

CARBON CAPTURE STORAGE

SOLVING THE CLIMATE PUZZLE
FOR INDUSTRY AND ENERGY



BELLONA
EUROPA

BELLONA HAS ALWAYS SAID: FROM POLLUTION TO SOLUTION. WE NOW HAVE THE SOLUTIONS AND NEED TO ACT.

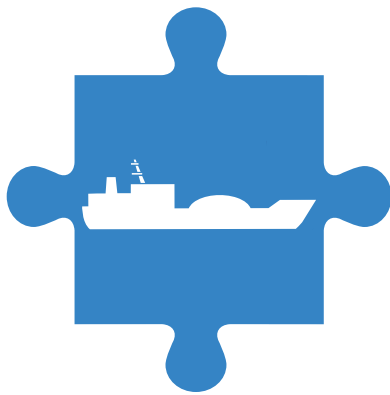
A massive expansion of renewable and regenerative energy is imperative to halt runaway climate change. As is a steep reduction of energy demand through energy efficiency investments, energy storage and smarter infrastructure. But we know this will not be enough. A massive and swift deployment of CO₂ Capture and Storage (CCS) is also required.

The IPCC 5th Assessment Report states beyond doubt that CCS is crucial and that Bio-CCS – the combination of CCS and sustainable bioenergy that can achieve negative emissions - will be necessary to compensate for the emission cuts we are already failing to make in time.

CO₂ emissions are the greatest threat to our climate. CCS must provide the bridge between our current condition and our destination of a low-carbon society. For several energy-intensive industries, CCS is the only available technology to reduce emissions sufficiently in the foreseeable future. Yet until we roll-out CCS on a large scale, power plants and industrial production facilities, old and new, continue to fill the atmosphere with CO₂.



Capture of carbon dioxide (CO₂) from power plants or CO₂ intensive industries.



Transportation of CO₂ via pipeline or ship to a selected storage site.



CO₂ injection into a suitable underground geological formation for permanent storage.

ALL THREE STAGES ARE BEING UNDERTAKEN SUCCESSFULLY IN VARIOUS CAPACITIES ACROSS THE GLOBE.

BELLONA'S WORK IN BRUSSELS:

- CCS
- Bioenergy
- Arctic
- Energy Storage
- Energy Security
- Nuclear issues (with the Russian office)
- Sustainable cities
- R&Dialogue

ENERGY SECURITY

The dependence of Member States on imported energy, such as natural gas, is forecast to increase. Affordable and secure energy supply is a key pillar of a prosperous European economy. Coal and lignite constitute more than 80% of EU fossil reserves; the future use of this indigenous, secure and affordable energy resource is dependent on CCS. In a low-carbon society, CCS will mitigate the climate damaging effects of its CO₂ emissions while also reducing other pollutants hazardous to human health such as SO₂ and particulates.



BELLONA ASKS:

- Member States with high exposure to energy imports such as Poland must prioritise CCS in both EU and national energy policies.

LOW CARBON ELECTRICITY

CCS applied to a coal or natural gas power plant enables the production of large volumes of low-carbon electricity. Individual CCS projects result in large scale emissions reductions of national significance. Power generation with CCS also complements renewables as low-carbon electricity that is available on demand when renewables cannot generate.

Full-scale CCS in power production exists today. A coal power plant in Canada called Boundary Dam will begin capturing one million tonnes of CO₂ in 2014. The Kemper County coal gasification facility in the U.S. will also begin capturing CO₂ in 2014. In Europe, the UK is progressing two full-scale CCS projects. White Rose will capture CO₂ from a coal/biomass facility for storage in the southern North Sea, while Peterhead will capture CO₂ from a fossil gas power plant to be stored in the central North Sea. There are numerous other smaller-scale or research-focused projects.

BELLONA ASKS:

- Proactive engagement with nations beyond Europe investing in CCS, notably Canada, the U.S., China, South Korea and South Africa, to seek best practice exchange on both technology, policy and societal engagement.
- Set a sufficiently strict emission performance standard (EPS) in Europe to drive CCS deployment.

INDUSTRY EMISSIONS

CCS is the only technology that can enable the EU to deliver climate goals and retain a strong industrial base. CCS is the only technology that can deliver sufficiently deep CO₂ reductions in energy-intensive industries such as steel, cement, aluminium, refineries and chemicals. Without these materials we cannot build railways, houses, windmills, solar panels, computers, and electricity networks – in short, the infrastructure we need to attain a low-carbon society.

Even with renewables, release of CO₂ is unavoidable in several of these manufacturing processes, and efficiency limits are being reached. Industrial activity stands for 40% of the world's CO₂ emissions. In the EU, CCS in industry has the potential to mitigate up to 0.4 Gt CO₂ by 2050 and up to 2.5 Gt CO₂ per year globally. This would be a true industrial renaissance for Europe.

BELLONA ASKS:

- Develop CCS clusters: Plan and deploy CCS for energy-intensive industries in parallel with fossil-fuel power generation and attain economies of scale for CO₂ transport and storage.



13.3

GIGATONNES
OF CO₂ FROM
INDUSTRY IN
2010

Photo by onepony / Bigstock

CARBON NEGATIVE

Biomass* binds CO₂ from the atmosphere as it grows. When it rots or is combusted, the CO₂ is released back into the natural cycle. Provided sustainable sourcing and processing of the biomass, this cycle is virtually carbon neutral. If the released CO₂ is captured and stored, the result is negative CO₂ emissions: removing more CO₂ from the atmosphere than is emitted.

Bio-CCS can deliver carbon negative power and a real industrial renaissance: an industry with emissions below zero. Bellona initiated a Bio-CCS report in 2012, joining the expertise of the European Commission's Technology Platforms for CCS (ZEP) and Biofuels (EBTP). The report found that by 2050, Bio-CCS could remove 800 million tonnes of CO₂ every year in Europe alone.

BELLONA ASKS:

- Reward negative emissions under the EU Emissions Trading Scheme (ETS).
- Deliver a sustainable, holistic and progressive bioenergy policy for Europe.
- Promote and support the development of integrated and regenerative solutions similar to Bellona's Ocean Forest and Sahara Forest Project.

*Organic matter for fuel, e.g. wood, waste, seaweed and other algae.



10 Gigatonnes of
**CO₂ CAN BE REMOVED
FROM THE ATMOSPHERE
BY BIO-CCS ANNUALLY**

Photo by Martin Nikolaj Bech / CC BY

> 100

**YEARS OF OFFSHORE
CO₂ STORAGE IN
THE UK NORTH SEA
ALONE**



NORTH SEA POTENTIAL

The future of CCS in Europe depends on the timely development of the North Sea as a CO₂ storage hub. The North Sea is both the largest potential CO₂ storage in Europe and conveniently located for the most industrialised and emissions intensive regions of the continent. The skill and infrastructure of the aging oil and gas industry can open the door for CO₂ storage.

Mapping of suitable CO₂ storage sites takes time; therefore it is necessary to begin now to build the detailed knowledge that provides accessible and secure CO₂ storage. The provision of bankable CO₂ storage in the North Sea will remove roadblocks and help prevent delay of future CCS project.

BELLONA ASKS:

- Rapid strategic development of 'bankable' North Sea CO₂ storage capacity. Affordable CO₂ from industrial sources can be transported via ship to a network of candidate CO₂ storage sites.
- A framework to assist development of pilot and commercial scale CO₂ for enhanced oil and gas recovery (EOR). This can be achieved through preferential taxation, grants and legal requirement for action.

TRANSITIONAL SUPPORT

To date, incentives for CCS deployment in Europe have been solely based on the carbon price. This will remain insufficient in preparing Europe for commercial CCS deployment.

The successful deployment of wind and solar energy in Europe has relied on additional transitional measures such as feed-in tariffs, introduced by EU Member States to attain their binding targets for renewable energy sources. The Renewable Energy Directive ensured the introduction of such mechanisms that remove much of the commercial risk, accelerating deployment, learning and cost reductions. As a crucial climate change technology, CCS would benefit from similar deployment mechanisms.

BELLONA ASKS:

- Set an ambitious EU target for CCS deployment to aid the development of skills, technology and CO₂ storage capacity
- Introduce measures to aid swift deployment of CCS, such as binding EU and/or national targets delivered through e.g. a certificate system.

EUROPEAN OPPORTUNITY

The future of CCS is global. The International Energy Agency (IEA) anticipates the bulk of CCS deployment to take place in the countries now industrialising. CCS offers huge commercial potential, with CCS technologies anticipated to play a larger role in decarbonisation than the nuclear industry.

Active European support through mechanisms such as FP7, H2020, EEPR and the NER300 has assisted European firms and researches to be world leaders on CCS technologies. Europe must now put this skill to use in building new globally competitive industries in CCS manufacturing and services. The growing delay in deployment of CCS at home is already eroding European firms' competitive advantage, ceding future market share as well as job creation and retention to others.

BELLONA ASKS:

- Consider and integrate CCS in relevant policy, from the CCS Directive to wider policy initiatives such as the 2030 framework, ETS reform and energy security.

THE COST OF CARBON

The EU Emissions Trading System (EU ETS) is the world's largest multi-sector greenhouse gas trading scheme and the cornerstone in the EU's policy to address climate change. The objective of the ETS is to promote reductions of such gases in a cost-effective and economically efficient manner.

However, the system has failed to deliver a clear and robust price signal which would ensure the investments needed to decarbonise cost-efficiently. The unexpectedly deep and long recession, combined with the interaction with other carbon reduction policies, has led to a significant oversupply of allowances in the market.

BELLONA ASKS:

- A structural reform of the EU ETS, entailing the establishment of an independent European Central Bank of Carbon that would allow the system to respond to unpredictable changes in CO₂ demand, thereby safeguarding the effective functioning of the market.
- Take steps to integrate the true societal cost of CO₂ emissions.

LOW CARBON DIALOGUE

Energy production based on coal, oil and gas has a profound impact on the world's climate. CCS is one amongst many measures aimed at reducing our CO₂ emissions, energy consumption, increasing energy efficiency and the share of renewable energies.

Awareness of the importance of reducing CO₂ emissions is rising, but the transition towards a low-carbon society is slow and complex. Much needed fundamental changes require extensive research and involves many public, industrial and civil society stakeholders, each with vested interests that are often not aligned.

AS A LEAD PARTNER IN THE EU-FUNDED PROJECT R&DIALOGUE, BELLONA ASKS:

- Build social confidence to further the deployment of CCS technologies and renewable energy sources.
- Develop national short- and long-term climate action plans in each Member State, and a European vision towards a low-carbon society.

THE CLIMATE CHANGE PUZZLE CAN ONLY BE SOLVED WITH ALL THE PIECES

"The biggest threat to the climate is lack of commitment. We need politicians who dare to think outside the box and invest where it really counts - brave politicians that can swim against the current, take unpopular decisions and think further ahead than the next opinion poll and election"

Frederic Hauge, Bellona President.



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