



EUROPEAN COMMISSION

Brussels, 12.01.2011  
C(2010)9516 final

In the published version of this decision, some information has been omitted, pursuant to articles 24 and 25 of Council Regulation (EC) No 659/1999 of 22 March 1999 laying down detailed rules for the application of Article 93 of the EC Treaty, concerning non-disclosure of information covered by professional secrecy. The omissions are shown thus [...].

**PUBLIC VERSION**

**WORKING LANGUAGE**

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**Subject: State aid N 193/2010 – Sweden  
Individual R&D aid to Södra Cell AB for the LignoBoost project**

Dear Sir,

#### **1. PROCEDURE**

- (1) The measure under assessment was pre-notified on 20 January 2010 and registered the same day under number PN 21/2010.
- (2) On 9 March 2010, a meeting took place between the Commission, the Swedish authorities and representatives of the beneficiary concerning the pre-notified measure.
- (3) By the letter of 22 March 2010, the Commission informed the Swedish authorities about the additional information to be provided within the scope of the formal notification.
- (4) By electronic notification dated 19 May 2010, registered the same day, the measure was notified by the Swedish authorities in accordance with Article 108 (3) of the Treaty on the Functioning of the European Union (hereafter "TFEU") in view of its assessment under the Community Framework for State aid for research and development and innovation<sup>1</sup> (hereafter "the R&D&I Framework").
- (5) On 16 July 2010, the Commission sent a request for information to the Swedish authorities.
- (6) The Swedish authorities requested a delay extension to submit their replies on 11 August 2010, 24 August 2010, 28 September 2010 and 30 October 2010 which the Commission

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<sup>1</sup> OJ C 323, 30.12.2006, p. 1.

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accepted by letters dated respectively 12 August 2010, 26 August 2010, 30 September 2010 and 5 November 2010.

- (7) On 25 November 2010, registered the same day, the Swedish authorities submitted their reply. Complementary information was submitted by the Swedish authorities on 6 December and registered the same day.

## 2. DESCRIPTION OF THE MEASURE

### 2.1. Legal basis and granting authority

- (8) The notified measure will be implemented under an aid scheme approved by the Commission on 1 August 2008 (N 561/2007)<sup>2</sup>. The national legal basis is:

- Regulation (1988:764) on State support for the industry ("*Förordning 1988:764 om statligt stöd till näringslivet*");
- Regulation (2008:761) on State support for research and development and innovation within the energy field ("*Förordning 2008:761 om statligt stöd till forskning och utveckling samt innovation inom energiområdet*").

- (9) The granting authority is the Swedish Energy Agency.

### 2.2. The beneficiary

- (10) The beneficiary of the measure under assessment is Södra Cell AB (hereafter "Södra Cell"), a wholly owned subsidiary of Södra Skogsägarna Ekonomisk Förening (hereafter "Södra").

- (11) Södra is an economic association of 50,000 forest owners which aims to purchase and process forest raw materials from its members and turn it into pulp, wood and interior products.

- (12) Södra's operations are divided into four main business areas:

- Södra Cell AB forms the paper pulp business unit of Södra.
- Södra Skog AB supplies Södra's pulp mills with forest raw material, its key products being pulpwood, saw logs and biofuel (mainly for internal use of the group).
- Södra Timber AB is the group's producer and supplier of wood products for, above all, construction and housing related use.
- Södra Interiör AB manufactures mouldings, panels, floors, hobby boards, interior fittings, and components.

In 2009, Södra employed 3 967 employees, including 591 in countries other than Sweden. The consolidated net revenue of Södra in 2009 amounted to SEK 16 696 million (ca. €1 824 million<sup>3</sup>).

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<sup>2</sup> N 561/2007 – SE – Energy research, development and innovation scheme STEM, OJ C 238, 17.9.2008, p. 2.

<sup>3</sup> ECB exchange rate as of 1.12.2010: 9.1540 SEK = 1 EUR.

- (13) Södra Cell is one of the world's leading manufacturers of paper pulp for the open market. The company owns three pulp mills in Sweden. The operations and expertise of Södra Cell concentrate on pulp alone and the company does not carry out any papermaking. Customers are primarily European producers of fine paper, printing paper, tissue, speciality paper and board. In 2009, Södra Cell employed 1 634 employees and had a net revenue of SEK 9 601 million (ca. €1 049 million).

## 2.3. The project

### 2.3.1. Objective of the project

- (14) The project under assessment consists of research and development activities concerning construction and testing of an industrial scale demonstration plant for the production of chemical grade lignin (sulphate lignin) from pulp mill residue material (so called black liquor<sup>4</sup>). The demonstration plant will be integrated into an existing and fully operational pulp mill of Södra Cell, located in Mörrum in southern Sweden.
- (15) Black liquor is a type of biomass which can be used as a raw material for the production, among the others, of sulphate lignin. Due to its high heat value, low ash content and high dry content, sulphate lignin constitutes a replacement for fossil fuels such as oil, coal or gas. Because of its solid consistency (e.g. lignin pallets), sulphate lignin cannot be considered as biofuel, in the meaning of Directive 2009/28/EC<sup>5</sup>. It can however be considered as a source of a renewable energy<sup>6</sup>.
- (16) If successful, the project will allow replacing fossil oil in the Södra Cell Mörrum pulp mill's lime kilns with sulphate lignin, therefore limiting the pulp mill dependency on fossil fuel. The project will not lead to an increase of the mill's pulp production capacity. In fact, the production volume of sulphate lignin will be determined by the production capacity of the pulp mill. The purpose of the project is therefore to integrate the sulphate lignin production process into the fully operational pulp mill of Södra Cell Mörrum.

### 2.3.2. LignoBoost technology

- (17) The project will be based on the LignoBoost technology, which concerns the method of extraction of the sulphate lignin from black liquor and was developed by Innventia AB<sup>7</sup> in cooperation with Chalmers Technical University. The developed innovations were patented and transferred to LignoBoost AB, a subsidiary of Innventia AB. Södra Cell acquired rights to use the LignoBoost technology on the basis of a license agreement signed in August 2006.
- (18) To date the LignoBoost technology has only been tested at small experimental scale in Bäckhammar in Sweden by LignoBoost AB. The Bäckhammar pilot plant is however not integrated into the host mill, and thus provides for significantly reduced synergies and

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<sup>4</sup> The black liquor is a type of a residue material obtained within a pulp mill production process in a form of an aqueous solution of lignin residues, hemicellulose, and the inorganic chemicals used in the process.

<sup>5</sup> Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, OJ L 140 of 5.6.2009, p.16, Article 2 (i): "biofuel means liquid or gaseous fuel for transport produced from biomass".

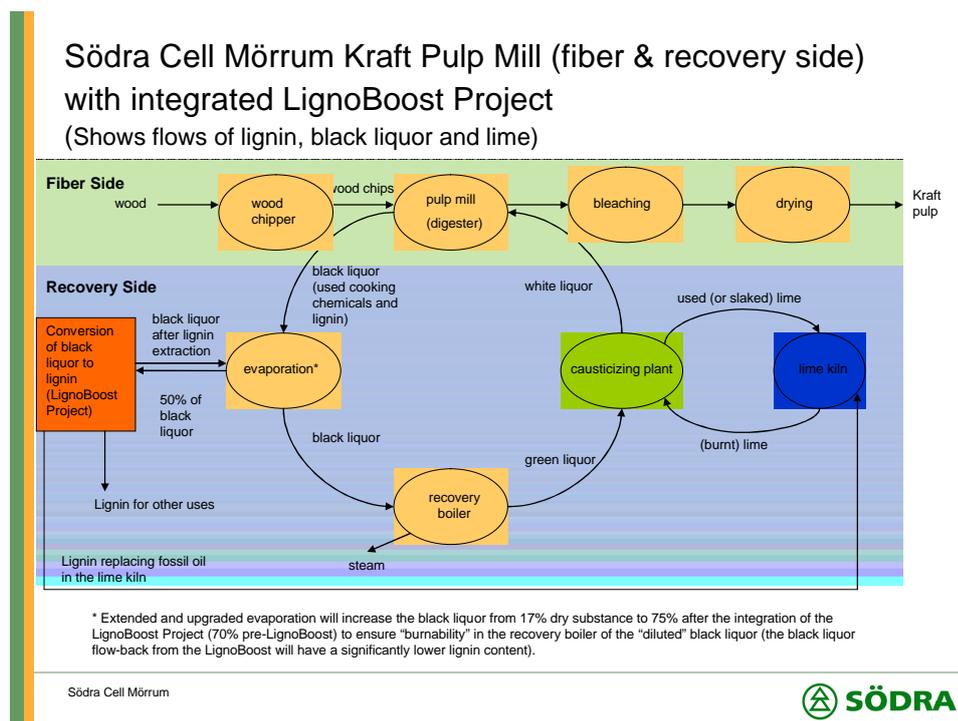
<sup>6</sup> Directive 2009/28/EC, Article 2(a): "energy from renewable sources means energy from renewable non-fossil sources, namely [...] biomass, [...]"; Article 2(e): "biomass means the biodegradable fraction of products, waste and residues from biological origin from [...], forestry and related industries [...]".

<sup>7</sup> Innventia AB (former STFI Packforsk) is a R&D joint venture between a number of pulp and paper mills and the Swedish Government.

represents much lower level of possible risks than those associated with the sulphate lignin production in a fully integrated pulp mill.

### 2.3.3. Description of the project

- (19) The project will span from the production of sulphate lignin, i.e. lignin extraction from black liquor (precipitating, washing and dewatering) through post-treatment of lignin (drying, handling, transportation and storage), as well as ensuring the correct particle size for the powder burner in the lime kiln, to subsequent burning of lignin in the lime kiln of the pulp mill, where sulphate lignin will replace fossil oil.
- (20) The integration of the LignoBoost technology into Södra Cell Mörrum can be summarized in the following way:



- (21) In particular, the main novelties and risks associated with the implementation of the LignoBoost technology in the fully operational pulp mill can be described as follows:

- integration into the operations and system of the existing pulp mill:

The integration of the LignoBoost technology will affect the pulp mill's chemical balance due to large amounts of sulphur introduced into the mill. The relationship between sulphur and sodium in the mill is decisive for the digestion of chips into pulp to function and maintain a high quality of pulp.

- new type of filtration concerning residues and clogging issues:

In this step experimental development activities are necessary concerning the heat exchange of liquor with precipitated lignin before the first filtering takes place. There is a great risk that lignin will cause coatings and residues in the heat exchangers, which will lead to important efficiency decrease of the exchangers.

- new process for precipitating, washing and dewatering the lignin, dissolving the lignin in acidic water solution and collecting malodorous gases:

Experimental development required in this step is related to the optimization of carbon dioxide input in the precipitation stage. A new [...] \* will be developed, where [...]. At the same time, experimental development regarding washing and dewatering of the lignin will test various options for minimizing the amount of washing liquid and the volume of chemicals required. The chemical consumption has a huge impact on the operational economy, but so far only tests at laboratory scale have been performed.

- new method to prevent that filtrate liquids create increased scaling in the evaporation plant:

In the production process, carbon dioxide and sulphuric acid are added to the black liquor, which increases its salinity. At the same time, the lignin is precipitated from the liquor. Thus, the liquor which is returned to the evaporation system has a different composition than normal liquor. When the liquor comes into contact with hot surfaces in the evaporation system, there is a risk of precipitation of sparingly soluble salts. If precipitations are forming, the energy efficiency in the installation will decrease until it eventually reaches a point where it has to be stopped to be cleaned off the precipitates and scales. Unless a proper method is devised to prevent increased scaling, this would require a stoppage for cleaning each month, which could take between a few hours to several days.

- changes in the chemical specifications of the black liquor which affect the heat transfer and scaling:

Lignin depleted liquor should increase the capacity of evaporation. However, since the salinity is higher in the lignin depleted liquor than normal liquor, it is likely that the scaling and precipitation in the evaporators will increase and this will counteract the increased evaporation capacity due to lower viscosity. To reduce this risk it will be necessary to develop new constructions in the evaporator plant.

- black liquor concentration:

The change of liquor properties causes uncertainties, meaning that the combination of increased salinity and decreased lignin content raises concerns about extended scaling, especially at a concentration of between [...]%. Evaporators that are fully adapted to the new liquor properties cannot be designed in advance. Experiments will have to take place after start up and may render future modifications of the evaporator design and construction necessary.

- energy optimisation:

At present, the black liquor is burned in recovery boilers of pulp mills, generating heat, which is usually used in the process or in making electricity used in a pulp mill, much as in a conventional steam power plant. In order to compensate for the energy removed from the black liquor as a consequence of lignin extraction and taking into account that energy demand of the evaporation plant will actually increase due to the additional load the use of energy has to be optimised in the whole pulp mill.

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\* Business secret

- handling of the wet lignin, transportation and storage:

Wet lignin is very difficult to handle with conventional technologies. Lignin is so sticky that it clogs up around the screws and forms a tight cylinder, which prevents further loading. Further testing of technical solutions for transport and loading from the silos of wet lignin will be required in order to find a reliable technical solution.

- drying and handling of dry lignin:

Dry lignin is highly explosive. The dryer is yet to be designed and must also address the risk of explosion. Very few tests and limited information are available. During the project, most likely a [...] technique based on [...] will be used, but a number of uncertainties exist and will require extensive research during the construction phase<sup>8</sup>.

- feeding systems:

There is no previous long-term operational experience in handling and advancing of lignin as a fuel to lime kilns. For instance, lignin is a material with finer particles compared to bark powder, which affects the material's ability to fluidize. Fluidization is thus important to achieve even loading from day silos to burner, which requires the development of equipment for uniform dosage of lignin into the feeding system to the burner.

- effects of the changed chemical properties of the fuel (oil being replaced by lignin) on the lime kiln operation:

Lignin has higher sulphur content than the heating fossil oil used today in Södra Cell Mörrum. Sulphur normally binds the lime in the lime kilns and produces gypsum. When the re-burnt lime moves on in the process, the gypsum is dissolved and the sulphur is further moved through the mill's chemical circle. Since [...], it is not possible to determine *a priori* [...]. It is also impossible to determine without [...] how [...]. This will involve substantial experimental development activities and tests of the lime and liquor to ensure the overall sulphur and sodium balance at the mill.

- burning of the lean gases in the recovery boiler:

The lean gases will continue to be burnt, although in increased volumes, in the recovery boiler. To destroy (burn) the malodorous lean gases in the recovery boiler is in itself not a new technology, but to do so in combination with lignin-poor liquor, which will be the case in the project, will be new. To develop a new stable operating process for the recovery boiler will require further development and optimization.

- (22) The research and development activities to be undertaken during the project will therefore concern mainly the consequences of the integration of the LignoBoost technology into the fully operational pulp mill, including the impact on the pulp mill's chemical balances in the short and long term, effects on the evaporation plant and

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<sup>8</sup> Dry lignin dust in the right concentration is as explosive as hydrogen, which requires that considerable resources will be spent on finding dense solutions with or without the combination of inert environments. Also all equipment coming into contact with lignin that has a dry level exceeding 80%, must be classified according to the ATEX Directive 94/9/EC (which demands that equipment that is placed in an explosive environment is constructed so that it does not induce ignition, electrical or mechanical), and provided with for example an explosion vent. It is thus extremely important that all equipment used in the project is constructed so dense that lignin leakage may not occur.

accessibility of the evaporation plant and of the black liquor recovery boiler, the way the sulphate lignin quality affects lime kiln operation when sulphate lignin is used as a fuel, and how the overall, combined concept can interact during continuous production, post-treatment and burning in lime kilns, as well as transport and storage of sulphate lignin.

- (23) Once the demonstration plant will reach its full capacity, sulphate lignin will mainly be used for replacing fossil oil in the Södra Cell Mörrum's lime kilns. At this stage it is expected that approximately 40,000 tonnes of sulphate lignin could be produced per year, out of which approximately 28,000 tonnes would be used for Södra Cell Mörrum own lime kilns, constituting an equivalent of 16,500 m<sup>3</sup> of oil. The remaining production of 12,000 tonnes would be sold to other users such as pulp mills, or combined power and heat producers.
- (24) According to the Swedish authorities, it would be too expensive to develop the demonstration plant, which will constitute a part of the fully operational pulp mill, exclusively for demonstration and validation purposes. Therefore, if the integration of the LignoBoost technology turns out to be successful, the demonstration plant will be commercially used after the completion of the project.

#### **2.4. Duration**

- (25) The duration of the project is estimated at 7 years, i.e. until 2016. The project is divided into two phases: 2-3 years for the construction of the demonstration plant and 4-5 years for subsequent testing of the new technology.
- (26) After the end of the project, and subject to its technological success, the demonstration plant will be commercially used until the end of the expected lifetime of the installation, i.e. during an additional 3 years (until 2019).

#### **2.5. The R&D categories and eligible costs**

- (27) The notified project consists entirely in experimental development activities. Considering that the demonstration plant is going to be commercially used after the end of the project, the revenue generated from this subsequent commercial use has been deducted from the eligible costs as stipulated in point 2.2 (g) of the R&D&I Framework. To this purpose, the Swedish authorities took into consideration both the net present value of revenue generated during the subsequent commercial use of the demonstration plant and the present value of any remaining book value of buildings and land after the demonstration plant has been fully depreciated, respectively discounted at a rate of [...] % for the experimental development phase (i.e. during the implementation phase of the project, and in view of its technological risks) and [...] % thereafter (see also point (83) below).
- (28) The project has nominal total eligible costs of SEK 675.2 million (ca. € 73 million), corresponding to a gross present value of SEK 445.3 million (ca. €48.7 million). The net present value of the possible subsequent commercial use equals SEK [...] million (ca. € [...] million), and the present value of the remaining book value of buildings and land equals SEK [...] million (ca. € [...]). The resulting net present value of the eligible costs of the project thus equal to SEK [...] million. (ca. € [...] million).
- (29) The Swedish authorities informed also the Commission that since the revenue deducted from the eligible costs was based on values established *ex ante*, they decided to implement a special claw-back mechanism in order to reassure that any excessive aid

amount will be re-paid. By "excessive aid amount" the Swedish authorities refer to any amount which brings the internal rate of return of the project to a value which is higher than the weighted average capital cost (WACC) of the whole project at the time when the aid was granted (see also section 3.6.5 below). Any such excessive aid amount will be repaid with interest at the rate determined by the Swedish Central Bank.

## **2.6. The aid instrument, aid amount and aid intensity**

- (30) The aid will be granted in the form of a nominal grant of SEK 90 million (i.e. €9.8 million), paid in several instalments until 2012.
- (31) According to the Communication from the Commission on the revision of the method for setting the reference and discount rates<sup>9</sup> (hereinafter "the Communication") for discount purposes, a rate corresponding to the reference rate plus 100 basis points should be applied. The reference rate for Sweden was 1.49% at the time of the preliminary granting decision by the Swedish Energy Agency<sup>10</sup>, i.e. a discount rate of 2.49% should be used according to the Communication. Such a rate results in a discounted value of the grant amounting to SEK 87 million (ca. €9.5 million), corresponding to an aid intensity of 22.9% of the eligible costs after deduction of forecasted net revenues from the subsequent commercial use of the demonstration plant.

## **2.7. Cumulation**

- (32) According to the Swedish authorities, the aid can not be cumulated with aid from other local, regional, national or Community schemes to cover the same eligible costs.

## **3. ASSESSMENT**

### **3.1. Existence of aid**

- (33) According to Article 107(1) of the TFEU, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, insofar as it affects trade between Member States, be incompatible with the internal market.
- (34) The notified measure concerns a direct grant provided by Sweden to Södra Cell. The resources involved are State resources, as they will be provided from the State budget by the Swedish Government. The measure is selective as it favours explicitly only one undertaking, Södra Cell, to which it confers an advantage by financing part of its R&D costs. Since Södra Cell is involved in trade with other Member States, a financial advantage favouring it, compared to its competitors distorts or threatens to distort competition and affects trade between the Member States.
- (35) Therefore the measure constitutes State aid according to Article 107 (1) of the TFEU.

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<sup>9</sup> OJ C 14, 19.1.2008, p. 6.

<sup>10</sup> OJ C 236, 1.10.2009, p. 4.

### **3.2. Legality of aid**

- (36) The Swedish authorities intend to implement the measure only after authorisation by the Commission and, therefore, the Swedish authorities fulfil the obligation imposed by Article 108 (3) of the TFEU.

### **3.3. Basis for analysing the compatibility of the aid**

- (37) According to Article 107(3)(c) of the TFEU, aid may be compatible with the internal market if it facilitates the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest.
- (38) The R&D&I Framework sets forth criteria based on which the Commission will assess whether aid for certain R&D activities (including experimental development activities) are compatible with the internal market under e.g. the mentioned Article 107(3)(c) of the TFEU.
- (39) In the notified case, the objective of the measure is to promote R&D&I activities (more precisely, experimental development activities) in the field of renewable energy. In accordance with point 2.1, fifth paragraph, of the R&D&I Framework, such aid falls within the scope of the R&D&I Framework.
- (40) The R&D&I Framework provides for two levels of assessment:
- *A general level of analysis:* Chapters 5 (for this case, particularly section 5.1 Aid for R&D projects), 6 (Incentive effect and necessity of the aid) and 8 (Cumulation) lay down general conditions for the compatibility of R&D aid.
  - *A detailed level of analysis:* For certain aids for which the risk for distortion of competition is higher (e.g. where aid amounts exceed certain thresholds), a detailed analysis has to be carried out in addition to the general analysis. The purpose of this analysis is to ensure that high amounts of aid for R&D do not distort competition to an extent contrary to the common interest, but actually contribute to the common interest. This occurs when the benefits of State aid in terms of additional R&D&I outweigh the harm to competition and trade. Chapter 7 of the R&D&I Framework provides assessment criteria for positive and negative effects of the aid and the balancing of such effects.
- (41) The aid measure under assessment concerns an individual aid for a project consisting exclusively of experimental development. According to section 7.1 of the R&D&I Framework, aid which is covered by the Framework and supports projects in which the supported activities are not predominantly fundamental research or industrial research, should be subject to a detailed assessment if the aid amount, as in the case under assessment, exceeds €7.5 million per undertaking and per project.
- (42) For the purposes of the assessment of the notified measure, it must be underlined that, although Södra Cell is the undertaking receiving the advantage financed from State resources, Södra Cell is a wholly owned subsidiary of Södra. The Swedish authorities informed the Commission that the strategic decisions concerning investments in large research and development projects are not undertaken by Södra Cell but by its only shareholder, i.e. Södra in accordance with the overall strategy of the group. Moreover,

concerning the implementation of the project, Södra Cell will sign contracts with subcontractors only after approval by the general assembly of Södra. In view of the above, the Commission therefore considers appropriate to carry out the assessment of the compatibility of the aid both at the level of Södra Cell and Södra.

- (43) The assessment of the notified aid presented below follows the order of the criteria for detailed assessment, as presented in Chapter 7 of the R&D&I Framework. However, the assessment of the fulfilment of the general conditions is integrated in the appropriate parts of the detailed assessment. More precisely, part 3.5 of the present decision covers the requirements concerning the incentive effect and necessity of the aid as required by Chapter 6 and point 7.3.3. of Chapter 7 of the R&D&I Framework while the compliance with the conditions set out in section 5.1 of Chapter 5 concerning aid for R&D projects and Chapter 8 concerning cumulation are assessed under part 3.6 of the present decision regarding proportionality.

### **3.4. Positive effects of the aid**

#### *3.4.1. Existence of a market failure*

- (44) According to the R&D&I Framework, market failures may prevent the market from achieving optimal output, and State aid may be necessary to increase R&D&I in the economy only to the extent that the market, on its own, fails to deliver an optimal outcome. It stems from point 7.3.1 of the R&D&I Framework that the analysis of the level of R&D activities as well as of market failures should be carried out at the European Union level. The Commission will consequently analyse if the level of R&D activities undertaken within the European Union would be inferior if the project would not be undertaken and, if so, if this result is optimal or if a market failure exists.
- (45) The possible existence of a market failure concerning the R&D&I in the area of the renewable energy has been already acknowledged by the Commission its Communication on Investing in the Development of Low Carbon Technologies<sup>11</sup> dated 7 October 2009. The Communication indicates that there is a significant need to demonstrate new, carbon dioxide efficient technologies at the appropriate scale: pilot plants, pre-commercial demonstration or full industrial scale. It is estimated that the total public and private investment concerning those technologies in Europe shall amount to €9 billion over next 10 years. Moreover, the Communication concludes that public financial support is crucial in establishing the new carbon dioxide efficient technologies in order to minimize the financial risks associated with their introduction.
- (46) In the view of the above, it might be concluded that there is a general market failure in the area of the renewable energy at the European Union level. Nevertheless, according to the R&D&I Framework, the Commission should establish precisely the specific market failure which the beneficiary is faced with and which justifies the aid subject to the detailed assessment.
- (47) Depending on the specific market failure addressed, the Commission takes into consideration the following elements: knowledge spill-overs, imperfect and asymmetric information and coordination failure. For State aid targeting R&D&I projects or activities, the Commission also takes into account other positive externalities. In this case

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<sup>11</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Investing in the Development of Low Carbon Technologies (SET-Plan), COM (2009) 519, page 6.

the Commission found that the relevant elements are: knowledge spill-overs (section 3.4.1.1 below), imperfect and asymmetric information (section 3.4.1.2 below) and other positive externalities (section 3.4.1.3 below).

#### 3.4.1.1. Knowledge spill-overs

- (48) According to the Swedish authorities, the pulp mill industry is not willing to undertake on its own the implementation of the LignoBoost technology as it was not yet tested at full industrial scale. Most of the pulp mills prefer to wait instead of taking the lead in the implementation of the process and to let other industry players to carry the R&D costs and cope with the possible technical and operational problems. The Swedish authorities underline that the results of the required experimental development activities are expected to produce knowledge which is of significant value for any following investments meaning that it creates a real "value of waiting".
- (49) In view of the above, the Swedish authorities consider that the project will create important knowledge spill-overs within the pulp mill industry. If successfully developed, the first industrial scale demonstration plant implementing the LignoBoost technology will significantly reduce the level of uncertainty concerning this technology within the European Union, which in turn will facilitate its subsequent industrial deployment with a significantly lower level of risk.
- (50) This is mostly due to the fact that, the general knowledge developed during the project cannot be appropriated exclusively by Södra Cell. Firstly, Södra Cell is open for universities and researchers to participate in the project, and will cooperate in particular with Chalmers University of Technology and Innventia AB, an important part of the academic network within the industry continuously disseminating research findings. Secondly, Södra Cell will disseminate results of the project on a regular and continuous basis, either through publications in journals<sup>12</sup> or during the presentations and conferences within and outside EU<sup>13</sup>. Thirdly, contractors and suppliers will obtain know-how that can be used in subsequent applications of the technology, providing additional benefits to the supply chain. Finally, the industry players will be invited to visit the demonstration plant in order to study the technology and obtain information concerning, for example, the chemical processes developed in the course of the project.
- (51) Moreover, the Swedish authorities underline as well that sulphate lignin might, apart from being a source of renewable energy, constitute a raw material for green chemicals and might be therefore used for the development of new materials (e.g. phenols, carbon fiber, binders, dispersants, activated carbon). In the medium term, the production of sulphate lignin could therefore trigger the development of other technologies, thereby increasing the knowledge spill-overs of the project.

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<sup>12</sup> E.g.: Energivärlden, Beyond (Customer magazine, Innventia), Svensk papperstidning, Ny teknik, Research EU, Bio FPR (fuels, products and refining), Pulp & paper international, Chemical engineering news, Tappi journal.

<sup>13</sup> E.g.: Energitinget (arranged by the Swedish Energy Agency), World Bioenergy Conference in Jönköping (Elmia), Nordic wood biorefinery conference (NWBC) in Stockholm, The SPCI conference in Stockholm, International Chemical Recovery conference, Tappi PEERS (Pulping, Engineering, Environmental, Recycling and Sustainability and International Bioenergy & Bioproducts Conference), ABTCP (arranged by the Brazilian Pulp and Paper Technical Association).

### 3.4.1.2. Imperfect and asymmetric information

- (52) According to the Swedish authorities, the main market failure affecting the project would relate to the imperfect and asymmetric information. More specifically, the Swedish authorities claim that the market would not provide all the necessary financial resources, nor could Södra Cell or its only shareholder Södra alone afford to self-finance the entire project given its capital-intensive nature and the technical and commercial risks involved.
- (53) The Commission, on the basis of its previous decisions, has assessed the asymmetry of information with specific reference to the company's ability to obtain financing on the market and its need to do so. These variables are also affected by the very nature of a project underlying the request for funding. Projects targeting the development of new products, with high up-front investment and long delays for the return on capital are likely to encounter more difficulties in obtaining financing on the market due to the higher risks involved in successful completion. Therefore, the characteristics of both the project and the company were considered when assessing the alleged asymmetry of information.
- (54) In this context, the Swedish authorities underline that the project targets the implementation of a new technology into the fully operational pulp mill as well as the development of a new product (*sulphate lignin*) which requires high up-front investment and encompasses a high level of technological, financial and commercial risks, summarised below.
- (55) Technological risks: The technology has previously only been tested stage-by-stage on a sub-commercial scale and never previously integrated into a operational mill. The integration of an entirely new technology for the production of sulphate lignin into an existing pulp mill will thus entail specific risks related to adjacent processes concerning: evaporation, digestion, causticizing and the use of black liquor in the recovery boiler. Such processes must be tested simultaneously at full scale in order to verify the effects of the integration of the LignoBoost technology into the pulp mill and its functioning as a whole.
- (56) Financial risks for the core business of Södra Cell: The integration of the demonstration plant into the pulp mill may create serious disturbances to its main activity. In order to remain competitive, the pulp mill must provide continuous production for 18 consecutive months, interrupted by approximately one 48-hour stoppage followed by a 14-day maintenance stoppage, which amounts to an average of 350 days of continuous production or 8,400 hours of operation per calendar year. Since a number of process cycles are closely integrated, it only takes a few hours from one part of the process experiencing a problem until the entire production process is affected. In terms of loss of production for Södra Cell, the daily costs of a stoppage can be estimated at SEK [...] million (ca. €[...]). As an example, should the filtrate liquids from the project lead to increased blockages in the evaporation plant, it would be likely that the evaporation plant has to be switched off and cleaned [...], which would entail losses in the region of SEK [...] million (ca. €[...] million) per year ([...] x SEK [...] million). Insofar as various different problems could arise [...] it is likely that the project will result in significant reductions of availability of the mill, which could ultimately endanger the pulp mill's production as a whole.
- (57) Market risks: Sulphate lignin is not currently available as a product on the market, which makes it impossible to precisely determine a price, quality or quantity requirements.

Furthermore, the commercial prospects of the project also depend on the future prices for fossil oil and the evolution of the US Dollar exchange rate vis-à-vis the Swedish Crown.

- (58) Considering the characteristics of the aid beneficiary, the Swedish authorities underline that Södra Cell is wholly owned by Södra which, as an economic association of forest owners, does not have large liquidity reserves. As described in its annual reports, Södra has indeed only access to deposited funds from its members that can be withdrawn without prior notice and for which Södra pays market interest rates. Thus, these funds are equivalent to short term cash loans and actually limit Södra's ability to borrow the money on the market. Moreover, Södra is obligated to keep [...] % of its resources as cash reserves under covenants of its syndicated loan with commercial banks. According to the Swedish authorities, Södra is also highly vulnerable to the world economy and thus has a high demand on available liquidity, including loan commitments (representing [...] % of annual turnover) and high requirements of solvency, which further limit its ability to borrow.
- (59) Considering its above mentioned characteristics, as well as the magnitude and nature of risks inherent to the project, Södra did not try to obtain external financing in the form of bank loans.
- (60) Alternatively, according to the Swedish authorities, a strong commitment from the pulp mill industry would be needed to provide sufficient private investment able to share the costs and risks of the project. Such a commitment can however not be secured under the present circumstances, in particular given the general reluctance of the pulp mills to engage in the implementation of the LignoBoost technology outlined in point (48) above. In addition, insofar as the essence of the project is to assess the technology at a demonstration scale, integrated into a fully operational pulp mill, it could not have been achieved at a smaller scale.

#### **3.4.1.3. Other positive externalities**

- (61) In the present case, the project will contribute to environmental protection through in particular:
- (62) Reduction of fossil carbon dioxide emissions to the atmosphere: If successful, the project will allow for the replacement of the fossil oil used today in pulp mills, which will consequently decrease the emission of fossil carbon dioxide. The replacement is expected to amount to an estimated annual reduction of fossil carbon dioxide emissions of 56,000 tonnes at Södra Cell Mörrum alone. If sulphate lignin were to replace fossil oil in all existing lime kilns in Sweden the annual reduction of fossil carbon dioxide would add up to approximately 630,000 tonnes.
- (63) Reduction of dust, sulphur dioxide and nitrogen dioxide emissions to the atmosphere: The load of the recovery boiler will decrease as lignin is precipitated from the black liquor. For Södra Cell Mörrum this means that the outlet to the atmosphere from the recovery boiler will decrease by approximately [...] tonnes dust, [...] tonnes sulphur dioxide and [...] tonnes nitrogen dioxide. Although the effect on other pulp mills would depend on the amount of lignin that is taken out from the mill in combination with the overall pulp production, it can thus be considered that total emissions would decrease significantly in case the LignoBoost technology was to be introduced in other pulp mills in Sweden.

- (64) Reduction of chlorate emissions into water: The total outlet of chlorate from Södra Cell Mörrum in 2008 was 34 tonnes and, following the integration of the LignoBoost technology, could be reduced to approximately [...] tonnes. A comparable reduction would be possible at other pulp mills of Södra Cell Mörrum's size that use chlorine dioxide as a bleaching agent.
- (65) In the light of the elements described above, it can thus be considered that the Project responds to the objectives of the *EU Energy Package*<sup>14</sup>, i.e. reduction of at least 20% in greenhouse gases and increase in the share of renewable energies in EU energy consumption to 20% by 2020.

#### 3.4.1.4. Conclusion

- (66) In conclusion, the Commission finds that the aid will be provided in order to correct a specific market failure resulting from asymmetry of information, knowledge spill-overs, and other positive externalities.

#### 3.4.2. *Appropriate instrument*

- (67) State aid for R&D&I can be authorised under Article 107(3)(c) of the EC Treaty when it is necessary to achieve an objective of common interest, as an exception to the general prohibition of State aid. An important element in the balancing test is whether and to what extent State aid for R&D&I can be considered an appropriate instrument to increase R&D&I activities, given that other less distortive instruments may achieve the same results.
- (68) The Swedish Government strategy for achieving an economy which is based on sustainable energy solutions is formed upon a mixture of different instruments, some general, some more selective, including instruments constituting State aid. According to the Swedish authorities, the activities in the field of R&D&I ought to be in harmony with instruments forming the general regulatory framework for undertakings, taxes included.
- (69) Considering the above, in the opinion of the Swedish Government State aid for R&D&I should constitute only an addition to the general regulatory framework, whenever the latter does not achieve its objectives (in line with section 1.1 of the R&D&I Framework). Indeed, in Sweden exist already general instruments supporting R&D&I in the energy, such as the law (1994:1776) on taxation on energy.
- (70) The Swedish authorities considered different alternatives for the choice of the support instrument, such as for example tax credits. However, tax credits are a general measure to stimulate private sector investment in research and development by reducing business' corporation tax liability and can not be relied upon to stimulate a specific large R&D project.
- (71) The Commission thus considers that in this case the State aid in the form of a direct grant is an appropriate instrument to achieve the envisaged results.

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<sup>14</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 2020 by 2020 - Europe's climate change opportunity; COM (2008) 30 final.

### 3.5. Incentive effect and necessity of aid

- (72) State aid must have an incentive effect, i.e. result in the recipient changing its behaviour so that it increases its level of R&D&I activity. Identifying the incentive effect means assessing whether the planned aid will induce the beneficiary undertakings to pursue R&D&I activities which they would not otherwise have pursued.
- (73) Chapter 6 of the R&D&I Framework lays down formal criteria to determine whether the aid has an incentive effect. As laid down in Chapter 6 of the R&D&I Framework, the aid does not present an incentive for the beneficiary where the R&D&I activity commences prior to the beneficiary applying for aid to the national authorities.
- (74) Södra Cell made the application for aid on 28 November 2008. The aid was granted by the Swedish Energy Agency on 25 September 2009 subject to the approval of the aid by the Commission. To date the project did not commence, which ensures compliance with the formal condition of Chapter 6 of the R&D&I Framework.
- (75) When the Commission undertakes a detailed assessment of an individual measure, the indicators mentioned in Chapter 6 of the Framework may however not be considered sufficient demonstration of an incentive effect and the Commission may need additional evidence. In its analysis, the Commission takes into consideration the following elements mentioned in point 7.3.3 of the R&D&I Framework: specification of intended change, counterfactual analysis, level of profitability, amount of investment and time path of cash flows, the level of risk involved in the research project and continuous evaluation. The Swedish authorities have provided all elements required under point 7.3.3 of the R&D&I Framework enabling the Commission to assess the incentive effect of the aid.

#### 3.5.1. Counterfactual analysis

- (76) According to the Swedish authorities, the aid has a strong incentive effect upon the beneficiary since without aid the notified project would not have been undertaken by Södra Cell at all considering its high technological, financial and commercial risks.
- (77) In absence of aid, Södra Cell would have waited for a successful integration of the LignoBoost technology at full scale at another existing pulp mill in order to be reassured that the technology has been proven under such conditions. The most likely alternative strategy would be to focus on regular re-investments in existing production units and to upgrade the existing facilities using proven techniques and applications without embarking into any important and innovative R&D project. The aid would therefore change a trend towards more traditional investments of Södra Cell and allow the Mörrum pulp mill to become a *bio-refinery* able to produce alternatives to fossil fuel from its own process.
- (78) The Commission has received internal documents from the beneficiary showing its internal decision-making process and establishing that the project, although included in an initial version of Södra Cell's 2008 budgetary plan and considered as potentially strategic, had to be abandoned due to its high costs and very uncertain outcome. The project was only reconsidered when Södra Cell found out that there was the possibility to obtain State funding to support part of its costs.
- (79) The Commission therefore considers that Södra Cell would not have carried out the project without the aid and could not have resorted to any other R&D project instead.

### 3.5.2. *Specification of intended changes:*

- (80) Compared to the counterfactual situation where the project would not have been carried out, the change brought about by the aid is identical to the entire size and scope of the project in question, implying full-time employment of [...] persons in R&D activities conducted at Södra Cell and total costs to the nominal amount of SEK 675.2 million (ca. €73 million) over seven years. Such R&D investments clearly go beyond the normal R&D spending that Södra would undertake on its own, as evidenced by its behavior in previous years: total R&D spending in 2006/2007 was SEK 75 million (ca. €8.2 million), in 2008 SEK 77 million (ca. € 8.4 million) and in 2009 SEK 80 million (ca. € 8.7 million)<sup>15</sup>.

### 3.5.3. *Level of profitability*

- (81) According to point 7.3.3 of the R&D&I Framework, if a project would not in itself be profitable to undertake for a private undertaking but would generate important benefits for society, it is more likely that the aid has an incentive effect.
- (82) Based on the information provided by the Swedish authorities, the project has an internal rate of return (IRR) on investment of [...] % without aid and [...] % with aid. Moreover, without the aid, the project would generate a negative net present value (NPV), which increases to a value close to zero with aid. Without aid, the financial prospects of the project would therefore not be sufficient to compensate for the uncertainty and risks associated with its implementation.
- (83) The profitability calculations have been made considering a discount rate of [...] % during the experimental development phase of the project, calculated on the basis of a risk free rate plus a market premium and a risk premium based on the characteristics of the project. According to the Swedish authorities, the nominal risk free interest rate in Sweden is estimated to 3.3%, which was the average interest rate on Swedish government bonds (10 years) during 2009<sup>16</sup> and the market premium is estimated to be 5.5%<sup>17</sup>. Moreover, the profitability calculations also take into consideration the fact that the risks related to technological failures are significantly reduced after the completion of the research and development phase (i.e. after 2016). Therefore, the rate used to discount future revenues stemming from the subsequent commercial use of the demonstration plant (i.e. from 2017 to 2019) as well as its residual value is set at [...] % (slightly above the [...] % rate used by the company for non-risky projects). Over the whole period, the applicable weighted discount rate is therefore [...] %.
- (84) Although the risk of the project cannot be easily quantified in the case at hand, a discount rate (and necessary IRR) of [...] % is in line with return on capital required by Swedish venture capital firms. LinkMed, a company listed on the Nasdaq OMX developing life science companies, applies a 20% IRR to estimate the value of its holdings<sup>18</sup>. Moreover, it has been found<sup>19</sup> that the venture capital firms Industrifonden, Affärsstrategerna,

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<sup>15</sup> Available from Södra's website at <http://www.sodra.com/en/About-Sodra/Financial/>

<sup>16</sup> [http://www.scb.se/Pages/TableAndChart\\_32290.aspx](http://www.scb.se/Pages/TableAndChart_32290.aspx)

<sup>17</sup> Based on Frennberg, P. and B. Hansson (1992), "Swedish Stocks, Bonds, Bills and Inflation (1919-1990)", *Applied Financial Economics*, June 1992, v. 2, iss. 2, pp. 79-86, and a study by PriceWaterhouseCoopers [http://www.pwc.com/en\\_SE/se/assets/riskpremiestudie\\_2009.pdf](http://www.pwc.com/en_SE/se/assets/riskpremiestudie_2009.pdf) (in Swedish).

<sup>18</sup> LinkMed annual report 2008.

<sup>19</sup> Borg, G. and H. Eklund (2005), "Venture capital & jakten på den perfekta investeringen". Thesis at the School of Business, Economics and Law, Gothenburg University (in Swedish).

Investor Growth Capital, ChalmersInvest and Volvo Technology Transfer all consider an IRR in the range of 20-30% necessary on their investments.

- (85) In the view of the above, it can be considered that by providing the notified State aid, Sweden is raising the company's return on investment to the level that is necessary and sufficient to undertake the project, which is the level that would be required by a commercial investor, with due regard to the risk of failure and taking into account potential revenues from the investment until the end of the expected lifetime of the installation (i.e. until 2019).

#### 3.5.4. *Amount of investment and time path of cash flows*

- (86) High start-up investment, low level appropriable cash flows and a significant fraction of cash flows arising in the very long-term future are considered positive elements in assessing the incentive effect.
- (87) The total investment of the project will be SEK 675.2 million (ca. €73 million) over seven years. The high investment amounts will occur mainly during the first three years of the project. However, the risks during the trial and evaluation period are important, considering probable significant reductions of availability of the pulp mill, which may be such as to endanger the pulp mill's production as a whole. Moreover, the exact duration of construction and experimental operations is uncertain and there is a risk that operations will be delayed due to technical problems with construction and integration. Similarly, the period to reach availability and functioning integrated production may be extended. It is therefore far from certain that operations ever reach a period of subsequent commercial use.
- (88) As explained before, there is a concrete possibility that none of the forecasted revenues will ever materialise, whereas the costs of the project (being investment costs for the demonstration plant or costs linked to interruption of the main activity) can only increase. These characteristics of the project, closely related to its risks (detailed in section 3.4.1.2 above) and low level of profitability thus appear to justify the aid.

#### 3.5.5. *Continuous evaluation*

- (89) The Commission considers as positive element the existence of a mechanism of continuous evaluation of the projects, which define well-specified milestones that can lead to their termination in the event of failure and provide for publicly available ex-post monitoring.
- (90) The decision of the Swedish Energy Agency to grant the aid requires regular progress reporting. The aid instalments are subject to the submission of a status report and detailed accounting of the eligible costs in respect of which payment is sought. In addition, an annual report must be submitted, describing how the work is progressing and any deviations from the plan, as well as important results achieved during the project and, finally, the actual costs compared with budgeted amounts.
- (91) After the end of the project, a written final report must be submitted in to the Swedish Energy Authority. The data provided to the Swedish authorities will be used to verify *ex post* that the financial assumptions at the basis of the project's business plan were correct. Should this not be the case and the project has a higher profitability than expected (i.e.

should the IRR of the project be higher than [...] %), Sweden will recuperate the aid or part thereof by applying the claw-back mechanism detailed in point (108) below.

- (92) The information provided allows the Commission to conclude that the project under examination is subject to continuous evaluation.

### 3.5.6. *Conclusion on incentive effect*

- (93) On the basis of the above, the Commission can conclude that the aid has an incentive effect and ensures that the project takes place at all, given its high specific risks and financial perspectives.

## 3.6. **Proportionality of the aid and limitation to minimum necessary**

- (94) Section 5.1 of the R&D&I Framework sets out general conditions for analysing the proportionality of State aid for R&D projects. Compliance with these rules is examined in section 3.6.1 below, as regards research categories, in section 3.6.2 as regards eligible costs and in section 3.6.3 as regards the aid intensity.

- (95) The R&D&I Framework states that additional information is necessary to demonstrate the proportionality of aid above certain thresholds. In accordance with point 7.3.4 of the R&D&I Framework, the Commission verifies the requirement of the open selection procedure in section 3.6.4 and analyses in section 3.6.5 of the present decision the extent to which the notified aid is limited to the minimum necessary.

- (96) Finally, compliance with the cumulation rules set out in Chapter 8 of the R&D&I Framework is assessed in section 3.6.6.

### 3.6.1. *Categories of research activities*

- (97) In accordance with point 5.1.1 of the R&D&I Framework, the aided part of the research project must completely fall within one or more of the following research categories: fundamental research, industrial research, experimental development.

- (98) According to the Swedish authorities, the research and development activities conducted by Södra Cell consist of developing an industrial scale demonstration plant to produce sulphate lignin. The project will be based on an existing technology and installations which combined, shaped and improved will result in a new integrated process. The integration and scaling-up of the Lignoboost technology into the sulphate pulp mill (with a new combination of process stage) will therefore require a large degree of new development, design, adaptation, and optimization. The innovative nature of the project also relies on the post treatment of the lignin (handling, transportation, storage and drying), the development of the lignin burning in an existing lime kiln and the optimisation of the energy consumption of the whole plant.

- (99) According to point 5.1.1 of the R&D&I Framework, in its classification of different R&D activities, the Commission will refer to its own practice as well as to the Frascati Manual<sup>20</sup>. According to point 116 of the Frascati Manual, the construction and operation of pilot plants is part of R&D as long as its principal purposes are to obtain experience and to compile engineering and other data to be used in evaluating hypotheses, writing

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<sup>20</sup> The Frascati Manual on the Measurement of Scientific and technological Activities, Proposed Standard Practice for Surveys on Research and Experimental Development, Organisation for Economic Co-operation and Development, 2002.

new product formulae, establishing new finished product specifications, designing special equipment and structures required by a new process and preparing operating instructions or manuals on the process. In the case at hand, the principal purpose of the project is to obtain experience of the designing of special equipment and structures required by a new process and to prepare operating instructions or manuals on the process.

- (100) An examination of the activities to be undertaken during the project thus allow the Commission to conclude that they comply with the definition of experimental development given in point 2.2 (g) of the R&D&I Framework, which consist in acquiring, combining, shaping and using existing scientific, technological, business and other relevant knowledge and skills for the purpose of producing plans and arrangements or designs for new, altered or improved products, processes or services. The development of commercially usable prototypes and pilot projects is also included where, as in the case at hand, the prototype is necessarily the final commercial product and where it is too expensive to produce for it to be used only for demonstration and validation purposes. However, in line with the requirement of point 2.2 (g) of the R&D&I Framework, the revenue generated from a subsequent commercial use of the project is deducted from its eligible costs.

### 3.6.2. *The eligible costs*

- (101) The Commission has verified that the eligible costs specified in the notification are in line with the eligible costs listed in point 5.1.4 of the R&D&I Framework:
- personnel costs are included to the extent that researchers, technicians and other supporting staff are employed on the research project;
  - the only costs included for instruments, equipment, buildings and land are the costs corresponding to the life of the research project, as calculated on the basis of good accounting practise;
  - costs of contractual research, technical knowledge and patents are bought or licensed from external sources at market prices;
  - other operating expenses (including e.g. the costs of materials and consumable supplies for the experimental development phase).
- (102) The Commission can, therefore, conclude that the proposed aid is in compliance with points 5.1.1 and 5.1.4 of the R&D&I Framework.

### 3.6.3. *Aid intensity*

- (103) As described in point (30) above, the support for the project from the Swedish Energy Agency will amount to 22.9% of its eligible costs. This therefore complies with the provisions of the R&D&I Framework.

### 3.6.4. *Open selection procedure*

- (104) On 11 December 2008, the Swedish Energy Agency published a call for tender entitled “*Call for interest for demonstration and commercialisation of second generation biofuels and other energy technology*”, which attracted 39 responses of interest. The project under assessment as well as two other projects was selected for funding based on open, transparent and non-discriminatory criteria.

### 3.6.5. *Aid limited to minimum necessary*

- (105) In addition to the proportionality check, under point 7.3.4 of the R&D&I Framework the Commission assesses whether the aid is limited to minimum amount necessary for the implementation of the project in question.
- (106) The Swedish authorities calculated the aid with the intention of providing the minimum necessary support to trigger the project, defined as the amount that brings its NPV to zero (or close to it). In fact, a company would not undertake a R&D project without aid if the return on investment is not sufficient to compensate for its risk, i.e. if the IRR of the project is not at least equal to the capital costs of financing it incorporating the risk.
- (107) As described in point (83) above, the amount of the aid has been calculated on the basis of forecasted financial projections without aid, discounted at a weighted rate of [...] % ([...] % during the experimental development phase of the project and [...] % during its subsequent commercial use). However, since the said calculations are already based on a risk-adjusted analysis, the Swedish authorities consider that an aid amount leading to a positive expected NPV would be disproportionate, and thus limit the direct grant to the amount that yields an IRR that brings the project's NPV to zero (or close to it). The aid should accordingly create an incentive for the beneficiary to undertake the project while being limited to the minimum necessary.
- (108) Furthermore, this *ex-ante* calculation is coupled with an *ex post* evaluation linked to a claw-back mechanism. By the end of the project, the beneficiary has to submit audited reports to the Swedish authorities. If the actual *ex-post* net revenues of the project have been higher than expected and/or if its forecasted residual commercial value exceeds the value already deducted, the excess aid has to be repaid so that the *ex post* NPV is brought down to zero. In case of repayment, which is limited to the aid amount received for the project, interest will be applied from the date of the initial payment until the date of repayment.

### 3.6.6. *Cumulation*

- (109) According to Chapter 8 of the R&D&I Framework, aid ceilings shall apply regardless of whether the aid is financed entirely from State resources or is partly financed by the Community. The Swedish authorities have confirmed that the aid measure at hand cannot be cumulated with aid received from other local, regional, national or Community schemes to cover the same eligible costs. The conditions set out in Chapter 8 of the R&D&I Framework are thus met.

### 3.6.7. *Conclusion*

- (110) In view of the above, the Commission finds that the aid is proportionate and limited to the minimum necessary.

## **3.7. The distortion of competition and trade**

- (111) As set out in section 7.4 of the R&D&I Framework, the Commission focuses its analysis of the distortions of competition on the foreseeable impact of the aid on competition between undertakings in the product markets concerned. The relevant markets for the case at hand are identified in section 3.7.1 below.
- (112) In the following sections, the potential effects of the aid on these markets will be

analysed. As set out in point 7.4, fifth paragraph, of the R&D&I Framework there are three distinct ways in which R&D aid can distort competition in product markets: it can distort the dynamic incentives of market players to invest, so called *crowding out* effect (section 3.7.2), it can create or maintain positions of market power (section 3.7.3) and it can maintain an inefficient market structure (section 3.7.4).

- (113) Moreover, it is stated in point 7.4, third paragraph, of the R&D&I Framework that in certain cases the results of R&D (e.g. intellectual property rights) are themselves traded in technology markets, for instance via patent licensing. In such cases, the Commission may also consider the effect of the aid on competition in these markets.

### 3.7.1. *Identification of the affected markets*

- (114) The project under assessment is based on the LignoBoost technology and consists of research and development activities concerning its integration into an existing pulp mill, with a view to the production of sulphate lignin from pulp mill residue material, i.e. black liquor. If successful, the project will allow replacing fossil oil in the pulp mill's lime kilns with sulphate lignin as a source of renewable energy.
- (115) In accordance with the information provided by the Swedish authorities, sulphate lignin constitutes an entirely new product which does not exist on the market. Sulphate lignin may replace fossil fuels such as oil, coal or gas used in lime kilns of pulp mills or in power and heat plants, provided that accurate facilities are used (boiler technique, environmental equipment etc.).
- (116) With reference to the specific features of the product, the Swedish authorities underline that sulphate lignin with high dry content (95% ds) has a high heat value, which means a high risk of dust explosions when handling. Because of the risk of explosion, it is more likely that sulphate lignin will be sold on the market with a lower dry content (65% ds)<sup>21</sup>. Considering that fuel with low dry content can not be transported longer distances and taking into account the cost of transport, sulphate lignin produced at Södra Cell Mörrum will unlikely reach outside the region of southern Sweden. If however the risk of explosion of sulphate lignin with high dry content is handled to become limited then the area of transport might increase due to the heat value being approximately 35 % higher.
- (117) Sulphate lignin will contribute to the reduction of the fossil carbon dioxide emissions, although, as described in point (15) above, it cannot be considered as biofuel, in the meaning of the Directive 2009/28/EC but rather as a source of a renewable energy. According to the Swedish authorities, sulphate lignin as a renewable energy source will not primarily compete with biofuels (or other renewable energy), but rather with fossil fuels, such as oil, coal and gas.
- (118) The Swedish authorities underline that the production volume of sulphate lignin will be determined by the production capacity of the relevant pulp mill, i.e. by the availability of the black liquor constituting a residue material obtained within a pulp mill production process. The production of sulphate lignin will not therefore influence the input market of black liquor.
- (119) As to the project at hand, it will not lead to an increase of the mill's pulp production capacity. The integration of the LignoBoost technology will only affect the "recovery

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<sup>21</sup> With a lower dry content the heat value of the sulphate lignin would be 17 Mj/kg instead of 26 Mj/kg (95% ds).

side” of the mill’s operations. An increase of the pulp production capacity would require further investment in its core activity operations and it is not envisaged within the framework of the project. Consequently, the project will not influence the input market of the pulp production, e.g. the market of timber.

- (120) The Swedish authorities moreover informed the Commission that sulphate lignin might constitute a raw material for green chemicals and materials, such as phenols, carbon fiber, binders, dispersans, and activated carbon. However, the development of such new environmentally friendly applications cannot be triggered until sulphate lignin is available in significant quantity on the market.
- (121) In the view of the project's objectives and requirements, the Commission does not consider that its outcome will affect the market of pulp, black liquor or timber. In addition, the Commission considers as premature to consider the market of the green chemicals and materials as an affected market for the assessment of the impact of the present project.
- (122) Therefore, for the purposes of the assessment of possible distortions of competition and trade, the Commission considers that the project, if successful, will enable the production of a new product i.e. sulphate lignin, which can be seen as a substitute for fossil fuels. Considering however that sulphate lignin will replace fossil oil in the pulp mill's lime kilns, the market for fossil oil shall be considered as the relevant one for the purposes of the measure under assessment.
- (123) Moreover, taking into account that the project will also prove the technical and economic viability of the LignoBoost technology, the Commission considers that some technology markets could be potentially affected by the notified aid.
- (124) Taking the above into consideration, the impact of the aid has to be examined on the relevant market oil (section 3.7.1.1) as well as on the relevant technology markets (section 3.7.1.2). The above outlined definitions of relevant markets will be subject to a forward-looking analysis focusing, on the one hand, on the use of the product and on the substitutes from a demand perspective (the product market) and, on the other hand, on the most appropriate delimitations of that market from a geographical dimension (the geographical market).

#### **3.7.1.1. Oil market**

- (125) Crude oil is a fossil fuel constituting together with coal and natural gas non-renewable sources of energy. In 2007 oil was the world’s primary source of energy (36 %), followed by coal (27.4%) and natural gas (23%) and amounting to an 86.4% share for fossil fuels in primary energy consumption in the world<sup>22</sup>.
- (126) Global oil consumption has increased by 20% since 1994, and global oil demand is projected to grow by 1% per year. The International Energy Agency estimates in its World Energy Outlook 2010 that oil will remain the dominant fuel in the primary energy mix to 2035. Nonetheless, its share of the primary fuel mix will start to diminish as higher oil prices and government measures to promote fuel efficiency lead to further switching away from oil in all sectors.
- (127) According to the "Energy in Sweden 2009" report prepared by the Swedish Energy

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<sup>22</sup> According to U.S. Energy Information Administration (EIA).

Agency in 2008, oil provided 31.7% of Sweden's energy supply<sup>23</sup>, less than EU average which was 37 %<sup>24</sup>.

- (128) As indicated in point (23) above, once the full-scale demonstration plant in Södra Cell Mörrum reaches its full capacity, it is expected that approximately 40,000 tonnes of sulphate lignin will be produced per year. Approximately 28,000 tonnes will be used for Södra Cell Mörrum own lime kilns constituting an equivalent of 16,500 m<sup>3</sup> of oil. The remaining production of 12,000 tonnes, an equivalent of 7,071 m<sup>3</sup> of oil, would be sold to other users such as pulp mills and other industrial customers and combined power and heat producers.
- (129) According to the Swedish authorities, if sulphate lignin were to replace 100% of the fossil oil used in lime kilns of Swedish pulp mills, the fossil oil consumption in Sweden would decrease by approximately 210,000 m<sup>3</sup> annually. The total Swedish delivery volume of the fossil oil was 13 million m<sup>3</sup> in 2008<sup>25</sup>.
- (130) The Swedish authorities underline moreover, that the corresponding decrease in EU consumption of fossil oil, if all pulp mills that could theoretically do so implement the LignoBoost technology and replace fossil oil in their lime kilns with sulphate lignin, would be approximately 0,97 million m<sup>3</sup> out of the total EU market of 753 million m<sup>3</sup><sup>26</sup>. Consequently, a 100% replacement of the fossil oil used in lime kilns would decrease the delivery of the fossil fuel in Sweden by 1.6% and by 0.28% in the EU. The Swedish authorities underline that since not all mills are ever likely to implement the LignoBoost technology the effect on the oil market shall be therefore even smaller.
- (131) With reference to the geographical market, it must be underlined in view of point (116) above that sulphate lignin when (and if) produced at Södra Cell Mörrum will in principle not reach outside the region of southern Sweden. However, as for other similar energy sources, the scale of production affects the potential geographic reach of the product and it is not excluded that in the future sulphate lignin could be sold on further reaching market (at least European).
- (132) In the view of the above, the possible effect of the replacement by sulphate lignin of the fossil oil used in lime kilns of pulp mills in Sweden and in the EU as well as its other industrial use shall be considered as negligible. The same applies to the eventual replacement by sulphate lignin of coal or gas taking into account in particular that it might require additional technical adaptations allowing for such a replacement.

### 3.7.1.2. Technology markets

- (133) The project under assessment is based on the already patented niche technology concerning the production of sulphate lignin from pulp mill residue material (black liquor), i.e. LignoBoost technology. The purpose of the project is to bring this technology to the market and stimulate its take off. At present there are approximately 91 sulphate mills in Europe and 403 world-wide<sup>27</sup> which could potentially use the LingoBoost technology.

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<sup>23</sup> Energy in Sweden 2009, page 116.

<sup>24</sup> According to the Market Observatory for Energy prepared by the European Commission.

<sup>25</sup> According to the Swedish Petroleum Institute.

<sup>26</sup> BP (British Petroleum) estimates the overall oil market in Europe and Eurasia at approximately 1,027 million m<sup>3</sup> in 2008: <http://www.bp.com/sectiongenericarticle.do?categoryId=9023771&contentId=7044470>.

<sup>27</sup> Jaakkoo Pöyry, status as of March 2010.

- (134) The Swedish authorities emphasize that there are numerous research and development initiatives which target pulp industry with the aim to transform pulp mills into bio-refineries able to produce renewable energy from its own residue materials. Such technologies concern in particular: (i) alternative ways of lignin extraction through *ultrafiltration*, (ii) production of second generation biofuels through the black liquor *gasification*, (iii) production of biogas through anaerobic digestion of activated sludge, (iv) new recovery boilers, including new steam systems and turbines, with higher pressure and efficiency and finally (v) research and development projects concerning production of tall oil.
- (135) According to the Swedish authorities, companies exploring the market for black liquor recovery technology are in particular: Chemrec AB, Andritz AG, Metso Oy, Mitsubishi Heavy Industries Kawasaki and Babcock & Wilcox. Most of them are large and well-diversified undertakings or have partnered with industrial partners to carry out their research and development projects and have therefore solid positions in the technology fields of lignin and black liquor recovery. The choice of the relevant technology will depend on the individual mill characteristics of the given pulp mill. Sulphate lignin production should be seen as an alternative to the other technologies listed above. That market is global.
- (136) In the view of the above, and also taking in consideration that Södra is currently not active on the technology markets, the effect of the aid on such markets does not appear as significant. On the contrary, instead of enabling Södra to acquire any relevant market share, the aid will normally reduce the level of uncertainty concerning the LignoBoost technology within the pulp mill sector across Europe and globally, thus facilitating its industrial use. Moreover, it has to be noted that the envisaged aid could also prompt further research activities in new areas concerning in particular use of sulphate lignin as a source for green chemicals and materials.

### 3.7.2. *Distorting dynamic incentives*

- (137) According to the R&D&I Framework, the main concern related to R&D aid to undertakings is that competitors' dynamic incentives to invest are distorted. When an undertaking receives aid, this generally increases the likelihood of successful R&D on the part of this undertaking leading to an increased presence on the product market in the future. This increased presence may lead competitors to reduce the scope of their original investment plants (crowding out).
- (138) In its analysis of the potential distortion of dynamic incentives, the Commission considers the following elements: aid amount, closeness to the market, open selection process, exit barriers, incentives to compete for the future market and product differentiation and intensity of competition on the market.

#### 3.7.2.1. Aid amount

- (139) In total, the nominal aid amount is SEK 90 million (ca. €9.8 million) over a period of three years. Insofar as, as shown in point (134) above, several technologies are being developed with reference to the black liquor recovery and the project could contribute to research activities in new areas, such aid amount is therefore not likely to dissuade any renewable energy supplier to further invest in research. It is, on the contrary, possible that the aid will trigger similar, complementing R&D projects in this field.

### 3.7.2.2. Closeness to the market

- (140) The more the aid measure is aimed at R&D activity close to the market, the more it is liable to develop significant crowding out effects.
- (141) Considering that the experimental development activities represent 100 % of the project's total eligible costs and taking into account that the demonstration plant can be operated commercially after its completion, the project shall be considered as close to the market. Nevertheless, the project has a long duration and with respect to its product, i.e. sulphate lignin, there is not yet an established market. Moreover, given the fast growing, large market and the alternative technologies being developed in parallel, it can reasonably be considered that other companies will not abandon or reduce their R&D investments.

### 3.7.2.3. Open selection process

- (142) As mentioned in point (104) above, the Commission notes that the aid beneficiary was selected after an open and transparent selection process based on objective criteria. Instead of having distorted the dynamic incentives on the market, the selection process can therefore be deemed to have encouraged competition between companies active on the market of renewable energy technologies.

### 3.7.2.4. Exit barriers

- (143) Point 7.4.1 of the R&D&I Framework indicates that the existence of exit barriers may reduce distortions of competitors' dynamic incentives. The reason is that competitors are more likely to maintain (or even increase) their investment plans when exit barriers to the innovation process are high. This may be the case when many of the competitors' past investments are locked into a particular R&D trajectory.
- (144) In the case at hand, the fast developing large markets of renewable energy and second generation biofuels *sensu largo* and technology market for black liquor recovery *sensu stricto* are highly specialized and already advanced. As indicated in point (134) above, several technologies concerning pulp mill industry are under development. It cannot be excluded that some of those technologies can be actually complementary to each other. With the long term commitment the companies mentioned have made to these projects, it is even more unlikely that they would abandon their current projects as a result of the success of the project under assessment<sup>28</sup>. Therefore it can reasonably be considered that the competitors will not abandon or reduce their R&D investments, irrespective of the aid to the project or its success. Moreover, the aid being subject of this decision should further incentivise the market players to innovate.
- (145) Consequently, the Commission concludes that the exit barriers on the relevant markets make any crowding out effect of the aid less likely to occur.

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In this context, the Swedish authorities moreover underline that several companies in Sweden (Stora Enso, Weyerhaeuser, Aracruz, Mercer, UPM) are involved in lignin related research within the scope of the Biorefinery II cluster managed by Innventia AB. Furthermore, the initiative LigniMatch is a project that reviews research activities done over the years and also involves such industry players like Stora Enso and Borregaard Lignotech.

### **3.7.2.5. Incentives to compete for a future market**

- (146) R&D aid may lead to a situation where competitors to the aid beneficiary renounce competing for a future market, because the advantage provided by the aid (in terms of the degree of technological advance or in terms of timing) reduces the possibility for them to profitably enter this future market.
- (147) In this case, the Commission estimates that there is no such significant risk insofar as the product resulting from the aided R&D activities, i.e. sulphate lignin is an entirely new product which does not exist on the market but has a significant potential for additional innovation with reference to new, alternative applications. Such applications might concern in particular "green" chemicals and materials based on sulphate lignin and in particular the use of lignin as a primary component in carbon fibre, i.e. for lightweight constructions with focusing on the transport sector. Therefore the incentive to compete for future markets should not significantly be affected by the aid.
- (148) Moreover, as mentioned in point (50) above, Södra Cell will not be able to appropriate all innovations generated by the R&D undertaken in the context of the project. The knowledge spill-overs of the project will affect the whole sector and may therefore positively contribute to the dynamics of the market.
- (149) For these reasons, the Commission estimates that there is no significant risk that the aid will discourage competitors to compete either for black liquor recovery technologies or on the market of renewable energy in the future.

### **3.7.2.6. Product differentiation and intensity of competition**

- (150) According to point 7.4.1 of the R&D&I Framework, where product innovation concerns developing differentiated products related, for example, to distinct standards or technologies, and when there are many effective competitors on the market, competitors are less likely to be affected by the aid.
- (151) It should be noted that large multinational groups, with important innovation potentials, are already established on the European energy markets. Consequently, at least in the medium to long-term, numerous companies will be able to position themselves as effective competitors with reference to product and technology market under assessment. This could in particular be in the form of other methods for black liquor recovery or of future use of sulphate lignin as a raw material for "green" chemicals and materials.
- (152) Therefore, it is unlikely that the aid will stifle the intensity of competition.

### **3.7.2.7. Conclusion**

- (153) Taking into account the amount of aid granted to Södra Cell, the intensity of competition on the market of fossil fuels, renewable energy and technologies for black liquor recovery, the related incentives to compete for future markets, and the new and highly differentiated product that will result from the project, it can be considered that the aid will not have the effect of distorting the dynamic incentives of the market.

### *3.7.3. Creating market power*

- (154) As mentioned in point 7.4.2 of the R&D&I Framework, aid in support of R&D&I may have distortive effects in terms of increasing or maintaining the degree of market power

in product markets. Market power is the power to influence prices, output, the variety or quality of goods and services, or other parameters of competition on the market for a significant period of time, to the detriment of consumers.

- (155) The Commission is concerned mainly about those R&D&I measures allowing the aid beneficiary to transfer or strengthen market power held on existing product markets to future product markets. The Commission is therefore unlikely to identify competition concerns related to market power in markets where each aid beneficiary has a market share below 25 % and in markets with a market concentration with Herfindahl-Hirschman Index (HHI) of below 2000.
- (156) In its analysis of creation of market power, where relevant the Commission takes into account the following elements: market power of aid beneficiary and market structure, level of entry barriers, buyer power and the selection process.

#### **3.7.3.1. Market power of the beneficiary and market structure**

- (157) Where the recipient is already dominant on a product market, the aid measure may reinforce this dominance by further weakening the competitive constraint that competitors can exert on the recipient undertaking. Similarly, State aid measures may have significant impact in oligopolistic markets where only a few players are active.
- (158) The relevant markets identified above are the oil market, which should be assessed at a national and European level, and the technology markets for black liquor recovery, which should be analysed at a global level.
- (159) As regards the project under assessment, neither Södra Cell nor Södra have any market share in the fossil oil market or in any other fossil fuels markets, such coal or gas.
- (160) With reference to the technology markets, the Swedish authorities underline that neither Södra Cell nor Södra are technology providers. Moreover, according to the Swedish authorities, considering that the project is based on already patented technology, any IPR resulting from it shall be very limited. Furthermore, any such IPR would be widely licensed to third parties, since one of the aims of the beneficiary is to stimulate the market for sulphate lignin as a source of renewable energy to take off. With reference to the non-appropriable knowledge which can be expected from the project, it will be widely disseminated to universities and research institutions, as well as within the industry, as described in section 3.4.1.1 above. The results from the project will, therefore, to a large extent stimulate further research concerning sulphate lignin.

#### **3.7.3.2. Level of entry barriers**

- (161) In the field of R&D, significant entry barriers may exist for new entrants. These barriers include legal entry barriers (in particular intellectual property rights), economies of scale and scope, access barriers to networks and infrastructure, and other strategic barriers to entry or expansion.
- (162) According to the Swedish authorities, there is a "*waiting game*" in the relevant markets, meaning that competing companies are waiting for the technology to be proven before they invest. Due to the risks and costs involved in the project and the fact that the eventual knowledge to be acquired during its implementation can only to a very limited extent be protected by intellectual property rights, if at all, the industry players are not

willing to carry out the necessary R&D themselves. Therefore, a successful completion of the project could rather contribute to lower the present barriers by contributing to the development of the market and proving the potential commercial viability of the LignoBoost technology.

### **3.7.3.3. Buyer power**

- (163) With reference to the project under assessment, the Swedish authorities underline that the produced sulphate lignin will primarily be used as source of renewable energy by the beneficiary who will replace fossil oil at Södra Cell Morrum's own lime kilns. Only the excess of the produced lignin will be sold to the industrial customers such as combined power and heat producers that currently use fossil fuels. Markets for fossil fuel are already well established with strong operators and with high buyer power.

### **3.7.3.4. Conclusion**

- (164) Taking into consideration that neither Södra Cell nor Södra have any market share in the fossil fuels markets and the limited intellectual property rights that are expected to arise from the project, the expected growth of the market and the strong buying power of potential customers, the aid does not seem likely to create or maintain any significant market power in favour of either Södra Cell or Södra.

### **3.7.4. Maintaining inefficient market structures**

- (165) R&D aid must not support inefficient undertakings and thus lead to market structures where many market players operate significantly below efficient scale. In its assessment of the market structure, the Commission will consider whether the aid is granted in markets featuring overcapacity, in declining industries or in sensitive sectors. Concerns are less likely in situations where State aid for R&D aims at changing the growth dynamics of the sector, notably by introducing new technologies.
- (166) In the case under assessment, the aid is granted to Södra Cell a company with steady revenue in recent years. Södra Cell annual report showed operating profit of SEK 406 million (ca. €44.3 million) for year 2009. Södra Cell is not a company in difficulties. Therefore Södra Cell cannot be considered to be an inefficient undertaking and as a consequence the aid does not contribute to maintaining an inefficient market structure.
- (167) Moreover, given that the concerned product, i.e. sulphate lignin constituting a source of renewable energy, as well as the concerned market of technology relate to growing markets and not markets with overcapacity in declining industries, the aid does not lead to maintaining inefficient market structures.
- (168) The Commission hence concludes that there are no indications that the aid would contribute to maintaining inefficient market structures. On the contrary, it could even create an incentive for stronger competition on the market.

## **3.8. Balancing test**

- (169) Pursuant to section 7.5 of the R&D&I Framework, the Commission balances the effects of the measure in light of the positive and negative elements assessed above and determines whether the resulting distortions adversely affects competition and trading conditions to an extent contrary to common interest.

- (170) Following a detailed assessment, the Commission considers that the project suffers from market failure since the market would not deliver the same outcome without aid mainly because of imperfect and asymmetric information linked to the level of related technological, financial and market risks, and knowledge spill-overs in terms of non-appropriable and disseminated R&D results. It can thus be considered that State aid is necessary for the project to be carried out and has a clear incentive effect. Moreover, the envisaged State aid appears to be proportionate and limited to the minimum necessary.
- (171) Due to the number of players on the technology market, and considering that neither the beneficiary nor its sole shareholder is a technology provider or holds a market share on the fossil fuels market, the negative effects of the aid are limited. The aid measure does not support the creation of a position of power nor maintain inefficient market structures.
- (172) Under these circumstances, since the positive effects of the measure significantly outweigh its negative effects, the Commission concludes that the result of the balancing test for the aid under assessment is positive.

#### **4. DECISION**

- (173) The Commission considers the aid compatible with the TFEU on the basis of Article 107(3)(c) thereof and has accordingly decided not to raise objections to the implementation of the notified measure.
- (174) The Commission reminds the Swedish authorities of their obligations to submit an annual report on implementation of the aid.
- (175) The Commission further reminds the Swedish authorities that, in accordance with Article 108 (3) of the TFEU, all plans to alter the project must be notified to the Commission.

If this letter contains confidential information, which should not be disclosed to third parties, please inform the Commission within fifteen working days of the date of receipt. If the Commission does not receive a reasoned request by that deadline, you will be deemed to agree to the disclosure to third parties and to the publication of the full text of the letter in the authentic language on the Internet site:

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Yours faithfully,  
For the Commission

*Joaquin Almunía*  
Vice-President