# PROGRAMME PLAN
2017–2022

CLIMIT

## Preface

CLIMIT is a programme for research, development and demonstration of carbon capture and storage technologies (CCS). The programme is carried out in cooperation between the Research Council of Norway, which handles CLIMIT R&D, and Gassnova, which handles CLIMIT Demo. The programme has a joint secretariat and Programme Board.

CLIMIT has supported development of CCS technology in Norway for more than ten years. The knowledge and solutions created during this time have laid the technological foundation for work on $CO_2$ full-scale projects in Norway. CLIMIT has also made significant contributions to CCS development outside Norway's borders.

The Paris Agreement, signed in 2015, gives an important mandate to decision-makers in our society. In the same vein, this Programme Plan gives a mandate to the players in the Norwegian CCS community. Over the next five years, the Programme Board will allocate around NOK 1 billion to CCS technology development. The Programme Board is responsible for ensuring these funds are allocated in a manner that will help achieve the objectives in the Paris Agreement.

The CLIMIT Programme Plan for 2017-2022 is focussed on targeting future CCS activities and the opportunities that may be created through international application of this technology. The achieved results must be relevant in both the short and long term, and must be useful in a range of sectors and beyond our own borders. The programme plan describes how the programme is organised, as well as what is expected of applicants that are awarded support from the programme.

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# 1 Summary

The CLIMIT programme is founded based on extensive analyses from recognised global institutions which conclude that CCS is a cost-effective and necessary tool for achieving the two-degree target that was adopted in Paris in 2015. The value of CCS has been substantiated in a number of studies and scenarios that show how the climate goals can be met – for example from the IEA and IPCC. The programme is also anchored in the Government's CCS strategy with the goal of developing technology and solutions and reducing the costs and risks associated with utilising the technology. The ambition is for the developed technology to be suitable for widespread international application. With its excellent research and technology communities, as well as the storage potential on the Norwegian shelf, Norway is in a good position to develop CCS technology and actually apply the solutions.

$CO_2$ capture, transport and storage technology is available today. However, there are not many examples of players that consider CCS to be a profitable climate measure. Some countries, including Norway, are therefore at the forefront when it comes to utilising the technology through development of early full-scale CCS projects. These activities are important for promoting innovation, spreading the technology and steering technology development. The Paris Agreement will place new demands on government regulations, business models and technology and maturing new concepts for carbon capture and storage is a necessity for ensuring that CCS remains a competitive climate solution in the future energy and industrial markets.

The programme has therefore identified three focus areas:

A. Early full-scale CCS value chain in Europe
B. Large-scale storage of $CO_2$ on the Norwegian shelf in the North Sea
C. Future solutions for CCS

The programme covers the entire development chain (research to demo) and the entire value chain (capture to storage). The programme can also support activities related to pre-processing of fossil fuels prior to combustion, as well as activities that can contribute to value creation from captured $CO_2$. However, the projects that are granted support must contribute to reducing the costs and risks associated with CCS and the long-term storage of captured $CO_2$.

CLIMIT is a key instrument in the national CCS effort. The programme will help create a network of players that accumulate and spread expertise, and strengthen international CCS cooperation. The programme will also contribute to a comprehensive national portfolio within CCS technology development.

The programme is designed to be proactive, to ensure that the supported projects contribute to achieving the defined performance goals within the CLIMIT focus areas. The projects supported by CLIMIT are required to help share the knowledge and results they achieve. This will strengthen the reputation of CCS and increase the likelihood that CCS will be implemented as a climate measure.

## 2 Background and challenges

**The climate goals cannot be achieved without widespread global application of CCS.** At the climate summit in Paris in 2015, the nations of the world agreed to limit the global temperature increase to a maximum of 2 degrees, and to strive to limit the temperature increase to 1.5 degrees. Both the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) consider CCS a necessity. There are numerous scenarios describing different ways of achieving the two-degree target. Most scenarios agree that widespread use of CCS will be necessary to achieve the emission reductions that are needed. The scenarios that outline achievement of the two-degree target without CCS entail a much higher cost for society[1].

**Technology for capture, transport and storage of $CO_2$ is available today.** CCS has been implemented at a number of locations all over the world where the framework conditions are in place and the preconditions for CCS are met[2]. However, for most $CO_2$ emission sources the cost is too high for the owners to implement the technology, even though it would be profitable for society to embrace CCS. In other words, there is a market failure that must be solved through government regulations and incentives. The Paris Agreement encourages the development of incentives that make it profitable for the players to implement CCS.

**Global energy markets are changing**, and these changes are taking place at a much faster pace than many experts predicted. Nevertheless, analyses show that oil, gas and coal will continue to be an important part of the energy mix for a long time to come. The implementation of the Paris Agreement will increase the pace of the ongoing energy reorientation. This will play out through technology development, policy design and new business models. Demographic changes, energy efficiency measures and attitude changes can, over time, have a significant impact on the demand for energy and industrial products. It could also open the door for new products and solutions and create new business models. As one example, production of hydrogen with CCS could be interesting for manufacturing and transport, as well as the power sector. In addition, CCS from bioenergy is expected to become a necessity, and this could also have a major impact in a low emission society in the future.

**The industrial sector will need to secure its operations through a strengthened focus on climate.** The climate issue has received much attention in the general population in recent years, which has resulted in considerable negativity towards industries with high $CO_2$ emissions. CCS is the only alternative for removing $CO_2$ emissions from industrial production, such as cement and steel. In line with a stricter climate regime, CCS will therefore be essential for achieving the climate goals. In a low carbon society, players that utilise CCS can achieve a competitive advantage compared with players that continue to offset their emissions by purchasing quotas.

**CCS must be utilised to reduce costs.** Technology development and technology application are both necessary to reduce costs and risk, optimise performance and integrate CCS in the value creation process in companies. The first full-scale projects will be able to utilise results that CLIMIT has helped finance over the past 10 years and results that are still being developed. At the same time, early full-scale projects will generate a need for further research and development.

**All political parties agree on an aggressive CCS strategy in Norway.** Norway, along with the US and Canada, is at the forefront of the CCS endeavour. The main objective of the Government's CCS strategy is to identify measures that can contribute to technology development and cost reductions[3]. A wide array of activities have been initiated, including Centres for Environment-friendly Energy Research (FME), the CLIMIT programme, Technology Centre Mongstad (TCM),

international cooperation to promote CCS and, not least, the Government's work to realise a full-scale demonstration plant in Norway.

**Norway is well equipped to develop and implement CCS technology.** The oil and gas industry, various R&D and technology communities and the maritime industry possess a wealth of expertise and resources that are relevant for the development of CCS technology. Europe has only two full-scale CCS projects in operation, Sleipner and Snøhvit. Together with TCM they constitute an important basis for the Norwegian efforts. An international market for CCS in the future could provide business opportunities for Norwegian service and technology providers. The Norwegian shelf is also well suited for storing large volumes of $CO_2$[4]. Many countries in Europe are opposed to storing $CO_2$ in the subsurface onshore. $CO_2$ storage on the Norwegian shelf could become a key solution for Europe's CCS efforts.

## 3 Programme objectives

The overarching social policy goal for the Government's CCS work is: "to stabilise the concentration of greenhouse gases in the atmosphere at a level that will prevent a harmful anthropogenic impact on the climate system". The effect goal for the measures initiated by the Government is "to provide an independent and measurable contribution to the development and demonstration of CCS technology with a potential for dissemination"[3].

CLIMIT's primary objective, stipulated in the mandate from the Ministry of Petroleum and Energy, is

> To contribute to the development of CCS technologies and solutions

CLIMIT will support technology development in the areas where Norway has national advantages that can be utilised to promote CCS. Norway's long traditions within industrial technology development and strong knowledge institutions must be developed further in a broad-based international cooperation in order for Norwegian CCS efforts to be successful.

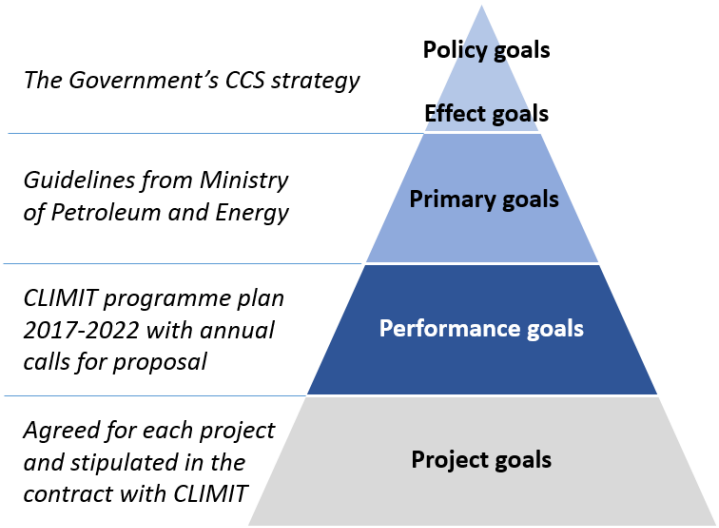
CLIMIT is an essential instrument in the national CCS effort. The interaction between CLIMIT R&D and CLIMIT Demo will be utilised to create synergies with regard to reducing the risks and costs of realising CCS technology and reducing the time spent from research until demonstration of new technology. The programme will contribute to the establishment of a network of players that accumulate and spread expertise and strengthen international CCS cooperation.

Projects that are supported must contribute to developing knowledge, expertise, technology and solutions that can yield cost reductions and widespread international application of CCS. The projects that receive support must also contribute to value creation within Norway. Through cooperation with other policy instruments, as well as calls for proposals and grants, CLIMIT will manage a portfolio of projects that support government efforts to promote CCS technology development.

CLIMIT covers technology development within all aspects of the CCS chain from industrial processes with integrated $CO_2$ capture, to transport and storage of $CO_2$. The programme is open to projects aimed at capture of $CO_2$ from power generation, as well as other industrial sources. The requirement for long-term storage means that the programme can also support development of technology that utilises $CO_2$ to make new products, provided the $CO_2$ is not

subsequently being released into the atmosphere. CLIMIT can also support social science research on CCS when this is anchored in technological issues and contributes to the programme's goals.

CLIMIT's priorities for the programme plan period, called performance goals, are described in Chapter 4. The annual call for proposals will also show priorities from the programme. Furthermore, when funds are awarded to individual projects, specific project goals will be established based on the programme's priorities. The overall goal hierarchy for the programme is shown in this figure.



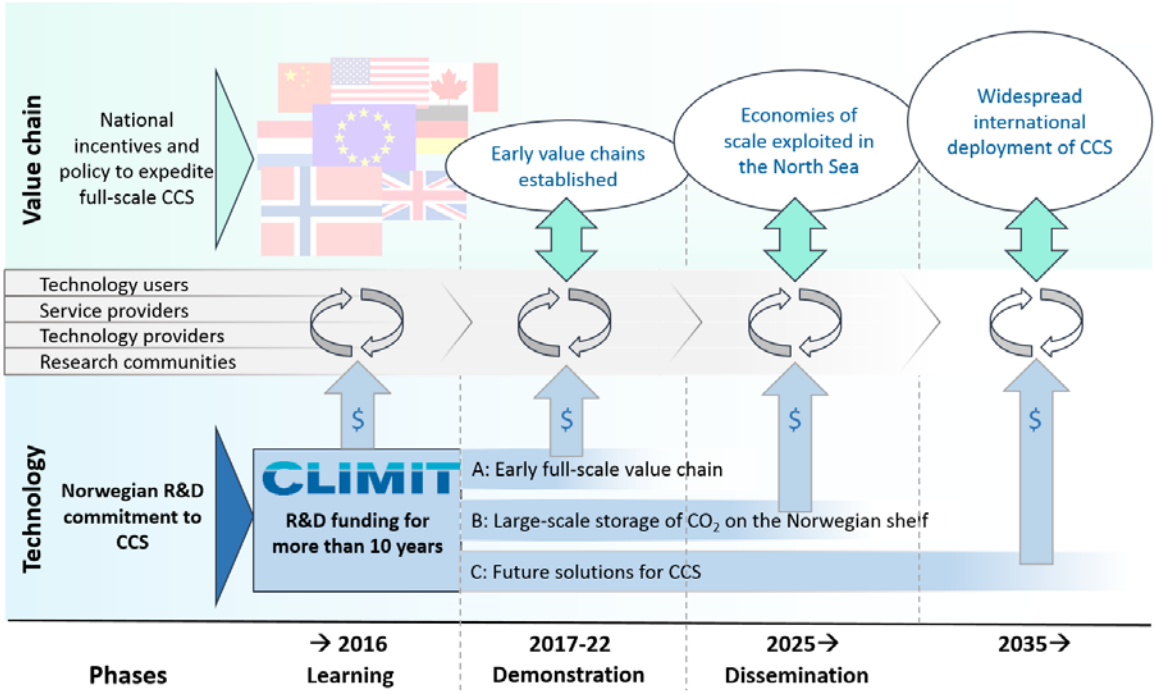

# 4 Priorities

## 4.1 Focus areas and performance goals

CLIMIT's focus areas and performance goals highlight drivers that are important to set the direction for and increase the pace of technology development. The projects supported by CLIMIT must make contributions within one or more focus areas:

A. Early full-scale CCS value chain in Europe
B. Large-scale storage of $CO_2$ on the Norwegian shelf in the North Sea
C. Future solutions for CCS

The focus areas balance the need for a short-term and a long-term perspective for technology development. The figure below shows the focus areas in a simplified time perspective. The blue part of the figure shows CLIMIT's contributions towards financing technology development that is channelled through research and industrial communities. The green part shows national efforts to utilise CCS on an industrial scale.




Performance goals that CLIMIT will help achieve during the programme plan period, have been established for each focus area and these are described below.

A. Early full-scale $CO_2$ value chain in Europe

The first European investments in CCS will likely make use of technologies already qualified for large scale applications. Still, challenges will be encountered and new research and development needs will be uncovered. CLIMIT will contribute to reducing costs and project risks in parallel with establishing the first projects, so that lessons learned from these projects can form the foundation for upcoming CCS projects.

There are opportunities for risk and cost reduction measures throughout the value chain, in connection with planning, development, operation, as well as maintenance of the plants. The work must firstly aim to reduce technical, HSE-related and financial risks. The Norwegian expertise and testing infrastructure for CCS is considered world-class, and can make valuable contributions towards solving the potential challenges in the first CCS projects.

Performance goals:
Contribute to making Norwegian technology and solutions available to the CCS value chains being realised in Norway and Europe.

Contribute to using experience from the work on the first full-scale projects for further expertise and technology development.

B. Large-scale storage of $CO_2$ on the Norwegian shelf in the North Sea

There are numerous opportunities for geological storage in Europe, particularly offshore. On the other hand, there is little support for storage of $CO_2$ onshore, underneath populated areas. This has created challenges for several European CCS projects in recent years.

The proven potential for storing $CO_2$ on the Norwegian shelf is substantial, and Norway is a world leader when it comes to offshore technology and operations. Development of a $CO_2$ storage on the Norwegian shelf which is flexible and available to many $CO_2$ suppliers is considered important to ensure the spread of CCS in Europe. Economies of scale will also yield significant cost reductions per tonne stored $CO_2$. Business models that ensure storage operators sufficient risk relief and earnings must also be developed. $CO_2$ for enhanced oil recovery (EOR), combined with long-term storage, could be a crucial commercial driver if there is access to sufficient $CO_2$ volumes.

When developing new storage infrastructure, it will be important to strengthen the knowledge base for large-scale storage solutions in connection with assessments of capacity, integration and flexibility. Analyses from operation and maintenance of storage facilities, including wells and fixed and floating installations, will also be vital. This will help reduce future project risk, and provide essential expertise when developing regulatory requirements, standards, commercial models and practical solutions.

Performance goal:
Contribute to the acceleration and scale up of technology and solutions for large-scale storage of $CO_2$ on the Norwegian continental shelf in the North Sea.

C. Future solutions for CCS

It is hard to predict the development of industrial and energy markets, but it is essential that CCS technology will be available and competitive for a range of scenarios.

New business models will be developed and it is important to monitor international developments, particularly in the markets that already have CO2 waste streams, such as hydrogen production.

New CCS technology concepts are expected to trigger significant cost reductions. This will require targeted efforts throughout the development chain from research to pilots. There are several technologies with a low technical maturity level that can contribute to reducing the costs associated with CCS. This can be achieved through a lower energy demand, simplifications in the process or process integration, smaller facilities and a smaller environmental footprint. The commercial potential of new technologies must be assessed with regard to the market development in each sector. Technology that is close to market introduction will be awarded support if the applicant can highlight the technical and commercial potential of the technology.

Performance goal:
Contribute to making CCS technology available to a wide range of industries at a competitive cost.

## 4.2 Technical priorities

This chapter outlines the general direction of the development within the various technology areas. Priorities will depend on the needs identified by the players that plan to utilise the technology or gap analyses that are conducted prior to call for proposals in the programme. If necessary, players will be invited to workshops to identify the most relevant development

needs. At such workshops the players will be encouraged to join forces and prepare applications for CLIMIT on selected topics.

Capture

There are a number of capture technologies, at varying levels of maturity. Mature technologies are used in full-scale plants today, but it is expected that risks and costs can be reduced further.

Projects that apply for support from CLIMIT should be founded on the industry's objectives to reduce $CO_2$ emissions and the projects must aim to improve, optimise and reduce risks and costs if the technology is mature. This could, for example, be achieved through improving solvent-based absorption technology or through hybrid solutions. Improvements can also be achieved through better integration of capture technology throughout the process. This includes improved solutions for heat recovery, optimisation of capture rate and carbon-neutral processes.

Different $CO_2$ capture technologies can be optimised in different ways depending on the sector in which the technology will be implemented. In some cases, available residual heat could be a decisive factor, while the most important element in other cases could be the capture plant's space requirements, electricity consumption or tolerance to variations in the composition of flue gas. It will be relevant to support projects that address industry-specific requirements for integration and operation of capture technologies. All industry segments are important, such as cement and steel.

CLIMIT will also support research in cutting-edge capture technology and solutions. This could be new technology or existing technology that is utilised in new ways. These projects should focus on a faster incremental development towards increasing maturity where the long-term potential for the process has been substantiated. Examples include projects that focus on the development of materials, sorbents, solvents, membranes, and simpler solutions or smarter design. More specifically, this could be integrated solutions for industrial processes and simultaneous capture of $CO_2$, gas power with flexible load and bio-CCS. It could also be relevant to support further development of capture technologies that are now ready for scale-up to pilot or demo. Examples include $CO_2$ capture at low temperature, solid sorbents, Chemical Looping Combustion (CLC), oxy-fuel at high pressure and hydrogen combustion.

Transport

Transport of $CO_2$ currently takes place in pipelines and with ships on a commercial scale. However, there is still room for improved solutions involving less risk and lower costs within $CO_2$ transport.

There could be a need for studies to optimise ship transport with regard to the interface between interim storage on shore and offloading offshore. Furthermore, it may be relevant to support technical studies that elucidate the risk associated with $CO_2$ transport and interim storage in populated areas.

The effect of impurities with regard to corrosion in pipes and tanks is an important research topic, for example to establish the most cost-effective material selection and volume. Research has revealed that strict requirements will be necessary in connection with the composition of the $CO_2$ flow to prevent corrosion, which has a major impact on costs upstream in the CCS chain. Models and calculations of multiphase flow can be developed further in the existing infrastructure. Models and prediction tools for $CO_2$ flows in pipeline systems can be developed

further to reduce uncertainties. Testing of material properties at both the laboratory and full-scale levels can be part of the maturing process for $CO_2$ transport technologies.

Storage

The next offshore $CO_2$ storage sites will most likely be developed using current petroleum technologies. Costs and risks can be reduced by looking at simplifications, standardisation and optimisation of technology elements that are used in wells, subsea templates and other installations.

We need improved knowledge, methods and tools to gain a better understanding of the optimal method for storing $CO_2$. New or improved experimental analyses and calculation methods can increase our understanding of storage capacity, injectivity, sealing and flow properties. This will reduce the uncertainty of an investment decision for a $CO_2$ storage site. Improved methods will also provide more assurance that a storage site can be operated without negative environmental impact.

There is a need for cost-effective solutions for evaluating, building and operating $CO_2$ storage sites with associated injection wells and subsea installations. Simulation tools are particularly important during the evaluation phase, the injection phase, as well as after injection is completed.

Methods for monitoring reservoirs, cap-rocks and the marine environment should be developed further for a more cost-effective real time monitoring of the most critical parameters. There will be a need to develop improved methods, procedures and tools for securing and de-commissioning storage sites, and for monitoring after injection is completed. Procedures for quantifying the risk associated with undesirable incidents in a lifecycle perspective are important in this context. It is also important to develop methods to prevent or mitigate undesirable incidents. Methods for assessing and mitigating problems related to legacy wells are of particular interest in this connection.

In order to accelerate large-scale storage on the Norwegian continental shelf, it is important that storage sites are designed to efficiently receive $CO_2$ of varying qualities from different sources. The methods for qualifying such systems, as well as the development of cost-effective requirement specifications, are important for risk management. To give the storage players and suppliers predictable prices, it is also important to develop requirements for approval solutions relating to receipt of $CO_2$.

Projects that examine use of $CO_2$ for enhanced oil recovery in combination with long-term storage, will qualify for support. This could increase the commercial value of the CCS projects now, as well as provide useful experience for subsequent storage facilities.

$CO_2$ value chain

Because market failure is considered an important reason why CCS is not being utilised, today research can identify the market changes necessary to ensure widespread application of CCS as a climate measure. CLIMIT can support social science research when it is founded in technological issues. Relevant topics of research include barriers to and incentives for technology implementation, work processes and other non-technological aspects that must be accounted for in order to promote R&D and innovation within CCS.

# 5 Structural priorities

The CLIMIT programme can support projects that are carried out by technology providers, service providers, technology users, research institutions, universities and university colleges, when this will trigger new activity related to the priorities outlined in this Programme Plan. Special emphasis is placed on industry relevance and business involvement in all CLIMIT projects to ensure the supported technology development covers specific industrial needs.

Multidisciplinary projects are emphasised as well as cooperation between industry and research communities, as is international project collaboration to strengthen knowledge dissemination and to ensure relevance for industrial application.

## 5.1 CLIMIT R&D

Applicants can mainly apply for support within the following project types in CLIMIT R&D:

- **Researcher projects** (FP - Forskerprosjekter) cover basic research that provides new knowledge which can be used to develop products and services. Research projects can include PhD studies.
- **Knowledge-Building Projects for Industry** (KPN - Kompetanseprosjekter for næringslivet) to contribute to industry-oriented researcher training and long-term competence development in the Norwegian research community within topics that are crucial to the development of business and industry in Norway.
- **Innovation projects for the Industrial Sector** (IPN - Innovasjonsprosjekter for næringslivet) To stimulate R&D activity in trade and industry, particularly activities that promote innovation and sustainable value creation.

Applications for CLIMIT R&D will mainly be within focus area B (Large-scale $CO_2$ storage) and C (Future solutions for CCS). Focus area A (Early full-scale $CO_2$ value chain in Europe) is mainly looking for IPN projects. Organisations that submit an application to CLIMIT R&D must be Norwegian. CLIMIT R&D can also support projects that contain social science research.

A small portion of the budget will be allocated to calls for projects covering participation in international networks of high strategic value. There will also be minor calls for event support and mobility grants.

CLIMIT R&D will also cooperate with other programmes at the Research Council of Norway on joint calls for proposals if this contributes to promoting the priorities in CLIMIT's Programme Plan. The same applies to joint calls for proposals with R&D programmes in other countries.

## 5.2 CLIMIT Demo

Applicants can apply for support for the following within CLIMIT Demo:

- **Industrial development projects** to apply research results to the development of new technologies or solutions or to substantially improve existing solutions.
- **Pilot and demonstration projects** are the final step before commercialisation of new products and services, and can comprise construction of facilities for testing of technology.
- **Other support** can comprise feasibility projects for development and pilot projects, support for international collaboration, or participation in strategically important international forums.

Applications for CLIMIT Demo must describe how the projects can contribute to Norwegian value creation. CLIMIT Demo also requires the project applicant to explain how the development work will be integrated in a commercialisation plan, including handling of IPR.

# 6 Cooperation and communication

Cooperation with other national and international policy instruments is important to ensure effective goal achievement for the programme. Cooperation with other programmes, nationally and internationally, can contribute to more efficient use of public funding for technology development. It is also important to strengthen knowledge about and confidence in CCS as an essential technology for achieving climate goals, among a wide range of players and the general public.

## 6.1 Cooperation with national policy instruments

Through cooperation with other national policy instruments, CLIMIT will contribute to coordination of the total Norwegian effort for CCS technology development. This will allow the expertise that has already been developed through the FMEs and CLIMIT projects to be used in further development work. It will allow test infrastructure such as ECCSEL (European CCS Laboratory Infrastructure) and TCM to be filled with relevant activities, and the work on early full-scale CCS can also be significant for further technology development.

Beyond coordinating CLIMIT's activities with strategic agencies such as Energi21 and OG21, CLIMIT will also cooperate and coordinate its activity with other policy instruments that are managed by organisations such as Innovation Norway and Enova. Cooperation can also be related to issues that do not directly fall under CLIMIT's mandate, but that might be advantageous for developing CCS technology. This could, for example, be related to areas such as CCU, EOR and energy efficiency. Cooperation with private institutions and funds may also be relevant.

## 6.2 Cooperation with international policy instruments

CLIMIT will contribute to international application of CCS. This will be achieved in part by helping Norwegian technology and knowledge communities to be competitive internationally. In order to develop knowledge and competitive technology, it will be important to prioritise cooperation with countries that already have a CCS market and that have ambitions to continue using the technology. Another goal of international cooperation is to promote Norwegian technology for use in other countries. Examples of countries that have made strides within the field of CCS include Canada, USA, UK and the Netherlands.

The Ministry of Petroleum and Energy in Norway and the Department of Energy in the USA have established a bilateral Memorandum of Understanding (MoU) within energy. This includes the objective of achieving cooperation synergies within capture, transport and storage of $CO_2$, as well as EOR, within larger scale pilot testing, technology development and research.

The SET Plan[5] provides the direction for the desired development within CCS in Europe as regards implementation, innovation and research in the energy sector. The SET Plan is a strategic instrument for the EU's framework programmes and is therefore very significant for the EU's climate and energy policies. CLIMIT will contribute to coordinating national CCS work processes with the SET plan and prioritise synergies with processes at the EU level. This will be

implemented through annual action plans that ensure optimal coordination with the SET Plan's implementation plan for CCS. CLIMIT will continue working for Norwegian technology and expertise communities to be successful in the EU arena through projects in the European research programme Horizon 2020 and upcoming framework programmes (FP9). CLIMIT also cooperates with several international organisations on the international rollout of CCS. This cooperation includes the "Carbon Sequestration Leadership Forum" (CSLF) and IEAGHG.

Norwegian research communities are encouraged to establish cooperation with players across national borders, to set clear goals for what they want to achieve and make concrete plans to extract value from the cooperation.

### 6.3 Knowledge dissemination, communication and arenas

The CLIMIT programme will contribute to the sharing and dissemination of acquired knowledge. Implementation of CCS technology and results achieved through the CLIMIT programme will primarily take place through the buying and selling of products and services within a commercial marketplace. There is also a need for active dissemination of information about each grant, about project results and about the portfolio development. CLIMIT requires projects to share information about the work being done and the results they achieve at project milestones and after each project is concluded. Target groups for this communication are research communities, industry players, investors, public administration, political decision-makers and the general public.

Results from research are among the topics covered at the CLIMIT Summit conference that is organised each year. In addition, newsletters and the CLIMIT website are used to share information about the projects. Seminars and workshops organised by CLIMIT are also used to ensure knowledge sharing.

Projects supported by CLIMIT are encouraged to contribute with communication aimed at the general public. It is important that CLIMIT-supported projects help to spread information to provide the general public and decision-makers with the necessary knowledge about CCS as a crucial climate measure. In addition to publication of results from the projects, CLIMIT also supports popular science communication through mass media, social media, discussion forums and other non-technical forums.

## 7 Expected results, impact and societal effects

The projects that receive support from CLIMIT must help fulfil the programme's objectives. As the nature of the programme's performance goals is long-term, more specific project goals will be developed for each project.

### 7.1 Results from projects that are supported by CLIMIT

When a project receives funding, *project goals* will be established in a contract or funding letter signed by the project manager and the Research Council of Norway for CLIMIT R&D and by the project manager and Gassnova for CLIMIT Demo. The project goals will describe the results that must be achieved when the project is finalised. The goals must be verifiable and, to the extent possible, quantifiable. The project goals must underpin one or more of the following *result indicators*:

- *International research collaboration:* This can take place by strengthening the project through staffing with resources from research institutions in multiple countries.
- *Expertise development in technological and industrial communities, as well as research environments:* It is important to continue building on the expertise that has already been developed in Norway, to include related disciplines, and to contribute to effective cooperation arenas for the players.
- *Development and qualification of new technical solutions, methods or technology components:* CLIMIT will assess the maturity level of each technology and help set quantifiable goals relating to technology maturation, performance and safety for each project.
- *Cost reductions and/or performance improvements in the value chain:* Cost reductions can be achieved through improvements in a number of areas, including more efficient processes, solutions that reduce risk, coordination with related systems, economies of scale and utilisation of potential gains, such as enhanced oil recovery.
- *Commercialisation and international spread of solutions and expertise:* CLIMIT shall contribute to preparing technology for international application.

## 7.2 Impacts that the programme should help generate

The expected impacts of the programme can be deduced from its *performance goals*. Achievement of the performance goals will mainly be assessed through continuous *portfolio management* and by conducting *external evaluations* of the programme, initiated by the Programme Board. Concrete performance indicators will be developed before evaluations are conducted.

The ultimate success for the programme is that owners of international emission sources implement CCS as a climate measure and that technology that was supported by CLIMIT is used when projects are being developed. To ensure goal achievement, CLIMIT will continuously direct the call for proposals and grants towards the international development of CCS and towards sectors with the greatest opportunity to utilise CCS. CLIMIT will also work proactively with players that may have an interest in developing technology and solutions within the Programme Plan, and closely follow up the projects that receive funding. The CLIMIT portfolio will be balanced over time, segments and technologies, and the portfolio will be managed to achieve efficient technology maturation from research to demonstration.

## 7.3 Expected societal effects

The societal effects that CLIMIT should contribute to are outlined in the Government's CCS strategy and are formulated through a *social policy goal* and an *effect goal*[3]:

- To stabilise the concentration of greenhouse gases in the atmosphere at a level that will prevent a harmful anthropogenic impact on the climate system
- To provide an independent and measurable contribution to the development and demonstration of CCS technology with a potential for dissemination

Through CLIMIT's work spanning more than 10 years, and through what will be achieved in the upcoming programme plan period, the programme lays an important technological foundation for the Government's CCS work. This applies both to the work of creating better opportunities to demonstrate CCS in early value chains, and to developing technology for long-term international application.

The Programme Board also emphasises that a successful CCS effort will contribute to more robust Norwegian businesses, through strengthening industry's adaptability to the low carbon society and the development of new, sustainable industries. If infrastructure for transport and storage of $CO_2$ is available at key Norwegian industrial sites, this could also, in a low carbon society, help attract new, energy-intensive industry. Furthermore, Norwegian investment in CCS can strengthen export of Norwegian technology, if CCS becomes widely used internationally.

## 8 Resources and budget

CLIMIT R&D is financed through annual allocations from the national budget of the Ministry of Petroleum and Energy (MPE) to the Research Council of Norway. The funding from the MPE can vary from year to year, but has remained stable in recent years at just over NOK 100 million per year. A significant portion of this funding is for large calls for proposals every autumn. Smaller calls for proposals are also conducted when necessary. Active and planned calls for proposals are available on the CLIMIT and the Research Council of Norway websites. Projects that receive support normally have a project period of several years. Project funding is disbursed in line with the agreed progress in the projects.

CLIMIT Demo is financed through annual allocations from the national budget of the MPE to Gassnova. The funding from the MPE can vary from year to year, but has remained stable in recent years at about NOK 100 million per year. Any un-allocated funding is accrued and may be used to support larger projects in certain years.

## 9 Management and organisation

CLIMIT operates under a mandate issued by the Ministry of Petroleum and Energy (MPE) and reports to a Programme Board appointed by the MPE. R&D activities are managed by the Research Council of Norway and Demo activities are managed by Gassnova. Coordination is ensured by a joint secretariat, which is administered by Gassnova.

The Programme Board specifies the topics for CLIMIT's calls for proposals. They are announced on the CLIMIT and the Research Council of Norway websites.

Applications for CLIMIT R&D funding normally have a fixed deadline and are evaluated by the Research Council of Norway using their standard procedures, often involving international peer review.

Applications for CLIMIT Demo funding are evaluated by technical experts in the CLIMIT secretariat on a continuous basis according to guidelines from the MPE[6]. Funding decisions are made by the Programme Board based on recommendations from the secretariat.

Gassnova and the Research Council of Norway have a duty of confidentiality towards project applicants according to Section 13 of the Public Administration Act. This means that the secretariat will ensure that sensitive information is not shared or used for other purposes than processing the application in question.

A funding decision by either Gassnova or the Research Council of Norway, is characterised as an individual decision according to the Public Administration Act. The Programme Board uses its expert discretionary assessment in funding decisions. Upon awarding funding, the Programme

Board may stipulate requirements that the applicant must meet in order for the decision to become valid. The Programme Board does not have a duty to give grounds for its decisions. The Programme Board's expert discretion cannot be appealed. However, there is a limited right of appeal for CLIMIT R&D, pursuant to the customary practice in the Research Council of Norway.

The Programme Board normally holds five meetings each year and programme results are reported to the MPE through the Research Council of Norway and Gassnova.

## 10 References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6. MPE. *Regelverk for tilskuddsordning Utvikling og demonstrasjon av teknologi for $CO_2$-håndtering (Fond for $CO_2$-håndtering)*. (2015).


## 11 Abbreviations

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| CCS | Carbon Capture and Storage |
| CCU | Carbon Capture and Utilisation |
| CLC | Chemical Looping Combustion |
| CSLF | Carbon Sequestration Leadership Forum |
| EOR | Enhanced Oil Recovery |
| FME | Centres for Environment-friendly Energy Research |
| FP9 | Framework Programme # 9 |
| IEA | International Energy Agency |
| IEAGHG | IEA Greenhouse Gas R&D Programme |
| IPCC | Intergovernmental Panel on Climate Change |
| IPR | Intellectual Property Rights |
| MoU | Memorandum of Understanding |
| MPE | Ministry of Petroleum and Energy |
| SET | Strategic Energy Technology |
| TCM | $CO_2$ Technology Centre Mongstad |