barriers for deployment of CCS and its related technologies

CCS4CEE PROJECT COUNTRIES

Across project countries, several commonalities relevant to CCS have been identified:

- Many project countries **rely on manufacturing sectors**, while their energy production depends heavily on fossil fuels. This condition, coupled with sometimes distant or uncertain deadlines for emissions reduction targets, means that **CCS for the energy sector cannot be ruled out in the CEE region**.
- Various transportation methods may be available to move CO_2 from emitters to storage sites in project countries or within the region. However, **CO_2 transportation infrastructure is mostly absent**.
- Amongst project countries, Ukraine has the highest estimated potential for geological storage of CO_2, followed by Romania and Poland. However, **more research is needed** to refine knowledge on storage potential, which often relies on theoretical estimates.
- Most project countries have a history of research (and occasionally testing) of CCS. Future projects would be supported by **existing know-how and experience**, including international cooperation.
- The regulatory environments of project countries are **relatively underdeveloped**, and many fail to provide certainty for CCS, particularly regarding storage and transportation.
- **Funding support** is available at the EU level, and frameworks such as Projects of Common Interest may lend themselves to large-scale regional CCS projects.
- Many stakeholders in project countries **are cautious about deploying CCS** due to its high costs, lack of clear government support and financing, and challenging administrative procedures. Many also tend to favour CCU over CCS due to perceived lower complexity and risks.
- An overall **lack of public and institutional knowledge** of CCS is an important feature evident in project countries.

HUNGARY

Although after 1990 emissions steadily decreased in Hungary, **since 2013 there has been a slow increase**, reaching 64.6 $MtCO_2eq$ in 2019. **The energy sector (including electricity, heat and transport) contributed 72%**, industrial processes and product use (IPPU) - 12% and agriculture - 11%. **A large share of Hungary's emissions is concentrated in a handful of emitters**; in 2020 the largest emitters were MVM Visonta[2] (lignite power plant, 4.2 $MtCO_2eq$), MOL[3] (oil and gas, 3.1 $MtCO_2eq$), Nitrogénművek (fertilizer plant, 1 $MtCO_2eq$),

[2] The lignite-fired power plant units are planned to be phased out by the end of 2025, and new gas turbines equipped with carbon capture will be installed by that time.
[3] Approximately half of MOL's emissions (1.6 $MtCO_2$) are associated with its oil refinery branch in Százhalombatta, and around 1 $MtCO_2$ is emitted annually by MOL Petrochemicals in Tiszaújváros.

ISD DUNAFERR (iron and steel plant, 0.7 $MtCO_2eq$), Lafarge Cement at Királyegyháza (cement plant, 0.5 $MtCO_2eq$) and Heidelberg Cement (or Duna-Dráva Cement) (cement plant, 0.5 $MtCO_2eq$) (Figure 1).

FIGURE 1 HUNGARY'S LARGEST EMITTERS IN THE EU ETS IN 2021

Hungary is well suited for the application of CCS technologies, as its **geological potential for CO_2 storage is substantial**: around 97 Mt CO_2 in depleted hydrocarbon reservoirs and 750 Mt CO_2 in deep saline aquifers. Furthermore, the most suitable hydrocarbon reservoirs with high storage potential are located in the vicinity of large industrial emitters. However, **deep saline aquifers would require more detailed exploration** to accurately assess their potential and suitability for storage. In addition, there are other barriers to CCS deployment, such as the absence of suitable temporary surface storage (overground depots for buffer storage) and transport systems.

Due to Hungary's mature oil and gas industry, **there is vast experience in CO_2 injection** for Enhanced Oil Recovery (EOR), mostly accumulated by MOL. However, **no CCS project has been implemented in Hungary** to date. Despite this, Hungary has been active in researching CCS, with Hungarian stakeholders formerly participating in three completed EU-funded CCS projects:

1. EU GeoCapacity, aiming to refine the knowledge of subsurface storage potential in EU countries;
2. CGS Europe project, which promoted CCS deployment through networking and cooperation across the Member States and Associated Countries;

3. CASTOR, whose goals were to investigate the costs and acceptance of CO_2 capture and storage.

From a legal and regulatory perspective, Hungary has taken steps to enable CO_2 storage, but **multiple regulatory gaps remain**. Hungary integrated Directive 2009/31/EC on the geological storage of CO_2 in May 2012 with the Decree No. 145 of 2012 (VII. 3.) of the Government. The aim of the decree on the geological storage of carbon dioxide was to create consistency between regulations on mining, EU ETS, environmental protection, and waste management. Currently, the key regulatory requirements for the establishment of CO_2 storage are:

1. storage capacities must be assessed every five years;
2. access to the transport network must be ensured;
3. storage sites must be inspected by both the operator and the Mining Inspectorate.

However, the administrative burdens are enormous for CCS projects as there are **no guidelines for the licensing process for storage sites**. Even the construction of new pipelines for CO_2 transport is challenging due to the administrative burden.

In December 2022, a **new Ministry of Energy was set up** as a response to the recent energy crisis. Consequently, the energy-related topics formerly handled by the Ministry of Technology and Industry are now under the responsibility of the Ministry of Energy, most likely including the subject of CCS. This governance transition is still unfinished, leaving substantial uncertainty around the future of CCS regulations.

Stakeholders in Hungary see **great potential for CCS in hydrogen production**. Blue hydrogen can serve as a low-carbon alternative to green hydrogen that is not available at scale yet. Although it relies on mostly mature technologies, **the role of blue hydrogen is unclear in the EU hydrogen strategy,** and the investment risk would be too high for private companies. Stakeholders require a more stable financial and taxation framework to support CCS projects, including more active innovation grants at both the national and EU level. Furthermore, **the feasibility of CCS technologies still has to be proved** to investors as no CCS project has been deployed in Hungary yet. Stakeholders do not invest in long-term projects as EU regulations and climate targets are also uncertain.

In order to advance CCS deployment in Hungary stakeholders recommend to:

- Set up a platform to facilitate the knowledge sharing between stakeholders as technical and market-related knowledge sits with the companies who are either large CO_2 emitters or have experience in delivering projects in mining or other geological tasks[4].
- Ensure a more stable regulatory, financial and taxation framework to support CCS projects.
- Use the Carbon Contracts for Differences (CCfD) mechanism that could bridge the cost gap between conventional and low carbon alternative technologies[5].
- Conduct more geological exploration on saline aquifers and depleted hydrocarbon reservoirs[6] and prioritize the use of geological storage sites[7].
- Prove the feasibility of CCS projects to investors.

[4] The stakeholders agree that these initiatives should be facilitated at the government level due to its complexity and the number of potential stakeholders involved. Market players lack the means of bringing together all stakeholders.
[5] The revision of the EU ETS proposes the use of CCfDs as a complementary instrument within the Innovation Fund (pg. 61).
[6] Currently, about 25 depleted oil and gas fields have been identified as suitable for CO_2 storage. Long-term storage is safer in aquifers as CO_2 dissolves in salty water and mineralizes, but they are not yet explored in Hungary. Only theoretical aquifer storage capabilities have been determined, which are thought to be quite large.
[7] Storage sites must be seen as tradable commodities because there are multiple ways to use them (storing CO_2, gas, hydrogen, etc.). Hungary participated in the CASTOR project that, as part of its goal, collected storage data Hungary and from seven other EU countries and integrated them into a Geographic Information System (GIS).

- Create a market for low-carbon products as stakeholders currently cannot charge higher prices for them compared to high-carbon substitutes.
- Include blue hydrogen in the supported low-carbon technologies to reduce its competitive disadvantage compared to green hydrogen.

Detailed assessment of the current state, past experiences and potential for CCS/CCU deployment in Hungary and other project countries is available on the project website: ccs4cee.eu

Policy roadmap for the scaled-up deployment of CCS and its related technologies in Hungary

Based on the assessment of past experiences and CCS potential, a national policy roadmap was prepared to outline how the future development of CCS technologies could proceed in Hungary, and under which enabling conditions. The roadmap provides an overview of various policy actions along the innovation cycle, from research and development to enabling policy and financial frameworks for commercialization. While the roadmap aims to describe an enabling environment to deploy CCS projects, it also focuses on ways to develop transferable knowledge and skills by national stakeholders (governments, research organizations, academia, private sector) in one or more stages along the carbon capture, transport, storage and utilization chain, and create linkages to gain knowledge and experience from more experienced stakeholders across the globe.

Based on the developed roadmap, the next and immediate steps are highlighted for the further advancement of CCS in Hungary:

Regulatory framework

- **Set up a new department responsible for CCS in the national government** that also facilitates a platform for the stakeholders. The set-up of the new Ministry of Energy provides a great opportunity to start this department.
- **Establish a market for low-carbon alternatives**, e.g. by regulations requiring the use of low-carbon hydrogen in transportation or the use of low-carbon fertilisers in agriculture. If a market for low-carbon products is established, producers will be more confident that their investments in CCS solutions will pay off.
- **Create low-carbon certificates** to identify products with lower CO_2 intensity due to CCS so that suppliers of these low-carbon alternatives can market these products accordingly, receiving a higher unit price or incurring other market advantages by more favourable contracting terms.
- **Set up technical standards for CO_2 capture, transportation and storage solutions, legal framework, and subsidies**. Details of CCS-related regulation need to be worked out, filling the regulatory gaps.
- **Clarify the role of CCS-related projects**, especially blue hydrogen, in European and national climate strategies. This must include a **detailed definition of CCS, low-carbon and green technologies**, and it should be communicated clearly to all stakeholders. According to feedback from stakeholders, blue hydrogen could be the most important field of use of CCS in Hungary.

Market conditions and coordination

- **National governments have a crucial role in coordinating the CO_2 market** and in bringing the relevant stakeholders together to realize CCS projects in Hungary. Therefore, the responsible ministry

(currently the Ministry of Energy) should **facilitate an industry-wide CCS platform**, integrating the national hydrogen strategy and the role of blue hydrogen with other CCS applications.

- **Ensure a level playing field in the hydrogen market**. Currently, there are no subsidies for blue hydrogen projects, only for green ones. According to stakeholders, although blue hydrogen production is not entirely emissions free, it could serve as an interim technology while green technology matures. A subsidy proportional to the avoided emissions could foster the development of a hydrogen market.
- **Launch a geological survey** to explore the full potential of CO_2 storage. Hydrocarbon reservoirs are well explored, but deep saline aquifers are not yet fully investigated, although theoretical storage potential is considered as vast.
- **Support a clear regulatory framework and strict emission reduction targets at the EU level**. Stable and high carbon prices are essential for stakeholders to invest in CCS technologies. Although carbon prices in the EU ETS have been at an all-time high recently, the volatility of these prices increases the risks associated with the returns of the projects.

Longer-term actions

- **Launch small-scale pilot projects** located at depleted hydrocarbon reservoirs to prove the feasibility of CCS and build trust in all stakeholders. The pilot project could be built at an emissions source where capture costs are low and which is located close to the potential storage sites.

Detailed CCS national roadmap for Hungary and other project countries is available on the project website: ccs4cee.eu

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