Electricité de France, 22-30 av. De Wagram, 75382 Paris Cedex 08
Register ID Number: 3996610183569
To the European Commission

EDF RESPONSE TO THE PUBLIC CONSULTATION ON THE FUTURE OF CARBON CAPTURE AND STORAGE IN EUROPE

KEY MESSAGES

EDF welcomes the opportunity to participate in the European Commission Consultation on Carbon Capture and Storage (CCS). As a global leader in the power sector EDF is acting as a socially responsible company, committed to the long-term and deeply involved in the process of decarbonisation: benefiting from one of the lowest carbon foot-print of the utility sector in Europe (87% CO2-free generation), EDF has set a goal to reduce CO2 emissions from its thermal power plants by 30% by 2020. It is currently supporting the Commission efforts to set ambitious GHG targets for 2030.

Global CO2 emissions are rising rapidly – up more than 30% in the 10 years to 2010. This puts at risk the target for a maximum of +2°C global warming, above which scientists predict potentially dangerous effects from climate change. In this context, **CCS is likely to be a necessity in order to keep the average global temperature rise below 2 degrees**[1]. However, it depends on whether CCS can be used as a large scale technology that can be commercially viable to allow for large scale deployment. **While low-carbon Europe appears only achievable with CCS in the long-run, there is a clear need to identify plausible role for CCS by 2030**.

In EDF's view, **CCS is key to help Europe move toward two main goals: generate carbon-free power in the decade after 2020 and create opportunities to become a world leader in advanced related technologies**. Coal provides 30.3% of global primary energy needs and generates 42% of the world's electricity[2]. In many countries, especially in Asia, coal will stay the dominant fuel in the energy-mix[3] and coal prices are expected to be more stable than oil or gas prices over the medium and long term. Europe should keep ahead in developing low-carbon technologies such as CCS, in order to participate actively to the global evolution of the energy sector and preserve the long-term competitiveness of its energy industry.

In order to keep ahead on those technologies, **EDF has developed its own expertise through various experiments and pilots**, currently tested and deployed in Europe, with a holistic approach not only narrowly focusing on CO2 capture:

- On the capture side, EDF is developing its own post-combustion research pilot in Le Havre, with the support of ADEME (French Environment Agency). It is also participating to ELCOGAS pre-combustion capture project in Spain as one of the stakeholders of the power plant, sharing valuable technical data and analysis on this technology.
- On the storage side: EDF has been involved in "France-Nord" project as a majority stakeholder (together with TOTAL and GDF SUEZ) testing storage in saline aquifer in the Parisian region. This joint project was stopped in 2012 but the Group has acquired a very good knowledge on this technology which could serve as a basis for future research and demonstration projects in Europe.
- On the transport side, EDF supports directly and indirectly various research studies on-shore and off-shore (theses).

[1] According to the IEA 2050 scenario "+2°C", CCS should represent 20% of the total CO2 emissions reduction by 2050, equally distributed between electricity generation (coal, gas) and industry (steel, cementeries, refining industries...).
[2] World Coal Institute, Coal Facts 2012
[3] World Energy Outlook 2012 estimates that fossil fuels represent 80% of global energy use today, while it will represent 75% in 2035 in the "new policies" scenario.

Electricité de France, 22-30 av. De Wagram, 75382 Paris Cedex 08
Register ID Number: 3996610183569
To the European Commission

Nevertheless, for the time being, the CCS whole technological chain is not mature and remains too costly:

- One the one hand, the cost of a CCS installation is directly linked to the number of hours during which the power plants are running. If, like it is currently the case in Europe, the power plant run less than 1/3 of their capacity, the economic conditions are far from being fulfilled. CCS can be regarded as cost-competitive compared to other low-carbon technologies when considering base-load plants and not peaking ones (more than 7000h / year in operation), which is not the reference case in Europe ultimately.
- On the other, several technologies already exist for capture but the approach makes sense only if the other two components (transport and storage) are progressing at the same time in view of an industrial development. The CCS is facing a "chicken and egg problem" as a CO2 transport and storage infrastructure is needed to attract many CO2 capture projects.

A lack of solid business case is still hampering the development of CCS in Europe in the absence of:

- Long-term investor confidence, i.e. **strong robust EUA price under the ETS**. The energy sector can efficiently contribute to decarbonising at reasonable cost and without damaging the EU's competitiveness, provided a sufficient and sustained carbon price signal is sent to generators and the economy as a whole. In the long run, **low carbon investments should be driven by the most efficient signal, which is the carbon price**, be they renewable or conventional generation coupled with CCS.
- **Transitional support to cover the incremental costs of demonstration** and early deployment projects, for which EU action can be beneficial. This action should be well focused and adjusted in time: the current situation of the renewables sector in Europe shows that supporting measures, not limited in time, could generate negative effects (over capacities) and unefficient cost allocations. In a time of economic crisis, these support schemes must be used sparingly and **the CCS commercialization should not be artificially subsidized**.

Having all this in mind, EDF believes that **the development of CCS technologies, if seriously needed, will take place gradually** in the future:

- a steady state for the commercialization of CCS projects that given **the state of technology maturity does not seem possible before 2025-2030** at best;
- **by then, a period where a wide range of technologies and solutions will have to be tested** with appropriate support during this transition period. In particular, it could be wise to address the storage constraints (technological, public acceptance) by supporting initiatives to evaluate the real potential for geological storage in Europe, especially on its continental margins and closest "off-shore" locations.

Thus, in our response to the consultation, we reiterate EDF Group's commitment and interest to keep long-term investing in low-carbon technologies such as CCS in Europe and would like to call for an adequate framework to help the CCS technologies reach progressively maturity by 2030.

Electricité de France, 22-30 av. De Wagram, 75382 Paris Cedex 08
Register ID Number: 3996610183569
To the European Commission

EDF RESPONSE TO THE CONSULTATION

1) Should Member States that currently have a high share of coal and gas in their energy mix as well as in industrial processes, and that have not yet done so, be required to:
- **develop a clear roadmap on how to restructure their electricity generation sector towards non-carbon emitting fuels (nuclear or renewables) by 2050**
- **develop a national strategy to prepare for the deployment of CCS technology.**

Various European countries have already discussed or are currently discussing their mid-and long-term energy orientations, including low-carbon scenarios. The EU paved the way few years ago with its energy Roadmap 2050 and through its recent Green Paper, the EC is acting to develop a new integrated climate and energy policy framework for the period up to 2030. This kind of exercise, conducted at national level, can be fruitful provided it delivers more predictability to the stakeholders on how the national energy-mix might evolve in the future and how they could anticipate this evolution. However, **these national Roadmaps and scenarios should be consistent with EU Roadmap 2050 in order to send converging signals to investors and operators**. If not, they might contribute to discourage or delay further investments in the energy sector.

For the time being, the CCS technology is still at the start of the learning curve and its development will inevitably be assessed in accordance with the varying national fuel mixes around Europe. In this context, EDF is broadly supportive of the development of national strategies for the deployment of CCS technology for those Member States that consider consistent to do so, provided it **should not be made mandatory**.

In case roadmaps should be defined at national level, they **should not only cover the power sector, but other carbon-intensive industries**[4], whose emissions reduction targets are also not achievable without CCS. Given the cross-border impacts of national energy policy, roadmaps should consider the potential impact on other Member States, as the wider implementation of CCS will, in some cases, depend on the availability of shared transport and storage infrastructure.

2) How should the ETS be re-structured, so that it could also provide meaningful incentives for CCS deployment? Should this be complemented by using instruments based on auctioning revenues, similar to NER300?

The ETS system provides no incentive to invest. The financial crisis, oversupply of EUAs and impact of feed-in tariffs for other low-carbon technologies have driven the EUA price down to a dissuasive level. The ETS system needs structural reform to send a clear and attractive carbon price signal which could (re)activate interest in investing in CCS projects.

In the long term, EDF believes the ETS remains the most cost-efficient mechanism for driving decarbonisation in the EU. Accordingly, **the ETS structural reform should be a priority in**

[4] Industrial plants are responsible for 66% of CO2 emissions worldwide (not only the energy sector but also iron, steel, cement refining industries, etc.)

Electricité de France, 22-30 av. De Wagram, 75382 Paris Cedex 08
Register ID Number: 3996610183569
To the European Commission

order to create a stable C02 market in the long run, in particular setting a tighter cap out to 2030, 2040 and 2050 in line with the EU low-carbon Economy Roadmap 2050.

In the short-term, support **to ETS backloading and transitory measures helping to drive CCS deployment and create a level playing field by 2020-2025 should be privileged**. Such measures should have the least possible negative effect on the ETS, **with a phasing-out plan developed as the ETS strengthens and the technology matures, allowing CCS to stand on its own merits in the longer term**. This would lead to avoid negative effects such as the ones now commonly recognized on renewables.

However, even if action is taken now, **it will not result in EUA prices that are high and robust enough to deploy CCS at the rate required to deliver EU energy and climate goals for 2030**. For building and operating a CCS demonstration unit, there are over-costs both in CAPEX and OPEX making investment in fossil fired plant more difficult to decide (and finance). **CCS is at a different stage from other low-carbon technologies**: while individual elements of the value chain are proven, it still needs to be scaled up to large, integrated demonstration projects – with huge potential to drive costs down from technology improvements and economies of scale.

3) Should the Commission propose other means of support or consider other policy measures to pave the road towards early deployment, by:
- **support through auctioning recycling or other funding approaches**
- **an Emission Performance Standard**
- **a CCS certificate system**
- **another type of policy measure**

EDF regrets the failure of the first NER 300 (no CCS projects being awarded funding despite 13 projects originally applying for support) but acknowledges that technology and market conditions were not fulfilled at that time.

In the long run, this drawback explains why EDF supports a structural reform of the ETS and considers that during a transition period, in order to help the technology growth, **demonstrators should be adequately and temporarily supported**.

For the first CCS demonstration units, during this transition period, the over-costs related to investments and operation should be supported by public subsidies on a previously agreed scheme. In order to avoid a potential lack of funding for future CCS demonstration projects, **unspent EEPR could be redirected to a limited number of CCS projects which might be implemented soon** (about 10 projects in the current second NER 300 call for proposals). The experience of the first NER 300 demonstrates that some significant CCS projects have been cancelled due to insufficient funding perspective. Drawing conclusions from this, it makes sense to concentrate the public funding on a limited number of demonstrators[5], which would result in **a higher level of public funding per demonstrator**.

However, this financial support to CCS technologies at the operational stage should be limited in time and progressively disappear. Such a way the demonstration units would be dispatched a similar way as new state of the art coal fired units to be decided when the European energy market conditions might allow again to do so. The corresponding value of the

[5] EEPR funds: 1 b€ for large-scale CCS demonstration projects + NER 300 Program reserving 300 Mio allowances reserved

Electricité de France, 22-30 av. De Wagram, 75382 Paris Cedex 08
Register ID Number: 3996610183569
To the European Commission

ETS certificates that would be saved thanks to the CCS operation should be deducted from the amount of the public subsidies to allow for a level playing field.

Another issue would be to ease the development of a CCS certificate system. This option would need to be further assessed due to its complex interaction with the ETS. Any support scheme for CCS could have negative impacts on the workings of the ETS, as the unfortunate situation caused by RES support schemes has demonstrated in the recent past. **In case CCS certificate should be retained as a possible option their scheme should be designed in a way that they can demonstrate compliance with the ETS**.

As far as Emission Performance Standard (EPS) is concerned, from now on, this regulatory action has nowhere contributed to the development of CCS. In practice, it appears not applicable until the feasibility and acceptability of the capture technology and aquifer storage in particular are not previously solved.

4) Should energy utilities henceforth be required to install CCS-ready equipment for all new investments (coal and potentially also gas) in order to facilitate the necessary CCS retrofit?

We note the existing requirement in the 2009 CCS Directive for new fossil plant to be capture-ready, requiring developers to examine potential pipeline routes and storage options and ensure that sufficient land is available for a capture installation. We believe that this is a sensible approach which will ensure that the technology can be retrofitted once CCS becomes commercially available. **EDF reserves already sufficient space on site to accommodate CCS units in time.** It should be noted however that having enough land for the capture kit represents an additional constraint (this entails having an implantation site greatly increased) and as a consequence, in most of the cases, additional costs. It should be also acknowledged that it is only the first stage of the process which will additionally integrate transport and storage operational solutions, when technological and market conditions would be met.

The first priority should be to enable the delivery of CCS demonstration projects in Europe. Once CCS has been demonstrated technically and market conditions have been established to make the technology commercially viable, operators will have the incentive to construct CCS facilities as part of their new projects. Until then, measures to ensure that sufficient space is available to retrofit CO2 capture facilities in new plants are justified and **should apply not only to fossil fuel power plants but also to other large emitters of CO2.**

5) Should fossil fuel providers contribute to CCS demonstration and deployment through specific measures that ensure additional financing?

It is fossil fuels' providers issue.

6) What are the main obstacles to ensuring sufficient demonstration of CCS in the EU?

There are three main barriers to CCS development:

1. **Technological maturity:** R&D and pilots are needed before considering any large deployment.

Electricité de France, 22-30 av. De Wagram, 75382 Paris Cedex 08
Register ID Number: 3996610183569
To the European Commission

2. **Huge development costs and insufficient related funding:** CCS innovative technologies require enormous upfront investment costs during development and demonstration, including the necessary incentives for technology providers to invest in CCS. In case the CCS is related to a Combined Cycle Gas Turbine (CCGT) power plants, extra costs should also be taken into consideration, due to less CO2 to capture.
3. **Public awareness and acceptance** is a key issue. It is obviously a major concern for CO2 transport and storage projects but not only: depending on where the capture site is located, it could prove to be difficult to make it publicly and administratively acceptable.

The first call NER300 in which no CCS projects were awarded provides an interesting feedback: 13 CCS projects were submitted, 10 short listed, 3 withdrawn by Member States and finally none of the Member States confirmed because of the following reasons: funding gaps, delays in permitting and no sufficiently mature projects.

7) How can public acceptance for CCS be increased?

The issues of C02 transportation and storage are two critical areas where public acceptance must be obtained. The technology for CO2 storage is very similar to that used by the oil and gas industry but its acceptance remains a very serious concern.

The general public is accustomed to the benefits of oil and natural gas pipelines but still need to become familiar with CCS. Significant explaining efforts should be done to fill this acceptance gap. Considering that each storage site is specific due to different indigenous geological conditions, **a "case by case" approach should be locally deployed**, engaging the public in an inclusive and participative way before the start of the project and developing appropriate communication tools and campaigns throughout the implementation process. However, in the eventuality that storage would occur in former hydrocarbon natural underground reservoirs, the acceptance would certainly prove to be easier.

Last but not least, another suggestion would be **to promote, where locally appropriate, the industrial use of C02 itself**, as a fertilizer in crop production (greenhouses) or as a substitute to replace petroleum in chemical industries for instance, thus helping to reduce their carbon footprint.