

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

CCS National Roadmap

Romania

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Chapter 1. Role of CCS in decarbonisation pathways

In 2019, the EU launched the European Green Deal to transform the EU into a modern, resource-efficient and competitive economy, cut GHG emissions by at least 55% by 2030 and reach net-zero emissions by 2050. Many 1.5°C compatible scenarios have assessed these targets and shown that a credible but narrow pathway exists and will require the use of all decarbonisation tools available. **Renewables and energy efficiency** are key components of that pathway, accounting for 80% of emissions reductions and providing solutions to many sectors, including power, transport and energy-intensive industries. However, to reach net-zero, renewables and energy efficiency **need to be supplemented by CO₂ capture and storage (CCS) and utilisation (CCU) and carbon dioxide removal (CDR)** (particularly bioenergy with CCS/CCU) **technologies** (Figure 1), in sectors such as power and heat, cement, steel, chemicals production and waste incineration. In addition, to address emissions from other sources as well as historic emissions, direct air capture with storage (DACCS) or utilisation (DACCU), can also be deployed. In particular, the benefit of CDR processes is that they remove CO₂ from the atmosphere, rather than reducing the CO₂ being added to it, and in combination with long-term CO₂ storage, they can result in negative emissions. As such, they are a critical component of net-zero pathways in the European Green Deal and most recently the Glasgow Climate Pact. There are preconditions to be assessed: biomass for BECCS needs to be sourced sustainably, while DACCS requires access to cheap renewable energy.

Together, CCS, CCU and CDR technologies can mitigate **20% of global CO₂ emissions**, but to do so, **the scale must increase significantly** (Figure 2), from the current 0.04 Gt of CO₂/year to circa 8.5 Gt of CO₂/year in 2050 (IRENA, 2021).¹ The current momentum to speed up energy and industrial transition considers these technologies as necessary components, and **activities at the national and regional levels** may help to **enhance the collective understanding** of the issues surrounding CCS, **build confidence** and **scale up their deployment to reduce technology and infrastructure costs**. The pace of progress in validating and deploying these technologies across sectors has been slow to date and in many cases with significant costs overruns. There are currently many commercial CCS, CCU and CDR plants globally capturing 40 Mt of CO₂ per year (IRENA, 2021), with many more being developed and an increasing number of pilot and demonstration projects that focus on safety issues, environmental impacts and economic costs, while generating lessons learned to be used to further improve these technologies and bring their costs down.

All these CCS, CCU and CDR systems utilise the same components of the value chain: the CO₂ transport, storage and utilisation. In Romania, the discussion on CDRs is in a nascent stage, with much of the focus on the CO₂ value chain being centred on carbon capture from industrial installations. However, no demonstration or commercial projects have been implemented in Romania so far, and as will be shown below, several major steps must be taken in order to enable CCS projects.

¹ IRENA, 2021. [Reaching zero with renewables: capturing carbon.](#)

Figure 1: Carbon cycle with the use of CCS/CCU, BECCS/BECCU and DACCS/DACCU technologies².

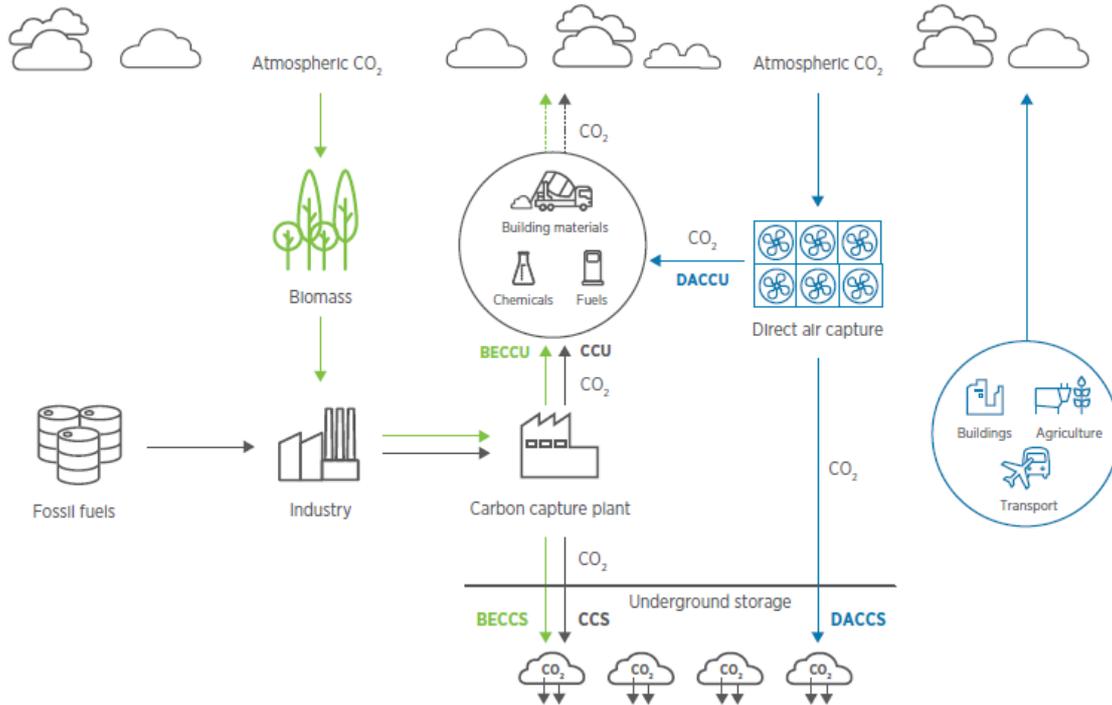
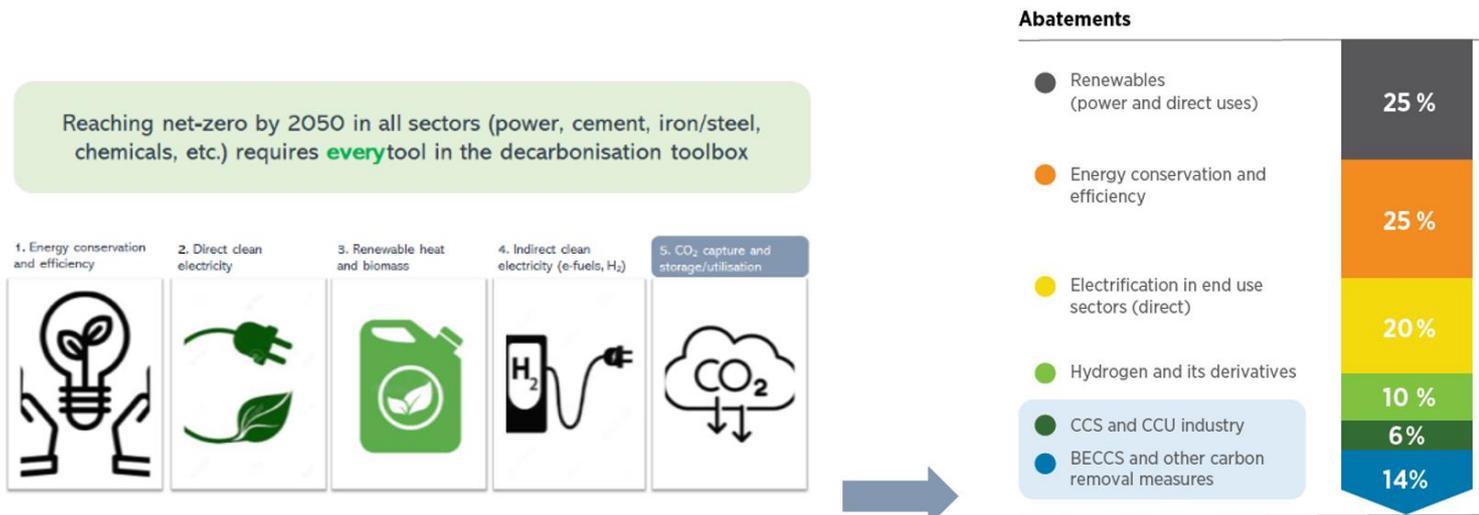


Figure 2: Carbon capture and storage as a part of the global decarbonisation toolbox.³



² Ibid.

³ Ibid.

Chapter 2. Opportunities and barriers for deployment of CCS and related technologies in Romania

Emissions

- Emissions in Romania have declined significantly since 1989 due to the closure or operational improvement of industrial plants
- In 2019, 85.5% of Romania's total CO₂ emissions (equivalent to 65.83 Mt) were from the energy sector; 33% of energy-related emissions were from the supply of public utilities and 22% from the supply of major manufacturing industries, especially cement and chemicals
- A further 13.8% of total CO₂ emissions originate in industrial processes and product use, particularly the mineral industry (cement) and metallurgy (iron and steel)
- Romania's industrial process emissions and those from fuel combustion for the manufacturing industries contribute a higher share to total emissions than the EU average
- High-emitting manufacturing industries in Romania include cement production (7.9% of total CO₂ emissions in 2019), metallurgy (6.5%) and chemicals production (5.4%)
- Many of these high-emitting sectors are also high-value from an economic point of view: electricity, cement, iron and steel and fertilizer production all contributed more to Romania's Gross Value Added in 2018 than the EU average
- Romania's largest emitters are the Oltenia Energy Complex (fossil energy production), Liberty Steel Galați (steel), Holcim (cement plants at Aleșd and Câmpulung), Azomureș (fertilizers) and Petrobrazi (oil refinery and combined-cycle gas turbine)

Storage and transport

- Romania has a potentially significant geological CO₂ storage capacity (the theoretical capacity has been estimated at 22.6 Gt., mostly in saline aquifers), however much more research is needed to accurately estimate technical and economic CO₂ storage potential
- The Transylvanian Depression has highest potential, but the South Carpathian Foredeep also offers opportunities in both aquifers and depleted hydrocarbon fields and spans the carbon-intensive industrial regions of Gorj, Dâmbovița and Argeș
- There may also be Enhanced Oil Recovery (EOR) potential – previous studies have identified 19 oilfields with EOR potential in Romania
- Offshore CO₂ storage sites are relatively understudied and need an upheaval of regulation to promote research and implementation
- Further extensive geological research is required, to refine knowledge on storage capacities, narrow the knowledge gap between saline aquifers and depleted hydrocarbon fields as potential CO₂ reservoirs, and explore offshore storage potential
- Knowledge of storage potential can also help to map potential CCS clusters, e.g in the Getica Depression.

- Considerations are due for different modes of transport for CO₂.
 - If pipeline transport is deemed viable, Romania is still missing procedures for third-party access to the CO₂ transport network, which is legally required under the CCS Directive
 - Several technical codes on the transportation of natural gas should also be modified to enable national CO₂ transportation infrastructure, and for the actual design of pipelines subsidence and mining areas should be mapped and public evidence of land ownership should be improved
 - Transboundary cooperation for pipeline CO₂ transport should also be addressed, particularly in the context of the TEN-E regulation and PCI framework
 - For non-pipeline transport, studies addressing road, rail, riverine, maritime or multimodal CO₂ transport potential in Romania should be conducted, as well as opportunities for transboundary cooperation.

Experience

- Romania's experience with CCS can contribute to this roadmap by outlining concrete actions that can be taken for advancing it, and by contributing directly to the identification of suitable CCS projects or clusters
- The Getica CCS project, Romania's only proposal for a CCS demonstrator (on hold since 2012), entailed a detailed feasibility study for capturing 1.5 Mt CO₂/year from the Turceni thermal power plant and storage within nearby saline aquifers
- Romania's mature oil and gas extraction industry offers a wealth of geological research on hydrocarbon fields, and some potential CO₂ storage sites have been identified and characterized
- Romania also has a solid history of CCS research, including participation in international consortia and networks, and capture technologies are being researched in several universities
- However, research and innovation funding is generally scarce – despite industrial interest in CCS apparently gaining momentum with the rise in ETS prices, a more structured drawdown of research and innovation funding for CCS is needed
 - This may align with a pre-existing objective of Romania's 2016-2030 energy strategy and NECP to fund research and innovation in carbon capture
 - Partnerships between academic and private institutions should be established to scale up new and existing technologies.

Legal and regulatory frameworks

- Romania's transposition of the EU CCS Directive, meant to facilitate the implementation of the Getica project, is mostly "on paper" and lacks the administrative and procedural aspects to enable commercial CO₂ storage projects [above 100 kt CO₂](#)
- Interacting legislation relevant to CCS includes laws on petroleum, gas transportation, and the expropriation of land (currently a bureaucratic burden)
- CCS is sparsely mentioned in Romania's national policies and no specific policy support is offered for these technologies
- Regulatory adjustments and policy commitments to CCS are likely one of the foremost steps to be taken in deploying CCS
 - They are unlikely to be sector-specific, but rather will require updating across the board to incentivize capture and regulate or finance transportation and storage
- Romania recently committed to phasing out coal-based electricity production by 2032.

Stakeholder perspectives on CCS

- Most stakeholders engaged in the first phase of the CCS4CEE project are classified as pace-setters (active promoters of CCS), followed by fence-sitters (neither promoting nor opposing CCS), and perceive CCS as beneficial due to its emissions reduction potential and economic benefits
- Key stakeholders with potential high influence on CCS activity include academic institutions, cement producers and chemicals manufacturers (whose interest was primarily directed towards CCU rather than CCS)
- The most important barriers to CCS deployment identified by stakeholders were institutional (lack of involvement from government and industry inertia) and financial (high costs)
- Recommendations from stakeholders not already highlighted above include:
 - A coherent national strategy with cross-ministerial support (including identifying procedural bottlenecks)
 - Development of transportation infrastructure
 - Drawing down of EU funding through a national financing framework and identifying suitable financial instruments
 - Setting up industrial clusters and inter-sectoral/regional collaboration
 - Transparent public/institutional education and dialogue
 - Capacity-building and knowledge transfer.
- Stakeholders in Romania are generally cautious about CCU/CCS and look to national and European authorities for more clarity on incentives and timescales for deployment; some exhibit a preference for CCU over CCS.
- Stakeholder positions identified in the first phase of the CCS4CEE project also suggest that specific barriers may need to be overcome, e.g. in the steel industry (competition with hydrogen) and in some chemicals producers (reticence towards CCS)
- Crucially, the positioning of public institutions is not cemented.

Social acceptance

- The public discourse around CCU and CCS is negligible in Romania, with low public understanding, vague institutional positioning, and low media uptake.
- The risk of social opposition to potential CCS projects should not be discounted, particularly given the history of protesting other subsurface exploration projects.
- Deploying CCS in Romania should include an assessment of local politics and public dialogue in relevant areas, as well as broader improvements of public dialogue and social and institutional understanding of CCS.

Developments between September 2021 and February 2022

- Azomureş, Romania's largest producer of fertilisers, publicly expressed interest in CO₂ storage (September 2021); since then, the company was severely affected by the gas price crisis, being forced to suspend operations in December 2021.
- CIROM, Romania's business association for cement producers, publicly pointed to the high carbon costs of Romanian cement production, and the need to invest over €700 million in carbon capture technologies.
- OMV Petrom released its strategy to 2030 (December 2021), repeatedly shared in the national press, in which it outlines a commitment to investing in CCS technologies and the aim of storing 2 Mt CO₂ per year.
- Hydrogen was a key topic discussed in the Romania International Gas Conference (December 2021), including blue hydrogen production using as yet unexploited offshore gas reserves in the Black Sea.
- Several Romanian media outlets reported on the launch of the Orca Direct Air Capture project in Iceland and the inclusion of Direct Air Capture in the investment priorities of the Breakthrough Energy Catalyst (mostly in the context of Bill Gates' investment partnership with the UK Government in the lead-up to COP26).

- Romania's Ministry of Energy presented opportunities for financing under the EU Modernisation Fund, including CCS for energy and industrial installations, encapsulated in a programme for "industrial energy efficiency"; the suitability of the proposal for Modernisation Fund financing is questionable.

Chapter 3. Policy roadmap for the scaled-up deployment of CCS and related technologies in Romania

A) Scaling-up RD&D activities and building national knowledge and experience

Key action	Approach	Stakeholders	Timeline
Knowledge platforms	<ul style="list-style-type: none"> • Create a national platform for Romania to drive legislative activity and knowledgeⁱ 	<p>Responsible: trilateral effort of Ministries of Energy, Economy and Environment (e.g. an inter-ministerial committee) for coordination and funding</p> <p>Involved: authorities (national and local), economic operators, NGOs, academia</p>	Short-term
Engagement with international fora	<ul style="list-style-type: none"> • Involve authoritiesⁱⁱ more in international platforms, in particular the Zero Emissions Platform (ZEP), SET-Plan Technical Working Group on CCUS and other existing or emerging CCS platforms such as the European Commission's CCUS Forum, and global initiatives such as the Clean Energy Ministerial's CCUS initiativeⁱⁱⁱ • Involve the academic sector as promoters of these platforms^{iv} 	Responsible: trilateral effort of Ministries of Energy, Economy, and Environment	Short to medium-term

Identifying industrial hubs/clusters/CO₂ transport networks	<ul style="list-style-type: none"> • Update existing EU GeoCapacity CO₂ storage map with layered assessment of emitters, storage sites, infrastructure, transport modes and potential future changes • Bring this map to the attention of authorities, including the European Commission, and future project proposals^v 	<p>Responsible: National Agency for Mineral Resources</p> <p>Involved: a consortium formed of academia/research, government authorities, economic operators, and NGOs</p>	Short-term and priority
Funding and financial support for RD&D projects	<ul style="list-style-type: none"> • Set a framework to govern corporate-research partnerships for pilot projects^{vi} 	Responsible: Ministry of Education and Research	Short-term
	<ul style="list-style-type: none"> • Coordinate financing frameworks, including disseminating information and supporting applications to EU funding programmes^{vii} 	Responsible: trilateral effort of Ministries of Energy, Economy, and Environment	Short-term
	<ul style="list-style-type: none"> • Economic operators should approach researchers and apply for EU funding^{viii} as consortia^{ix} 	Responsible: economic operators (e.g., cement producer)	Medium-term
Storage site exploration	<ul style="list-style-type: none"> • Coordinate a national evaluation of geological potential in a refinement to existing estimations, such as the 2008 EU GeoCapacity study^x and the CO₂STOP project, in line with the layered assessment outlined in “Identifying industrial hubs/clusters/CO₂ transport networks” 	<p>Responsible: National Agency for Mineral Resources</p> <p>Involved: a consortium formed of academia/research, government authorities, economic operators, and NGOs</p>	Short-term and priority
	<ul style="list-style-type: none"> • Following evaluation, the National Agency for Mineral Resources should invite applications for exploration permits and storage permits 	Responsible: National Agency for Mineral Resources	Medium-term
	<ul style="list-style-type: none"> • Where potential hubs are identified (see “Identifying industrial hubs/clusters/CO₂ transport networks”), conduct individual evaluations of storage capacity in depleted oil and gas reservoirs, including CO₂ injection parameters⁴ 	Responsible: National Agency for Mineral Resources	Short-term/medium-term

⁴ As there is generally better knowledge of oil and gas reservoirs, these should be prioritized for individual evaluations.

	<ul style="list-style-type: none"> • The National Agency for Mineral Resources must then approve whether CO₂ storage can happen at the same time as oil and gas extraction activities • While exploration and storage in depleted reservoirs is ongoing, the National Agency for Mineral Resources must direct financing to evaluate the potential of saline aquifers, which can be exploited in the longer-term 	<p>Responsible: National Agency for Mineral Resources</p> <p>Involved: a consortium formed of academia/research, government authorities, economic operators and NGOs</p>	Short-term/medium-term
Bridging the valley of death	<ul style="list-style-type: none"> • Storage site exploration actions must be completed 	<p>Responsible: National Agency for Mineral Resources</p> <p>Involved: GeoEcoMar (expert), economic operators, Ministry of Energy, Ministry of Economy and Ministry of Environment</p>	Short-term and priority
	<ul style="list-style-type: none"> • Industries of strategic importance should receive support from the state through a coherent and accessible regulatory and financial framework for CCS, coordinated by an inter-ministerial committee^{xi} 	<p>Responsible: trilateral effort of Ministries of Economy, Energy and Environment</p>	Short-term and priority
	<ul style="list-style-type: none"> • Pressure must come from EU level through legislative push or targets, to incentivise Romanian authorities to get involved 	<p>Responsible: European Union</p>	Short-term and priority
	<ul style="list-style-type: none"> • Engineering design firms should be coopted to project consortia^{xii} 	<p>Responsible: project consortium leaders (e.g. economic operators)</p>	Short-term
Building knowledge and capacity	<ul style="list-style-type: none"> • The CO₂ storage division of the National Agency for Mineral Resources must be given the appropriate staff and resources 	<p>Responsible: Romanian Government</p>	Short-term and priority

	<ul style="list-style-type: none"> • Knowledge dissemination and capacity-building should be conducted within institutions and authorities, possibly as a programme associated with the national CCS platform (see “Knowledge platforms”) 	<p>Responsible: trilateral effort of Ministries of Economy, Environment and Energy</p> <p>Involved: academia (experts)</p> <p>Targeted: government institutions, local authorities, economic operators</p>	<p>Short-medium-term</p>
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B) Policy, standards and regulations

Key action	• Approach	Stakeholders	Timeline
Policies	<ul style="list-style-type: none"> • A trilateral CCS strategy between the Ministries of Economy, Energy, and Environment must be championed from within government and integrated with other relevant strategies, including clear targets and mapping of CCS potential as well as incentives and plans for capacity-building^{xiii} • Good-practice examples include Norway, Netherlands, and the UK^{xiv} 	<p>Responsible: trilateral effort of Ministries of Economy, Energy, and Environment^{xv}</p> <p>Included: relevant Ministries, economic operators, NGOs and academia (in consultation)</p>	Short-term and priority
Guidelines and standards	<ul style="list-style-type: none"> • Coordinate and align relevant authorities with specific attributions relevant to permitting of CCS projects^{xvi} • Standards for CO₂ transport and storage infrastructure (e.g. purity specifications, pipeline design, safety standards) should be incorporated into national legislation^{xvii} 	Responsible: National Agency for Mineral Resources	Short-term
Regulatory framework	<ul style="list-style-type: none"> • The NAMR should contact similar competent authorities for CO₂ storage in countries such as Norway and Netherlands, and learn from existing projects such as Longship (Norway)⁵ • The EU CCS Directive transposition must undergo amendments in several areas (see Endnotes), followed by a Government Decision on support schemes for CCS technologies^{xviii} • Several country-specific regulations should be amended for CCS: the national petroleum law, the natural gas transportation framework; CCS should be included as public utility projects; large utilities should be mandated to include carbon capture in their installations (see Endnotes for more details)^{xix} • Several procedures and operational arrangements should also be amended or developed (see Endnotes for more details)^{xx} 	<p>Led by: National Agency for Mineral Resources, who must promote storage opportunities and develop a strategy around these, as well as develop the legislative framework for CCS and promote storage opportunities</p> <p>Involved: governmental stakeholders (Ministries of Energy, Environment and Economy, the National Environmental Guard, Environmental Protection Agency)</p>	Short-term and priority

⁵ The Longship project is a CO₂ transport and storage project initiated by the Norwegian state, transporting liquefied CO₂ by ship from Norway to storage sites in the North Sea.

	<ul style="list-style-type: none"> Romania should ratify the London Protocol and the amendment on transboundary transport of CO₂ for offshore storage 	Responsible: Romanian Government	Medium-term
	<ul style="list-style-type: none"> The management of CO₂ transport and storage should be assigned to a specific operator – this could be state-owned or private, or operate as a partnership or mixed-ownership business model between the public and private sectors^{xxi} 	Responsible: Romanian Government	Short-term
Strategies for CCS application for industrial decarbonisation and climate neutrality of the economy	<ul style="list-style-type: none"> Currently, there is no industrial decarbonization or specific technology strategy (e.g., hydrogen) which includes CCS There needs to be a coherent trilateral strategy on CCS, without disfavouring certain industries Relevant strategies should be updated to reflect developments in CCS and the potential for deployment in Romania 	Responsible: Romanian Government Involved: relevant Ministries, economic operators	Short term and priority
	<ul style="list-style-type: none"> The Romanian Government should make an effort to disseminate existing EU strategies and communications on CCS 	Responsible: Romanian Government (the same entity representing Romania in international CCS platforms) Involved: economic operators, storage operators, NGOs	Short-term
Enabling environment for CO₂ market	<ul style="list-style-type: none"> Emerging CCS hubs should encourage horizontal business opportunities for CCS-related activities, for example CCS equipment production, eventually supported by the government 	Responsible: capture, transport, and storage operators; Romanian Government (Ministry of Economy)	Long-term
Resilience of CCS strategies	<ul style="list-style-type: none"> CCS strategies should be an inter-ministerial effort and be detached from politics to ensure stability across political cycles 	Responsible: trilateral effort of Ministries of Economy, Energy and Environment	Short-term and priority
	<ul style="list-style-type: none"> Energy, industry, climate, and environment experts from across political parties should be approached and encouraged to discuss the role of CCS in industrial decarbonization 	Responsible: economic operators and authorities (through the association outlined in “Engagement with stakeholders”)	Short-term

C) Stakeholder engagement, cooperation & know-how dissemination

Key action	Approach	Stakeholders	Timeline
Engagement with stakeholders	<ul style="list-style-type: none"> • Communication on CCS, based on needs and capabilities of stakeholders, should occur from the start (i.e., from before applying for an exploration permit), to raise awareness of CCS technologies • A financial framework should be put in place to provide certainty to stakeholders and enable them to engage, separating the public and private financing components (i.e., the state should finance large infrastructure projects such as transport and storage components, while capture installations may be financed privately)^{xxii} 	<p>Responsible: trilateral effort of Ministries of Economy, Energy and Environment, in partnership with an independent NGO</p> <p>Involved: economic operators</p>	Short-term
	<ul style="list-style-type: none"> • As part of the knowledge platform outlined in Section A, an association of economic operators and authorities should be formed^{xxiii} to focus specifically on implementation of CCS projects^{xxiv} 	<p>Responsible: trilateral effort of Ministries of Energy, Economy, and Environment</p> <p>Involved: economic and infrastructure operators</p>	Short-term
International/ regional cooperation	<ul style="list-style-type: none"> • Knowledge transfer workshops may serve to incentivise international and regional cooperation on CCS 	<p>Responsible: trilateral effort of Ministries of Economy, Energy and Environment or designated representatives of Romania to international knowledge platforms or fora</p>	Short/medium-term

	<ul style="list-style-type: none"> • Explore the possibilities for Romania to act as a CO₂ storage hub for neighbouring countries, in view of cross-border projects^{xxv} 	Responsible: trilateral effort of Ministries of Economy, Energy and Environment or designated representatives of Romania to international knowledge platforms or fora	Medium/long-term
	<ul style="list-style-type: none"> • Romania could classify CCS projects as projects of national interest or apply for PCI (Projects of Common Interest) or PMI (Projects of Mutual Interest) status for transborder CCS projects 	Responsible: Government	Short/medium-term
Stakeholder cooperation towards CO₂ market	<ul style="list-style-type: none"> • Petroleum companies as CO₂ users and emitters from the cement, metallurgy and chemical industries can cooperate to catalyse the CO₂ market and form CCS hubs 	Responsible: oil and gas industry and/or Ministry of Economy or another national authority ^{xxvi}	Short-term

D) Social aspects and public support

Key action	Approach	Stakeholders	Timeline
Build public support	<ul style="list-style-type: none"> • A national plan for education on CCS must be implemented, with the purpose of increasing understanding of the public, formal and informal community leaders and institutions (see details in Endnotes)^{xxvii} • The national communication campaign should run in parallel with regional targeted campaigns^{xxviii} • There is no need for a new entity on public communication of CCS • The NAMR should be enlarged to include communication specialists, or alternatively an NGO could develop a communication campaign^{xxix} 	<p>Responsible: Romanian Government in partnership with independent NGO and Regional Development Authorities</p> <p>Involved: NAMR, economic operators, NGOs, academia, press and media, celebrities, public health authorities, trade unions, employer organisations, educational institutions</p>	Short-term
Building awareness	<ul style="list-style-type: none"> • Preceding an information campaign on CCS, an awareness campaign on climate change is necessary • Institutional awareness should also be increased^{xxx} 	Responsible: Romanian Government in partnership with independent NGO	Short-term
Improving fairness of the decision-making process	<ul style="list-style-type: none"> • Compensation schemes should be implemented as part of a regulatory framework^{xxxi} 	Unclear ^{xxxii}	Medium-term (in line with project implementation)
	<ul style="list-style-type: none"> • Public consultations should be an integral part of the policymaking and project planning processes on CCS, and participation in them should be actively encouraged 	Responsible: Romanian Government	Short-term
Communication of costs, risks and benefits of CCUS projects	<ul style="list-style-type: none"> • Key messages on benefits and risks should be tailored to the audience and context and communicated across the full chain^{xxxiii} 	<p>Responsible: Romanian Government in partnership with international NGO</p> <p>Stakeholders involved: NAMR, economic operators, NGOs, academia, press and media, celebrities, public health authorities, trade unions, employer organisations, educational institutions</p>	Short-term

<p>Making sure the CCS project fits within the local context</p>	<ul style="list-style-type: none"> Local communities in areas where CCS projects can be expected should be targeted early on in regional information campaigns^{xxxiv} 	<p>Responsible: Regional Development Authorities, local authorities, independent NGOs, economic operators</p>	<p>Medium-term (in line with actual project implementation)</p>
<p>Building trust in decision-makers and other relevant stakeholders</p>	<ul style="list-style-type: none"> In communicating on CCS, neutral messengers should be used^{xxxv} The benefits and risks of CCS projects should be communicated equally 	<p>Responsible: government in partnership with international NGO</p> <p>Involved: press, local opinion leaders (communication), academia incl. social science and communication experts (design of communication of benefits and risks)</p>	<p>Short-term</p>

Chapter 4. Next and immediate steps

Romania's roadmap for implementing CCS technologies must start with the policy and regulatory framework at a national level. Without establishment of this framework, there is little certainty for investors on the success of CCS projects, due to the absence of both explicit government commitment and a suitable financial framework for delivering incentives. In order to establish this framework, specific activity is needed at the regulatory level, but must be preceded by 1) establishing government commitment and industry interest in CCS; 2) a detailed assessment of CCS potential in Romania, including a robust analysis of storage site capacities⁶; 3) formulating a national CCS strategy, including a roadmap in agreement with the industry sector; 4) building institutional knowledge and capacity; 5) coordinating interested actors and 6) preparing a large-scale public education and participation plan, and building institutional knowledge and capacity. The latter is not directly related to the establishment of a regulatory framework but must happen in parallel in order to build understanding within the public and among local and regional stakeholders.

Near-term actions to be planned for WP5 of the CCS4CEE project are as follows:

- 1) Establishing government commitment
 - Commit "champions" for CCS in the Ministries of Energy, Environment and Economy
- 2) Detailed assessment of CCS potential in Romania
 - Hold bilateral meetings with the National Agency for Mineral Resources in view of requirements for conducting this assessment
 - Hold bilateral meetings with the Ministry of Education and Research, in view of financing an update of the EU GeoCapacity study (evaluation of storage capacities)
- 3) Formulating a national CCS strategy
 - Support the promotion of the need for a national CCS strategy
- 4) Building institutional knowledge and capacity
 - Hold bilateral meetings and consultations with the Ministry of Energy, in view of enlarging the NAMR CO₂ storage division and diversifying its competencies
- 5) Coordinating interested actors
 - Establish an association of interested actors for knowledge transfer and advocating for changes to the regulatory framework
- 6) Preparing a public education and participation plan
 - Hold bilateral meetings and consultations with relevant actors coordinating national education campaigns on climate change (e.g. Ministry of Environment, Presidential Administration) in view of including CCS in campaigns

⁶ As mentioned by a workshop stakeholder, a phased approach could be taken in which depleted oil and gas reservoir capacities are estimated first (likely the potential will be in gas reservoirs, as there are too many oil wells which would need to be abandoned or re-abandoned for CO₂ storage, which would increase costs prohibitively). While oil and gas reservoir capacities are exploited as an immediate CO₂ storage solution, analysis and demonstration of CO₂ storage capacities in saline aquifers can take place, eventually becoming the "long-term" solution.

Endnotes

ⁱ The national knowledge platform for Romania could:

- Be coordinated through the Operational Programme for Competitiveness
- Bring together authorities and companies
- Drive legislative activity
- Continuously enhance understanding of the legislative framework through knowledge transfer workshops and conferences

ⁱⁱ Authorities were highlighted as the main Romanian stakeholders who should be involved in these platforms; however, industry representatives could also be involved.

ⁱⁱⁱ Other potential initiatives include the Carbon Sequestration Leadership Forum (where Romania seems to be represented by GeoEcoMar, a research institute for geological studies, but it is unclear if national authorities are also participating), the European energy research alliance partnership for CCS (EERA CCS) and IEAGHG.

^{iv} Involving Romanian authorities more in international platforms could occur by sending government and/or NAMR staff as representatives and coordinators of Romania's participation in fora such as SET-Plan, IEA-GHG and ZEP.

The academic sector, as well as projects such as CCS4CEE, can be encouraged by ministries and NGOs to promote these platforms, in order to expand knowledge of the opportunities they offer.

^v Updates to the existing EU GeoCapacity map should include:

- A layered and detailed assessment of emitters, storage sites (bearing in mind differences between theoretical and effective storage capacities), and infrastructure, including potential transport modes (pipeline, road, rail, riverine, maritime and multi-modal)
- Cost-benefit analyses for economic operators to determine the best economic efficiency and investment certainty of storage sites, based on the detailed assessment of these sites
- Potential future changes in locations of emitters or the layout of transport networks

This map should not only be brought to the attention of authorities, but it should also be disseminated internationally, to ensure that future international studies and proposals for CCS projects in Romania are using the most up-to-date data.

^{vi} To enable pilot projects, the Ministry of Education and Research should set a framework to govern corporate-research partnerships for pilot projects, initiated by industrial actors providing the infrastructure for

demonstration/testing (cement and fertilizer producers first and foremost), under increased financing for research, including expert support of the NAMR for centralisation and detailed analysis in order to evaluate project feasibility.

vii It should be noted that a number of projects are undergoing evaluation or awaiting financing/organizational decisions, and an inter-ministerial committee for financing CCS should evaluate past performance in project financing through EU grants, in order to best set up its plan for supporting future EU applications.

Financing frameworks for CCS include not only EU and international funding, but also funding from the Romanian state, for example from the revenues generated by auctioning allowances under the EU ETS.

viii Examples of funding sources that could be used for CCS projects include Horizon Europe (focused on research and innovation), revenues from sale of emission allowances in the EU ETS, national State Aid, and funding through the Just Transition Mechanism (depending on national transition plans) and the Connecting Europe Facility (Energy) (focused on developing infrastructure and recognizing Projects of Common Interest). The EU Taxonomy regulation can also help mobilise private capital towards CCS, if projects meet the relevant sustainability criteria.

ix Projects based on partnerships between economic operators and researchers should focus on specific solutions to specific problems and should apply for EU funding as consortia including international partners (e.g., engineering design firms, which are lacking in Romania).

x The national evaluation of geological CO₂ storage potential should be coordinated by NAMR, in cooperation with authorities, academia and oil & gas operators, and financed by the state or EU funding. This evaluation should be integrated with the layered assessment described in endnote (v) and should include:

- Making public the potentially advantageous storage areas already identified by economic operators
- Allowing for an assessment of leakage risks and mitigation measures
- An assessment of the necessity of CCS for energy security (coordinated by the Ministry of Energy)
- A prioritization of industries suitable for CCS to attract investment (coordinated by the Ministry of Economy)
- An evaluation of potential environmental impact (coordinated by the Ministry of Environment)
- An evaluation of oil and gas wells and their leakage risks

Following the identification of wells and leakage risks, these should be sealed to prevent leakage from EOR or EGR projects. Once evaluation has been completed, the NAMR should invite applications for exploration permits and investment in storage.

^{xi} This framework should cover national financing instruments such as State Aid and CCfDs, as well as disseminate information and support applications to EU funding programmes for full-chain projects, declare CCS projects as Projects of Common Interest and finance part of demonstration projects.

^{xii} The role of design firms would be to implement actual projects, whereas universities could support with the technologies themselves.

^{xiii} A trilateral CCS strategy between the three Ministries, with involvement of Prime Minister and Secretary of State, must be championed from within government and should be coordinated with economic operators, developed based on discussions with authorities, grounded in a clear and robust evaluation of capture, transport and storage potential as well as Direct Air Capture technologies, and integrated with other relevant strategies such as the upcoming Hydrogen Strategy and Long-Term Strategy, as well as the update to the National Energy and Climate Plan, where CCS would sit alongside other clean technologies such as renewable energy, and investments such as grid and installation modernisation.

The strategy should include clear targets for carbon capture, at national and EU level, informed by scientific study (including the mapping of CCS potential proposed in endnote (v)), operationalized through incentives, rather than punitive measures, and including a plan for strengthening understanding and capacity amongst decision-makers (politicians).

It should also include milestones, financing sources, and a monitoring plan.

^{xiv} Specific good-practice measures can be highlighted in each of these countries: Norway (carbon tax, mapping of storage potential and explicit permitting of CO₂-EOR in wells reuse), Netherlands (CO₂ storage included in national decarbonisation strategies and public-private partnerships for infrastructure decommissioning) and the United Kingdom (proactive regulatory support and guidance to support timely execution).

^{xv} A potential split of responsibilities is as follows: National Agency for Mineral Resources (under the Ministry of Energy) – regulatory responsibility; Ministries of Economy and of Energy – executive function; Ministry of Environment – information, dissemination, and co-financing.

^{xvi} Including a framework for coordinating local authorities for issuing construction permits.

^{xvii} E.g. CO₂ purity specifications, standards for the design of pipelines and other carriers, safety standards, all drawing from existing practices and ongoing debates, including within the International Organization for Standards (ISO).

^{xviii} The EU CCS Directive must be amended to clarify conditions applicable to pilot projects (at EU level); the transposition of the EU CCS Directive into Romanian law (through Government Emergency Ordinance 64/2011) should be amended to detail and ease permitting and licensing processes, assign responsibility to specific institutions, address transboundary cooperation for CO₂ transport, clarify long-term liability requirements, responsibilities for storage management and the transfer of responsibility, conflicting uses of potential storage sites and differentiation between onshore and offshore storage (specific provisions or distinct regulations for offshore); the amended transposition should be harmonised with EU legislation.

This amended Directive must be followed by a Government Decision on the establishment of support schemes for CCS technologies, creating a national financing framework to regulate financial incentives for CCS.

^{xix} Country-specific regulations that should be amended for CCS are the national petroleum law (include CO₂ injection, permit transfer of oil well rights between more than just hydrocarbon operators, give priority for extraction rights holders to store CO₂ in depleted oil or gas reserves (also not explicitly permitted in the EU CCS Directive) and auction rights to store CO₂ if these are relinquished by oil or gas producers), the natural gas transportation framework (to include details on the transport of CO₂, provisions on the areas of protection and safety for CO₂ transport), Law 255/2010 on expropriation for public utility purposes (to include CCS as public interest projects); additionally, large utilities should be mandated to include carbon capture in their installations.

^{xx} Procedures that should be amended or developed include developing procedures for third-party access to the CO₂ transport network, the recording of geological data in well conservation or abandonment projects and approvals issued by NAMR, establishing standards for the purity of CO₂ streams.

Operational arrangements that should be amended or developed include clarifying the division of responsibilities between environmental and resource organisations (National Environment Guard and NAMR; Ministry of Environment and Energy on GHG monitoring protocols), the inclusion of local and regional authorities in funding decisions for CCS projects, the securing of areas for CO₂ pipeline transport and the finalization of cadastral surveys to improve public evidence of land ownership.

^{xxi} It should be noted that there was significant disagreement between participants in the CCS4CEE stakeholder workshop as to whether the CO₂ storage and transport operators should be state-run or private. Arguments for a private operator were based on the low efficiency of state-owned companies, while those for state-run operators were based on the complexity of CCS projects and the strategic nature of CO₂ transport and storage.

Some stakeholders suggested that storage could be managed by a private operator and transport by a state-run operator (or vice versa) or both transport and storage could be managed in a public-private partnership. There are several business models for infrastructure management through mixed ownership, for example the Regulated Asset Base model. The government should identify potential viable business models for CO₂ transport and storage, in consultation with stakeholders (perhaps through the aforementioned knowledge platform or CCS association of economic operators).

^{xxii} This framework could include financial incentives from the Romanian Government to attract Foreign Direct Investment in full-chain CCS.

^{xxiii} An association of interested actors (integrated with the national CCS knowledge platform), would include companies, business associations, research centres, universities, professional development organizations, public administration units, and function based on partnership agreements, rules for operation and development and promotion strategies.

^{xxiv} Such an association of economic operators and authorities should be apolitical and is an appropriate means for incentivising collaboration on CCS. Romania's CO₂ Club, set up following the French model, could be a foundation from which to start this association.

^{xxv} Building on the recent agreement between Polish, Slovakian, Hungarian and Romanian gas transport operators to cooperate on transborder transport of hydrogen and CO₂, partnerships could be formed and developed to build cross-border CO₂ transport and storage infrastructure (also with other neighbour countries). In this sense, Romania could also co-apply with partners from other countries for EU funding for cross-border projects.

^{xxvi} It should be noted that stakeholders in the expert workshop were divided between national authorities and the oil and gas industry as taking the lead for creating a CO₂ market. Arguments in favour of the Ministry of Economy (or other national authorities) included their helicopter view of economic operators, while arguments for the oil and gas industry included the success of existing projects carried out by private operators (e.g., Norway).

^{xxvii} The communication campaign should have the following characteristics:

- It should start early and encompass local information campaigns using educators as messengers
- It should involve all relevant actors including environmental NGOs, the academic sector, economic operators, local authorities (including public health authorities to communicate health risks and concerns) and celebrities (to act as “ambassadors” familiar to the local communities)
- It should avoid technical language and attempt to use a neutral tone in communications
- It should be based on specialist evidence to avoid manipulation of potential fears
- Messengers (e.g., journalists and public health experts) should complete some form of training on CCS before addressing the general public.

^{xxviii} It should be noted that there was no consensus in expert interviews and workshop as to whether or not mass-media or social media should be used in these communication campaigns. Concerns around use of this media are around fearmongering or cherry-picking information, while concerns around not using it are around the higher reach that may be secured by using these channels.

^{xxix} There are past campaigns and evaluations of lessons learnt from them, available through other projects – both in Romania (the Getica project) and abroad. These can be used as a foundation when developing such a communication campaign.

^{xxx} For example, by sending an NAMR representative to the Zero Emissions Platform (ZEP).

^{xxxi} Romanian communities tend to be worried about agriculture, and compensation schemes could be implemented as part of a regulatory framework, in cases where CCS projects interfere with local land-use for agriculture. The perception of compensation is positive in Romania.

^{xxxii} Although this was proposed as an action in bilateral interviews, no input was given in the expert workshop aside from the fact that these compensation schemes should not be implemented.

^{xxxiii} For example, both the number of jobs created and the potential damage to agriculture should be highlighted, and any potential cost increases to end-users due to capture costs (e.g., if capture costs outweigh the savings from avoided payments for emissions certificates) should also be evidenced.

^{xxxiv} Communities should also be engaged before project implementation, including an assessment of existing perceptions through informal meetings.

^{xxxv} For example, independent NGOs, the press, and local key opinion leaders.