Vattenfall's view on CCS in brief

CCS is needed to tackle climate change

As a user of fossil fuels, Vattenfall is deeply involved in the climate change issue. Therefore, we have a responsibility to take initiatives and lead the way. We want to be a good force in society, recognised for our efforts to find solutions, not for being part of the problem. Such an approach adds values to Vattenfall, to our customers and to society as a whole.

To capture and store CO_2 produced in connection with the combustion of fossil fuels could be an important part of the solution. Commercial deployment for this technology will make it possible to continue using fossil fuels – a necessity both for tackling climate change and for securing sufficient energy supply in Europe and the rest of the world. CCS at fossil fuelled power plants would provide us with breathing space by building a bridge to the future.

Vattenfall regards CCS as an intermediate solution. Therefore, we also continue to develop long-term sustainable solutions of energy supply. Already today Vattenfall has a substantial amount of hydropower, biomass and wind power in its portfolio. Both share and amount of wind power and biomass is increasing. However, energy savings and renewables alone are not enough to achieve the substantial CO_2-reductions that are urgently needed. CO_2 reduction targets can't be reached without continued use of nuclear power.

Vattenfall efforts regarding CCS do not compete with efforts regarding other energy sources. Our R&D and investment programmes support and complement each other.

Vattenfall's CCS ambition presupposes that storage can take place in a manner acceptable to society, and also that a set of legal regulations are in place and an emission trading system that sets a price on carbon dioxide emissions is operative.

Vattenfall has taken a leading position in the European development work in this field. Our ambition is that CCS technology should become fully commercialised by 2020 under the ETS. We assess that it would be enough to reach EUR 25-35 per ton CO_2 for CCS to be commercially implemented by 2020. We believe that this target is within our reach.

CCS would be commercially introduced under the ETS

Vattenfall is convinced that CCS will become commercial as well as generally accepted as an intermediate and partial solution to tackle the threat of global climate change. CCS would be commercially introduced under the European ETS in competition with other carbon lean or CO_2-neutral solutions.

Based on the knowledge that we have built regarding CCS since 2000, we are convinced that commercial CCS could be realised by 2020, with the necessary support from society, not least the political community. Needed support includes funding for demonstration and removal of legal and other formal obstacles, but also in terms of opinion making in favour of CCS on local and national areas, as well as European and global level. Without a strong, immediate and focused support, the commercial introduction of CCS will come later.

Vattenfall's belief in CCS is independent of funding support. However, the magnitude and the rate of our continued efforts regarding CCS development are dependent on funding and

general political support as well as of general public acceptance. The stronger public support, the stronger our own efforts.

We openly share our position regarding preferred funding support in the EU to promote a fleet of CCS demonstration plants to be realised – plants that are necessary for CCS to become commercial in Europe under the ETS by 2020.

Vattenfall's interest in CCS is as future buyer and user of the technology. As such, we welcome all kinds of CCS initiatives and projects all around the world. The development rate of new technology gains from:

- Competition,
- Pluralism in thinking and
- Being driven by future business opportunities

CCS is no exception. The more and larger initiatives and projects carried out by different stakeholder categories in different cultures/countries around the world, the faster CCS could be matured for commercial introduction.

CCS works and can be done safely

We know that the three parts of the CCS chain: capture, transport and storage, work and that all three can be done safely – at the power plant, along transport routes, during injection and after sealing the storage. We are convinced that the total CCS costs could be cut to the necessary levels that would make CCS commercial.

We base this statement on the following reasoning and arguments:

- Capture: The three capture technologies (oxyfuel, postcombustion and precombustion) all basically contain components that are already in commercial use, albeit in other applications in smaller scale. Up-scaling, energy efficient integration into the power plant concepts and further technology development, together with development of a market for these technologies, are all underway.

- Transport: CO_2 has been safely and commercially transported in pipelines for about 40 years in North America. Ships for transporting CO_2 already exist.

- Storage: Storages will take place in the same kinds of formations in which oil and natural gas are found. CO_2-accumulation occurs in nature all around the world. Since these formations can hold natural gas, including naturally occurring CO_2, they could also safely store injected CO_2. Over time, part of the CO_2 would stabilise by dissolving and being fixed in minerals. CO_2 will thus be stored in a manner similar to storage of natural gas – with the difference that CO_2 is easier to stabilise. Fundamental physics and chemistry support this reasoning.

Leakages from permanent CO_2 storages are unlikely to happen. Even if CO_2 would start leak after being injected, it would be a small and diffuse flow that would not be to immediate harm to humans.

The critical parameters for CCS to become commercially introduced in the EU

Climate change is the overriding environmental challenge of our time. It requires resolved action from the international business community.

We believe that he determination and ambitions of EU regarding climate change have strong influence of the further development, demonstration and commercial deployment of CCS, not only in Europe, but also globally. Also Vattenfall has had and will continue to have influence on this development.

The commercial introduction and deployment rates of CCS are dependent on several parameters that are complexly interdependent. Three key parameters are:

- Affordability. The solutions to tackle climate change must be affordable. Affordability in general is dependent on both the actual cost in relation to alternative costs and risks. In Europe, affordability is also dependent on at what affordability level(s) the rest of the global community decides upon when it comes to tackle the CO2 emissions.

- Security of supply. Europe, as well as the rest of the world, is dependent on fossil fuels for its energy supply. Measures to reduce CO2 emissions must include continued use of fossil fuels, if we want to achieve fast and significant results without jeopardising the security of energy supply.

- General acceptance. Large infrastructure changes such as transport and storage of CO_2 must earn broad public acceptance to be realised – both locally by neighbours and as general principle.

CCS is the most promising option to significantly reduce CO_2 emissions seen to both “affordability” and “security of supply”.

The general acceptance is a necessity for CCS to be commercially introduced at large enough scale to make a difference in reducing the CO_2 emissions. Vattenfall strongly believes that general acceptance can be earned, once the affordability issue and the issue of security of supply come up on the public agenda.

General acceptance is connected to the perception of different risks. Like all other human activity, there are risks with CCS. These small risks are well known and can be handled with known and proven technology and skills.

The risks with CCS are small in comparison with the risks (and foreseen consequences) of either neglecting the climate change issue, or limiting the means of achieving a “CO_2-neutral world”. In the latter, likeliness to reach a global consensus has to be taken into account. CCS risks are also small in comparison to other accepted industrial risks that we are exposed to already today.

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