



## ***The EU Flagship Programme for CO<sub>2</sub> Capture and Storage (CCS)***

### ***ZEP Recommendations: Implementation and Funding***

**21st February 2008**



## EXECUTIVE SUMMARY - BACKGROUND

### **CCS is crucial to achieving the European CO<sub>2</sub> emission goals of the “SET-Plan”**

- It is now widely accepted that CO<sub>2</sub> Capture and Storage (CCS) is a major carbon mitigation technology whose wide-scale deployment is essential. Indeed, without CCS, the European Union (EU)'s target to reduce CO<sub>2</sub> emissions by 60%-80% by 2050 is simply not achievable.
- CCS will therefore play a critical role in achieving the objectives of the European Commission's recently published “European Strategic Energy Technology Plan” (SET-Plan). It will also help to meet the goal of the Lisbon Strategy of a more dynamic and competitive Europe that can take advantage of the opportunities offered by globalisation.

### **CCS is unproven at commercial scale: the “EU Flagship Programme” is the next step**

- The European Spring Council confirmed in its Communiqué of March 2007 the need “*to establish a mechanism to stimulate construction and operation by 2015 of up to 12 demonstration plants of sustainable fossil fuel technologies in commercial power generation.*” This initiative has been named the **EU Flagship Programme** for CCS; its goal is to kick-start the large-scale deployment of CCS in Europe - and potentially worldwide.
- CCS consists of a bundle of technologies proven at the experimental level, but not yet deployed together in practice at commercial scale. Questions regarding the integration of project components, scale-up of technology, policy and regulation, public acceptance, cross-border issues and cost are all yet to be answered.
- The Flagship Programme is therefore intended to accelerate the development of CCS across a diverse geographical and technological spread of projects. Its aim is to demonstrate by 2015 or soon after that CCS is a viable technology that could be fully deployed by 2020.
- The Spring Council's 2007 resolution was stimulated by the work carried out by the European Technology Platform for Zero Emission Fossil Fuel Power Plants (ZEP) over the previous two-year period. ZEP's work is continuing. This paper presents the recommendations of ZEP to the Commission on the implementation and funding of the Flagship Programme.

### **The EU Flagship Programme needs co-investment from private *and* public sources**

- The Flagship Programme will be expensive: estimates suggest that ten moderately-sized commercial CCS projects will together carry incremental costs of €6 -10 billion - or even more - compared to conventional power plants without CCS.
- Industry hopes and expects that a large part of these costs will be justified by a return from the future revenues generated by the emerging low-carbon power market. Given time, a developing market and a staged investment process, it would be able to make prudent investments in the technology with its own funds.
- However, the accelerated process means that both the market and the costs of the Programme are subject to exceptional uncertainties. These arise primarily from:
  - 1) The immaturity and uncertainty of a carbon market whose regulatory framework and implementation is still being decided at Government level;
  - 2) The unrecoverable costs that will result from making accelerated investments in immature technology, without the time to climb a “learning curve”.
- Following the precedent set by other low-carbon technologies, we therefore expect industry will share these costs and risks as partners alongside the Commission and other EU and Member State entities.

## **EXECUTIVE SUMMARY**

### **ZEP RECOMMENDATIONS ON IMPLEMENTATION AND FUNDING**

#### **EC and Member States must work together to implement the Flagship Programme**

- The Flagship Programme should continue to be led by the EU, though in collaboration with Member States, so that its integrity can be maintained across the EU, while fully engaging with Member State programmes.
- The EU will need to provide financial support for its commitment to partnering industry in the Flagship Programme, in a form to be decided.
- The decision on the form of support to be applied is needed very rapidly (in 2008); identified options are an EU cash budget of several billion Euros, an allocation of auction revenues arising from Phase 3 of the European Emissions Trading System ("ETS3"), or the allocation of additional EU Allowances for CO<sub>2</sub> emissions ("EUAs") under ETS3.

#### **Industry should carry a major portion of the costs and risks**

- A major portion of the risks and costs of the Flagship Programme will be carried by industrial sponsors - ZEP member companies are already making substantial commitments and intend to make more.
- Industrial sponsors should only receive financial support on the basis of actual performance - tonnes of CO<sub>2</sub> stored or MWh of clean power delivered.
- The support mechanism should include provisions that limit the potential for windfall profits and should be competitively allocated.

#### **'First Mover' costs and risks should be shared between the EU and industry**

- There are two kinds of cost and risk the EU needs to share with industrial sponsors of Flagship Programme projects: 'First Mover' costs resulting from accelerated investment and operating costs at large scale in immature technology; and Market Risk arising because their investment will rely for returns on a market for CO<sub>2</sub> that does not yet exist and whose political background is still developing.
- First Mover Costs are likely to have to be shared between industrial sponsors and public funding; possible sources of such funding are direct cash budgets, application of a portion of ETS3 auction revenues or an allocation of additional EUAs.
- Market Risk is more likely to be shared through a form of underwriting agreement that provides limited and specific support for the future price of EUAs, such that if the market price is above the agreed support price there will be no cost to the public.
- There is a potentially important role for the European Investment Bank (EIB) in the sharing of Market Risk.

#### **The principles of funding support to be determined as a matter of urgency**

- A new cash budget is the simplest and most direct method of applying support to the Flagship Programme, but it may be impracticable, especially in the required time frame.

- An alternative source of cash support is a portion of the revenues from the auction of EUAs, as discussed in the Commission's recent ETS review; subject to the agreement of Member States and the eventual design of ETS3, this may be a more practical way forward.
- The use of an additional direct allocation of EUAs as an alternative to cash has potential attractions; while it would be controversial because of the perceived danger of market distortion, there should be room to design a structure as ETS3 is developed, for implementation in 2008.
- Funding policy decisions will need to be taken in the next few months; no funding option should be summarily rejected now.

#### **Competition among sponsors for funding support is essential**

- For transparency, optimum risk-sharing and least public cost, all support should be allocated on a competitive basis.
- Partnership arrangements with industry should be established through competition, probably a separate one for each project, defining the terms of support and the technologies to be tested. Private sector sponsors should be invited to bid for the level of support they require, with the award being made to the proposal showing maximum net public benefit.

#### **Next steps**

- ***Within the structure of the proposed SET Steering Group, the Commission should establish an Executive, structured with industry and Member States as appropriate, to take the work of the Flagship Programme forward.***
- ***The Executive should urgently undertake or contract a more detailed study of several aspects of the Flagship Programme - including funding - as the policies that will shape the Programme become clear. An early priority will be to select the support mechanisms that cause least market distortion, lead to appropriate risk allocation and have lowest cost to the public purse.***
- ***The Executive should take responsibility for designing and administering the competitive process for allocation of public support.***
- ***A strong statement on financial support is essential at the 2008 EU Spring Council and by mid-2008 there should be a clear policy direction as to how the Programme will be implemented. This is crucial in order to maintain momentum both among industrial sponsors and within the public sector.***

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## 1. INTRODUCTION

### 1.1. ZEP supports the “SET-Plan”

In November 2007, the European Commission published its Communication outlining a European Strategic Energy Technology Plan - the SET-Plan. The SET-Plan is driven by the urgent need for action on low carbon energy technologies to ensure that CO<sub>2</sub> emission targets laid down by the EU for both 2020 and 2050 are met. ZEP<sup>1</sup> fully endorses that urgency and supports the implementation of the SET-Plan.

This paper argues that within this policy initiative, action is needed now, early in 2008, to ensure that CO<sub>2</sub> Capture and Storage (CCS) can be developed as a commercial technology. Indeed, any material delay not only risks, but ensures, that CCS technology will not be commercially available by 2020 and that the target for 2050 emission reductions will be gravely endangered. The actions we recommend are therefore fully consistent with the SET-Plan - except that they need to be carried out more urgently.

### 1.2. The EU Flagship Programme for CCS: crucial to Europe’s climate change targets

It is now widely accepted that CCS is a major carbon mitigation technology<sup>2</sup>, whose rapid, wide-scale deployment is essential. Indeed, without CCS, the EU’s target to reduce CO<sub>2</sub> emissions by 60% by 2050 is simply not achievable within the bounds of current policy and technology.

While each technology element of CCS is considered proven on an experimental basis, commercial viability, structure and costs have yet to be demonstrated at a fully integrated, operating scale. Establishing CCS as a viable and maturing technology is therefore urgent - arguably the single most urgent climate change action the EU needs to undertake.

Hence ZEP’s recommendation to the Commission in early 2007 that a programme of full-scale CCS demonstration projects was needed as a high priority. The European Spring Council confirmed in its communiqué of March 2007 the need “to establish a mechanism to stimulate construction and operation by 2015 of up to 12 demonstration plants of sustainable fossil fuel technologies in commercial power generation.” This programme has been named the EU Flagship Programme. Its goal is to demonstrate by 2015 that CCS is a viable technology that could be fully deployed by 2020.

### 1.3. Principles and guidelines established

The EU Flagship Programme is to consist of up to twelve industrial-scale CCS demonstration projects, Europe-wide. This major technology initiative will integrate all aspects of CO<sub>2</sub> capture, transport and storage – including technology, infrastructure, the environment, health and safety, legal and regulatory issues, funding mechanisms, public communication and international collaboration.

At its General Assembly in October 2007, ZEP identified the more precise objectives of the Programme as being to:

- Prove that CCS works and is safe across a range of technologies;

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<sup>1</sup> European Technology Platform for Zero Emission Fossil Fuel Power Plants. ZEP is a coalition of scientists, industry and environmentalists, united in their support for CCS as a key solution for combating climate change - within a portfolio of solutions, including renewable energies and energy efficiency.

<sup>2</sup> If deployed in all industrial and transportation sectors, CCS could reduce CO<sub>2</sub> emissions in the EU by over 50% by 2050 (compared to a strategy without CCS). See “A Model for the CO<sub>2</sub> Capture Potential” by Dr Aage Stangeland, International Journal of Greenhouse Gas Control, October 2007:

[www.bellona.org/filearchive/fil\\_Stangeland - Bellona Paper- Model for CO<sub>2</sub> capture potential.pdf](http://www.bellona.org/filearchive/fil_Stangeland_-_Bellona_Paper-Model_for_CO2_capture_potential.pdf)

- Accelerate cost discovery and test fundability in a variety of environments within Europe;
- Demonstrate Europe's leading edge technology and spur action by other countries, particularly large CO<sub>2</sub> emitters, such as India, China and the US.

ZEP also laid out some principles and guidelines for the Programme:

- Projects should be coordinated and interact with each other so as to share lessons learned and avoid unwanted duplication;
- They should demonstrate the application of CCS to various plant types, fuel sources, capture technologies, transport and infrastructure systems and storage regimes;
- The Programme should ensure a diverse geographical spread of projects and encourage projects with a cross-border transport/storage element.

ZEP has made a tentative estimate that the additional CCS-related costs of the Flagship Programme, given certain as yet unproven assumptions, are likely to be in the range of €6 - €10 billion.

Several European States have already announced their wish to take forward CCS demonstration projects – including post-combustion capture projects in Norway and the UK, for gas and coal respectively. These have raised the issue of how such national actions will relate to the EU Flagship Programme and internationally.

#### **1.4. The Flagship Programme will not be achieved without market intervention**

A principle underpinning the Flagship Programme is that CCS is expected to be economic in the long-term carbon-abated power market. The market for carbon emissions (the ETS, however it develops) and the various European markets for power will either support the full long-term economics of CCS, or it will not happen. Free market principles would therefore suggest that if we wait long enough (several decades?), and if the ETS is properly designed and regulated, and if CCS is economic in competition with other low-carbon technologies, it will arrive of its own accord.

The proposition that the EU should intervene in this market is driven only by the urgency of the target date for achieving low-carbon power production. Any market intervention of this kind is uncomfortable and carries risk; the task is to find the least market-distorting (and lowest cost) approach to providing the necessary financial support.

We therefore agree fully with the SET-Plan that “Public intervention to support energy innovation is thus both necessary and justified”. Intervention of the kind proposed is not a new or shocking principle. All the competing low-carbon technologies have benefited in one way or another over past decades from co-investment by either tax-payers or consumers. For CCS to benefit from support now, in what is effectively a “catch-up” with renewables and nuclear, is entirely appropriate in policy terms.

#### **1.5. Key issues**

The Flagship Programme is now at a crucial stage. While it is accepted politically that CCS is essential to achieving EU CO<sub>2</sub> reduction targets - with the Flagship Programme an essential step to implementing it on a wide scale - vital issues of funding and organisation remain unresolved, including:

- a. How Member State actions, pan-European and global initiatives will interact;
- b. How the financial requirement - amount, type, timeframe - for the Flagship Programme will be determined;

- c. The degree to which the emerging ETS3 will provide market confidence for the long-term, including consideration of its eventual successor schemes;
- d. The structures through which industry and the EU will cooperate to share risk and funding of the Flagship Programme, and how their relative contributions will be determined;
- e. The sources from which the public sector contribution to the Programme can be provided;
- f. The technical and geographical framework of the Flagship Programme and the process for choosing specific projects for support;
- g. The organisational structure of the Flagship Programme and its operation.

## **2. THE FLAGSHIP PROGRAMME AND MEMBER STATES**

### **2.1. The Flagship Programme must be an EU initiative**

Given that two European States have already launched processes for demonstration projects, and more may do so soon, why is there a need for an EU initiative? After all, any funding provided by the EU is ultimately sourced from Member States - so why interpose a bureaucratic middleman?

ZEP is convinced that an EU programme is essential so as to ensure that:

- There is a concerted and rapid start to a very large programme; it is unknown which Member States will implement programmes, how large they will be and when;
- There is a proper spread of technologies - a crucial objective - including technologies of higher risk or capital cost that may in the long run prove more beneficial; a piecemeal programme will not achieve this;
- There is scope for transnational cross-border projects, for example where there is economy of scale in transportation or storage;
- There is not an arbitrary exclusion of good projects in countries unable or unwilling to fund them.

So, consistent with the recommendations of the SET-Plan, the Flagship Programme needs input both from Member States directly and from the EU. Direction and coordination of the Programme will need to be by some form of central EU Executive. It is unlikely that Member States will agree to provide direct funding for projects that are to be allocated, awarded and controlled by such a body. The Executive will need to have control over the award of financial support to projects and will therefore need to have financial resources at its disposal.

### **2.2. Working with Member States**

The early practical moves towards CCS demonstration projects have been initiated by industry responding to the direction, encouragement and funding offers from Member States. It is expected that several more Member States will also promote national initiatives and ZEP wholly supports such moves.

Such projects can supplement and substitute for those that would otherwise be essential to the centrally coordinated Flagship Programme - they can be part of the Flagship Programme. The extent of their integration is a matter to be determined. At minimum, they would be the beneficiaries of the regulatory environment and State Aid provisions currently being so successfully developed by the Commission as a basis for the Flagship Programme. But they could also be included in some form of co-funding initiative in exchange for agreement to coordinate development of their projects with the rest of the Flagship Programme.

ZEP recommends the implementation of a hybrid funding scheme by agreement between relevant EU parties and interested Member States - noting as always that the primary responsibility for launching and funding individual projects must lie with industry.

***Recommendation: The EU will need to provide financial support (sourced ultimately from Member States) for its commitment to the Flagship Programme, in a form to be decided. This financial support will be additional to any that is provided directly by Member States.***

### **2.3. Mutual support between EU and Member States**

ZEP recommends that discussions are initiated immediately with Member States to determine the most effective way of managing this relationship. Some questions to be addressed are:

- a. How can the support of Member States for the Flagship Programme and its objectives best be encouraged? The task is to show that beyond the sponsorship of national projects, Member States have shared national interest with other States in a full range of technical, geographic and organisational solutions is investigated, including approaches that may appear to carry higher risk or show less proven economics.
- b. How should the EU Executive and Member States share control and coordination of Member State projects within and alongside the Flagship Programme? Will Member States share, and obligate their industrial partners to share, experience that they may consider proprietary or commercially confidential?
- c. Under what conditions would Member States be ready to fund the necessary EU budget for central financing? Would they, for example, agree to dedicate a proportion of EUA auction revenues to a central fund for this purpose?
- d. If they are ready to support such funding, what form of support or co-investment will they prefer - for example, as between providing cash grants or underwriting risk (see Section 3.2 below)? Should the responsibility for different forms of support be allocated differentially between Member States and central budgets?
- e. Given timely and well-supported EU budgeting, and an agreement on the principles of sharing between Member States and EU funds, how in practice would coordination of the Programme be organised? Some possible approaches to be considered are:
  - Lead by Member States, with an agreement on matching support project by project from the EU;
  - Lead by Member States, with a separate series of Flagship Programme projects filling the technology or regional gaps;
  - A fully coordinated Flagship Programme in which Member States and the EU cooperate at each point;
  - A Flagship Programme in which Member States cede primary control to an EU body, but assist their own national sponsors to compete for support.

ZEP considers that the more the Flagship Programme is able to take the leading role, the greater the likely public benefit.

***Recommendation: The Flagship Programme should continue to be led by the EU, though in collaboration with Member States, so that its integrity can be maintained across the EU, while fully engaging with Member State programmes; this collaboration should be initiated immediately.***

### 3. THE COSTS AND RISKS OF THE EU FLAGSHIP PROGRAMME

#### 3.1. Industry should carry a major portion of the costs and risks

The private sector will carry the major part of the risk and costs in the Flagship Programme. It has not to date been said loudly, because it has seemed obvious, but Flagship Programme projects will be conceived, developed, owned, operated and primarily financed by their industrial sponsors. These sponsors expect to provide very large budgets for the Programme and to take considerable risks on their own balance sheets. Indeed, they have already made some major commitments to CCS<sup>3</sup>.

But as is laid out in Section 1 (Introduction) of this paper, the urgency of the target date for achieving viable CCS demands some form of co-financing support from public sector funds. While industrial companies can take a very long view of markets and make experimental expenditures, they will not (cannot by fiduciary law) make investments where there is not a clear and prudent prospect of return to shareholders. Left on their own, we speculate that they would indeed invest in CCS, as the carbon market, power market and technology developed. But the timescale to 2015 does not give them time to see these markets develop so as to justify investment.

***Recommendation: A major portion of the costs and risks of the Flagship Programme should be carried by industrial sponsors.***

#### 3.2. Co-investment support from the public sector is needed

ZEP sees the need for co-investment from public sources in two roles:

- 1) To share the risks of a future market for EUAs for which there is no history, and indeed as yet not even legislation ("Market Risk"), and
- 2) To help support the costs of accelerated investment in unproven technology ("First Mover Costs").

With the exception of certain explicit force majeure risks, we consider that the other risks and costs of the Flagship Programme should in principle be borne wholly by industrial sponsors.

This concept, which underlies the whole rationale for EU support of the Flagship Programme, is summarised in the table below:

<b>Cost category:</b>	<b>.. consisting of:</b>	<b>.. met by:</b>	<b>.. risk allocated to:</b>
First Mover costs	Capital, operating and efficiency costs of accelerating an immature technology	Co-investment of public money with industrial partners	Once cost estimates are made (competitively) and agreed, industrial partners bear the risk of performance
Mature CCS costs	Long-term excess capital, operating and efficiency costs over those of similar but unabated technology	Industrial partners, against a reasonable expectation of future return from the market	As for First Mover costs, but risk of market price of CO <sub>2</sub> is borne through public sector support at a level determined competitively
Base power plant costs	Normal capital, operating and efficiency costs	Industrial partners	Industrial partners

<sup>3</sup>See concurrent letter from several leading industrial members of the ZEP addressed to commissioner Piebalgs

### 3.3. Sharing the Market Risk

Several authorities and consultants have drawn conclusions as to the market prices of power and of EUAs that would be needed to support different CCS technologies over their project life. Although the studies produce different results, they all show that to generate a “normal” shareholder return on CCS investment, much higher market prices for EUAs and/or power are needed than are available today, or are projected by forward markets (which anyway have a very limited term).

If CCS is to be viable, these higher figures will be achieved in the market-place. The mechanism by which that will come about is not yet clear, though some of the economic inputs will be prices of different fuels, merit order power pricing, levels of allocation of EUAs, new global trading schemes and incentives for competing low-carbon technologies. But we do know that the future market for CCS, if there is one, will have to have high prices for EUAs over the long term, even if they are subject to medium-term volatility, as markets always are.

We consider that a major part of the public-sector contribution to the Flagship Programme will therefore be mitigation of this risk for sponsors. This form of support can be characterised as “Market Risk-sharing” rather than direct cash contribution. If expectations of where the future market will settle are correct, in the long term, Market Risk-sharing (e.g. in the form of an underwritten price) may turn out to be costless to the underwriter.

While of course the option value of risk-sharing today may be very large, and realisable in cash, we believe this conceptual separation between risk underwriting and cash contribution is useful for the purpose of assessing how much support should be allocated and where.

***Recommendation: Market Risk-sharing will require a public-sector contribution which can be in the form of an underwriting of future market prices rather than a direct injection of cash or value.***

### 3.4. First Movers will carry the additional costs of accelerating an immature technology

Because of the experimental nature of a demonstration project, it is likely to cost more than a mature project. The excess cost may be incurred in the form of capital cost, operating cost, reduced availability or increased heat rate; and because of the speed with which the Flagship Programme needs to move, there will be few learning curve effects to allow a prudently cautious approach. So the second area where financial support is needed is co-investment with industry in what we call First Mover Costs.

First Mover support needs to be in the form of direct co-investment, rather than simply risk-sharing. It may structurally be payable as costs are incurred, or, as we recommend, on a deferred basis. In either case, First Mover costs should not be exposed to the risk of movements in EUA or power prices.

***Recommendation: First Mover Costs will need to be shared from public sources in the form of cash or realisable value.***

### 3.5. Other risks, subject to “force majeure”, should be carried by industrial sponsors

There are many other economic risks implicit in the Flagship Programme (e.g. operating cost, capital cost and efficiency achieved), which ZEP considers should be carried primarily by industrial sponsors. We propose that in bidding for co-investment in the projects they promote, sponsors will state their expectations of what they will achieve technically, and when. The successful bidders will reach agreement with providers of support on what they will achieve, and then be held to those expectations. Where support is to be provided, it should be allocated on the basis of stated economic targets and delivered when Projects are completed, and probably when they are operating.

Some other risks (e.g. geological, legal and regulatory) may need to be shared between sponsor and the public sector. We believe that these risks are likely to be dealt with through the “force majeure” and similar provisions of development agreements between industrial sponsors and public sector partners, rather than through financial instruments. Given the immature regulatory and legal environment for CCS into which industry will be making its investments, and the reality that such matters are under the control of governments not industry, ZEP expects that the some protections of this kind will be shown to be justified - and essential for the success of the Flagship Programme.

***Recommendation: Industrial sponsors should carry all “normal” project risks and receive financial support only on the basis of actual performance - tonnes of CO<sub>2</sub> stored or MWh of clean power delivered.***

#### **4. EU SUPPORT FOR THE FLAGSHIP PROGRAMME**

##### **4.1. How much support is needed?**

ZEP has estimated that total support - beyond the contribution of industry - needed for the Flagship Programme may be in the range €6 - €10 billion, though other and generally higher figures have also been suggested<sup>4</sup>. These figures are both controversial in the industry and highly dependent on assumptions. One difficulty with a global figure of this nature is that it does not allow for any conceptual split, which we regard as important, between Market Underwriting and First Mover Co-investment.

Another way of looking at support is to assess the levels at which Market Underwriting (for example, of EUA prices alone) might be sought. Consensus to date has suggested figures of around €35/t, but Climate Change Capital speculates that a figure of over €100/t might be required.

We therefore recommend that estimates of the support required for budgeting purposes are now developed in a more definitive study. However, the actual support to be allocated Project by Project, at least from central EU funds or institutions, should be determined on a competitive basis. The outcome of any budgeting study is therefore not likely to affect our recommendations as to principles and processes for allocating support.

In designing the competition for support it will be important to use structures that limit the risk of “windfall profits” to industrial sponsors.

***Recommendation: Partnership arrangements with industry should be negotiated through competition to minimise public-sector costs, incentivise industrial sponsors to carry cost and risk, and limit any risk of windfall profits.***

***Recommendation: Further studies should be initiated immediately to help size the budget for support required.***

##### **4.2. Considering the “Norwegian Model”**

The Norwegian Government has mandated a model for its post-combustion gas-fired CCS demonstration at Mongstad in which all the costs of CCS lie with the owners of the plant (in this case the refinery), while transportation and storage are the responsibility of Government.

ZEP is considering this model further and some members of the Advisory Council believe it may be a useful structure for the Flagship Programme. It has the virtues of simplicity and of placing in Government hands some of the risks that it is hardest for industry to control (e.g. legal matters

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<sup>4</sup> For example, Climate Change Capital Ltd has suggested a figure of €10 - €16 billion in work it has carried out for ZEP.

relating to networks and storage, public acceptance of storage). But a majority considers that the aims of the Flagship Programme require the investigation of a variety of technologies across the entire CCS chain, involving industry at every stage, not least to reflect the current European direction in favour of a fully liberalised market in power.

Within this framework, there is also room to try out different contractual structures. While the Norwegian Model is seen as a useful contractual experiment within the context of the Flagship Programme, and may be able to teach some important lessons in implementation, it is not likely to be mandated as a structure for the further development of the whole programme.

***Recommendation: ZEP should continue to investigate the Norwegian Model as a contractual structure of potentially wider application to the Flagship Programme.***

### **4.3. Sharing First Mover Costs**

Any public-sector contribution to First Mover Costs will need to be provided in the form of cash or instruments of easily determined cash value. We have recommended that the payments should be made only when the Project is performing. Although there are precedents for staged payments being made as a Project approaches completion, the majority view of ZEP is that the proper allocation of risk demands that payments are made only in exchange for actual performance by the Project.

Within the principle of payment-for-performance there are several options for payment mechanisms. However, we believe that there are in effect only two choices for the “currency” in which a support payment can be made towards First Mover Costs - cash or EUAs. It has been noted that every one of the mechanisms has the potential to distort markets; that is true, and is the inevitable result of any decision to support the Flagship Programme with public funds. Opinions vary as to which of the approaches is least harmful in this respect.

Co-investment payments could be made simply for completing the Project - either in a lump sum, or staged over time. They can be divided into capital and operating components. They can be paid per tonne of CO<sub>2</sub> stored (something like a “decarbonisation certificate”) or per MWh of clean power produced (“feed-in tariff”), or some combination of both. Payment in EUAs can be more direct and would be made as a payment for storing CO<sub>2</sub>. A brief summary of some of the issues raised by these options follows:

- |   |  |
|---|--|
| <b>Capital or operating grants</b>      | <ul style="list-style-type: none"> <li>• Straightforward and easy to explain</li> <li>• ZEP recommends payment only when the Project is operational</li> <li>• Capital grant can be staged or paid in a lump sum</li> <li>• Capital grant is arguably less market-distorting than other methods</li> </ul>   |
| <b>Cash payment for decarbonisation</b> | <ul style="list-style-type: none"> <li>• Payment per tonne actually stored at a pre-agreed value</li> <li>• Directly rewards achievement of the decarbonisation goal</li> <li>• May appear to subsidise the dirtiest technologies...</li> <li>• ...but may be justifiable in a demonstration programme</li> <li>• Potentially extendable to non-power Projects</li> <li>• Need to consider mechanisms to reward efficiency</li> <li>• Risks interference with other decarbonisation regimes (e.g. ETS)</li> <li>• More complex formulas possible to share other risks</li> </ul> |
| <b>Feed-in tariffs</b>                  | <ul style="list-style-type: none"> <li>• Paid per clean MWh delivered at a pre-agreed value</li> <li>• Similar to decarbonisation: arguably a less direct reward for storing CO<sub>2</sub>, but may avoid some of the objections</li> </ul>   |
| <b>EUAs</b>                             | <ul style="list-style-type: none"> <li>• Allocated per CO<sub>2</sub> tonne stored or avoided (or possibly clean MWh)</li> </ul>   |

- delivered?);
- Value varies with market value (unless underwritten)
- Could be allocated as a simple multiple per US precedent (e.g. 3 EUAs per CO<sub>2</sub> tonne), but...
- ...while simple, may risk windfall profits and misallocated support
- Do not require a cash transfer, as support is provided by the whole market
- Rewards a clean energy programme with a right to pollute, but...
- ...objection may be overcome if EUAs are reallocated from other carbon producers

Each of the first three forms of co-investment requires cash funding, which could be sourced by the EU in a variety of ways, but the alternatives are likely to reduce to:

**Funds from EU budgets voted by Member States**

- Transparent and easy to understand;
- Even if deferred, will need full budgeting in advance;
- Voted ultimately by Member States, so subject to their support;
- Is there any possibility of such a budget being authorised . .
- ...and if so, how long will it take?

**ETS3 auction revenues**

- Allocation of a proportion of revenues, whether accrued by EU directly, or allocated by Member States on an agreed basis
- No new sources of finance needed
- Revenues from ETS stay within the GHG mitigation and power industry ring-fence;
- No distorting interference with workings of ETS
- Still time to implement this before the 2008 EU Spring Council
- But auctioning policy and resulting revenues are uncertain
- Some Member States may have accounted for revenues in their budgets, so for them little different from cash payment to EC
- Growing support for auction revenues as a source of funding

**Reallocations within structural funds**

- Explicit nomination of CCS as a Structural Fund priority
- May be possible within existing policy
- Selective and limited in scope, but may have a contributing role

***Recommendation: The structure of First Mover support (payment for stored CO<sub>2</sub> or clean power, or other methodologies) should be considered carefully, and more work on this subject is currently being undertaken by ZEP.***

***Recommendation: The two ways to support First Mover Costs are by cash payments or allocations of EUAs; especially given the need for support commitments in 2008, neither should be ruled out now and further work should be done urgently.***

***Recommendation: The possibility of providing a cash pool for First Mover support from ETS3 auction revenues should be considered urgently in discussion with Member States as the ETS3 structure is developed.***

#### 4.4. Sharing Market Risk

Risk of the shape, pricing and operation of the future carbon market could be shared in a variety of ways, for example:

- |   |  |
|---|--|
| <b>Simple EUA<br/>“contract for<br/>difference<br/>(CFD)”</b> | <ul style="list-style-type: none"><li>• Agreement sponsor/underwriter to pay/receive difference between a “strike” price and market price for EUAs earned</li><li>• Strike price to be set by agreement - fixed, variable over time or more complex</li><li>• The purchase “currency” could be additional EUAs</li></ul>   |
| <b>More complex<br/>market risk<br/>mitigation</b>            | <ul style="list-style-type: none"><li>• Strike price could be adjusted on the basis of power price</li><li>• Floor or collar price for EUAs (risks windfall profits)</li><li>• Strike price could vary by reference to sponsor’s achieved or pro-forma return target</li><li>• Other mechanisms could have the same commercial effect as a CFD</li><li>• EUAs could be used as “currency of settlement” for CFD</li><li>• Legal and technical work is needed on the form of contract</li></ul> |

Whatever the mechanism used, it should be designed to introduce the least possible market distortion, and should protect the public against the risk of windfall profits to industrial sponsors. Whichever EU entity is the counterparty, this element of support should be structured so as give rise to a liability to the underwriter only when the EUA market price is “in the money”.

Potential public sector sharers of Market Risk are presumably only the EU itself and the European Investment Bank. Should the EU become the direct counterparty, it is not clear what legal structure would be used, or which legal entity would undertake the contract. It would be necessary to determine how such a contingent liability would be valued and budgeted for.

These questions would not arise if EIB were the counterparty. EIB has already expressed interest in structures of this kind, though we assume that the term and strike price sought here would be so far “out of the money” that it would be hard to characterise this as a market instrument; it would require a major balance sheet allocation. That may bring the question directly back to the Commission to consider. We recommend early consultation with EIB on this matter.

***Recommendation: Further work should be done urgently on the legal, financial and risk aspects of possible Market Risk sharing structures, in which the EIB should be consulted and closely involved.***

## 5. PROCESS AND COMPETITION

### 5.1. Competition - essential for transparency and maximum public benefit

Implicit in the argument of this paper has been uncertainty about the level of support needed - whether for First Mover Costs or Market Risk - to ensure that the Flagship Programme takes place. ZEP considers that the level of support can only be determined through a competitive process - probably a separate process for each of the Projects directly sponsored under the Programme, of which, depending on Member State activity, there could be up to 12. In this way, each technology group can be properly tested and would not be required to compete against apparently more attractive or less risky technologies for the same funds.

It is likely that each competition would set parameters for technology and possibly other features (e.g. size and contractual structure) and that potential participants would be invited to bid on specified terms for the minimum amount of support required. Although the forms of support to be

used are still to be determined, the competitive process will need to be definitive as to the terms of support so that there can be a meaningful competition as to support levels.

Some of the principles governing the design the competition are transparency, simplicity, proper allocation of risk, avoidance of “gaming” competition rules and prevention of windfall profits. But, above all, Projects should be chosen on the basis of their ability to demonstrate the relevant CCS technology and minimising their cost to the public sector. Design of the competitive process therefore requires very careful study.

## **5.2. Establishing an EC Flagship Programme Executive**

The Flagship Programme has achieved considerable momentum and now has several marked achievements behind it. Excellent work has been done to prepare the ground for the Programme, for example, in the legal sphere by DG ENV and **[Robert - please add other EC milestones]**. ZEP has also laid out clear principles and guidelines for how it should move forward.

ZEP now considers that the process has reached the point where a professional Executive within the EC is needed to take matters forward. Not only is there a great volume of work to be done - internally or under contract - but it also has a high policy and political content that cannot be handled by a volunteer industry body like the ZEP working on its own.

The SET-Plan proposes a high-level Steering Group on Strategic Energy Technologies, which is to be tasked among other matters with a “European CCS Initiative”. Our proposal for a Flagship Programme Executive should be fully consistent with this structure.

As to organisation, elements of public-private partnership may be appropriate, and existing Joint Technology Initiatives may provide partial models. Particularly in the planning stages, where financial structure and organisation is developed, there may be room for a three-way partnership among the Commission, Member States and industry. There is also likely to be a need for very specific financial expertise.

However, the Flagship Programme will be implemented through a competitive process, in which the most likely competitors will be companies represented in the ZEP. The competition will need to be designed and run by a body that is not only properly resourced, but also independent, so that industry partnership may have to be limited at that point.

Meanwhile, consistent with the recommendations of the SET-Plan, ZEP offers to continue in its present role in the preparation and transition phase

***Recommendation: Support should be allocated competitively; considerable work will be needed to design the competitive process and this should start immediately.***

***Recommendation: An Executive should be established within the framework proposed in the SET-Plan to develop and implement the Flagship Programme from this point on, including the design and implementation of the competitive process for allocating support..***

## **5.3. Immediate actions**

Early tasks of the new Executive should include the following:

- Consideration of these recommendations and actions that follow
- Development of mechanisms for cooperating with Member State programmes
- Further study of costs so as set support budgets
- Decision on support mechanisms - incentives for efficiency as well as carbon stored
- Decision on support mechanisms - cash vs. EUAs
- Consideration of cash funding sources

- Consideration of Market Risk support mechanisms in consultation with EIB
- Consideration of the “Norwegian Model”
- Confirm Flagship Programme project design guidelines
- Preliminary design of the competitive process

A schedule should be set for these activities that provides strong financial commitment to the process by the time of the 2008 EU Spring Council and clear policy direction by mid-2008 as to how the Flagship Programme is to be implemented.

***Recommendation: Several urgent tasks should be launched immediately by the proposed EC Flagship Programme Executive; consultation with ZEP, particularly in the early transition stages, is likely to be important.***

***Recommendation: The 2008 EU Spring Council needs to make a financial commitment to the Flagship Programme and give clear policy direction as to how the Programme is to be implemented by mid-2008.***

**European Technology Platform for  
Zero Emission Fossil Fuel Power Plants (ZEP)**

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