DNV Climate Change Services

Third Party Assessment of the Comprehensive Refurbishment of the Prunéřov II Power Plant

Draft Report for the Ministry of the Environment of the Czech Republic

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Summary:

DNV was contracted by the Ministry of the Environment of the Czech Republic to conduct an independent assessment of the refurbishment project of the Prunéřov II power plant, as proposed by Čez a.s. in June 2008. The scope of work was limited to a technical and environmental evaluation of the proposed project, and did not include economical or strategic analyses, comparison of alternative scenarios, or the formulation of recommendations.

A team of four international experts, supported by a local expert, conducted the work during February – March 2010. The assessment was divided in three parts:

- In Part A, all relevant project aspects were compared against the BAT requirements of the LCP- and the EE-BREF. For each requirement, compliance was discussed and a more in-depth analysis was performed for deviations.
- Part B comprises two parts, i.e. the evaluation of the EIA procedure on the one hand, and the evaluation of the EIA report on the other.
- The impact of deviations from BREF in terms of CO_2, as observed in Part A, was calculated in Part C.

The proposed project complies with nearly all requirements of the LCP and the EE BREF. Deviations from the BREF were observed in terms of the proposed net unit efficiency and CO-emission. The technical information provided did not support the deviations from BREF.

The EIA procedure for the project was conducted in line with the requirements of the applicable act, and was done in a transparent manner. The EIA report adequately shows improvement of the environmental quality for most factors and areas. Items of concern are: local deterioration of air quality, the absence of the asbestos and contaminated land survey data in the project documentation, and inconclusive information on potential seepage from energy by-products.

The CO_2-impact of the deviation from BREF was quantified based on the EU ETS MRG approach.

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Executive Summary

In June 2008, Čez a.s. submitted a proposal for the comprehensive refurbishment of three of the five blocks of the Prunéřov II Power Plant to the Ministry of the Environment (MoE).

The scope of the refurbishment includes renewal of all core process components of the facility, as well as an upgrade of the common fuel, limestone and residue handling systems.

The MoE contracted DNV to provide an independent assessment of the technical and environmental aspects of the proposed project, with as primary objectives:

- To assess compliance of the proposed project against BREF, and to evaluate if local technical grounds could justify deviations from BREF,
- To evaluate the EIA of the project, and to compare it to best practice within Europe, and
- To quantify the impact of deviations from BREF in terms of CO_2 emissions.

Correspondingly, the assessment was split in three parts.

DNV's scope was limited to a technical and environmental evaluation of the proposed project, and excluded economical analyses, comparison of alternatives, or the formulation of recommendations.

The work was performed in February – March 2010 by four international DNV experts, supported by one local DNV expert.

The conclusion of the first part of the assessment is that the proposed project complies with most requirements from the relevant BREF documents. Two non-compliances were observed. First, the proposed net unit efficiency of 40% is below the minimal requirement of 42%, and the corresponding local technical grounds to support this deviation have insufficiently been explored. Although outside of the scope of the current assessment, significant economical and strategic considerations in this respect have been highlighted. Second, the proposed emission limit for CO of 250 mg/Nm³ exceeds the BAT ELV of 200 mg/Nm³, with insufficient technical grounds to support this deviation.

The conclusion of the second part of the assessment is that the EIA process for the proposed project was in line with the legal requirements, and that adequate transparency was provided. With respect to the EIA documentation, only a basic assessment of other alternatives is included before ruling them out. This is not good practice, but it is consistent with what is seen in many EIA's. However, at the request of the MoE and other stakeholders, more detailed information was provided to justify why a higher efficiency alternative was not considered further. This more detailed information would normally in terms of its extent and type satisfy the requirements of EIA for the justification of submitting only one alternative. However, the adequacy of ČEZ' arguments in terms of their content and quality is appraised in detail in the first part of this assessment. With regard to the key environmental issues, DNV agree with the EIA Documentation that for most impact generating factors and impact receiving areas, the project leads to improved environmental quality compared against the reference situation. Issues of concern are the local deterioration of air quality close to the EPR II plant, the absence of the asbestos and contaminated land survey data in the project documentation, and the insufficient evidence regarding the acceptable future impact from seepage water from the stabilised EBP.

Finally, in the third part of the assessment, the impact in terms of CO_2 emission of the deviation from the BAT-requirement on net unit efficiency was calculated by means of the method prescribed by the EU ETS MRG. For stable operation during 6,300 hours per year at nominal capacity of all three of the refurbished blocks (i.e. a total electrical capacity of 3 x 250 MW_{el}), the impact in terms of CO_2 emission is calculated as 205,082 tons of CO_2 per year.

Contents

1. Introduction

In June 2008, Čez a.s., the state-owned energy company in Czech Republic, submitted a proposal for the comprehensive refurbishment of three of the five blocks of the Prunéřov II Power Plant to the Ministry of the Environment (MoE). The Prunéřov II Power Plant was taken into operation in 1981-82 and is nearing the end of its lifetime.

The refurbishment project aims to extend the lifetime of three of the five blocks, allow for the further use of nearby lignite reserves, improve energy efficiency, reduce emissions, and ensure meeting contractual obligations regarding the delivery of heat. During the project, all key components related to the combustion, the heat recovery, the electricity production, and the flue gas cleaning, will be replaced by new components.

The Prunéřov plant constitutes the 18th largest single emitter of CO_2 in Europe and, as a result of the raising awareness on Climate Change, the project has attracted significant attention form various stakeholders. Illustrative of this is the request from the Federated States of Micronesia for a transboundary EIA to assess the degree to which the project could endanger them due to increased greenhouse gas emissions.

To support the permitting decision in this important case, the MoE contracted DNV to formulate a third party opinion on the technical and environmental information and arguments that were submitted by the investor and by other stakeholders related to the proposed project.
The primary objectives of DNV's work are to:

- Assess compliance of the proposed solution to relevant Best Available Techniques Reference Documents (so called BREFs) and specifically evaluate whether deviations can be justified based on technical and/or environmental arguments linked to local conditions,
- Evaluate the Environmental Impact Assessment (EIA) that was submitted by the investor and to compare it to best practice within Europe, and
- Quantify the impact of potential deviations from BREF in terms of CO_2 emissions over the proposed lifetime of the project.

In line with these objectives, the scope of work of the project was split in three parts:

- Part A: BREF Compliance Assessment
- Part B: EIA Evaluation
- Part C: Calculation of the CO_2 Impact

The bulk of the work, including two site visits, was conducted during February – March 2010, by a team of four international experts, supported by a local Czech expert. In order to ensure quality and to produce results in a timely manner, the experts worked in pairs on all of the above listed parts of the work. Prior to the release of the report and in line with DNV's standard procedures, an internal peer review of the work was conducted.

DNV is an independent foundation since 1864 and is specialised in, among other activities, conducting third party assessments on technical, environmental and managerial aspects. In its history, DNV has provided this type of service for other highly publicised cases such as, for example, the Brent Spar investigation. For more information on DNV, please visit www.dnv.com.

Section §2 of this document contains a more detailed description of the proposed refurbishment project and its context. DNV's assessment approach is described in §3, which has been structured in line with the three Parts that were identified above. The assessment team is briefly introduced in §4. The adopted methodology and the chronology of the actual project are discussed in §5, while §6 provides an overview of the documents that were taken into account during the assessment. Finally, the results of the assessment are included in §7 and the conclusions are formulated in §8.

In order to increase the reading and interpretation of the report, all substantial tables and calculations have been included in Annexes.

2. Situation

At present the Prunéřov power plant, located on the western bank of the North-Bohemian coalfield in the vicinity of Chomutov, comprises two parts, i.e. EPR I and EPR II. Both units run on lignite coal (lignite) from a nearby mine.
Originally, EPR I consisted of six 110 MWel units, first taken into operation in 1967-68, but two of them were decommissioned and dismantled in the 1980's. Similar to other lignite and coal fired power plants, the remaining units were retrofitted with SO_2 scrubbers in the mid 90's. The net unit efficiency of the remaining units with respect to electricity production is approximately 30.5%.
EPR II, which constitutes the focus of the project, consists of five 210 MWel units, which were first taken into operation in 1981 – 1982. In 1996, all units were retrofitted with limestone based wet scrubbers to ensure proper SO_2 emission control. Dust removal is achieved by means of four field electrostatic precipitators (60 kV), located between the air pre-heater (Ljungström at the end of the boiler) and the wet scrubbers. Each unit is equipped with a two-draft natural circulation boiler (superheated steam of 540℃ & 128 bar, reheated steam of 540℃ & 25 bar (design v alues)), with an efficiency of 88%. A dry bottom ash furnace (definition as in [1] p 30) with 8 pulverised lignite burners and 8 natural gas start-up burners is located at the bottom of the first draft. All units operate entirely separately from each other and are equipped with their own steam-condensate cycle and condensing turbine. The main common parts for the units are the fuel unloading and storage, the limestone unloading, storage and preparation, the residue handling and transport, and the cooling towers. The latter are operated by means of water from the local river Ohře. In addition to the production of electricity, also district heating is supplied to the neighbouring urban agglomerations of Klášterec nad Ohří, Chomutov and Jirkov. For this purpose, steam is extracted from the turbine and the district heating water is heated by means of heat exchangers. In a purely condensing operating mode, i.e. no heat supply, the current net unit efficiency of EPR II is 32.8%. The availability of the plant lies in the range of 6500 to 7000 hours per year. All residues from the plant, i.e. slag, fly ash, gypsum and wet scrubber waste water, are currently mixed and returned to the nearby lignite mine for re-use as stabilization product.
Operational data from 2007, 2008 and 2009, supplied by the investor in project documents 71, 72, 73, 74 and 79 (see Annex I), indicate that the units are operating in a stable manner with typical emissions (yearly average for 2009) of:

- SO_2 470 – 540 mg/m³
- NO_x 560 – 570 mg/m³
- CO 18 – 22 mg/Nm³

The Prunéřov II power plant uses lignite from the Severočeské doly a.s. company. It is transported by train in self-discharging wagons over an approximate distance of 8 km.
According to project document 79, actual average lignite quality in 2009 was:

- heating value (LHV) in MJ/kg 11,3
- water content in %mass 33,7
- ash content in %mass 22,0
- sulphur content in % mass 1,6

The scope of the project which is the subject of the current third party assessment, is defined in project document 57 (see Annex I) as "the reconstruction of the Prunéřov II power plant, consisting of the reconstruction of three existing production blocks of 210 MWel per unit."

The primary purpose of the project, as described in project document 57 (see Annex I), is to:

- extend the useful life of the three blocks with a period of 25 to 30 years,
- improve electricity generation efficiency,
- reduce pollutant emissions,
- implement a technical solution providing optimum block performance while maintaining the existing steel structures of the boiler and the boiler room, and
- maintain the supply of heat to external customers using only the capacity of the three renewed blocks.

The reconstruction project comprises the following activities:
- upgrading and maintenance to the existing lignite unloading, handling and transport system
- upgrading and maintenance to the existing limestone unloading, handling, and transport system (including enclosing the limestone stockpile)
- refurbishment of the existing lignite mills with redesigned classifiers, new motors and hydraulic controls
- replacement of the three existing boilers, including combustion chamber and lignite burners by three once-through boilers (Benson boilers) with higher steam parameters
- partial replacement of the turbine
- installation of new electrostatic precipitators for dust removal
- installation of new wet scrubbers for SO_2 removal
- complete replacement of the automatic control system for the entire facility
- partial replacement and modernisation of electrical equipment
- introduction of cleaned flue gas in the reconstructed cooling towers

The three refurbished blocks of EPR II will have an increased unit capacity of 250 MW_{el}, supplied by a two-draft once-through boiler with 575℃ & 183 bar as superheated steam parameters and 580℃ & 37 bar as reheated steam parameters. The efficiency of the boiler will be in excess of 90%. Along with the new boilers, a new combustion chamber will be implemented, equipped with low-NO_x burners. Additional primary measures to control NO_x emissions include staged combustion, low air-excess, and flue gas recirculation. The net unit efficiency of the new blocks in full condensing mode, i.e. without supply of heat, was originally projected as 38.17%, but later revised by the investor to 39.06% (using the definition of the investor).
In terms of pollutant emissions, following limits have been proposed:

- dust	20 mg/Nm³
- SO_2	200 mg/Nm³
- NO_x	200 mg/Nm³
- CO	250 mg/Nm³

After completion of the project, EPR I is expected to keep running on all four blocks, but with a limited operating time of 2800 hours/year. The two unreconstructed blocks of EPR II will be operated with an annual use of 3200 hours/year, while the three reconstructed units of EPR II will run for 6300 hours/year (see also project document 57). While it is the intention to shut down EPR I and the unreconstructed blocks of EPR II in the future, no clear indication was given with respect to the timing of their decommissioning.

3. Assessment Approach

In line with the three objectives of the third party assessment, the scope of work was split in three parts, i.e. part A, part B and part C (see also §1.). Each of these parts is discussed below.
Note that part A and C are related, and separate from part B.

3.1. Part A – BREF Compliance Assessment

According to the IPPC Directive [4], projects throughout Europe need to ensure that Best Available Techniques (BAT) are employed. Typically, IPPC Reference Documents for Best Available Techniques (BREF) are used to verify compliance with this requirement.

For the current project, two relevant BREF's have been used:

1. IPPC Reference Document on Best Available Techniques for Large Combustion Plants (version of July 2006; http://eippcb.jrc.es/reference/lcp.html), see [1]
2. IPPC Reference Document on Best Available Techniques for Energy Efficiency (version of February 2009; http://eippcb.jrc.es/reference/ene.html), see [2]

During Part A, the proposed project was compared on a point-by-point basis with all relevant principles and concepts (Chapter 2 in [1]), currently applied techniques (§4.1 in [1]), techniques to consider when determining BAT (§4.4 in [1]) and the actual BAT-requirements (§4.5 in [1]) of the BREF LCP. For the BREF EE, use was made of the comparison table between BREF EE and BREF LCP (§3.1, Table 3.2, p117-119). For each relevant point, an opinion was formulated and documented.
For the cases in which the proposed project was not compliant with a relevant BAT-requirement of any of the above BREF documents, an analysis was conducted. The latter was aimed at evaluating local and other relevant technical and environmental conditions that could justify a deviation from the BREF requirement.

Since the third party opinion is restricted to the verification and evaluation of technical and environmental aspects, issues such as e.g. the financial or the social feasibility of the BREF requirements are not addressed.

3.2. Part B – EIA Evaluation

During this part, the existing Environmental Impact Assessment (EIA) for the proposed project was evaluated. Special attention was given to evaluate the relevance, the completeness, the reliability, the accuracy, and the transparency of the EIA.

The EIA was evaluated both in terms of the process that was adopted, as well as the content of the assessment.

3.3. Part C – Calculation of CO_2 Impact

In this part of the opinion, the CO_2 impact of the observed deviations from BREF (see Part A) was assessed in comparison to full compliance with BREF. For each deviation, if relevant, a separate calculation of the difference in CO_2 emission (of the proposed project versus full compliance with BREF) was made.
The total impact was also be assessed by combining the contribution of all individual deviations.

In all of the above parts, recent cases of similar European projects were referenced. An overview of the main lignite fired power plants in Germany that have been built or refurbished after 1995, has been included in Annex IV for this purpose.

4. Assessment Team

A group of four international experts, supported by a local Czech expert, was assembled to conduct the third party assessment.

Within the group, two teams were identified, which worked in parallel on the different aspects of the assessment.

Team A consisted of an American and a Belgian expert with specific background in power generation coal fired power plants, and energy efficiency. Each member of the team has 10+ years of relevant industry experience. This team was responsible for Parts A and C of the assessment.

Part B of the work was performed by the second team, containing a Belgian and a British expert in terms of EIA studies. Both members have 15+ years of relevant industry experience.

The above teams were complemented with a local expert. The primary role of the latter was to facilitate the process by providing assistance to both teams with respect to local aspects of the project. Typical tasks of the local expert were: identification and follow-up of local contacts, translation, identification of local sources of information, etc.

To safeguard objectivity and impartiality, the local expert was not involved in the actual decision process or the formulation of the third party opinion.

5. Methodology

The assessment was mainly performed between 5/2/2010 and 5/3/2010, and involved a combination of desk review, site visits, consultation of external experts, and internal discussions.

During this period, two site visits were conducted, i.e. on 11-12/2/2010 and on 22-23-24/2/2010. On each occasion, the actual site was visited, by the complete assessment team on 11/2/2010 and by Team A on 23/2/2010. The first visit served as an introduction to the project and to perform an overall assessment of the condition and state of the facility. During the second visit, all main components that will not be replaced during the refurbishment were visited and inspected to ensure their compliance with BREF.

The remaining time of the site visits was mainly used for discussions with the investor. At first, these discussions took place in the presence of the full assessment team, but during the second visit, parallel meetings were organized to expedite the assessment process.

Also during the second site visit, an external expert from the Czech grid operator (Čeps) was invited for a detailed discussion on ancillary services and local grid conditions and sensitivities. On this occasion, an additional DNV expert from DNV's Research and Innovation Department in Oslo took part in the discussions.

5.1. Part A – BREF Compliance Assessment

As indicated, Part A of the assessment was addressed by Team A. To a large degree, both experts of the team worked independently to form and justify their opinion. Prior to the site visits and during the preparation of the final report, a consensus was established. This consensus has been reflected in this report.

Specifically for Part A, templates with all relevant BREF principles and concepts, currently applied techniques, techniques to consider when determining BAT, and actual BAT-requirements were produced. During the assessment, each expert completed the template, including arguments and justification of possible deviations from BREF. At the end, a consensus was established, which has been included in Annex II and Annex III of the report.

As explained also before, when drafting the template for the BREF LCP, all relevant chapters and sections were consulted, i.e. not only §4.5 'Best available techniques (BAT) for the combustion of coal and lignite' was considered. On the one hand, this has resulted in several relevant additional aspects to consider, but, on the other hand, this has introduced a significant degree of repetition in the template.

In keeping with the remark in the Preface of BREF LCP [1] p xiii, it needs to be underlined that the BREF does not prescribe emission limit values or specific technologies that should be used. The determination of appropriate permit conditions needs to involve taking account of local, site-specific factors such as the technical characteristics of the installation concerned, its geographical location and the local environmental conditions.

The template for the BREF EE was based on §3.1, Table 3.2, p117-119, which specifically lists the energy efficiency related requirements from the BREF EE which are not covered by the BREF LCP.

To complement the information in the BREF documents, a concise overview of relevant lignite fired power plants in Germany has been compiled. Only plants that have been built or retrofitted since 1995 were taken into account. Key construction and operating data from a variety of sources (mainly available on-line) has been collected in a table, which is included in Annex IV.

5.2. Part B – EIA Evaluation

Similarly as in Part A, both experts of Team B performed individual evaluations of the EIA. Again, prior to each site visit and during the preparation of the final report, a consensus was established. This consensus has been reflected in this report.

First, the EIA process of the proposed project was compared against the corresponding act to verify whether all documents and timings have been adhered to during the different steps (notification, fact-finding, documentation, supplementation, expert opinion, and public hearing). An excel sheet with an overview of all documents was compiled for this purpose.

Second, the EIA documentation was analysed in detail. For the main stages in the documentation (project design, review of the environmental baseline, impact and mitigation, and alternatives), the following steps were conducted:

- the reference to the project documentation was verified and, if applicable, additional information was included,
- the relevance, the completeness, the reliability, the accuracy, and the transparency of the provided documentation was evaluated, and
- a partial conclusion was formulated.

Based on the partial conclusions, an overall assessment statement was compiled. Obviously, prior to this, a consensus was established between the findings of both experts.

5.3. Part C – Calculation of CO_2 Impact

Mainly the experts from Team A collaborated to calculate the CO_2 impact of each relevant deviation from BREF as observed in Part A. Experts from Team B performed a verification of the approach and the results as part of the QA/QC within the project.

The calculation was performed by using the European Emission Trading Scheme Monitoring and Reporting Guideline (EU ETS MRG) of 12/2008 - Annex II [8]. The National Greenhouse Gas Inventory Report (NIR) of the Czech Republic to the Secretariat of the UNFCCC of April 2009 [9] was used to determine the emission and oxidation factor for lignite. The values 99.9 t CO_2/TJ and 0.98 were used, respectively. The EU ETS MRG approach [8] was also used to quantify the emissions from the limestone wet scrubber, with an emission factor of 0.44 t CO_2/t limestone. The limestone consumption was determined by using the same ratio of limestone to lignite as specified in the project document /57/ for the refurbished blocks of EPR II. Finally, also the emission from the natural gas, used to start up the boilers, was taken into account. The same approach as before was used.

6. Document Overview

All documents that were received from the MoE during the course of the assessment have been numbered and characterised. An overview has been included in Annex I, and is referred to throughout this document. In the text, references to the project documents, as listed in Annex I, are provided between two ‘slashes’. For example, “/7/” refers to project document 7, as listed in Annex I.

Obviously, the bulk of the project documents relate to communications that took place prior to the current assessment. At the same time, all documents that were handed over during the assessment have also been included in the overview.

Based on the statement of the MoE, as included in Annex IX, DNV has assumed that all of the provided documents have been translated and supplied in full (i.e. with abbreviations or omissions), and that the set of provided documents are a fair reflection of all of the information, relevant to the project, that was known to the MoE at the time of making of this assessment.

7. Results

The current section contains the results of the third party assessment and is structured similarly as the previous sections.

7.1. Part A – BREF Compliance Assessment

As explained in §5.1, templates were developed to conduct this part of the assessment.

The completed templates have been included in Annex II and Annex III for the BREF LCP [1] and the BREF EE [2], respectively. The reader is referred to these Annexes for a detailed compliance analysis of the proposed project against all relevant principles and concepts, currently applied techniques, techniques to consider when determining BAT, and actual BAT-requirements in the two BREF documents. As a matter of completeness, all BREF requirements are listed and analysed in the Annexes, even though there are significant overlaps between and within the BREF documents.

The compliance assessment is based on the following assumptions:

a) The comprehensive refurbishment of the Prunéřov II power plant is considered as a 'new plant' rather than as an 'existing plant'.

   In keeping with the guidance of the IPPC directive [4], and similar to the issue of 'substantial change' (as defined in the directive), it is up to the competent authority to formulate an opinion on this matter.

   The opinion of the MoE, the competent authority in this case, was confirmed by the Minister of the Environment (Mr J Dusik) per e-mail on 2/03/2010, in which he refers to an internal communication from the Department of Integrated Prevention and IPR /70/, and the confirmation of this communication by the legal department. In turn, DG Environment of the European Commission confirmed this assessment, as evidenced by the email on behalf of Mr K Falkenberg on 9/03/2010, included in Annex XII.

   Consequently, the BREF requirements relating to 'new plants' were considered during the compliance assessment, rather than those relating to 'existing plants'.

b) The refurbished Prunéřov II power plant is proposed as a 'middle-load' plant (see discussion in [1], p 3), consisting of three units of 250 MW_{el} each. Characteristic for a 'middle-load' plant is its flexibility in terms of operating load, turndown ratio and load change speed between that of a 'base-load' and a 'peak-load' facility.

   This assumption is based on the documents provided by and the discussions with the investor about the planning to provide ancillary services, and to reliably supply heat to the existing district heating network for the period of 2010 until 2035.
   According to this planning, stable operation in a range between 50% and 100% load should be possible to ensure that the facility could be used to deliver ancillary services (maintaining voltage and frequency, island operation, load following, peak load production, and black start capability) in case of favourable commercial conditions.
   With respect to district heating, the investor has a binding commitment regarding the supply of heat to three nearby urban agglomerations for a variable but quasi continuous delivery throughout the year. In order to ensure the availability of this heat supply, the generation system requires a minimum degree of redundancy and/or back-up capacity. An acceptable degree of redundancy can be realized by implementing three independent units, e.g. 3 x 250 MW_{el}, as proposed by the investor.

The choice to conceive the facility as a middle-load plant consisting of three 250 MW_{el} units has clear implications on the type of technology that will be used, and the corresponding technical and environmental performance that will be reached.

As elaborated on further in §7.1.1, this assumption is important with respect to the observed deviation from BREF in terms of the proposed net unit efficiency of the refurbished blocks. The technical and environmental grounds upon which the assumption is based are explored further in §7.1.1.

c) Within the Czech Republic, there is no availability of additional or alternative fuel with equivalent or superior environmental characteristics than the lignite which is currently being fired in the Prunéřov II power plant.

Table 1: Overview of BREF principles, techniques and requirements

	Category	Sub-categories
1	Co – generation	
2	Combustion quality	. low unburned content in flue gas and residues . low air excess . good pulverisation and feeding system . good slag / fly ash distribution . proper combustion technology & furnace design . combustion air pre-heating
3	Combustion control	. use of advanced computerised control systems
4	Heating Rate / Efficiency	. high / supercritical steam parameters . low flue gas exit temperature . high vacuum in condenser . variable pressure operation . condensate & feed water pre-heating . use of advanced turbine blades . repeated superheating of the steam . use of latent heat in the flue gas for district heating . cooling tower discharge . proper boiler insulation to minimise heat loss . minimise internal energy consumption . fuel choice . reducing air leakage
5	Stack emissions	. proper fuel pre-treatment . fuel switch . dust (& Hg) abatement . SOx abatement . NOx abatement by primary and/or secondary measures . low-NOx burners
6	Fugitive emissions	. techniques for loading, storage and handling of fuel, limestone and residues to minimise fugitive emissions
7	Water treatment and discharge	. flue gas deSOx waste water . ammonia reduction in waste water (if applicable) . slag transport waste water . surface run-off water . storage of fuel stockpiles
8	Fire prevention	
9	Re-use of residue	slag, fly ash and gypsum

A concise study of the availability of alternative coal resources was conducted. A summary of this study has been included in Annex VI. The outcome of the study is that there are no additional or alternative fossil solid fuel sources within an acceptable radius of the Prunéřov site.

Given the presence of existing natural gas pipelines (operated by RWE Transgas) in the region, the switch from solid fuel to gaseous fuel could be considered. From a technical and environmental point of view, this represents an attractive option with a significant increase in power generation efficiency and a drastic cut in specific emissions. However, in addition to the technical and environmental benefits, also economical and security of supply issues would need to be evaluated. Both of these are outside the scope of the current assessment.

The principles and concepts, the currently applied techniques, the techniques to consider when determining BAT, and the actual BAT-requirements from the BREF documents ([1] and [2]), can be classified in nine categories, as illustrated in Table 1.

Based on the detailed compliance analysis, it can be concluded, in summary, that the proposed project complies with all but two aspects of the BAT-requirements, i.e. the heat rate or unit net efficiency, and the CO emission limit.

As far as time allowed, all requirements were verified by actual inspection of the equipment, or by detailed discussions on the design and the technical characteristics of new components. In a number of cases, also the contractual obligations and/or commitments from different parties were verified, e.g. the guarantees on boiler efficiency as provided by the boiler supplier in the final offer to the investor.

In the remainder of this section, the two observed deviations are discussed in detail.

7.1.1. Heat rate / Net unit efficiency

The net unit efficiency of the refurbished units is discussed in great length in /5/, /6/, /7/ and /57/, among others.

Unless indicated otherwise, the unit efficiencies in the current document are calculated in compliance with §1 of the VDI 3986 guideline “Determination of efficiencies of conventional power stations” [3], as prescribed in §2.7.3 of the BREF LCP [1]. In keeping with this definition, the electricity consumption of the lignite unloading, handling and transport until the feed to the pulveriser, has not been taken into account. Similarly, also the electricity consumption of the limestone unloading, handling and transport until entry in the lime slurry preparation system, has not been taken into account.

During the assessment, in keeping with the original submission of the project as in /57/, only the unit efficiency in full condensing mode (no steam extraction for heat supply) was considered. According to Graph 3 of /13/, operation in this mode occurs 43% of the time. Furthermore, this approach is in keeping with the IPPC since it allows a more transparent comparison of the proposed technology against BAT.

The net unit efficiency for condensation operation of the refurbished blocks is calculated to be 40.00% in the Expert Opinion regarding the environmental impact of the project /7/. This document is used since it constitutes the most recent document with specific information on efficiency.

The value for the net efficiency of the refurbished plant in condensation mode was verified by means of the ‘Integrated Environmental Control Model’ (IECM-cs 6.2.1 (2009)), which is produced by Carnegie Mellon University based on funding from the US Department of Energy, and which can be downloaded from http://www.iecm-online.com/.[1] More details on this inputs and output of this exercise are included in Annex VIII, part A.

[1] The interested reader is referred to this webpage for a description of the actual model.

The results of the simulation are included in the second line of Table 2.
For the 'Base' case, see column 1 of Table 2, the design fuel (as specified in /13/ Tab.2) has been used. The performed simulation indicates that the proposed net unit efficiency by the investor of 40.00%, is realistic. Due care was taken to ensure that realistic assumptions were used to support the simulation (e.g. in terms of own consumption of the unit). Wherever possible, the same conditions as for the refurbished EPR II blocks were adopted (e.g. air excess, flue gas temperature, etc).
The deviation between the simulation result and the proposed value, i.e. 40.7% versus 40.0%, can be explained by differences in some of the assumptions that were not identical to the projected design conditions of the refurbished EPR II blocks. The difference is not deemed relevant for the current purpose.

Table 2: Simulation results of proposed project units with different fuel qualities

Case	Lignite LHV [MJ/kg]	net unit efficiency [%]
Base	9.75	40.7
Low	8.5	40.4
High	11.0	41.0

The proposed value by the investor of 40.00% is significantly higher than the current average unit efficiency of 36% for sub-critical steam units using lignite [5]. At the same time, it is well below 43%, which is the unit efficiency that is currently reached by implementation of super-critical technologies for lignite [5]. Note that these figures are confirmed by the overview of the lignite fired power plants in Germany that have been built or retrofitted since 1995, which is included in Annex IV.

According to the BAT requirement in [1], Table 4.66 p 269, the net unit efficiency levels of new pulverised lignite fired plants should be between 42% and 45%. These values have been interpreted as reflecting stable operation at nominal load and under design conditions (fuel composition, metrological situation, etc).

Hence, there is a gap of 2% in thermal efficiency between the proposed project and the BAT-requirement.

The techniques to consider when determining BAT for efficiency and fuel utilisation in the BREF (see §4.4.3 Table 4.57-4.58 p 257 – 258 [1]) are: co-generation of heat and power, the use of advanced turbine blades, the use of advanced materials to reach higher steam parameters, the use of super-critical steam parameters, double-reheat, the use of regenerative feed water pre-heating, the use of advanced computerised control systems, the use of the heat content in the flue gas for district heating, low air excess, lowering the exhaust gas temperature, low unburned carbon in the ash, low CO in the flue gas, and the discharge of exhaust gas through the cooling tower.

In order to quantify the impact of the fuel composition and the choice of steam parameters on the net unit efficiency, additional simulations were run on the IECM-cs 6.2.1 model.

To assess the impact of fuel composition, two additional simulations were conducted for the proposed project with only changing the fuel characteristics (all other input values to the simulation were kept fixed). Details on the inputs and outputs are included in Annex VIII, part B. In the 'Low' case (see column 1, Table 2), the fuel composition was modified to reflect the lowest fuel quality that is expected to be encountered during the lifetime of the refurbished EPR II blocks (as supplied by the investor during the discussions). Similarly, for the 'High' case (see column 1, Table 2), the fuel composition was identical to that of the best quality fuel that is expected to be encountered in the lifetime of the refurbished EPR II blocks (again based on information supplied by the investor during the discussions).

The impact of the fuel composition on the efficiency is illustrated in Table 2. As expected, the efficiency for a lower grade fuel is lower than for a higher grade fuel. Note, however, that the influence is limited, with a span of 0.6% points between the lowest and the highest quality of design fuel specified in /57/.

The potential to improve current fuel quality is limited at best. Improving coal quality can include fuel blending (which is current practice at the lignite mine), additional drying or coal cleaning. Additional drying beyond the extent than what is proposed in the project would not be cost effective and be beyond current practice. Coal cleaning is cost prohibitive for lignite and would not result in a significant impact on efficiency. As discussed also before, also switching to a higher quality fuel is not a possibility (see Annex VI).

In order to determine the impact of steam parameters, one additional simulation was performed with super-critical conditions (i.e. in excess of 374 ℃ and 218 atm). Details on the inputs and outputs of this simulation are included in Annex VIII, part C, and the result is shown in Table 3. Note that all conditions, i.e. unit size, fuel composition, and combustion characteristics, were kept the same as in the ‘Base’ case. Only the steam parameters (and correspondingly also the own consumption of the unit) were modified.

Table 3: Simulation results of alternative units with higher steam parameters

Case	Lignite LHV [MJ/kg]	net unit efficiency [%]
Base	9.75	40.7
Super-critical	9.75	42.0

Table 3 shows that higher steam parameters, and in particular super-critical steam conditions, would make it possible to reach the minimum BAT-requirement of 42% net unit efficiency in case of the Prunéřov II project.
Note that this result is obtained for a relatively small unit of 250 MW_{el}. Due to some losses which are not linearly correlated with unit capacity, a slight improvement is to be expected when considering a larger unit (e.g. 500 MW_{el} or larger).

The above result is consistent with the overview of the lignite fired power plants that have been built or refurbished since 1995 in Germany, as included in Annex IV. This overview shows that all facilities with an efficiency of 42% or higher employ a Benson boiler with super-critical steam conditions. Furthermore, it is noted that all these units are conceived as base-load facilities with a size of 600 MW_{el} or higher. The former is in line with the statement in the BREF LCP [1] (§4.5.5, p 268) regarding the fact that units that have not been developed as base-load plants are designed with lower steam parameters to accommodate frequent start-up cycles, and, as a result, operate at lower efficiencies. With respect to the minimal commercial size of super-critical units, literature [6 & 7] indicates a range of 400 – 450 MW_{el}. According to the same references, the typical payback period for a super-critical unit, depending on its capacity and the fuel characteristics, is in excess of 30 or even 35 years.
Finally, the overview shows that no lignite fired units with an efficiency of less than 42% have been constructed in Germany during the last decade.

The technical feasibility to use super-critical steam parameters in case of the Prunéřov II project is linked to assumption b) from the beginning of this section. As a reminder, assumption b) relates to the fact that three 250 MW_{el} units are proposed, and that the new units will be operated as a ‘middle-load’ facility. The former as well as the latter preclude the implementation of a super-critical unit on technical grounds, i.e. 250 MW_{el} is below the minimal commercial size of such units, and super-critical units are primarily operated as base-load facilities rather than middle-load plants.

The investor provided the following technical rationale to support the implementation of three 250 MW_{el} units in ‘middle-load’ operation:

- The Prunéřov site has binding commitments to supply heat to neighbouring communities (Klášterec nad Ohří, Chomutov and Jirkov). The binding nature of these commitments is made clear by the investor's heat supply contracts (which were verified during site visit 2), and by the Energy Act /75/.

In order to ensure that this obligation can be fulfilled at all times, the investor has opted for the reconstruction of three independent 250 MW_{el} units (i.e. to safeguard availability of the heat supply through redundancy of supply sources).

Obviously, also a larger unit could securely supply the required heat, on condition that an adequate back-up supply would be put in place. Note in this respect, that several of the super-critical units in Annex IV do supply heat to neighbouring communities. With respect to the back-up and/or security of supply, there are several options that could be investigated further and that have not been covered by the investor in the project documents that were provided to DNV to date.
One such option is the construction of a gas-fired back-up boiler. Note that this solution was adopted by the investor to enable the refurbishment of the nearby thermal power station in Tušimice (4 x 210 MW_{el}). Alternatively, given the relatively short distance between the Prunéřov and the Tušimice site (approximately 8 km), a coupling of the Prunéřov district heating network with the Tušimice boilers or even only the existing back-up boiler at this facility could be envisioned. Both could possibly ensure security of supply in case the single larger unit at the Prunéřov facility would encounter operational difficulties or would be in a planned shutdown.
Further investigation of the different back-up options of the heating supply to the district heating network at Prunéřov is required to identify potential technical difficulties and to evaluate the economical implications of these alternative solutions. In any case, the implementation of a gas fired back-up boiler, similar to the Tušimice site, is deemed technically possible and would provide the required security of supply.

- The investor has binding agreements with the Czech Grid Operator (ČEPS) to provide ancillary services (maintaining voltage and frequency, island operation, load following, peak load production, and black start capability). In order to be able to provide this type of services with the refurbished plant, it should be conceived as a 'middle-load' rather than a 'base-load' unit.
  A discussion with a representative from ČEPS, conducted during the second site visit in Prague (24/2/2010), made clear that the delivery of these services is on a corporate basis, not on a plant specific basis. It is possible that the same services could be provided, for example, by the nearby power plant in Tušimice, which is a sub-critical unit with the required flexibility and corresponding technology.
  The minutes of the meeting with ČEPS have been included in Annex V.

Based on the above analysis, it is concluded that the technical grounds for assumption b) have not fully been explored. In turn, this implies that the implementation of a larger base-load unit cannot be ruled out based on the technical considerations that have currently been provided.

Although the scope of work excludes economical and strategic analyses, an initial scenario comparison regarding the operational lifetime of BAT compliant units of various sizes was established. The comparison is based on the assumption that no alternative fuel sources are available in addition to the 25 years reserve[2] (which has been verified by the coal study in Annex VI).
The results of the initial scenario comparison have been included in Annex XIV. They indicate that all but the smallest super-critical unit have an operational lifetime that is shorter than the above cited typical payback period for this type of units. A detailed economical analysis, taking into account the complete scope of capital expenses (e.g. also that of a back-up boiler or a coupling of district heating networks to ensure security of heat supply), should be performed to refine and confirm the aforementioned tentative results.

[2] Corresponding a unit comprising 3 blocks of 250 MWel with a net unit efficiency of 40% and operating at nominal load for 6,300 hours per year.

DNV's conclusion: The options to meet the BAT-requirement of at least 42% net unit efficiency were not fully explored and the implementation of a unit, compliant with BAT, cannot be precluded based on the currently available technical argumentation.

7.1.2. CO emission limit

The CO emission limit as proposed by the investor in /7/ and /57/, among others, is 250 mg/Nm³, which is in accordance with the current Czech legislation (No. 146/2007 Coll.).

According to BREF LCP [1], §4.5.10, p 279, the BAT ELV for pulverised lignite fired power plants should not exceed 100 – 200 mg/Nm³.

The proposed emission limit for the refurbishment of the Prunéřov II power plant is therefore not in line with BAT.

According to the investor, the relatively higher CO emission limit is a result of the projected degradation of fuel quality over time using the proposed operating equipment and NOx abatement approach. Indeed, in order to reach the proposed NOx-limit, operation at low air excess will be applied, which can result in increased CO emissions.

At the same time, it is DNV's experience that even with the given NOx limit of 200 mg/Nm³ and the given fuel quality, it should be possible to remain below the CO limit as indicated in BREF LCP [1]. Note that this opinion is consistent with the overview of recently built or refurbished lignite fired power station in Germany, as included in Annex IV.

DNV's conclusion: there are insufficient technical grounds for the deviation from the BAT ELV for CO of 200 mg/Nm³.

7.2. Part B – EIA Evaluation

7.2.1. Findings regarding EIA process

DNV have reviewed the EIA process that has been followed for the proposed project. The detail of DNV's review is provided in Annex VII, "Review of EIA Process", and is summarised below.

Notification:
The Notification /38/ /39/ /40/ was provided by ČEZ in accordance with Act No. 100/2001 Coll., as amended, on Environmental Impact Assessment from the Law of the Czech Republic (hereafter called "The Act") on 6 June 2008. The MoE then distributed the Notification and ensured it was published on the official notice boards of the affected territorial self-governing units on 30 June 2008 in accordance with The Act. Ten written opinions were received in response to the Notification, all within 20 days of the Notification being distributed and thus in adherence with The Act.

Fact-Finding procedure:
The MoE commenced the Fact-Finding procedure on 13 June 2008, one week after receiving the Notification, and thus in accordance with The Act. The conclusions from the procedure (Fact-Finding Conclusion /37/) were distributed and published on 30 July 2008, within the time-frame specified by The Act.

Documentation:
The EIA Documentation /57/ was prepared between July and December 2008 and was submitted on 10 December 2008. The MoE distributed and published the EIA Documentation on 29 December in accordance with The Act. The MoE also ensured it was published on the official notice boards of the affected territorial self-governing units on 14 January 2009 in accordance with The Act. 21 written opinions were received in response to the EIA Documentation for consideration.

Supplementation:
The Supplement to EIA Documentation /13/ (identical to /94/) was prepared between March and September 2009. It was submitted to the MoE on 25 September 2009. The Supplement was distributed and published on the 23 October 2009 in accordance with The Act. The MoE ensured that the Supplement was published on the official notice boards of the affected territorial self-governing units on 4 November 2009 in accordance with The Act. 19 written opinions were received in response to the Supplement, 5 of these were within the timeframe specified in The Act, 12 were not. Interested parties still had the opportunity to put forward opinions at the Public Hearing.

Expert Opinion:
An Expert was chosen to undertake writing the Expert Opinion on 13 January 2009. The Expert received all the relevant documents on 26 January 2009. The Notifier agreed to pay for the Expert Opinion on 27 January 2009. The Expert Report was initially prepared between 13 January 2009 and 2 March 2009 when the Expert was asked to discontinue work on the report until all information was received. The Expert resumed work on 7 October 2009 and issued the report on 20 October 2009 (Expert Opinion /7/). This was in adherence with The Act which requires the Expert Opinion to be prepared within 60 days. The Expert Opinion was distributed and published on the 23 October 2009 in accordance with The Act. The MoE ensured that the Expert Opinion was published on the official notice boards of the affected territorial self-governing units on 4 November 2009 in accordance with The Act. 19 written opinions were received in response to the Expert Opinion, 5 of these were within the timeframe specified in The Act, 12 were not. Interested parties still had the opportunity to put forward opinions at the Public Hearing.

Public Hearing:
Invites to the Public Hearing were sent on 13 November 2009 in accordance with The Act. Details of the Public Hearing were published on the notice board on 19 November 2009 in adherence with The Act. The Public Hearing took place on 3 December 2009 in accordance with The Act. The MoE prepared minutes of the Public Hearing on 14 December 2009 which were distributed (Minutes of public hearing /32/).

DNV's conclusion:
DNV are of the opinion that the EIA process for the proposed project was in line with the requirements of The Act, and that no significant inconsistencies were found.
It is clear that the EIA process involved consultation with different stakeholders throughout the process, and this provides confidence that the necessary transparency was present throughout the EIA process.

Czech Republic EIA process versus other EIA processes:
The EU EIA Directive does not govern EIA in Europe per se, it establishes the broad process to be taken by Member States, such as the Czech Republic, in transposing into national legislation. Hence although there are differences between Member States within the EU regarding the EIA process, all Member States follow the same broad EIA process.

7.2.2. Findings regarding the EIA documentation

The general environmental issues covered within the EIA Documentation are similar to those that are covered within other industrial EIAs (e.g. see Annex XIII).

7.2.2.1. Project design

Basic data

Reference:
- Chapter B.I of the EIA Documentation /57/.

Review of the scope:

- The project equipment covered is EPR II, but with emphasis on the blocks B23 to B25 that will be refurbished (the future blocks C to E). This is in accordance with the scope of the project as announced in the Notification /38/ /39/ /40/.
- For the assessment of the air pollution impact, project equipment covered is both Prunéřov power plants EPR I and II as a whole, in addition to EPR II separately. This is in accordance with an advice of the regional competent authority of Ústecký Region in the project design phase (pre-EIA phase).

Review of key values including EPR I:

- Table of equipment & operation properties.

Property	Value in reference situation	Value in future situation
Output in MW_{el}	EPR I, 4 x 110 EPR II, 5 x 210	EPR I, 4 x 110 EPR II, 2 x 210, 3 x 250
Input in MW_{th}	EPR 1, 4 x 308.2 EPR II, 5 x 591.2	EPR I, 4 x 308.2 EPR II, 2 x 591.2, 3 x 584.8
Equivalent operating hours	EPR I, 4 x 6,650 EPR II, 5 x 6,473	EPR I, 4 x 2,800 EPR II, 2 x 3,200, 3 x 6,300
Fuel used	guarantee coal	

- Table of fuel properties.

Property	Value
Raw coal	
Lower Heating Value in MJ/kg	9.75
Humidity in % m/m	31
Dry coal	
Ash content in % m/m	41
Sulphur content in % m/m (total)	3
Combustible % m/m in dry & ash free coal	
C	64.76
H	5.71
N	1.18
O	23.45
S	4.9

DNV's conclusion:

- The chapter provides a detailed description of the proposed project, its location and the technical details of the design concept.
- The description is sufficiently complete in explaining why EPR II is generating environmental impact.

Input data

Reference:

- Chapter B.II of the EIA Documentation /57/.

Review per environmental aspect:

- Land use. Input data provided are sufficient. ČEZ have confirmed that there are no underground hydrocarbon tanks involved in the proposed development.

- Water. The Prunéřov power plants draw untreated water from the Ohře River, and are permitted 30,000,000 m³ per annum (EPR I/II). EPR II currently uses approx. 15,000,000 m³ per annum (no data are provided for EPR I), primarily for cooling water, and this is expected to reduce to approx. 11,500,000 m³ per annum after the development owing to improved water re-use, which is good practice.
- Use of other resources (chemicals, compressed air, electricity). Input data provided are sufficient, and it can be said that there is a significant reduction in the consumption of many chemicals because of the new reverse osmosis equipment. ČEZ have confirmed that all tanks containing hazardous materials are bunded.
- Demands on infrastructure (road, rail, conveyor, pipeline). DNV deem it important to ensure that emissions (such as dust emissions from dirty roads) resulting from the movement of construction traffic, are monitored and controlled adequately.

Output data

Air pollution

Reference:
- Chapter B.III.1 of the EIA Documentation /57/. Chapter based on Annex SP2 to the EIA Documentation /62/ /67/ (adapted from Annex SP2 to the Notification /63/).
- Supplement to EIA Documentation /13/ (identical to /94/).

Review of the scope.
The emission burdens are described for:
- The reference situation (operation of current EPR I and EPR II blocks).
- The future situation with operation of current EPR I blocks, EPR II current blocks B21 to B22, and future blocks C to E.

Review of key values:
- Source parameters (outlet height and dimensions) and emission parameters (temperature, volume rate) are consistent with the basic equipment properties (input in MW_{th} and equivalent operating hours) and the guaranteed coal properties (LHV, chemical composition).
- Pollutant mass rates in the reference situation are based on the ČEZ 2007 emission monitoring (in compliance with Czech laws & regulations, regarding criteria pollutants) and on the tri-annual expert “Report on Authorized Measurements” (in compliance with Czech laws & regulations, regarding other pollutants).
- Criteria pollutant mass rates are derived from the equipment supplier’s guarantee for the end concentrations (therefore DNV consider these rates as maximum values).
- The monitored and measured mass rates as well as the guarantee mass rates are in compliance with the Czech laws & regulations and EU Directives.

Discussion:
- The following are missing in the EIA Documentation, 1. the outlet % oxygen for EPR I, and 2. the diameter of the cooling towers. However, these are minor shortcomings only affecting the transparency of the text.
- Regarding the guarantee for the CO end concentration of 250 mg/Nm³ (standard conditions, 6% oxygen, dry gas), DNV agree with ČEZ’s arguments for prioritising the removal of NO_x over the minimisation of the CO emission. At the same time, see also §7.1.2, based on DNV’s experience and operational results of similar plants in Germany (Annex IV), it is concluded that compliance with the BAT-requirements of 200 mg CO/Nm³ and 200 mg NO_x/Nm³ is achievable.
- The issue of CO_2 emissions was raised by stakeholders as it was not addressed in the EIA Documentation. It was consequently addressed in the Supplement to EIA Documentation. DNV agree with the conclusion of the Supplement that there will be reduction in CO_2 emissions from the proposed development relative to the existing CO_2 emissions from the current Prunéřov power plants. That is not to say that the future CO_2 emissions are insignificant, as the proposed project will be a big emitter of CO_2, but DNV consider that the control of CO_2 emissions is a global

issue. It is the task and ambition of global agreements (such as the Kyoto Protocol and the Copenhagen Accord), and the EU Emission Trading Scheme (EU ETS) to address the very serious issue of climate change, not a key intention of the EIA.

DNV's partial conclusion regarding the air compartment:
- The key values for source and emission parameters as well as for the pollutant mass rates are adequate as input values for the performed air pollutant dispersion study (see 7.2.2.3, "Impacts and mitigation - Air quality and climate").

Waste water and seepage

Reference:
- Chapter B.III.2 of the EIA Documentation /57/.

Review of the scope:
Wastewater emissions are described for:
- The current operation of EPR I and EPR II blocks.
- Wastewater during construction.
- Future wastewater discharges after project development.

In this review, DNV focus primarily on wastewater discharged during construction and operation of the proposed refurbishment, as that is what the EIA is intended to assess. However, attention is also focused on improvements to wastewater treatment compared to current methods.

Brief summary of wastewater streams & quality - now & future:
The following wastewaters are generated by EPR I/II.
- *Industrial Process wastewater* (discharges to Drain 1 at Prunéřov stream). In the future Industrial process wastewater will continue to discharge to Prunéřov stream via Drain 1, with improvements, such as:
    - Significant re-use of cooling water blowdown for EPR I/II process water
    - Re-use of wastewater from demineralised water process
    - Dry cleaning of coal handling units - thus reducing wastewater produced.
- *Sewage* - treated in a Sewage Treatment Plant (STP) and then discharged to Drain 1. A new STP will be built as part of the proposed development (during construction both STP will function to accommodate increased sewage production rate from the construction workforce).
- *Rainwater* from surface run-off (treated and discharged to Drain 1). This discharge will continue, with the potential for some re-use.
- *Sludge* generated from the various wastewater treatment processes throughout the site. Historically this sludge has gone via the dredger station to Ušák settling pit, but this practice has now been discontinued. New sludge treatment facilities will handle sludge wastes.
- *Seepage water* from AI/AII (discharges via Drain 3 to Prunéřov stream). This discharge will continue after the proposed development, but AI/AII will take no further wastes/EBP from the site. Hence, the discharged burden will gradually reduce, reason why this review takes no further analysis of this seepage wastewater stream.
- *Seepage water* from AIII/Ušák (discharges via Drain 2 to Ohře River). In the future, AIII/Ušák will take no further wastes/EBP from the EPR site, and the seepage water will not discharge via Drain 2 (for a period of time), but will be re-used within the EPR I/II plant as process water, because the current Dissolved Inorganic Solids (DIS) concentration is high (at approx. 3,000 mg/l). Only once it reduces below 2,000 mg/l will it be discharged to the Ohře River via Drain 2.
- *Seepage water* from Severní Lom, In the future this seepage water will be re-used as EPR process water (G1 pit) and dust suppression water (G3 pit).

Wastewater discharge from Drains 1, 2 and 3 all currently meet existing criteria (both volume and quality) based on information provided within the EIA Documentation.

DNV's partial conclusion regarding the water compartment:
- Wastewater management will improve in the future over current practice, with increased wastewater minimization, increased re-use of wastewater streams, improved and new

wastewater treatment facilities, and increased attention given to seepage waters with high DIS content.
- It is not clear how many samples were collected and analyzed to produce the analytical results presented in the EIA Documentation.

Waste generation

Reference:
- Chapter B.III.3 of the EIA Documentation /57/.

Review of the current situation:
- Waste products generated are currently categorized, labelled, handled and then transferred to companies licensed to the wastes.
- Dangerous wastes are stored separately.
- It can be seen that Asbestos Containing Materials (ACM) have been generated in the past at EPR II (Table 78 in /57/, approx. 3 to 4 tons per annum).

Review of the construction:
- As identified above, demolition waste will be produced. DNV consider that there is a risk it may contain ACM. The EIA Documentation states that “Parts of the construction that could be considered as a source of dangerous construction waste will be marked before the start of demolition works in order to minimize the risk of damage of the environment and human health. The waste produced in such ways will be collected in secured areas in compliance with the §5 of the MoE regulation no. 383/2001 Col.”. Through discussion with ČEZ, DNV understand that asbestos surveys have been conducted onsite in the past (most recently in 2005-2006) and that ACM was identified onsite, although this information is not presented in the EIA Documentation.
- Excavated soil will also be produced during construction. ČEZ conducted a contaminated land survey in 2005-2006 which (DNV are informed) found no known land contamination onsite. The EIA documentation provides no data from this survey.
- See also §7.2.2.5, “Impacts and mitigation - Soil”.

Review of the operation of the proposed project:
- Operational wastes remain similar and will be managed as per current practice, apart from sludge (from water management). After the comprehensive reconstruction, the sludge will be no longer pumped to Ušák, but will be disposed of via a new sludge terminal, which is an improvement on current practice.

DNV conclusion:
- Asbestos and contaminated land surveys should have been included within the EIA Documentation.

Noise, vibration and radiation

Reference:
- Chapter B.III.4 of the EIA Documentation /57/, supported by Annex SP1 /66/.

DNV review:
- Baseline Noise Levels (baseline) are as follows at the key receptors RD1 and RD2
  - RD1, 49.3 dB (Plant) + 46.0 dB (Traffic) = 51.0 dB
  - RD2, 46.8 dB (Plant) + 52.3 dB (Traffic) = 53.4 dB (there is a small error, 46.8 dB is 46.3 dB in Table 85 of /57/, resulting in 53.3 dB).
- The above noise levels currently exceed environmental limits for day-time (some instances) and night-time.
- Information provided on vibration and radiation is satisfactory.

DNV consider that there are some limitations to this section of the report, although they do not necessarily affect the conclusions of the EIA Documentation:

- The noise measurement process including the 'exclusion of traffic noise during acoustic analysis' cannot be verified based on the information provided in the EIA Documentation (including with reference to Annex SP1).
- Due to unclear information provided within the EIA documentation, DNV are unable to interpret and verify how the values in Table 86 of /57/ were derived / calculated.
- The applied limit (80 dB) for inside of the whole of the hygienic protection zone (HPZ) is not clear.

Old ecological burdens

Reference:

- Chapter B.III.4 of the EIA Documentation /57/.

Review:

- No comment.

Odour

Reference:

- Chapter B.III.4 of the EIA Documentation /57/.

Review:

- No comment.

By-products

Reference:

- Chapter B.III.5 of the EIA Documentation /57/.

DNV review:

- Significant quantities of Energy By-Products (EBP) will be produced by the future proposed facility, i.e. fly ash, boiler slag and flue gas desulphurisation (FGD) gypsum, in excess of 2 million tpa, the majority of which is fly ash.
- The Energy By-Products (EBP) are not 'waste', but are certified (via the Building Technical Certificates) by the MoE for use as certified construction materials at the Severní Lom mine. If they do not meet the stipulated parameters in the Certificates, the products are subject to waste disposal legislation.
- The environmental conditions of the future Certificates are understood to be stricter than the environmental conditions of the existing Certificates, and this is an environmental improvement. In the future, lime will be added to create a more stable material which results in reduced fugitive dust emissions and reduced dissolved substances in the EBP 'seepage' water (the seepage water from the EBP is considered separately in §7.2.2.1, "Project design - Output data - Wastewater & seepage").
- Historically, two methods have been used to transfer EBP to Severní Lom mine, a wet method (via dredger station and Ušák settling pit) and a dry method. The wet method will cease, hence the dredger station and Ušák settling pit will not be used for the proposed development, and are thus not considered further in this review. This change is an environmental improvement because the dry method has lower environmental impact.
- Currently, as advised by ČEZ, not much EBP is re-utilised, but in the future (based on information provided by ČEZ, but not included within the EIA Documentation) up to 50% is anticipated to be re-utilised in the construction industry, owing to increased quality of the EBP from proposed development. This is an environmental improvement on current practice.
- Fugitive emissions of dust are currently an issue at Severní Lom quarry. Airborne dust measurement is being introduced.

7.2.2.2. Review of the environmental baseline

Project data

Key characteristics

Reference:
- Chapter C.1 of the EIA Documentation /57/.

Review:
- No comment.

Environmental outputs

Reference:
- Chapter C.1 of the EIA Documentation /57/.

Review:
- No comment.

Environmental quality

Air quality

Reference:
- Chapter C.2.1 of the EIA Documentation /57/. Chapter based on Annex SP2 to the EIA Documentation /62/ /67/ (adapted from Annex SP2 to the Notification /63/).

Review of key values:
- Air quality review is mainly based on the measured air quality in the Ústecký Region in the period 2003-2006 as registered in the ISKO database of the ČHMÚ.
- Emphasis is on the year 2006 for which the ČHMÚ has provided a comprehensive survey with e.g. recalculated values for the grid nodal points of the study area for the air quality impact (see §7.2.2.3, "Impacts and mitigation - Air quality and climate").

Discussion:
- The levelling or moderately increasing PM10 values. The annual average criterion (40 μg/m³) as well as the 24-hours average criterion (frequency limit of 35 for > 50 μg/m³) of PM10 are not met in 1. locations as near to the Prunéřov power plants as Chomutov (NE) and Tušimice (SE), and 2. many more locations further away (probably due to traffic emissions and decentralised household heating that is not natural gas based).
- The annual/winter average criterion of SO_2 (20 μg/m³) is not met in Nová Víska u Domašína (W).
- The 2006 survey indicates that the annual average target (1 ng/m³) of PAH indicator B(α)P is not met in larger towns such as Teplice and Ústí nad Labem (NE).

Remark: DNV consider the other exceedence of criteria mentioned in the EIA Documentation to be due to time bound phenomena (such as meteorological episodes and accidental emissions) and therefore not an equally serious issue as the aforementioned.

Water

Reference:
- Chapter C.2.2 of the EIA Documentation /57/.

DNV review:
Some information is provided on groundwater quality. No data is provided on the existing quality of the waters (Prunéřov stream & Ohře River) that will receive discharges from the proposed development. DNV recommend that it is confirmed these streams are not currently under significant environmental stress due to pollution.

Natural resources

Reference:
- Chapter C.2.4 of the EIA Documentation /57/.

Review:
- No comment.

Fauna and flora, ecosystems

Reference:
- Chapters C.1.1 to C.1.7 of the EIA Documentation /57/. Some chapters based on Annex SP4 to the EIA Documentation /68/.
- Chapters C.2.5 (fauna and flora) and C.2.6 (ecosystems) of the EIA Documentation.

Review:
- Elaborated expert review in Annex SP4.
- No comments.

Landscape

Reference:
- Chapter C.2.7 of the EIA Documentation /57/.

Review:
- No comment.

Population

Reference:
- Chapter C.2.8 of the EIA Documentation /57/. Chapter based on Annex SP3 to the EIA Documentation /65/.

Key values:
- Expert review is mainly based on information regarding the Chomutov District.
- Emphasis is on Kadaň, the largest municipality near the Prunéřov power plants.

To be mentioned:
- Unemployment ranges around 15%.
- Health condition is lower than the Czech average (lower average life expectancy, and higher incidences of respiration diseases and cancer).

Cultural heritage

Reference:
- Chapter C.2.9 of the EIA Documentation /57/.

Review:
- No comment.

7.2.2.3. Impacts and mitigation

Air quality and climate

Reference:
- Chapter D.I.2 of the EIA Documentation /57/. Chapter based on Annex SP2 to the EIA Documentation /62/ /67/ (adapted from Annex SP2 to the Notification /63/).

Review of methods used:
- Study performed by external consultant authorized to perform air pollutant dispersion studies.
- Dispersion model used is version 5 of the SYMOS'97 model i.e. 1. a Gaussian dispersion model based on the Sutton equation, 2. it is the reference model in the Czech Republic and the MoE recommends it for air pollutant dispersion studies.
- Model however modified in order to deal with 1. air quality criteria in terms of a running 8-hours average (CO), 2. estimation of the concentration of NO_2 from the concentration of NOx, and 3. plume rise for emissions through a cooling tower.

After examining the model's key properties, DNV can agree with the use of the SYMOS'97 model, which is in accordance with the Czech laws & regulations. However, it is not clear to DNV whether the modified SYMOS'97 model is validated for its application in the study area i.e. whether the application for the underlying study has been preceded by an impact determination for one pollutant (e.g. SO_2) for which sufficiently complete global emission values are available for a representative time period (point sources, residential area and traffic area/line sources). The validation would then consist of a checking to what extent the global emission values for the period inputted in the model would result in the measured air quality in that period.

Review of the scope:
- Emission sources are 1. both Prunéřov power plants EPR I and II as a whole (this is consistent with the advice from the regional competent authority of Ústecký Region -see 7.2.2.3, "Project design - Basic data"-), 2. EPR II separately (this is consistent with the scope of the project as announced in the Notification /38/ /39/ /40/).
- Situations modelled are 1. the reference situation (operation of current EPR I and EPR II blocks), 2. the future situation with operation of current EPR I and EPR II current blocks B21 and B22 and future blocks C to E.
  DNV consider the latter viewpoint to be conservative (i.e. pessimistic) because:
  1) the global emission burden will be lower from the moment on that the EPR I blocks are decommissioned (when at the same time the operating hours of the EPR II blocks are not adapted);
  2) the input values regarding EPR II blocks C to E are derived from guaranteed concentration values from the provider of the equipment, and therefore can be considered as maximum values.
- Air pollutants included are 1. the criteria pollutants (PM, SO_2, NO_2 and CO), and 2. the other pollutants known to be present in emissions originating from coal combustion (gaseous components such as HCl and HF, metals such as As and Ni) and from combustion in general (PAHs, dioxins/furans).
- Study area covers the entire Ústecký Region and further includes the larger cities of Karlovy Vary (to the SW of the Prunéřov power plants) and Chomutov, Most, Teplice and Ústí nad Labem (to the NE).

Seeing as the prevailing wind directions are to the west, DNV consider the extend of the study area to the west of the Prunéřov power plants as insufficient (Germany, adjacent Region west of Ústecký). However this is not seriously affecting the interpretation in air quality terms because
1) the location of the highest impact values is within the study area;
2) the German competent authority was sent the EIA Documentation, and did not formulate any objections.

Review of values used:
- Background values regarding the environmental quality are 1. the measured air quality in the period 2003-2006 with emphasis on 2006, and 2. the applicable air quality criteria.

Above measured values come originally from
1 the Ústecký Region measuring stations operated by ČEZ (mostly gaseous pollutants);
2 the ČHMÚ (pollutant PM).
The values in the grid nodal points of the study area come from a comprehensive study by the ČHMÚ covering 2006. For the evaluation of the measured values, see §7.2.2.2, “Review of the environmental baseline - Air quality”.
The air quality criteria are defined in Czech laws & regulations on the basis of the EU Directives involved.

- Input values regarding the emission burdens, see 7.2.2.3, “Project design - Output data - Air pollution”.
- Input values regarding the meteorology come from the ČHMÚ i.e. wind direction and speed frequency percentages for five stability classes extrapolated to the Prunéřov area.

Remark: the prevailing wind directions are to the west. Since the data set was prepared by the Czech expert provider in meteorological data, DNV can agree with the use of the ČHMÚ set.

Review of the results mainly based on the contour maps /67/ in Annex SP2 to the EIA Documentation. Regarding the reference situation:

- The impact of the Prunéřov power plants is important in the W to N directions as well as in the S direction, and the major contribution to that impact comes from EPR II.
- The emissions do not contribute to exceeding of air quality criteria. For CO in particular, the gap between the highest impact (8-hours running average 112 µg/m³) and the quality criterion (10 000 µg/m³) is much larger than for the other criteria pollutants,
- For some criteria pollutants, limiting values are exceeded such as for SO2, the 1-hour and 24-hours average limits (350 and 125 µg/m³) and for PM10, the 24-hours average limit (50 µg/m³).
- The area involved is located in the NW direction (the Krušné Hory Mountains and especially Volyně).

Regarding the future situation:

- The impact levels will decrease in nearly all of the study area, but an increase is to be expected relatively close to the Prunéřov power plants.
- The areas involved are of course still located in the NW direction, i.e. Výsluní (approx. 5 km from the Prunéřov power plants) and the AI-AIII sludge beds (adjacent to and north of the Prunéřov site).
- The pollutant exceptions to the impact level decrease are CO and Ni, i.e. 1. for CO, the gap between the highest impact (8-hours running average 244 µg/m³) and the quality criterion (10 000 µg/m³) will decrease, but still be substantially larger than for the other criteria pollutants, and 2. for Ni in contrast to the other metals, the highest impact (annual average) will increase. Remark, that DNV have not assessed the reason for the Ni result.

DNV’s conclusion regarding the air compartment:
DNV agree with the EIA Documentation that the project leads to improved air quality compared against the reference situation (i.e. the current emissions), except in a relatively small part of the study area close to the Prunéřov power plants (criteria pollutants). The air quality for the pollutants CO and Ni in the greater study area will worsen be it not in a relevant degree.

Noise, vibration and radiation

Reference:

- Chapter D.I.3 of the EIA Documentation /57/ supported by Annex SP1 /66/.

DNV review:

- Statements on construction noise in the EIA Documentation are valid, although very general. As the project involves a significant amount of construction, construction noise should be examined in more detail prior to commencing construction, and it is understood that this has been agreed.
- DNV understand that the noise model used has been accepted for use by the MoE.

- Calculated Noise Levels after project implementation are as follows
  - RD1, 46.5 dB (Plant) + 46.2 dB (Traffic) = 49.4 dB
  - RD2, 43.7 dB (Plant) + 52.5 dB (Traffic) = 53.0 dB.

  The above noise levels hence exceed limits for day-time (some instances) and night-time.
- Noise Levels (after project implementation + attenuation)
  - RD1, 39.6 dB (Plant) + 46.2 dB (Traffic) = 47.1 dB
  - RD2, 37.9 dB (Plant) + 52.5 dB (Traffic) = 52.6 dB.

  The above noise levels are exceeding limits for day-time (some instances) and night-time. This is however caused by traffic, since the impact from the power plant is within the limits.
- Information provided on vibration and radiation is satisfactory.

DNV consider that there are some limitations to this section of the report, although they do not necessarily affect the conclusions of the EIA Documentation:

- The noise modelling and calculation process presented in the EIA Documentation is a ‘black box’, which makes it difficult to verify. For example, based on information made available in the EIA Documentation, DNV are unable to verify/understand
  - o traffic noise calculations
  - o how values are derived/calculated in Table 102 in /57/.
- Results of noise measurements presented in the main report range from 47.7 dB to 61.0 dB at the boundary of the Hygienic protection zone (HZP) and it is stated to be in compliance with the applicable limit. However, the Appendix provides noise levels in close proximity of EPR that range from 76.2 to 100.0 dB(A), which are not discussed in the main report.

DNV’s conclusion:

- The noise report is not straight forward and some of the calculated values are difficult to verify (based on the information provided in the EIA Documentation).
- Regardless, very significant noise abatement measures have been recommended in the EIA Documentation, and DNV are confident that these shall provide protection to the receptors. DNV are not convinced that the EIA Documentation supports the conclusion of implementing such significant noise abatement measures, because based on the significant levels of noise caused by traffic, the attenuation may not provide any ‘real’ benefits to the receptors; it is simply indicating adherence to the hygienic limit for noise levels that have been caused by the process plant.

Surface and groundwater

Reference:

- Chapter D.I.4 of the EIA Documentation /57/. Supporting information provided in Annex SP6.

DNV review:

- *Construction*.

  DNV support the measures that are recommended during construction to protect water and groundwater.
- *Operation - Impact of process wastewater discharges via Drain 1*.

  Owing to the improved future practices, with increased wastewater minimization, increased re-use of wastewater streams, and improved and new wastewater treatment facilities, DNV accept that the future quality of Prunéřov Stream should improve compared against the current practice.

  Although there will continue to be discharges from Drain 2 and Drain 3 in the future, these will be as a result of historical activities and not as a result of the proposed development (AI/AII/AIII and Ušák will take no further wastes/EBP from the site).
- *Operation - impact of seepage water from depositing EBP at Severní Lom*.

  The EIA Documentation argues that the groundwater flowing into Severní Lom already has high levels of dissolved inorganic solids (DIS), sulphate, ammonium, iron, boron, and is acidic (pH 5.6 to 5.8) prior to deposits of EBP. As a result, the EIA Documentation argues that there will not be *“any worsening of the existing groundwater conditions at the Severní lom quarry* *depositing site of PPCBs from the Prunéřov power plants and in the immediate vicinity. We therefore consider the depositing site to be suitable for the continued depositing of such materials"*. It goes onto to state that in the light of the future stabilisation of FGD materials with lime, the seepage waters will be improved in quality and hence depositing stabilised FGD materials with slaked lime *"will have a positive effect on the general condition of groundwater".*

DNV conclusions regarding the water compartment:

- Predicted impact of discharges during construction is acceptable.
- Predicted impact of industrial wastewater discharges during operation is acceptable.
- Whilst DNV agree that the environmental impact of seepage water in the future will be significantly reduced compared against current situation, owing to improvements in seepage water control, such as
  - Future stabilisation of FGD EBP with lime to reduce seepage water quantity and concentration.
  - Re-use of seepage water from Severní lom as process mixing water at EPR.
  - Partial re-use of seepage water from Severní lom G3 for dust suppression and part discharge to wastewater treatment at Bresno Wastewater Treatment Plant (Bresno WTP does not appear in the EIA Documentation but DNV have been advised of this intention by ČEZ).

  And whilst DNV accept that the groundwater flowing into Severní Lom from elsewhere already has high levels of DIS (note this conclusion is based on the analysis of only 5 water samples), DNV consider that the EIA Documentation does not currently provide sufficient evidence that the future impact of the Severní Lom seepage water from the improved stabilised EBP process is necessarily environmentally acceptable. It is considered that this information may be provided within the ČEZ applications for the Building Technical Certificates (/144/ and /148/), and within the additional stabilisation tests (with lime/stabilised EBP) that have taken place since the EIA Documentation was submitted. The Ministry should be confident that this information protects the environment satisfactorily.

Soil

Reference:

- Chapter D.I.5 of the EIA Documentation /57/.

DNV review:

- The EIA Documentation states that an exact specification of the types and quantities of waste created during construction is not currently available. The main construction contractor will be responsible for compliance with the environmental regulations for waste disposal.
- The Energy By-Products (EBP) are not 'waste', but are certified (via the Building Technical Certificates) by the MoE for use as certified construction materials at the Severní Lom mine.
- The EIA Documentation concludes that impact from future operational waste is no different to the current impact.

The key environmental issue with regard to the EBP relates to the seepage water that leaches from the Severní Lom mine. This is not discussed here, but is reviewed in §7.2.2.3, "Impacts & Mitigation – Surface & Groundwater".

DNV conclusion:

- DNV consider that the future operational waste impact will be no different than the current impact, and will be acceptable provided all waste management measures discussed in the EIA Documentation are implemented.
- DNV consider that, in the absence of asbestos and contaminated land surveys being provided within the EIA Documentation, that the MoE ensure they are satisfied that such surveys were sufficiently focused on the proposed EPR II development, and that the appropriate measures are taken to protect the environment during EPR II refurbishment. It is important that such materials are removed prior to construction/demolition, rather than during construction/demolition. See also 7.2.2.3, "Project design - Output data - Waste generation".

- Environmental improvements to the EBP management will be incorporated in the proposed development, for example
    - No further use of the wet method for managing the EBP;
    - Use of lime addition to create a more stable FGD EBP, with weaker seepage water produced and lower fugitive dust emissions;
    - Stricter environmental conditions are understood to be set within the Building Technical Certificates.

Natural resources

Reference:
- Chapter D.I.6 of the EIA Documentation /57/.

Review:
- No comment.

Fauna and flora impact, ecosystems

Reference:
- Chapter D.I.7 of the EIA Documentation /57/. Chapter based on Annex SP4 to the EIA Documentation /68/.

Review:
- Study is performed by external consultant authorized to perform the evaluation involved.
- Impact during construction phase as well as after implementation is zero.

DNV's conclusion:
- It is agreed with the EIA Documentation that the project globally leads to less indirect impact, compared against the current situation. Annex SP4 nor EIA Documentation are however sufficiently convincing in the demonstration, as e.g. Annex SP4 just jumps to the end conclusions rather than explains.

Landscape

Reference:
- Chapter D.I.8 of the EIA Documentation /57/.

Review:
- No comment.

Population

Reference:
- Chapter D.I.1 of the EIA Documentation /57/. Chapter based on Annex SP3 to the EIA Documentation /65/.

Assessment of methods used:
- Study is performed by external consultant authorized to perform health impact/risk evaluation.
- Methods and background used are sourced from adequate sources (WHO, U.S. EPA,…).

Review of the scope:
- The study involves 1. (indirect) impacts generated by air pollution and noise production (elaborate assessment), as well as radiation (concise assessment), and 2. social & economic impacts (concise assessment).

- The study area covers the entire Ústecký Region and further includes the larger cities of Karlovy Vary (to the SW of the Prunéřov power plants) and Chomutov, Most, Teplice and Ústí nad Labem (to the NE).

Review of values used:
- For air pollution, expert air pollutant dispersion study (Annex SP2 to the EIA Documentation /62/ /67/).
- For noise production, expert noise study (Annex SP1 to the EIA Documentation /66/).

Review of the results:
- The impact of the refurbished EPR II air pollution is relevant since limiting values for SO_2 and PM10 (short term) are still exceeded in the Krušné Hory Mountains (NW). Therefore monitoring is needed as proposed.
- The impact of the refurbished EPR II noise production is relevant since it is still originating 1% “heavy annoyance”, 3 to 5% “medium annoyance“ and 8 to 12% “light annoyance” for the 3 houses affected. For DNV’s opinion on the mitigation measures proposed, see §7.2.2.3, “Impacts and mitigation - Noise, vibration and radiation”.

DNV’s conclusion:
- It is agreed with the EIA Documentation that the project globally leads to less indirect impact on the population, compared against the current situation.

Cultural heritage

Reference:
- Chapter D.I.9 of the EIA Documentation /57/.

Review:
- No comment.

7.2.2.4. Alternatives

Consideration of Alternatives - Good EIA practice:
Environmental Impact Assessment should describe the main alternatives to the proposal that have been considered. For example, alternative sites, construction practices, plant and equipment, operating processes and site layouts should be considered (where appropriate). The advantages and disadvantages of each option should be clearly stated. The main reasons for the selection of the preferred option should be described in outline, taking into account the environmental effects. Other factors influencing the choice of alternative should be noted, e.g. feasibility, cost-effectiveness and reasonableness of each option.

References:
- Chapter E of the EIA Documentation /57/.
- Chapter ‘ADDRESSING THE CSP COMMENTS’ of the EIA Documentation. Chapter refers to Annex SP5 to the EIA Documentation /6/ and to the Fact-Finding Conclusion /37/.
- Supplement to EIA Documentation /13/ (identical to /94/).

Alternatives proposed by ČEZ in the Notification /38/ /39/ /40/:
- The proposed project.
- The continuation of the current situation i.e. continuation of the operation of the actual EPR II blocks B21 to B25 until expiry of their operational lifetime (the “zero variant”).
- The construction and operation of new blocks similar to the refurbished C to E (3 x 250 MW_{el}, guarantee coal) at another site.
  Additional alternatives were required by the Ministry through the Fact-Finding Conclusion.

- The construction and operation of equipment with a net efficiency in accordance with the BAT (42 to 45%) instead of the proposed 39% - 40% (see also §7.1.1).

Alternatives assessed by ČEZ in the EIA Documentation:
- The proposed project. Assessed in full by ČEZ.
- The "zero variant". Assessed in full since this scenario is the same as the existing situation. The environmental impact of the existing power station is known from the ambient environmental monitoring conducted, and it is reasonable to assume that a similar environmental impact will continue in the future if the same emissions continue.
- The construction and operation of new blocks in a different location. This alternative is assessed simply, concluding that the environmental impact would be similar (slightly more significant owing to increased transport of coal) to the proposed project, because it would be the same power generation facility, just in a different location.
- The termination of the current situation. It is not clear why this would be different from the above alternative with blocks at another site. The cited "negative social & economic impacts" are therefore equally not clear.

The additional higher efficiency alternatives required through the Fact-Finding Conclusion are not assessed. Instead arguments are made as to why 42% - 45% efficiency is not required by BAT. Reference is made to Annex SP5 and the statement therein that "practically all the options were evaluated from the viewpoint of use of BAT technology and the optimal approaches were selected from the BAT recommendations". The net unit efficiency provided in the most recent relevant project documentation is included in /7/, with a value of 40.00% (calculation according to §1.3 in [3]).

Additional consideration of alternatives by ČEZ in the Supplement to EIA Documentation:
Construction of equipment with a net efficiency of 42% is *"not technically and economically feasible given the initial conditions of the project. Consequently, ČEZ cannot submit the requested alternative. Therefore, the supplementation of the Project Documentation does not include the alternative suggested by the Ministry".* The Supplement provides further arguments why the 42% efficiency – calculated according to the EU method - cannot be achieved (e.g. limitations of low quality coal, and district heating requirements).
The net efficiency value appearing in the Supplement is 39.06% - 40.00% if calculated according to the EU method – (increased from 38.17% in the EIA Documentation). The Supplement contains also higher efficiency values, but these take into account heat supply (see also the Unger-Vlček "Refinement of technical aspects of KO EPR II" /2/).

DNV's conclusions:
- Section E of the documentation contains only basic assessment of the other alternatives before ruling them out. This is not good practice, but is consistent with what is seen in many EIA's regarding industrial projects. However, at the request of the MoE, more detailed information is provided within Annex SP5 and the Supplement EIA Documentation to justify why a higher efficiency alternative is not considered further. This more detailed information would normally in terms of its extent and type satisfy the requirements of EIA for the justification of submitting only one alternative. However, the adequacy of ČEZ' arguments in terms of their content and quality is appraised in detail in the first part of this assessment.

7.3. Part C – Calculation of CO_2 Impact

As elaborated in Part A, §7.1, two deviations from the BAT-requirements were observed, i.e. operation at 40.00% net unit efficiency instead of 42% (as required by BAT), and using a CO emission limit value of 250 mg/Nm³ instead of 200 mg/Nm³ (as required by BAT). While, in principle, also the latter has an influence on the CO_2 emission of the unit, its impact is negligible. Therefore, only the impact of the deviation from the BAT-requirement related to the net unit efficiency has been quantified in the current part of the work.

The methodology that was used to calculate the impact has been explained in §5.3. A step-by-step calculation of the contribution of the three aspects (i.e. combustion of lignite, use of limestone in the wet scrubber, and the combustion of natural gas), has been included in Annex XI.

The main results of the calculation are repeated in Table 4.

Note that the results cover the emissions of the three refurbished blocks of the Prunéřov II Power Plant, i.e. with a capacity of 250 MW_{el} each, and that operation at nominal load for 6,300 hours per year was assumed.

As expected, the main contribution to the CO_2 emission from the facility corresponds to the combustion of lignite. The wet scrubber and the natural gas combustion provide only a minor contribution.

In terms of the total annual CO_2 emissions, the impact of the deviation by the proposed project from the BAT-requirement regarding net unit efficiency is calculated to amount to 205,082 tons of CO_2 per year.

Table 4: Overview of results from CO_2 impact calculation

	Unit	Proposed Project	BREF Compliant Project
Net unit efficiency	[%]	40.00	42.00
Lignite combustion			
- annual CO_2 emission	[t CO_2/yr]	4,163,283	3,965,031
- specific emission factor	[kg CO_2/kWh el]	0.881	0.839
Wet scrubber			
- annual CO_2 emission	[t CO_2/yr]	143,438	136,608
- specific emission factor	[kg CO_2/kWh el]	0.911	0.868
Natural gas combustion			
- annual CO_2 emission	[t CO_2/yr]	741	741
Total CO_2 emission	[t CO_2/yr]	4,307462	4,102,380

The specific emissions factors are relatively high compared to the typical levels that are specified in the BREF LCP [1] Figure 1.7, p 20. The latter range from 700 to 750 kg CO_2/kWh el. This is explained by the fact that the emission factor that was used in the current calculation was taken from the National Greenhouse Gas Inventory Report of the Czech Republic [9], and, hence, reflects the average performance of lignite fired power plants in the country.

A site specific and more accurate calculation of the specific emission factor will be possible once the units are up and running and operational data on e.g. net electricity production, actual lignite consumption, slag production fly ash production, unburned carbon in slag, and unburned carbon in fly ash, will be available.

8. Conclusions

In June 2008, Čez a.s., the state-owned energy company in the Czech Republic, submitted a proposal for the comprehensive refurbishment of three of the five blocks of the Prunéřov II Power Plant to the Ministry of the Environment (MoE).

The scope of the refurbishment includes renewal of all core process components of the facility, as well as an upgrade of the common fuel, limestone and residue handling systems.

To support its permitting decision, the MoE contracted DNV to provide a third party assessment of the technical and environmental information and arguments related to the proposed project. The primary objectives of DNV's work were to:

- Assess compliance of the proposed project against all requirements of the BREF LCP and the BREF EE, and to evaluate if the deviations from BREF can be justified based on technical and/or environmental arguments linked to local conditions,
- Evaluate the Environmental Impact Assessment (EIA) of the project and to compare it to best practice within Europe, and
- Quantify the impact of potential deviations from BREF in terms of CO_2 emissions over the proposed lifetime of the project.

In line with the objectives, the scope of work of the assessment was split in three parts:

- Part A: BREF Compliance Assessment
- Part B: EIA Evaluation
- Part C: Calculation of the CO_2 Impact

The scope of work was limited to a technical and environmental evaluation of the proposed project, and did not include economical analyses, comparison of alternative scenarios, or the formulation of recommendations.

A team of four international experts, supported by a local expert was put in place to conduct the assessment. The bulk of the work was performed in February 2010 and included two site visits to the Prunéřov power plant.

The conclusions of the three parts of the assessment are provided below.

Part A

Compliance of the proposed project against the principles and concepts, the currently applied techniques, the techniques to be considered when determining BAT, and the actual BAT-requirements of the BREF LCP and the BREF EE was assessed on a point-by-point basis.

The conclusion is that the proposed project meets the large majority of the principles and concepts, the currently applied techniques, the techniques to be considered when determining BAT, and the actual BAT-requirements, but fails to comply on two issues:

a) The proposed net unit efficiency of the refurbished blocks in full condensation mode is calculated by the investor to be 40.00%. This value was confirmed by a simulation that was performed by DNV by means of a widely accepted power plant simulation tool. The value of 40.00% is below the BAT requirement for new pulverised lignite fired power plants (at least 42%).
From a technical point of view, the option to use a super-critical unit in order to meet the 42% efficiency requirement and the local heat supply commitments, were not fully explored. Specifically, alternative approaches to ensure the required security of heat supply (i.e. other than by means of redundancy through the implementation of three separate smaller units) have not been addressed.

Although the scope of work excludes financial and/or strategic considerations, the relevance of a detailed economical analysis to compare the payback period for a high efficiency unit against the projected operational lifetime (calculated based on the available lignite reserves), was illustrated.

b) The proposed emission limit for CO of the project (250 mg/Nm³) is higher than the BAT requirement of 200 mg/Nm³. In DNV's opinion, there are no technical reasons for not meeting this BAT requirement.

Part B

DNV have technically reviewed the EIA Documentation and have also reviewed the EIA process that has been followed for the project entitled "Comprehensive Reconstruction of the Prunéřov II 3 × 250 MW_e power plant", proposed by ČEZ, a.s.

Review of the EIA process

DNV is of the opinion that the EIA process for the proposed project was in line with the requirements of Act no 100/2001 Coll., as amended, and that no significant inconsistencies were found. It is clear that the EIA process involved consultation with different stakeholders throughout the process, and this provides confidence that the necessary transparency was present throughout the EIA process.

Technical review of the EIA Documentation

The EIA Documentation assessed in detail the impact of the redevelopment of the EPR II power plant with three new 250 MW_{el} boilers fuelled with lignite and with associated combustion equipment. Section E of the EIA Documentation contains only a basic assessment of the other alternatives before ruling them out. This is not good practice, but is consistent with what is seen in many EIA's regarding industrial projects. However, at the request of thee MoE, more detailed information is provided within Annex SP5 and the Supplement to EIA documentation to justify why a higher efficiency alternative is not considered further. This more detailed information would normally in terms of its extent and type satisfy the requirements of EIA for the justification of submitting only one alternative. However, the adequacy of ČEZ' arguments in terms of their content and quality is appraised in detail in the first part of this assessment.

With regard to the key environmental issues, DNV agree with the EIA Documentation that for most impact generating factors and impact receiving areas, the project leads to improved environmental quality compared against the reference situation (i.e. the current impact generation). However, DNV have the following comments regarding the key environmental aspects:

- The air quality will improve in nearly all of the study area (Ústecký Region to the east), with some deterioration expected relatively close to the EPR II power plant (northwest direction to the Krušné Hory Mountains). In order to finalise the EIA process and to issue an EIA statement, this should be taken into account along with the fact that the future air pollutant emissions are in accordance with applicable laws & regulations. Alternatives to the project with higher efficiency (using the same fuel type) will not further improve the air quality in the study area since the CO_2 reduction associated with the higher efficiency will only influence the global effect of climate change (emissions of parameters such as SO_2 are dictated by the engineering mitigation solutions).
- DNV consider that, in the absence of asbestos and contaminated land surveys being included within the EIA Documentation, the MoE ensure that the appropriate measures are taken to protect the environment from these hazards during the redevelopment.
- Very significant noise abatement measures have been recommended in the EIA Documentation; DNV are not convinced that the arguments support the conclusion of implementing such significant noise abatement measures.
- Whilst DNV agree that the environmental impact of the seepage water from the Energy By-Products (EPB) in the future will be significantly improved when compared against the current situation (owing to improvements in seepage water control), and whilst DNV accept that the groundwater flowing into Severní Lom from elsewhere already appears to have high levels of Dissolved Inorganic Solids, DNV

consider that the EIA Documentation does not currently provide sufficient evidence that the future impact of the Severní Lom seepage water from the improved stabilised EBP deposits is necessarily environmentally acceptable. It is believed that this information is provided within the ČEZ application process for the Building Technical Certificates. The MoE should be confident that this information sufficiently protects the environment.

Part C

The impact in terms of CO_2 emission of the deviation of the proposed refurbishment of the three blocks of the Prunéřov II Power Plant from the BAT-requirement on net unit efficiency was calculated by means of the method prescribed by the EU ETS Monitoring and Reporting Guideline – Annex II [8].

For operation during 6,300 hours per year at nominal capacity of all three of the refurbished blocks (i.e. a total electrical capacity of 3 x 250 MW_{el}), the impact in terms of CO2 emission is calculated as 205,082 tons of CO_2 per year.

9. References

[1] Integrated Pollution Prevention and Control – Reference Document on Best Available Techniques for Large Combustion Plants, European Commission, July 2006
(available from: http://eippcb.jrc.es/reference/)

[2] Integrated Pollution Prevention and Control – Reference Document on Best Available Techniques for Energy Efficiency, European Commission, February 2009
(available from: http://eippcb.jrc.es/reference/)

[3] Determination of efficiencies of conventional power stations, VDI 3986, Verein Deutscher Ingenieure, October 2000

[4] Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control

[5] Website DEBRIV (Bundesverband Braunkohle), the German lignite sector association (www.braunkohle.de) – last checked on 1/3/2010

[6] S.J. Goidich, Supercritical boiler options to match fuel combustion characteristics, Foster Wheeler North America Corp, 26/6/2007
(available from www.fwc.com/publications/tech_papers/files/TP_PC_07_01.pdf)

[7] Reliable and efficient steam generation system for modern utility service, The Babcock & Wilcox Company, 2004

[8] European Emission Trading Scheme – Monitoring and Reporting Guideline, December 2008
(available from www.ieta.org/ieta/www/pages/download.php?docID=1781)

[9] National Greenhouse Gas Inventory Report of the Czech Repubmic, NIR (reported inventory 2007)
(available from http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/4771.php)

Annex I: Project Document Overview

#	Title	Filename	Author(s)	Organisation	Received	# pages
1	Translation of slides 12 & 16 of Cez presentation (document 10)	. Original: "ad ppt - text_en_final.doc" . New: "1. Presentation Cez Document 10 - translation slide 12 and 16.doc"			5/02/2010	2
2	Annex to the letter entitled Comprehensive Refurbishment of the Prunerov II Power Plant 3 x 250 Mwe 22/4/2009	. Original: "priloha_dopisu_z_dubna_2008 prelozit cely_en_final.doc" . New:"2. Annex to letter_en_final.doc"	Ing Zdenek Unger Ing Zdenek Vlcek	Cez a.s.	5/02/2010	9
3	Translation of Own consumption vs ash dry matter, Boiler efficiency vs ash dry matter, Fuel characteristics Pruneroc & Ledvice power plant	. Original: "Vliv paliva na cinnost prelozit cely_en_final.doc" . New: "3. Part of Supplementation of EIA Documentation.doc"			5/02/2010	3
4	Overview EPRII - Efficiency of 250 and 660 MW blocks for subcritical and supercritical parameters for Libous and Bilina coal	. Original: "Porovnání úƒinností uhlí Libouт vers. Bilina_en_final.doc" . New: "4. Table provided by Investor during meeting in Spring 2009 (meeting date).doc"			5/02/2010	1
5	Assessment of efficiency KO EPRII3 X 250 MWE Project October 2009	. Original: "P²íloha - 5 - POSOUZEN╓ Θ¼INNOSTI - KO EPR II_EN_revize.doc" . New: "5. Annex of Expert Opinion - Euromatic efficiency assessment Oct09.doc"	Ing Vaclav Sramek Ing Pavel Pors Ing Miroslav Nerad	Euromatic sro	5/02/2010	46
6	Expert Assessment of the Comprehensive Refurbishment of the Prunerov II Power Plant 3x250MW in terms of BAT - Response to paragraphs 1-3 of the conclusion of the fact-finding procedure November 2008	. Original: "Image5_en_final.doc" . New: 6. Annex to EIA Documentation - Czech Tech Univ Prague Nov08.doc	Dr Ing T Dlouhy Dr Ing M Kolovratnik Dr Ing F Hrdlicka	Czech Technical University in Prague	5/02/2010	24
7	Expert Opinion regarding the environmental impact of the project "Comprehensive reconstruction of the Prunerov II 3 x 250 Mwe power plant" 19 October 2009	. Original: "POSUDEK EIA - KO EPR II_EN.doc" . New: "7. Expert Opinion on EIA 091019.doc"	Ing V Obluk		5/02/2010	89
8	Letter 25/9/2009 - Environmental impact assessment of the project "Comprehensive Refurbishment of the Prunerov II Power Plant 3 x 250 MWe" - supplementation of the documentation on the environmental impact of the project to Section 8 (5) of Act No. 100/2001 Coll., on environmental impact assessment and on amendment to some related laws (the Environmental Impact Assessment Act), as amended (herinafter the "Act")	. Original: "Image4_en_final.doc" . New: "8. Letter Cez 090925_en_final.doc"		Cez a.s.	5/02/2010	2

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#	Title	Filename	Author(s)	Organisation	Received	# pages
9	Letter 18/1/2010 - "We are hereby responding to the repeated ..."	. Original: "image3_en_final.doc" . New: "9. Letter Cez 100118_en_final.doc"		Cez a.s.	5/02/2010	8
10	Presentation - Documents for the joint meeting Cez - MZP 9/4/2009	. Original: "prezentace - prelozit_snimky_10-18_en_final.ppt" . New: "10. Presentation CEZ 090409_en_final.ppt"		Cez a.s.	5/02/2010	18
11	Project Documentation pursuant to Act No. 100/2001 Coll., as amended - "Comprehensive Refurbishment of the Prunerov II Power Plant 3 x 250 MWe" (incomplete)	. Original: "Image2_en_final.doc" . New: "11. Project Documentation - INCOMPLETE - DO NOT CONSIDER.doc"	RNDr J Horak Ing P Bohac P Bouska	Cez a.s.	5/02/2010	10
12	Project Notification pursuant to Act No. 100/2001 Coll., as amended - "Comprehensive Refurbishment of the Prunerov II Power Plant 3 x 250 MWe" (incomplete)	. Original: "Image1_en_final.doc" . New: "12. Project Notification - INCOMPLETE - DO NOT CONSIDER.doc"	RNDr J Horak Ing P Bohac P Bouska	Cez a.s.	5/02/2010	5
13	Supplementation of the Documentation on the Envrionmental Impact of the Project "Comprehensive Refurbishment of the Prunerov II Power Plant 3 x 250 MWe" September 2009	. Original: "Image6_en_final.doc" . New: "13. Annex to Document 8 - Supplement EIA Sep09.doc"	RNDr J Horak Ing P Bohac P Bouska	Cez a.s.	5/02/2010	17
14	Procedure Flow under the EIA Act in the Czech Republic	. Original: "anglické schéma.pdf" . New: "14. Schedule of EIA Procedure - 100_2001 Law.pdf"			8/02/2010	2
15	Chronology of the envrionmental impact assessment procedure of the project	. Original: "Chronology of the EIA process.pdf" . New: "15. MOE - Chronology of the EIA process.pdf"		MoE	8/02/2010	1
16	Description of the EIA Act No. 100/2001 Coll.	. Original: "Description of the EIA Act.pdf" . New: "16. MOE - Description of the EIA Act.pdf"			8/02/2010	1
17	EIA Procedure in General	. Original: "EIA procedure in general.pdf" . New: "17. MOE - EIA procedure in general - Document 14.pdf"			8/02/2010	1
18	In the matter of the EU IPPC Directive, Best Available Techniques and the Prunerov II power station - Opinion 19/1/2010	. Original: "opinion_BAT_Prunerov + CV.pdf" . New: "18. 100119 Opinion requested by NGO by P Roderick.pdf"	Peter Roderick		8/02/2010	11

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#	Title	Filename	Author(s)	Organisation	Received	# pages
19	B.II Input Data (incomplete)	. Original: "dokumentace_KO EPR II_EN_druha cast.doc" . New: "19. dokumentace_KO EPR II_EN_druha cast - DO NOT CONSIDER.doc"			8/02/2010	8
20	B. Data about the project (incomplete)	. Original: "dokumentace_KO EPR II_EN_prvni cast.doc" . New: "20. dokumentace_KO EPR II_EN_prvni cast - DO NOT CONSIDER.doc"			8/02/2010	36
21	B.II.2 Water (incomplete)	. Original: "dokumentace_KO EPR II_EN_treti cast.doc" . New: "21. dokumentace_KO EPR II_EN_treti cast - DO NOT CONSIDER.doc"			8/02/2010	88
22	Act No. 100/2001 Coll. On Environmental Impact Assessment and Amending some Related Acts, as amended by Act No. 93/2004 Coll. - Consolidated Version	. Original: "Zák 100-2001_konsolid_verze.pdf" . New: "22. Act 100_2001 - NOT OFFICIAL TRANSLATION - See Doc 16.pdf"			8/02/2010	46
23	Letter 14/12/09 - Statement of ČEZ, a.s. on the statement of MV Stavby s.r.o. (dated December 3, 2009) submitted with respect to the expert report on the environmental impact of the project "Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MWe"	. Original: "CEZ_MV_stavby_en_final.doc" . New: "23. 091214 Letter from Cez to MoE - NOT RELEVANT TO EIA.doc"	Ing Z Unger	Cez a.s.	9/02/2010	2
24	Letter 11/11/09 - Reply to the information on conclusion of a contract with the author of the expert report on the environmental impact of the project of "Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MWe"	. Original: "CEZ_odpoved_na_info_en_final.doc" . New: "24. 091111 letter from Cez - acceptance continuation pf processl.doc"	O Tucek	Cez a.s.	9/02/2010	1
25	Letter 10/12/08 - RE: Documentation of the project "Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MWe"	. Original: "CEZ_predlozeni_dokumentace_en_final.doc" . New: "25. 081210 Submission of documentation.doc"	O Tucek	Cez a.s.	9/02/2010	1
26	Letter 6/6/08 - Re: Confirmation of acceptance of project notification under Act No. 100/2001 Coll.	. Original: "CEZ_predlozeni_oznameni_en_final.doc" . New: "26. 080606 Submission of notification.doc"	Ing Z Unger	Cez a.s.	9/02/2010	1
27	Letter 27/1/09 - Re: Preparation of the expert report on the environmental impact of the project of "Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MWe"	. Original: "CEZ_souhlas_s_posudkem_en_final.doc" . New: "27. 090127 Letter from Cez - acceptance to pay for expert opinon.doc"	O Tucek	Cez a.s.	9/02/2010	1
28	MoE 19/12/09 - distribution of documentation to affected authorities	. Original: "MZP221_infDokumentace_en_final.doc" . New: "28. 091219 MoE - distribution of documentation to affected authorities.doc"	Ing J Honova	MoE	9/02/2010	5

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#	Title	Filename	Author(s)	Organisation	Received	# pages
29	MoE 13/6/08 - announcement commencement of fact finding procedure	. Original: "MZP221_infOznam_en_final.doc" . New: "29. 080613 MoE - commencement of fact finding procedure.doc"	Ing J Honova	MoE	9/02/2010	4
30	MoE 23/10/09 - distribution of expert report	. Original: "MZP221_infPosudek_en_final.doc" . New: "30. 091023 MoE - Distributiuon of expert report.doc"	Ing J Honova	MoE	9/02/2010	6
31	MoE 9/3/09 - request for supplementing information	. Original: "MZP221_vraceni_en_final.doc" . New: "31. 090309 MoE - Request for supplementing documentation.doc"	Ing J Honova	MoE	9/02/2010	5
32	MoE 14/12/09 - Minutes of public hearing	. Original: "MZP221_zapis1VP_en_final.doc" . New: "32. 091214 MoE - Minutes of public hearing.doc"	Ing L Vozka Ing J Honova	MoE	9/02/2010	12
33	MoE 13/11/09 - distribution of notification of public hearing	. Original: "MZPP221_inf1VP_en_final.doc" . New: "33. 091113 MoE - Distribution of notification of public hearing.doc"	Ing J Honova	MoE	9/02/2010	5
34	Appendix H9 - Assessment of compliance with the update of the regional Air Quality Improvement Programme	. Original: "Příloha dokum H9.doc" . New: "34. Appendix to EIA.doc"		Cez a.s.	9/02/2010	9
35	18/10/07 - OPINION On the plan “Comprehensive Renovation of Prunéřov II Power Plant” in terms of the territorial planning documentation	. Original: "13105A_1.doc" . New: "35. 071018 Statement of Kadan - Annex H1.doc"	P Brumlich	Municipal Authority Kadan	11/02/2010	1
36	The opinion of the authority in charge of the environmental protection on the plan of “Comprehensive Renovation of Prunéřov II Power Plant” in terms of a possible impact on the localities of European significance and bird habitats in accordance with Section 45i of the Act No. 114/1992 Coll., on the environmental and landscape protection	. Original: "13105A_2.doc" . New: "36. 011003 Annex H2.doc"	H Pumprova	Regional Authority of Usti Region	11/02/2010	1
37	30/7/08 - Conclusion of the fact-finding procedure	. Original: "13105A_3.doc" . New: "37. 080730 Conclusion of Fact Finding Process.doc"	Ing J Honova	MoE	11/02/2010	8

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#	Title	Filename	Author(s)	Organisation	Received	# pages
38	May 2008 - Part I - Plan Notification	. Original: "Part I_Notification for the EIA proces- Comprehensive refurbishment of EPRUII_complete version.doc" . New: "38. Part I_Notification EIA proces - complete version.doc"		Cez a.s.	14/02/2010	132
39	C. DATA PERTAINING TO THE STATE OF THE ENVIRONMENT IN THE AFFECTED AREA	. Original: "Part II_Notification for the EIA proces- Comprehensive refurbishment of EPRUII_complete version.doc" . New: "39. Part II_Notification EIA proces - complete version.doc"		Cez a.s.	14/02/2010	53
40	Image 18 and following of EIA complete version	. Original: "Part III_Notification for the EIA proces- Comprehensive refurbishment of EPRUII_complete version.doc" . New: "40. Part III_Notification for the EIA proces- complete version.doc"		Cez a.s.	14/02/2010	40
41	Statement pursuant to Section 9 (8) of Act No. 100/2001 Coll., on supplementation of the documentation and expert report for the project of “Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MWe”	. Original: "Ecological Law servis - NGO -statement to expert report and supplementation of the documentation.doc" . New: "41. Ecological Law - NGO.doc"	J Nezhyba		14/02/2010	12
42	Statement from Green Party	. Original: "Green Party --statement to expert report and supplementation of the documentation.doc" . New: "42. Green Party.doc"	P Klepis		14/02/2010	2
43	Statement from G-Team (component supplier)	. Original: "G-Team-Support for the refurbishment of the Prunéřov 2 power plant.doc" . New: "43. G-Team Statement.doc"	L Svitek	G-Team	14/02/2010	1
44	Chomutov authority statement	. Original: "Chomutov Municipal Authority-CONSTRUCTION AUTHORITY AND DEPARTMENT OF THE ENVIRONMENT-statement to expert report and" . New: "44. Chomutov Municipal Authority statement.doc"	A Turkova	Municipal Authority Chomutov	14/02/2010	1

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45	Kadan Municipal Authority statement	. Original: "Kadaň_Municipal Authority-statement to expert report" . New: "45. Kadaň Municipal Authority-statement.doc"	J Frajt	Kadan Municpal Authority	14/02/2010	1
46	Letter 12/1/10 - support from Ing M Kucera	. Original: "Letter - Ing. Kučera to MoE -Support for the" . New: "46. Letter 100112 - Ing. Kučera to MoE.doc"	Ing M Kucera		14/02/2010	2
47	Letter 08/1/10 - support from Nuclear Research Institute	. Original: "Letter-Nuclear Research Institute Řež a s to MoE.doc" . New: "47. Letter 100108 - Nuclear Research Institute Řež a.s. to MoE.doc"	Ing K Biza	Nuclear Research Institute	14/02/2010	2
48	Letter 08/1/10 - support from Vitkovice	. Original: "Letter-VÍTKOVICE MACHINERY GROUP to MoE.doc" . New: "48. Letter100108 - VÍTKOVICE.doc"	Ing J Svetlik	Vitkovice	14/02/2010	2
49	Letter 08/1/10 - support from ZVVZ Enven Engineering	. Original: "Letter-ZVVZ-Enven Engineering a s to MoE.doc" . New: "49. Letter 100108 - ZVVZ-Enven Engineering.doc"	Ing M Svab	ZVVZ enven engineering	14/02/2010	1
50	Letter 10/11/09 - Dept Air Protection	. Original: "MoE-Director of the Department of Air Protection-statement to expert report and supplementation of the documentation (2)" . New: "50. Letter 091110 - MoE Dpt Air Protection.doc"	Ing J Kuzel	MoE	14/02/2010	1
51	Letter 18/11/09 - Dept Integrated Prevention	. Original: "MoE-Director of the Department of Integrated Prevention and IRZ--statement to expert report and supplementation of t" . New: "51. Letter 091118 - MoE DIP.doc"	Ing J Marsak	MoE	14/02/2010	2
52	Letter 9/11/09 - Dept Water	. Original: "MoE-Director of the Department of Water Protection-statement to expert report and supplementation of the documentati" . New: "52. Letter 091109 - MoE Dpt Water.doc"	Ing V Jaglova	MoE	14/02/2010	1
53	Letter 1/12/09 - Dept EIA & IPPC	. Original: "MS Plechata--statement to expert report and supplementation of the documentation.doc" . New: "53. Letter 091201 - Moe Dept EIA & IPPC.doc"	Dept EIA and IPPC	MoE	14/02/2010	2

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54	Letter 3/12/09 - MV Stavby	. Original: "MV STAVBY s r o ---statement to expert report and supplementation of the documentation.doc" . New: "54. Letter 091203 - MV STAVBY s.r.o..doc"	MV Stavby		14/02/2010	2
55	Letter 26/11/09 - Reg Public Health Station agreement with expert report	. Original: "REGIONAL PUBLIC HEALTH STATION of the Ústí nad Labem" . New: "55. Letter 091126 - Reg Public Health Station.doc"	R Stastny	Regional Public Health Station	14/02/2010	1
56	Letter 1/12/09 - Statutory City of Chomutov	. Original: "STATUTORY CITY OF CHOMUTOV - - statement to expert report.doc" . New: "56. Letter 091201 - City of Chomutov.doc"	Ing P Chytra	Statutory City of Chomutov	14/02/2010	1
57	Project Documentation December 2008	. Original: "Documentation_comlete version.doc" . New: "57. Project Documentation_complete version.doc"	J Horak	Cez a.s.	15/02/2010	260
58	Annex No 5 - Assessment of the Immission Load in the Region of Usti	. Original: "Annex to the SP2.doc" . New: "58. Annex - Assessment of Immission Load.doc"	R Skeril	Cez a.s.	15/02/2010	20
59	Annex to the notification - SP1 - Acoustic study - part II May 2008	. Original: "Annex to the notification - SP1_ACOUSTIC STUDY_part II.doc" . New: "59. Annex - ACOUSTIC STUDY_part II.doc"	Enving	Cez a.s.	15/02/2010	49
60	Annex to the notification - SP1 - Acoustic study - part I May 2008	. Original: "Annex to the notification - SP1_ACOUSTIC STUDY_part I.doc" . New: "60. Annex - ACOUSTIC STUDY_part I.doc"	Enving	Cez a.s.	15/02/2010	54
61	Annex to the notification - SP6 - Evaluation of hydrogeological conditions	. Original: "Annex to the notification and documentation - SP6 - Archiv" . New: "61. Annex - SP6 - Hydrogeological Evaluation.doc"	Geotechnika	Cez a.s.	15/02/2010	45
62	Annex to the documentation - SP2 - Dispersion study	. Original: "Annex to the documentation - SP2_CONTRIBUTORY DISPERSION STUDY.doc" . New: "62. Annex to the documentation - SP2_CONTRIBUTORY DISPERSION STUDY.doc"	J Bucek	Cez a.s.	15/02/2010	56

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63	Annex to the notification - SP2 - Dispersion study	. Original: "Annex to the notification - SP2_CONTRIBUTORY DISPERSION STUDY.doc" . New: "63. Annex to the notification - SP2_CONTRIBUTORY DISPERSION STUDY.doc"	J Bucek	Cez a.s.	15/02/2010	113
64	Letter 091203 - Request for a transboundary EIA	. Original: "Letter - Mikronesie to MoE.pdf" . New: "64. Letter 091203 - Micronesia.pdf"	A Yatilman	Micronesia	15/02/2010	1
65	Annex to the documentation - SP3 - Impact on public health	. Original: "Annex to the documentation_SP3_Evaluation of Impacts of the Project upon public health .doc" . New: "65. Annex to the documentation_SP3_public health impact.doc"	M Wantochova	Health Care Institute at Kolin	16/02/2010	68
66	Noise study	. Original: "Dokumentace_EIA_priloha_SP1_hlukova_studie+ENG_kor.doc" . New: "66. Noise Study.doc"	M Lepka S Krajicek J Bucek	Enving sro	16/02/2010	96
67	Annex Dispersion & Immission Study	. Original: "P²ílohy_RS.doc" . New: "67. Annex Dispersion and Immission Study.doc"			16/02/2010	91
68	Assessment of the plan Impact on SAC and SPA - Annex SP4 December 2008	. Original: "Annex SP4 to the EIA documentation_Natura2000.doc" . New: "68. Annex SP4 to EIA documentation.doc"	V Bejcek		18/02/2010	40
69	Info coal mines in North Bohemian region (in Czech)	. Original: "vuc_b7.pdf" . New: "69. Info Coal Mines N Bohemia.pdf"			18/02/2010	35
70	Statement from Dept Integrated Prevention and IPR 25/02/2009	. Original: "MoE_IPPC department position.doc" . New: "70. Statement Dept Integrated Prevention and IPR.doc"	E Bauerova		18/02/2010	3
71	2009 emission data B23 (SOX, NOX, CO, O2)	. Original: "EMISE B23 pulhodina 2009.xls" . New: "71. 2009 Emissions B23.xls"		Cez a.s.	22/02/2010	

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72	2009 emission data B24 (SOX, NOX, CO, O2)	. Original: "EMISE B24 pulhodina 2009.xls" . New: "72. 2009 Emissions B24.xls"		Cez a.s.	22/02/2010	
73	2009 emission data B25 (SOX, NOX, CO, O2)	. Original: "EMISE B25 pulhodina 2009.xls" . New: "73. 2009 Emissions B25.xls"		Cez a.s.	22/02/2010	
74	2007-2008-2009 emission data B23, B24, B25 (yearly & monthly averages)	. Original: "Emissions EPRU II -23,24,25.xls" . New: "74. 2007 - 2008 - 2009 emissions B23-24-25.xls"		Cez a.s.	22/02/2010	
75	Energy act	. Original: "Energy Act.doc" . New: "75. Energy Act.doc"			22/02/2010	116
76	Extract from the grid code	. Original: "Kodex eng..pdf" . New: "76. Grid Code - Extract"			22/02/2010	83
77	Cross section boiler with indication of locations for which O2 levels are given	. Original: "KO_EPR_II_kotel.pdf" . New: "77. Cross section boiler.pdf"		Cez a.s.	22/02/2010	1
78	O2 levels for locations indicated in 77	. Original: "Komentá² k obsahu kyslíku_en_final.doc" . New: "78. O2 levels in boiler"		Cez a.s.	22/02/2010	1
79	2007-2008-2009 operational data B23, B24, B25	. Original: "Data EPR2_en_final.xls" . New: "79. 2007-2008-2009 operational data B23-24-25.xls"		Cez a.s.	22/02/2010	
80	Opening presentation site visit 1 - 11/2/2010	. Original: "KO EPR DNV 11 2 2010_eng.ppt" . New: "80. Opening presentation site visit 1.ppt"		Cez a.s.	22/02/2010	11

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#	Title	Filename	Author(s)	Organisation	Received	# pages
81	2nd presentation site visit 1 - 11/2/2010	. Original: "KO EPR II_DNV 11 2 2010_en-afternoon.ppt" . New: "81. Second presentation site visit 1.ppt"		Cez a.s.	22/02/2010	9
82	presentation - response of Cez to environmentalists	. Original: "Reakce ¼EZ a.s. na mediální_en_final.ppt" . New: "82. Response to environmentalists.ppt"		Cez a.s.	22/02/2010	28
83	Technical description coal pre-treatment	. Original: "1._Vnitrni_zauhlovani eng.doc" . New: "83. TD coal pretreatment.doc"		Cez a.s.	22/02/2010	5
84	Technical description combustion air	. Original: "2._Spalovaci_vzduchovy_system eng.doc" . New: "84. TD combustion air.doc"		Cez a.s.	22/02/2010	5
85	Technical description burners, waste gases	. Original: "3._Horaky eng.doc" . New: "85. TD burners & waste gases.doc"		Cez a.s.	22/02/2010	6
86	Technical description boiler	. Original: "4__Kotel eng.doc" . New: "86. TD boiler.doc"		Cez a.s.	22/02/2010	4
87	Technical description steam condensate cycle	. Original: "5._Parni-kondenzacni_cyklus eng.doc" . New: "87. TD steam condensate.doc"		Cez a.s.	22/02/2010	5
88	Technical description deslagging, ash removal	. Original: "6._Ostruskovani,_odpopilkovani eng.doc" . New: "88. TD deslagging & ash removal.doc"		Cez a.s.	22/02/2010	8
89	Technical description scrubber	. Original: "7._Odsireni eng.doc" . New: "89. TD scrubber.doc"		Cez a.s.	22/02/2010	6

Annex I: Project Document Overview (continued)

#	Title	Filename	Author(s)	Organisation	Received	# pages
90	Technical description control system	. Original: "8._Kontrolni_system_spalovani eng.doc" . New: "90. TD control system.doc"		Cez a.s.	22/02/2010	8
91	Technical description turbine	. Original: "9._Turbina eng.doc" . New: "91. TD turbine.doc"		Cez a.s.	23/02/2010	10
92	Request supplementation EIA to territoral self-governing units Annex to expert opinion 1 9/3/2009	. Original: "P²íloha - 1 - Dopis MªP - Dopracování D EIA - KO_=_iso-8859-2_Q__EPR_II=5Fen=5Ffinal=2E" . New: "92. Annex 1 to Expert Opinion"	Iing Vozka	MoE	25/02/2010	5
93	Letter Cez as - request continuation EIA Annex to expert opinion 2 25/9/2009	. Original: "P²íloha - 2 - Dopis ¼EZ - ªádost o_en_final.doc" . New: "93. Annex 2 to Expert Opinion"	V Hlavinka	Cez a.s.	25/02/2010	2
94	Supplementation of the Documentation on the Envrionmental Impact of the Project "Comprehensive Refurbishment of the Prunerov II Power Plant 3 x 250 MWe" Annex to expert opinion 3 September 2009 DO NOT CONSIDER	. Original: "P²íloha - 3 - DOPLN╗N╓ D EIA - KO EPR II - sam_=_iso-8859-2_Q_ostatn=E1_p=F8=EDloh=5Fen=5" . New: "94. Annex 3 to Expert Opinion"	RNDr J Horak Ing P Bohac P Bouska	Cez a.s.	25/02/2010	17
95	Request continuation work on expert report Annex to expert opinion 4 7/10/2009	. Original: "P²íloha - 4 - Dopis MªP - V∞zva k_en_final.doc" . New: "95. Annex 4 to Expert Opinion"	J Honova	MoE	25/02/2010	1
96	Municipality Domasin Statement to the EIA documentation 23/2/2009	. Original: "Vyjád²ení - 1- k D EIA - Domaτín_en_final.doc . New: "96. Statement 1 to EIA documentation.doc"	I Vondrova		25/02/2010	1
97	Town of Kadan Statement to the EIA documentation 20/1/2009	. Original: "Vyjád²ení - 2 - k D EIA - Kadaσ_en_final.doc" . New: "97. Statement 2 to EIA documentation.doc"	J Kulhanek		25/02/2010	1

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#	Title	Filename	Author(s)	Organisation	Received	# pages
98	Municipality of Kovarska Statement to the EIA documentation 28/1/2009	. Original: "Vyjád²ení - 3 - k D EIA - Ková²ská_en_final.doc" . New: "98. Statement 3 to EIA documentation.doc"	A Kepicova		25/02/2010	1
99	Municipality of Krimov Statement to the EIA documentation 20/1/2009	. Original: "Vyjád²ení - 4 - k D EIA - K²imov_en_final.doc" . New: "99. Statement 4 to EIA documentation.doc"	Z Vokaty		25/02/2010	1
100	Municipality of Medenec Statement to the EIA documentation 12/2/2009	. Original: "Vyjád²ení - 5 - k D EIA - M╪d╪nec_en_final.doc" . New: "100. Statement 5 to EIA documentation.doc"	V Markova		25/02/2010	1
101	Municipality of Misto Statement to the EIA documentation 2/2/2009	. Original: "Vyjád²ení - 6 - k D EIA - Misto_en_final.doc" . New: "101. Statement 6 to EIA documentation.doc"	Mayor of Misto		25/02/2010	1
102	Regional authority of Usti region Statement to the EIA documentation 11/2/2009	. Original: "Vyjád²ení - 8 - k D EIA - Θsteck∞ kraj_en_final.doc" . New: "102. Statement 7 to EIA documentation.doc"	T Krydlova		25/02/2010	1
103	Municipal authority of Kadan Statement to the EIA documentation 19/12/2008	. Original: "Vyjád²ení - 9 - k D EIA - M╪Θ Kadaσ_en_final.doc" . New: "103. Statement 8 to EIA documentation.doc"	J Frajt		25/02/2010	1
104	Municipal authority of the city of Chomutov Statement to the EIA documentation 21/1/2009	. Original: "Vyjád²ení - 11 - k D EIA - Mgistrát Chomutov_en_final.doc" . New: "104. Statement 9 to EIA documentation.doc"	A Turkova		25/02/2010	1
105	Regional authority of Usti region Statement to the EIA documentation 6/2/2009	. Original: "Vyjád²ení - 12 - k D EIA - KΘ Θsteckého kraje_en_final.doc" . New: "105. Statement 10 to EIA documentation.doc"	T Krydlova		25/02/2010	2
106	Regional public health station of Ustni region Statement to the EIA documentation 19/2/2009	. Original: "Vyjád²ení - 13 - k D EIA - KHS Θsteckého kraje_en_final.doc" . New: "106. Statement 11 to EIA documentation.doc"	J Lokvencova		25/02/2010	2

Annex I: Project Document Overview (continued)

#	Title	Filename	Author(s)	Organisation	Received	# pages
107	Czech environmental inspection Statement to the EIA documentation 26/1/2009	. Original: "Vyjád²ení - 14 - k D EIA - ¼lªP - OI Ɵstí na_=_iso-8859-2_Q_d_Labem=5Fen=5Ffinal=2E" . New: "107. Statement 12 to EIA documentation.doc"	I Humlova		25/02/2010	2
108	MOE - Dept of Water Protection Statement to the EIA documentation 15/1/2009	. Original: "Vyjád²ení - 16 - k D EIA - MªP-OOV_en_final.doc" . New: "108. Statement 13 to EIA documentation.doc"	V Jaglova		25/02/2010	1
109	MOE - Dept of Landscape Protection Statement to the EIA documentation 23/1/2009	. Original: "Vyjád²ení - 17 - k D EIA - MªP-OPK_en_final.doc" . New: "109. Statement 14 to EIA documentation.doc"	P Dobrovsky		25/02/2010	1
110	MOE Internal Communication Statement to the EIA documentation 2/2/2009	. Original: "Vyjád²ení - 18 - k D EIA - MªP-OUED_en_final.doc" . New: "110. Statement 15 to EIA documentation.doc"	V Vlk		25/02/2010	2
111	MOE Internal Communication Statement to the EIA documentation 9/3/2009	. Original: "Vyjád²ení - 19 - k D EIA - MªP-OIP - 2_en_final.doc" . New: "111. Statement 16 to EIA documentation.doc"	H Benes		25/02/2010	2
112	MOE Internal Communication Statement to the EIA documentation 11/8/2009	. Original: "Vyjád²ení - 19 - k D EIA - MªP-OIP - 3_en_final.doc" . New: "102. Statement 17 to EIA documentation.doc"	J Marsak		25/02/2010	4
113	Dissenting statement from GARDE Statement to the EIA documentation 13/2/2009 – SAME AS 114	. Original: "Vyjád²ení - 20 - k D EIA - EPS_en_final.BAK" . New: "113. Statement 18 to EIA documentation.doc"	GARDE		25/02/2010	26
114	Dissenting statement from GARDE Statement to the EIA documentation 13/2/2009	. Original: "Vyjád²ení - 20 - k D EIA - EPS_en_final.doc" . New: "114. Statement 19 to EIA documentation.doc"	GARDE		25/02/2010	16
115	Statement on project Statement to the EIA documentation 11/2/2009	. Original: "Vyjád²ení - 21 - k D EIA - Greenpeace_en_final.doc" . New: "115. Statement 20 to EIA documentation.doc"	Greenpeace		25/02/2010	2

Annex I: Project Document Overview (continued)

#	Title	Filename	Author(s)	Organisation	Received	# pages
116	Town of Kadan - Vysluni - Usti region - Chomutov - Authority of Kadan - Statement 1 to the notification several dates in July 2008	. Original: "13105A_7.doc" . New: "116. Statement 1 to the notification.doc"	J Kulhanek		25/02/2010	19
117	Town of Vysluni Statement 2 to the notification 2/7/2008	. Original: "Vyjád²ení - 7 - k oznámení - V∞sluní_en_final.doc" . New: "117. Statement 2 to the notification.doc"	M Hladik		25/02/2010	1
118	Municipal authority of Klasterec nad Ohri Statement 3 to the notification 26/6/2008	. Original: "Vyjád²ení - 10 - k oznámení - M╪Θ Klárte_=_iso-8859-2_Q_rec_nad_Oh=F8=ED=5Fen=5" . New: "118. Statement 3 to the notification.doc"	I Dzugasova		25/02/2010	1
119	Internal communication Statement 4 to the notification 11/7/2008	. Original: "Vyjád²ení - 15 - k oznámení - MªP-OOO_en_final.doc" . New: "119. Statement 4 to the notification.doc"	J Kuzel		25/02/2010	2
120	Answers on EIA info request 26-2-2010	. Original: "answers on EIA information request - 260210.doc" . New: "120. answers on EIA information request - 260210.doc	EIA Dept	MoE	1/03/2010	4
121	Requested data by DNV during site visit 2 - part 1	. Original: "DNV requests for data_I.doc" . New: "121. DNV requests for data_I.doc"		Cez a.s.	1/03/2010	1
122	Requested data by DNV during site visit 2 - part 2	. Original: "DNV requests for data_II.doc" . New: "122. DNV requests for data_II.doc"		Cez a.s.	1/03/2010	1
123	Requested data by DNV during site visit 2 - part 3	. Original: "DNV requests for data_III.doc" . New: "123. DNV requests for data_III.doc"		Cez a.s.	1/03/2010	1
124	Copy of the Energy Act with relevant paragraphs highlighted by Cez	. Original: "Energy Act.doc" . New: "124. Energy Act.doc"		Cez a.s.	1/03/2010	116

Annex I: Project Document Overview (continued)

#	Title	Filename	Author(s)	Organisation	Received	# pages
125	Letter from MoE to Sachsisches Staatsministerium fur Umwelt und Landwirschaft (30/10/2009)	. Original: "Komplexni obnova el. Prunerov II(informace pro SRN)_en_final.doc" . New: "125. mail 1.doc"	J Honova	MoE	1/03/2010	1
126	Request to V Obluk to prepare an expert opinion (13/01/2009)	. Original: "Komplexni obnova el. Prunerov II(povereni posudkare)_en_final.doc" . New: "126. mail 2.doc"	J Honova	MoE	1/03/2010	2
127	Request to continue work on expert opinion to V Obluk (7/10/2009)	. Original: "Prunerov_vyzva k pokracovani praci na posudku_en_final.doc" . New: "127. mail 3.doc	J Honova	MoE	1/03/2010	1
128	GARDE - Disapproving statement (13/2/2009)	. Original: "eia-cez-prunerov-vyjadreni-dokumentace_eps_13-02-2009.doc" . New: "128. statement to documentation 1.doc"	J Nezhuba	GARDE	1/03/2010	14
129	Reply to the Statement of Greenpeace (19/2/2009)	. Original: " KO EPR II-Greenpeace-reakce ¼EZ_en_final.doc" . New: "129. statement to documentation 2.doc"		Cez a.s.	1/03/2010	6
130	Expert report on part of the statement of Greenpeace (19/2/2009)	. Original: "PRETEL_EPR 2 posudek Greenpeace_en_final.doc" . New: "130. statement to documentation 3.doc"	J Pretel		1/03/2010	5
131	EIA - statement on the documentation Regional Authority of the Ústí region (11/2/2009)	. Original: "vyjadreni_Rady_Ust_kraje_en_final.doc" . New: "131. statement to documentation 4.doc"	T Krydlova		1/03/2010	1
132	Extract from resolution - Council of the Ústí Region (11/2/2009)	. Original: "vyjadreni_usneseni_Rady_en_final.doc" . New: "132. statement to documentation 5.doc"			1/03/2010	1
133	Statement on the documentation of the EIA (11/2/2009)	. Original: "VyjadreniGP_dokumentaceEIAprunerov_en_final.doc" . New: "133. statement to documentation 6.doc"	J Rovenský	Greenpeace	1/03/2010	2

Annex I: Project Document Overview (continued)

#	Title	Filename	Author(s)	Organisation	Received	# pages
134	Extract from resolution - Council of the Ústí Region (2/12/2009)	. Original: "13_kraj_2.12.09_nesouhlas_en_final" . New: "134. statement to expert opinion 1.doc"			1/03/2010	1
135	Extract from resolution - Council of the Ústí Region (3/12/2009)	. Original: "13_kraj_3.12.09_revokace_en_final.doc" . New: "135. statement to expert opinion 2.doc"			1/03/2010	1
136	Regional inspectorate in Ústí nad Labem - Statement on the notification (10/7/2008)	. Original: "¼lªP-UL_en_final" . New: "136. statement to notification 1.doc"	I Humlova		1/03/2010	2
137	Dissapproving statement to the notification (23/7/2008)	. Original: " eia-cez-prunerov-vyjadreni-eps_23-07-2008.doc" . New: "137. statement to notification 2.doc"	GARDE		1/03/2010	2
138	Regional public health station of Ustni region Request for extension of the deadline for providing a statement (1/7/2008)	. Original: "KHS_en_final.doc" . New: "138. statement to notification 3.doc"	O Zbuzková		1/03/2010	1
139	Regional Authority of the Ústí region - EIA - statement on fact-finding procedure (13/6/2008)	. Original: "KU_Usteckeho kraje_en_final.doc" . New: "139. statement to notification 4.doc"	T Krydlova		1/03/2010	3
140	Town of Kadan - statement to notification (8/7/2008)	. Original: "M╪stoKadaσ_en_final.doc" . New: "140. statement to notification 5.doc"	J Kulhanek		1/03/2010	1
141	Municipal authority of the city of Chomutov Statement to the notification (9/7/2009)	. Original: "MagM╪staChomutov_en_final.doc" . New: "141. statement to notification 6.doc"	A Turkova		1/03/2010	1
142	MoE - Internal Communication - Commencement of the fact finding procedure (23/6/2008)	. Original: "OOV_en_final" . New: "142. statement to notification 7.doc"	V Jáglová		1/03/2010	1

Annex I: Project Document Overview (continued)

#	Title	Filename	Author(s)	Organisation	Received	# pages
143	MoE - Internal Communication - Commencement of the fact finding procedure (4/7/2008)	. Original: "OPK_en_final.doc" . New: "143. statement to notification 8.doc"	P Dobrovsky		1/03/2010	1
144	Construction technical certificate - valid until 31/7/2012	. Original: "certifikát_stabilizát II_en_final.doc" . New: "144. certificate stabilisate with lime.doc"	Z Koci	TZUS	2/03/2010	3
145	presentation refurbishment Tušimice	. Original: "Komplexní obnova elektrárny Tuтimice II_en_final.ppt" . New: "145. presentation site visit 2 - Tusimice.ppt"		Cez a.s.	2/03/2010	21
146	measuring the mercury content in combustion products	. Original: "M╪²ení rtuti_en_final.doc" . New: "146. measuring Hg in combustion products.doc"			2/03/2010	2
147	formation of Nox and means of minimization	. Original: "Tvorba NOx_en_final.doc" . New: "147. formation of NOx.doc"	J Lojkasek	ORGEZ	2/03/2010	6
148	product certificate construction technical certificate	. Original: "certifikát_stabilizát_en_final.doc" . New: "148. product & construction certificate no lime.doc"		TZUS	3/03/2010	9

Annex II: BREF LCP Assessment Table

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
	Technologies: for solid fuels, pulverised combustion, FB combustion and grate firing are considered BAT under the conditions described in the document. Choice of system is based on economic, technical, environmental and local considerations, such as availability of fuels, the operational requirements, market conditions, network requirements.	p ii		From Executive summary - treated more elaborately below.
	BAT for preventing releases from unloading, storage and handling of fuels and additives. Relevant are particulate matter release, water contamination, and fire prevention.	Table 1 p iii		From Executive summary - treated more elaborately below.
	BAT associated thermal efficiency levels [net %] for coal & lignite are: - cogeneration: 75% - 90% (existing & new plants) - pulverised coal combustion: 43% - 47% new plants - pulverised lignite combustion: 42% - 45% new plants - existing plants: 36% - 40% or an incremental improvement of more than 3% points (split view on the lower limit)	Table 2 p iv		From Executive summary - treated more elaborately below.
	BAT for de-dusting of off-gas from new and existing combustion plants is considered to be the use of an electrostatic precipitator (ESP) or a fabric filter (FF), where a FF normally gives emission levels below 5 mg/Nm³. Cyclones and mechanical collectors alone are not considered BAT, but they can be used as pre-cleaning.	p v		From Executive summary - treated more elaborately below.
	BAT ELV for dust for coal and lignite plants with a capacity from 100 - 300 MWth: - technology: ESP or FF in combination with FGD for PC - new plants: 5 - 20 mg/Nm³ (split views on upper limit) - existing plants: 5 - 25 mg/Nm³ (split views on upper limit)	Table 5 p v		From Executive summary - treated more elaborately below.
	Heavy metals (As, Cd, Cf, Cu, Hg, Ni, Pb, Se, V, Zn) are normally released as compounds in association with particulates. Hence, BAT to reduce HM is the application of high performance de-dusting devices such as ESP or FF.	p vi		From Executive summary - treated more elaborately below.
	Use of low sulphur fuel and/or desulphurisation is considered BAT. For plants over 100 MWth, use of low S fuel can only be seen as a supplementary measure to reduce SO2 in combination with other measures.	p vi		From Executive summary - treated more elaborately below.

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Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
	BAT are wet scrubber (92% - 98% reduction rate) and the spray dry scrubber (85% - 92% reduction rate). Advantage of the wet scrubber is also the removal of HCl, HF, dust and heavy metals.	p vi		From Executive summary - treated more elaborately below.
	BAT ELV for SO2 for coal and lignite plants with a capacity from 100 - 300 MWth: - technology: low S fuel or/and FGD (dry/wet) - new plants: 100 - 200 mg/Nm³ - existing plants: 100 - 250 mg/Nm³ (split views on upper limit)	Table 6 p vi		From Executive summary - treated more elaborately below.
	For pulverised coal plants, the reduction of NOX by primary and secondary measures (such as SCR) are BAT, with reduction rates of the SCR between 80% - 95%. For pulverised lignite and peat fired plants, the combination of different primary measures is BAT, e.g. use of advanced low NOX burners in combination with other primary measures such as FG recirculation, staged combustion, reburning, etc. The use of primary measures tends to cause incomplete combustion, resulting in a higher level of unburned C in the fly ash and some CO.	p vii		From Executive summary - treated more elaborately below.
	BAT ELV for NOX for **coal** PC plants with a capacity from 100 - 300 MWth: - technology: combination of primary measures in combination with SCR or combined techniques (split view on use of SCR due to economical reasons) - new plants: 90 - 200 mg/Nm³ (split views on lower limit) - existing plants: 90 - 200 mg/Nm³ (split views on upper limit) BAT ELV for NOX for **lignite** PC plants with a capacity from 100 - 300 MWth: - technology: combination of primary measures - new plants: 100 - 200 mg/Nm³ - existing plants: 100 - 200 mg/Nm³ (split views on upper limit)	Table 7 p vii		From Executive summary - treated more elaborately below.
	BAT for the minimisation of CO emissions is complete combustion, based on good furnace design, use of high performance monitoring and process control techniques, and maintenance of the combustion system.	p ix		From Executive summary - treated more elaborately below.
	With respect to water contamination, oil separation wells are BAT.	p ix		From Executive summary - treated more elaborately below.
	BAT for wet scrubbing deSOX is the application of a waste water treatment plant, consisting of different chemical treatments to remove heavy metals and to decrease the amount of solid matter from entering the water. Also included is an adjustment of the pH, the precipitation of heavy metals and removal of solid matter.	p ix		From Executive summary - treated more elaborately below.

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Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
	Utilisation and re-use of combustion residues and by-products is BAT. Many different possibilities exist, with each specific criteria, such that they cannot be covered by BREF.	p ix		From Executive summary - treated more elaborately below.
1	Generic technical principles to improve LCP efficiency: - co-generation - good combustion (low unburned in flue gas) - low unburned carbon in ash - low air excess (typically 12%-20% for PC boilers with dry bottom) - high steam parameters (pressure & temperature) - lowest flue gas temperature (typically 120℃ - 170℃) - vacuum in condenser (typically dictated by cooling water temperature, common: 30 mbar(a)) - variable pressure operation - condensate & feedwater pre-heating	§2.7.9 p 49 - 50	ok	<u>Co - generation</u> . Heat for internal heating of EPR I & EPR II will be supplied by a new heat exchanger (33 MW_{th}) in reconstructed block E. . External heat to Chomutov, Jirkov and Klášterec nad Ohři will be supplied by reconstructed blocks C, D, and E. Each block will have its own heat exchanger (100 MW_{th}) and a peak heaters, ensuring a max delivery of 245 MW_{th}. . Nominal (statistically most common) heat supply for each block is 23.8 MW_{th}. Contracts for external heat supply as well as the Energy Act were verified. . Temperatures of the district heating network are 145°/ 55℃. <u>Good combustion</u> . An emission limit of 250 mg CO/Nm^3 is proposed for the new blocks. Motivation for this value is the expected degradation of lignite quality and the trade-off between low NO_x levels (through primary measures) and low CO levels. . This emission limit is in line with local legislation (N°146/2007 Coll. Annex 1 & 2), but **not** with BAT (200 mg/Nm^3), **nor** with experience from reference plants (see Annex IV). . See §7.1.2 in the main text for further discussion. The impact of CO in flue gas on plant efficiency is negligible, except for very high concentrations. <u>Low unburned carbon in ash</u> . Initial results from Tušimice (identical operation but still in commissioning phase) for fly ash and slag are < 1%mass and 5%mass, respectively. Furthermore, typical slag and fly ash production rates have been observed (8% and 92%, respectively). . No separate guarantees for ash quality were obtained from the boiler supplier, but they are indirectly covered by the guarantee on boiler efficiency (90,12%). <u>Low air excess</u> . The new blocks are designed to operate at 2,4 vol% O_2, 3,2 vol% O_2 and 4,1 vol% O_2 (dry), at the outlet of the combustion chamber, the inlet of the Ljungström, and the outlet of the Ljungström, respectively. This corresponds to an air excess of 13%, 18%, and 24% respectively.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
				High steam parameters . The steam parameters for the superheated and reheat steam of the new blocks will be 575℃ & 185 bar, and 580℃ & 37 bar, respectiv ely. These values are in line with BAT and other recent reference plants of the same type (i.e. subcritical power stations, see Annex IV). Low flue gas temperature . The design temperature of the flue gas at the exit of the Ljungström for the new blocks is 140℃ and therefore in line with BAT. Vacuum in condenser . The design vacuum in the condenser is 44 mbar (nominal conditions) and 30 mbar (if meteorological conditions allow). This is in line with BAT and recent reference plants (see Annex IV). Variable pressure operation . The boilers of the new blocks are of the Benson (once-through) type and will be operated in sliding pressure mode. Condensate & feed water pre-heating . The design of the new blocks includes an 8-stage feedwater preheating, mainly by means of uncontrolled taps of the turbine. The design value of the feedwater temperature at the boiler inlet is 250℃, which i s in line with BAT and recent reference plants of similar type (see Annex IV).
2	Applied feeder techniques for lignite combustion achieve three objectives: they pulverise, dry, and then distribute the fuel to the combustion chamber. Pulverisation is aided by recirculated hot flue gas, extracted from the boiler. Lignite particles are typically reduced to less than 90 µm (approx 60% passes through a 70µ mesh screen). The flue gas heat reduces the moisture content from 45%-70% down to 10%-20%.	§4.1.3.2 p 166	ok	No conceptual changes are planned for the lignite pre-treatment (storage, transport, grinders & pulverisers). Recirculated flue gas (taken from combustion chamber exit) is used to dry the lignite upstream of the mills. The eight MWB 55 mills will re-used, but with a new gearbox, a hydraulic coupling and a new motor at higher speed. Furthermore, the outlet of the classifier will be redesigned to obtain a favourable granulometry (scope and guarantee of boiler supplier). No data is available on the degree of drying of the lignite prior to injection in the boiler.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
3	Techniques applied in most of the new coal or lignite fired condensing power plants built in the 1990s yield a net heat rate of around 2.3, i.e. a net efficiency of 43%. When possilbe, direct once-through cooling is used to achieve the lowest possible condenser pressure and temperature, to maximise the plant power generation efficiency. Today's condensing power plant units are usually quite large, typically with power outputs from 300 to 900 MWel, with the fuel being burned in pulverised coal burners.	§4.1.4.1 p 168	nok	The heat rate of the proposed blocks is 2.5, corresponding to a net unit efficiency of 40%. This issue is discussed in further detail in §7.1.1 of the main text.
4	In dry bottom boilers (DBB), a commonly applied technique for lignite and coal fired power plants, typically 10%-20% of the ash is transferred to the dry bottom and is extracted as slag. The remaining 80%-90% of the ash is transported with the flue gas and then removed in the precipitators as fly ash.	§4.1.4.1.1. p 168	ok	The design values for the slag and fly ash production for the retrofitted blocks are 8% and 92%, respectively. These are in line with BAT.
5	Currently applied techniques for solid fuel, and for clean and new boilers reach 86% - 94% boiler efficiency. The effect of fuel is important, e.g. boiler with identical performance reach different efficiencies, depending on the nature of the fuel: - international coal: 94% - lignite: 92% - low grate lignite: 86%	§4.1.8.1 p179	ok	The guaranteed boiler efficiency by the supplier is 90,12%, which is in line with BAT. A detailed discussion on the influence from the moisture and ash in the fuel has been included in §7.1.1 of the main text.
6	In currently applied combustion processes, the excess air is dependent on the boiler type and on the nature of the fuel. Typically, 20% of excess air is the figure for pulverised coal fired boiler with a dry bottom. Flue gas temperature leaving the clean boiler traditionally lies between 120° and 220℃ so as to avoid the risk of a cid corrosion by condensation of sulphuric acid.	§4.1.8.2 p 179	ok	The new blocks are designed to operate at 2,4 vol% O_2, 3,2 vol% O_2 and 4,1 vol% O_2 (dry), at the outlet of the combustion chamber, the inlet of the Ljungström, and the outlet of the Ljungström, respectively. This corresponds to an air excess of 13%, 18%, and 24% respectively, and is in line with BAT. The design temperature of the flue gas at the exit of the Ljungström for the new blocks is 140℃ and therefore in line with BAT.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
7	Currently applied techniques for Emission control from pulverised fuel combustion include: - fuel pre-treatment (mixing, use of higher quality, washing / cleaning, gasification, homogenization) - fuel switch (may require exchange of burners and modification of heat exchanging surface) - dust abatement (ESP or fabric filters) - abatement of Hg (in general, no dedicated systems are used - ESP / FF + DeSOX suffice) - abatement of SOx (wet scrubbers are dominant for plants > 300 MWth, with spray, packed or double loop towers) - abatement of NOx (primary measures suffice for lignite combustion due to lower combustion temperature and the higher humidity of the flue gas)	§4.1.9.1 p 180 - 187	ok	Fuel pre-treatment . Mixing and homogenisation of the lignite is done at the mine, prior to arrival on site. It is achieved through specific handling and storage procedures. The effectiveness of this approach was verified by inspection of the main lignite properties (LHV, moisture, ash and S content), obtained from automated daily sampling and analysis, for 2009. . A study of higher quality solid fuels in an acceptable radius from the current facility was performed, see Annex VI). The conclusion of the study is that there are no sources of higher quality available without involving excessive transport (see also §7.1 of the main text). Fuel switch . There are no sources of solid fuel of higher quality available without requiring excessive transport (see also §7.1 in the main text). Dust abatement . The existing precipitators for each block will be replaced by new EPS with four fields (100 kV, <20 mg/Nm³ exit guarantee). Abatement of Hg . Hg removal will be achieved by the new precipitators (ESP) and the new wet scrubber for each block. Monitoring and sampling will be performed according to the requirements of the European legislation. See also item 30. Abatement of SOx . The existing wet scrubbers (Mitsubishi type) will be replaced by new wet scrubbers (Austrian Energy type). No preliminary guarantee could be provided during verification. Abatement of NOx . A combination of different primary measures (low NO_x burners, staged combustion, flue gas recirculation, and air staging) will be used to control NO_x emissions.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
8	Techniques to be considered when determining BAT regarding unloading, storage and handling of fuel include: - closed transfer conveyors with dedusting equipment - open conveyors with windshields - unloading equipment with adjustable height - cleaning devices for conveyor belts - enclosed storage of lime/limestone in silos with dust abatement - water spray systems - sealed surfaces with drainage systems - wind shields	§4.4.1 Table 4.55 p 255	ok	<u>Transfer conveyors</u> The fuel unloading, conveying and storage system will not change conceptually, but it will be upgraded to ensure reliability during the extended lifetime of the plant. Furthermore, fogging and cleaning systems, as well as dust extraction and filtration devices will be implemented to improve operations. Already at present, all conveyors are properly enclosed, except for very short stretches. A representative part of the fuel conveying system was inspected in detail during site visit 2 and no material fugitive emission sources were observed. <u>Open conveyors</u> Open sections of conveyors are very limited and do not produce material fugitive emissions. <u>Unloading equipment</u> Lignite arrives by train and is discharged in an enclosed building in an underground reception pit. A fogging system will be implemented during the refurbishment to further limit fugitive emissions. The area was inspected during both site visits. No material fugitive emissions were observed in either case. <u>Cleaning devices for conveyor belts</u> This item was not verified in detail during the site visits or the discussions, but it is assumed that, in line with the other upgrading activities, adequate cleaning systems will be implemented. <u>Limestone storage</u> The current limestone storage is an open stockpile and is a source of significant fugitive emissions. During the refurbishment project, the stockpile will be enclosed in a new building and the conveyor system from the unloading station will be completely renewed. <u>Sealed surfaces</u> The surface upon which the lignite stockpiles are placed, are formed of concrete slabs. The state of the slabs is such that they do not prevent run-off water from penetrating in the ground underneath. During site visit 2, the investor ensured that a drainage system below the stockpiles is in place. The condition will be inspected during the refurbishment project and - if needed - maintenance and repair will be performed. <u>Wind shields</u> Since most unloading, transport and storage is performed in enclosed buildings, the use of windshields is not required.

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Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
9	Techniques to be considered when determining BAT regarding fuel pre-treatment include: - fuel switch (to lower S, lower ash content) - coal blending and mixing - coal washing *- lignite pre-drying (only applied as pilot plant)* *- coal gasification (only applied in demonstration plants)*	§4.4.2 Table 4.56 p 256	ok	<u>Fuel switch</u> A study of higher quality solid fuels (lignite and coal) in an acceptable radius from the current facility was performed. The conclusion of the study is that there are no sources of higher quality available without involving excessive transport (see also §7.1 of the main text). <u>Coal blending and mixing</u> Mixing and homogenisation of the lignite is done at the mine, prior to arrival on site. It is achieved through specific handling and storage procedures. The effectiveness of this approach was verified by inspection of the main lignite properties (LHV, moisture, ash and S content), obtained from automated daily sampling and analysis, for 2009. <u>Coal washing</u> Coal washing is a technique that is cost prohibitive for lignite. Furthermore, it would not result in a significant impact on efficiency
10	Techniques to be considered when determining BAT to increase efficiency and fuel utilisation: - co-generation of heat and power (depending on site specific heat demand) - changing turbine blades (use of 3D blades) - using advanced materials to reach higher steam parameters (practised in new plants) - supercritical steam parameters (practised in new plants) - double re-heat (practised mainly in new plants) - regenerative feedwater heating - advanced computerized control systems - use of the heat content of the flue gas for district heating - low excess air - lowering of exhaust gas temperatures (exhaust gas temperature should be 10 - 20℃ above the acid dewpoint) - low unburned carbon in the ash - low CO concentration in flue gas - cooling tower discharge / wet stack technique	§4.4.3 Table 4.57 - 4.58 p 257 - 258	ok	<u>Co - generation of heat and power</u> . Heat for internal heating of EPR I & EPR II will be supplied by a new heat exchanger (33 MW_{th}) in reconstructed block E. . External heat supply to Chomutov, Jirkov and Klášterec nad Ohři will be supplied by reconstructed blocks C, D, and E. Each block will have its own heat exchanger (100 MW_{th}) and a peak heaters, ensuring a max delivery of 245 MW_{th}. . Nominal heat supply (statistically most common) for each block is 23.8 MW_{th}. Contracts of external heat supply and the Energy Act were verified. . Temperatures of the district heating network are 145°/ 55℃. <u>Changing turbine blades (use of 3D blades)</u> . Each refurbished block will be equipped with a new 250 MWel turbine (supplier: SKODA). The latter relies on the use of 3D shaped blades and has an overall thermodynamic efficiency of 88% - 89%. <u>Use of advanced materials to allow higher steam parameters</u> . The new boilers will be constructed from 'P91' (X10CrMoVNb9-1), a state-of-the-art material which can be used for parameters up to 580℃ - 600℃ and 270 bar ([1], Figure 4.44 p 235). <u>Supercritical parameters</u> . A detailed discussion on the use of supercritical parameters is included in §7.1.1 of the main text.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
				Double re-heat . A single re-heat will be used in the refurbished blocks. This is considered state of the art for the given size and type of installation. Regenerative feed water heating . The design of the new blocks includes an 8-stage feed water preheating, mainly by means of uncontrolled taps of the turbine. The design value of the feed water temperature at the boiler inlet is 250℃, which i s in line with BAT and recent reference plants of similar type (see Annex IV). Advanced computerised control system . Part of the refurbishment project is to equip the entire plant with new controls, based on Siemens SPPA T3000 technology. The new system will contain approx. 36700 i/o's and 4710 signals. Use of the heat content of the flue gas for district heating . Due to the relatively low temperature of the flue gas at the boiler exit, it is technically not possible to use them for district heating purposes. Low air excess . The new blocks are designed to operate at 2,4 vol% O2, 3,2 vol% O2 and 4,1 vol% O2 (dry), at the outlet of the combustion chamber, the inlet of the Ljungström, and the outlet of the Ljungström, respectively. This corresponds to an air excess of 13%, 18%, and 24% respectively, and is line with typical BAT values. Lower exhaust temperature of the flue gas . The design temperature of the flue gas at the exit of the Ljungström for the new blocks is 140℃ and therefore in line with BAT. Lower unburned carbon in the ash . Initial results from Tušimice (identical operation but still in commissioning phase) for fly ash and slag are <1%mass and 5%mass, respectively. Furthermore, typical slag and fly ash production rates have been observed (8% and 92%, respectively). . No separate guarantees for ash quality were obtained from the boiler supplier, but they are indirectly covered by the guarantee on boiler efficiency (90.12%). Low CO concentration in the flue gas . An emission limit of 250 mg CO/Nm³ is proposed for the new blocks. Motivation for this value is the expected degradation of lignite quality and the trade-off between low NOx levels (through primary measures) and low CO levels. . This emission limit is in line with local legislation (N°146/2007 Coll. Annex 1 & 2), but not with BAT (200 mg/Nm³), nor with experience from reference plants (see Annex IV). See §7.1.2 in the main text for further discussion. The impact of CO in flue gas on plant efficiency is negligible, except for very high concentrations.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
				<u>Cooling tower discharge</u> . Part of the refurbishment project is to redirect the flue gas from the outlet from the wet scrubbers to the cooling towers instead of the stack.
11	Techniques to consider when determining BAT regarding the prevention and control of dust and particle-bound heavy metal emissions include: - ESP (better economic solution for larger plants) - fabric filter (mainly downstream dry / semi-dry scrubbers; higher operating cost; 0.1% point reduction in efficiency) - cyclones (only as pre-duster in combination with other techniques) - addition of activated carbon (limited operational experience; raises Hg content in gypsum)	§4.4.4 Table 4.59 p 259	ok	The existing precipitators for each block will be replaced by new EPS with four fields (100 kV,< 20 mg/Nm³ exit guarantee).
12	Techniques to consider when determining BAT regarding the prevention and control of SO_2 emissions include: - use of low S fuel - FBC boiler - wet lime / limestone scrubber with gypsum production (economic for larger size plants) - seawater scrubber - other wet scrubber types (very limited operating experience) - spray dry scrubber - sorbent injection	§4.4.5 Table 4.60 - 4.61 p 260 - 261	ok	A study of low S fuel in an acceptable radius from the current facility was performed. The conclusion of the study is that there are no sources of higher quality available without involving excessive transport (see also §7.1 of the main text). See also item 19. The fuel properties (mainly the relatively high volatility) make it less suitable for combustion in a fluidised bed boiler. The existing wet scrubbers (Mitsubishi type) will be replaced by new wet scrubbers (Austrian Energy type). No preliminary removal guarantee could be provided during verification. The effluent treatment of the new scrubbers will be extended with an additional washing step and dewatering unit such that gypsum of commercial quality will be obtained.
13	Techniques to consider when determining BAT regarding the prevention and control of NO_x and N_2O emissions - low air excess (trend to higher unburned in ash and higher CO & CxHy levels) - air staging - flue gas recirculation - low NOx burners - reburning - *SNCR (very limited application)* - *SCR (only on hard coal fired plants)*	§4.4.6 Table 4.62 - 4.63 p 262 - 263	ok	The new blocks are designed to operate at low air excess: 2,4 vol% O_2, 3,2 vol% O_2 and 4,1 vol% O_2 (dry), at the outlet of the combustion chamber, the inlet of the Ljungström, and the outlet of the Ljungström, respectively. A combination of different primary measures (low NO_x burners, staged combustion, flue gas recirculation, and air staging) will be used to control NO_x emissions.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
14	Techniques to consider when determining BAT regarding the prevention and control of water pollution include: - FGD waste water treatment by flocculation, sedimentation and neutralisation - ammonia reduction by air stripping, precipitation or biodegradation - closed loop operation for FGD waste water - mixing of FGD waste water with coal ash - closed water circuit by filtration or sedimentation for waste water from slag flushing and transport - neutralisation and sedimentation for waste water from regeneration of demineralisers & polishers - sedimentation / chemical treatment and internal re-use of surface run-off	§4.4.7 Table 4.64 p 264	ok	<u>FGD waste water treatment</u> All FGD waste water is used in the mixing centre to produce the slag / fly ash / gypsum mixture that is returned to the mine. <u>Ammonia reduction</u> Not relevant since no SNCR or SCR is used or planned. <u>Closed loop operation for FGD waste water</u> All FGD waste water is used in the mixing centre to produce the slag / fly ash / gypsum mixture that is returned to the mine. The mixing centre and FGD waste water treatment was specifically inspected during site visit 2. <u>Closed loop operation for waste water from slag transport</u> After sedimentation, the waste water from slag transport is re-used in a closed loop operation. <u>Treatment of waste water from regeneration of demineralisers and polishers</u> This aspect was not verified or discussed in detail. <u>Treatment of surface run-off water</u> Surface run-off water is collected by means of an underground drainage system and subsequently flows to sedimentation ponds. The latter were inspected during site visit 2.
15	BAT for preventing dust emission from unloading, storage and handling of coal & lignite: - equipment that minimizes the height of fuel drop to the stockpile to reduce fugitive dust generation - water spraying to reduce fugitive emissions from stockpiles (if no risk on freezing) - covering of stockpiles to limit generation of fugitive emissions (for petroleum cokes) - grassing over long-term storage areas (prevent fugitive emissions & fuel loss by oxidation) - direct transfer of lignite via belt conveyors or trains from the mine to the on-site storage - placing conveyors such that damage from vehicles / other equipment can be prevented - using cleaning devices for conveyor belts that minimise the generation of dust - using enclosed conveyors with adequate extraction and filtration equipment on transfer points - rationalising transport systems to minimise generation and transport of dust - good design and construction + adequate maintenance	Table 4.65 p 267	ok	The fuel unloading, conveying and storage system will not change conceptually, but it will be upgraded to ensure reliability during the extended lifetime of the plant. Furthermore, fogging and cleaning systems, as well as dust extraction and filtration devices will be implemented to improve operations. Already at present, all conveyors are properly enclosed, except for very short stretches. Conveyor belts and handling systems are placed such that damage from vehilces or other equipment is prevented. A representative part of the fuel conveying system was inspected in detail during site visit 2 and no material fugitive emission sources were observed.

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Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
16	BAT for preventing water contamination from unloading, storage and handling of coal & lignite: - storage on sealed surfaces with drainage, drain collection and water treatment (settling out) - collecting surface run-off (rainwater) from storage areas and treating this collected stream (settling out) before discharge	Table 4.65 p 267	ok	The surface upon which the lignite stockpiles are placed, are formed of concrete slabs. The state of the slabs is such that they do not prevent run-off water from penetrating in the ground underneath. During site visit 2, the investor ensured that a drainage system below the stockpiles is in place. The condition will be inspected during the refurbishment project and - if needed - maintenance and repair will be performed. Surface run-off water is collected by means of an underground drainage system and subsequently flows to sedimentation ponds. The latter were inspected during site visit 2.
17	BAT for fire prevention from unloading, storage and handling of coal & lignite: - surveying storage areas with automatic systems to detect fires, caused by self-ignition and to identify risk points	Table 4.65 p 267	ok	Fuel conveyors are equipped with a heat sensitive rope to detect potential fires. Furthermore, they have been compartmentalised to contain a potential fire, and to facilitate the fighting of a potential fire.
18	BAT for preventing dust emission from unloading, storage and handling of lime & limestone - enclosed conveyors, robust extraction and filtration equipment on delivery and transfer points	Table 4.65 p 267	ok	Part of the refurbishment is to renew the limestone unloading, handling and storage system, which currently constitutes a significant source of fugitive emissions. The conveying system will be refurbished to minimise dust emission and an complete enclosure will be constructed around the stockpile.
19	BAT for pretreatment of coal and lignite is blending and mixing of fuel to ensure stable combustion and to reduce peak emissions. BAT is also to switch fuel from e.g. one coal to another coal with a better environmental profile.	§4.5.3 p 267	ok	Mixing and homogenisation of the lignite is done at the mine, prior to arrival on site. It is achieved through specific handling and storage procedures. The effectiveness of this approach was verified by inspection of the main lignite properties (LHV, moisture, ash and S content), obtained from automated daily sampling and analysis, for 2009. The availability of lignite with a better environmental profile within an acceptable transport distance from the site was investigated. No suitable source of lignite could be identified.
20	BAT for combustion of coal and lignite in new and existing plants is: pulverised coal (PC), fluidised bed combustion (FBC - bubbling & circulating), pressurized fluidised bed combustion (PFBC), and grate firing (preferably for new plants < 100 MW).	§4.5.4 p 268	ok	Also after the refurbishment, the plant will be based on the combustion of pulverised lignite.
21	BAT for firing systems for the design of new boilers or retrofit projects for existing plants are: those that assure high boiler efficiency and which include primary measures to reduce the generation of NOX emissions (e.g. air and fuel staging, advanced low-NOX burners and/or reburning, etc).	§4.5.4 p 268	ok	The refurbished firing system is aimed at increasing efficiency to a level corresponding to BAT for the given fuel composition (i.e. at least 90%), at reducing NOx to below levels corresponding to BAT (i.e. below 200 mg/Nm³) by means of primary measures such as air staging, low NOx burners, and flue gas recirculation.
22	BAT is the use of an advanced computerised control system in order to achieve high boiler performance with increased combustion conditions that support the reduction of emissions.	§4.5.4 p 268	ok	Part of the refurbishment project is to equip the entire plant with new controls, based on Siemens SPPA T3000 technology. The new system will contain approx. 36700 i/o's and 4710 signals.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
23	BAT for the heat rate and efficiency level for new coal- and lignite-fired condensing plants (PC in DBB or WBB boilers) with direct water cooling and capacity > 300 MWth is 2,3 - 2,2 or 43%-47%.	§4.5.5 p 268	nok	The projected unit efficiency of the refurbished plant is projected as 40% (calculated conform VDI 3986), which is below the BAT level of (> 42% – 43%). A detailed discussion on the efficiency of the projected unit has been included in §7.1.1 of the main text. *Note from the BAT - text:* *BAT levels are not achieved under all operating conditions and is highest at design point. Actual efficiencies throughout the operational range may be lower due to load changes, quality of fuel, etc. Also relevant are the geographical location, the cooling system, and the energy consumption of the FGC system.*
24	Highest efficiencies in line with BAT requirements are achieved only with extremely high steam parameters in base load plants. Peak load plants with frequent start-up cycles have to be designed with lower parameters, resulting in lower efficiencies.	§4.5.5 p 268	ok	After the refurbishment, the proposed plant is intended as a middle load or semi-base load facility. This is addressed when evaluating the proposed efficiency of the plant in §7.1.1 of the main text.
25	The most important BAT requirement to increase energy efficiency (fuel utilisation) is to use CHP or co-generation. CHP should be used in any new plant, whenever economically feasible (i.e. when local heat demand is high enough to warrant construction of the more expensive co-gen plant). Because of variations in heat demand, CHP plants need to be flexible in terms of the ratio heat / electricity and they should have high efficiency also at partial load. Plants with condensing turbines with steam tap are mentioned. CHP under BAT conditions has a heat rate of 1,1 - 1,3 and an energy (fuel) efficiency of 75% - 90%, depending on the application.	§4.5.5 p 268 - 269	ok	The refurbished plant will be supplying district heating to communities in Chomutov, Jirkov and Klášterec nad Ohři, with an average (statistically most common) delivery of 23.8 MW_{th} (per unit). The delivery is regulated in the Energy Act and severe penalties apply in case of failure to supply the energy. The actual heating delivery contracts were verified during site visit 2. *Note from the BAT - text:* *BAT levels are not achieved under all operating conditions and is highest at design point. Actual efficiencies throughout the operational range may be lower due to load changes, quality of fuel, etc. Also relevant are the geographical location, the cooling system, and the energy consumption of the FGC system.*

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
26	For existing coal- and lignite-fired plants, a number of retrofit and repowering techniques to improve thermal efficiency should be taken into account as BAT requirements: - combustion: minimise the heat loss due to unburned gases & elements in residues - highest possible steam parameters - repeated superheating of the steam - highest possible pressure drop in the LP end of the turbine through the lowest possible cooling water T - minimising the heat loss through the flue gas (utilisation of residual heat / district heating) - minimising heat loss through the slag - minimising heat loss through conduction & radiation with insulation - minimising internal energy consumption (e.g. scorification of the evaporator, high efficiency bfw-pumps, etc) - preheating of the bfw with steam - improving blade geometry of the turbines	§4.5.5 p 269	ok	<u>Minimise heat loss due to unburned gases & elements in residues</u> An emission limit value for CO of 250 mg/Nm³ has been proposed. This is in line with the current Czech legislation, but not with BAT (which requires 200 mg/NM³), nor with typical emissions from similar facilities (see Annex IV). While this is a relevant issue in terms of environmental impact, the influence on the efficiency of the plant is small. Unburned elements in residues (slag and fly ash) have a significant impact on plant efficiency. Initial results from Tušimice (identical operation but still in commissioning phase) for fly ash and slag are <1%mass and 5%mass, respectively. Furthermore, typical slag and fly ash production rates have been observed (8% and 92%, respectively), in line with BAT and experience from similar installations. No separate guarantees for ash quality were obtained from the boiler supplier, but they are indirectly covered by the guarantee on boiler efficiency (90.12%)..12 <u>Highest possible steam parameters</u> The steam parameters for the superheated and reheat steam of the new blocks will be 575℃ & 185 bar, and 580℃ & 37 bar, respectivel y. These values are in line with other recent reference plants of the same type (i.e. other subcritical power stations, see Annex IV). A detailed discussion on the use of higher and/or supercritical parameters is included in §7.1.1 of the main text. <u>Repeated superheating of the steam</u> A single re-heat will be used in the refurbished blocks. This is considered state of the art for the given size and type of installation. <u>Highest possible pressure drop in the LP end of the turbine</u> The design vacuum in the condenser is 44 mbar (nominal conditions) and 30 mbar (if meteorological conditions allow). This is in line with BAT and recent reference plants (see Annex IV). <u>Minimising heat loss through the flue gas</u> The design temperature of the flue gas at the exit of the Ljungström for the new blocks is 140℃ and therefore in line with BAT. <u>Minimising heat loss through the slag</u> After refurbishment of the plant, the slag production rate will be in line with BAT, i.e. approx. 10% of the total residue production. Initial operating results in the Tušimice power plant (identical operation but still in commissioning phase) have confirmed this expectation.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
				Minimising heat loss through conduction & radiation with insulation The boiler supplier provided a guarantee on the temperature of the casing of the boiler, ensuring that proper insulation would be used and that, as a result, the heat loss through conduction and radiation will be minimized. Pre-heating the feed water with steam The design of the new blocks includes an 8-stage feed water preheating, mainly by means of uncontrolled taps of the turbine. The design value of the feed water temperature at the boiler inlet is 250℃, which is in line with BAT and recent reference plants of similar type (see Annex IV). Improving blade geometry of the turbines Each refurbished block will be equipped with a new 250 MW_{el} turbine (supplier: SKODA). The latter relies on the use of 3D shaped blades and has an overall thermodynamic efficiency of 88% - 89%.
27	BAT associated thermal efficiency levels [net %] for coal & lignite are: - cogeneration: 75% - 90% (existing & new plants) - pulverised coal combustion: 43% - 47% new plants - pulverised lignite combustion: 42% - 45% new plants - existing plants: 36% - 40% or an incremental improvement of more than 3% points Note: split view on the lower limit: industry & one MS claims 30% due to plant & fuel characteristics, climatic conditions, and consumption of FGC equipment.	Table 4.66 p 269	nok	The projected unit efficiency of the refurbished plant is projected as 40% (calculated conform VDI 3986), which is below the BAT level for a new installation (42% - 45%). A detailed discussion on the efficiency of the projected unit has been included in §7.1.1 of the main text. *Note from the BAT - text:* *BAT levels are not achieved under all operating conditions and efficiency is highest at design point. Actual efficiencies throughout the operational range may be lower due to load changes, quality of fuel, etc. Also relevant are the geographical location, the cooling system, and the energy consumption of the FGC system.*
28	BAT requirement for de-dusting of off-gas from new and existing combustion plants is considered to be the use of an electrostatic precipitator (ESP) or a fabric filter (FF), where a FF normally gives emission levels below 5 mg/Nm³. Cyclones and mechanical collectors alone are not considered BAT, but they can be used as pre-cleaning.	§4.5.6 p 270	ok	The existing precipitators for each block will be replaced by new EPS with four fields (100 kV, <20mg/Nm³ exit guarantee).

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
29	BAT ELV for dust for coal and lignite plants with a capacity from 100 - 300 MWth: - technology: ESP or FF in combination with FGD for PC - new plants: 5 - 20 mg/Nm³ (split view: industry & 1 MS proposed 10 - 30 mg/Nm³) - existing plants: 5 - 25 mg/Nm³ (split view: industry & 1 MS proposed 10 - 50 mg/Nm3 for ESP in combination with wet FGD) BAT requires continuous monitoring of the dust emission level. . The dust levels take into account the need to reduce fine particles (PM10 and PM2.5) and to minimise the emission of HM. . The dust levels are based on a daily average, standard conditions and 6% O_2. . For peak load, start-up and shut-down periods as well as operational problems of the FGC, short-term peak values which could be higher have to be considered.	Table 4.67 p 271	ok	An emission limit on particulate for the refurbished plant of 20 mg/Nm³ has been proposed. This level has been guaranteed by the supplier of the corresponding equipment (contracts were reviewed during site visit 2). Each new block will be equipped with an individual and continuous dust monitor in the duct between the wet scrubber and the inlet in the cooling tower.
30	The BAT requirement to reduce emission of heavy metals from flue gasses of coal- and lignite-fired combustion plants is to used high performance ESP (reduction rate > 99,5%) or a FF (reduction rate > 99,95%). BAT is periodical monitoring of Hg (frequency: every year - every 3rd year, depending on fuel). (total Hg is to be monitored, not only particulate matter)	§4.5.7 p 271 - 272	ok	The existing precipitators for each block will be replaced by new EPS with four fields (100 kV, <20 mg/Nm³ exit guarantee). *Note from the BAT - text:* *High efficiency ESP's show good removal of Hg at T < 130°C.* *For ESP in combination with a wet limestone scrubber, an average removal rate of 75% (50% in ESP and 50% in FGD) can be obtained. For sub-bituminous coal or lignite, lower removal ranges are expected: 30% - 70%.*
31	Use of low sulphur fuel <u>and</u> desulphurisation is a BAT requirement. For plants over 100 MWth, use of low S fuel can be a supplementary measure, but is itself not sufficient to reduce SO_2.	§4.5.8 p 272	ok	The availability of lignite with a better environmental profile within an acceptable transport distance from the site was investigated. No such source of lignite could be identified. This issue is discussed in more detail in §7.1 of the main text.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
32	In addition to using low S fuel, BAT requirements for PC of coal and lignite are wet scrubbers, spray dry scrubbers, and dry sorbent injection (for smaller applications, i.e. below 250 MWth). Rate of DeSO2 for wet scrubbers: 85% - 98%. Rate of DeSO2 for spray dryer scrubbers: 80% - 92%. It is allowed to run below these levels, if the SO_2 emission would be far below the emission levels associated with BAT. Wet scrubbers also have a high reduction rate for HF and HCl: 98% - 99%, with associated emission level for both: 1 - 5 mg/Nm³. Existing plants can reduce SO_2 emissions by optimizing the flow pattern in the absorber. Gypsum may be a saleable product for cement or construction industries.	§4.5.8 p 272	ok	The existing wet scrubbers (Mitsubishi type) will be replaced by new wet scrubbers (Austrian Energy type). No guarantee on the removal efficiency of the scrubber or the SO_2 level in the flue gas had been established at the time of the current assessment (verified during site visit 2). The effluent treatment of the new scrubbers will be extended with an additional washing step and dewatering unit such that gypsum of commercial quality will be obtained.
33	BAT ELV for SO_2 for coal and lignite plants with a capacity from 100 - 300 MWth: - technology: low S fuel or/and FGD (dry/wet) - new plants: 100 - 200 mg/Nm³ - existing plants: 100 - 250 mg/Nm³ (split view: industry declared an upper level of 600 mg/Nm³) BAT requires continuous monitoring of the SO_2 emission level. . The SO_2 levels are based on a daily average, standard conditions and 6% O_2. . For peak load, start-up and shut-down periods as well as operational problems of the FGC, short-term peak values which could be higher have to be considered.	Table 4.68 p 274	ok	An emission limit on SO_2 for the refurbished plant of 200 mg/Nm³ has been proposed. No guarantee on the removal efficiency of the scrubber or the SO_2 level in the flue gas had been established at the time of the current assessment (verified during site visit 2). Each new block will be equipped with an individual and continuous SO_2 monitor in the duct between the wet scrubber and the inlet in the cooling tower.
34	In general, the BAT requirement for reduction of NO_x for coal- and lignite- fired combustion plants is a combination of primary and/or secondary measures.	§4.5.9 p 275	ok	The new blocks are designed to operate at low air excess: 2,4 vol% O_2, 3,2 vol% O_2 and 4,1 vol% O_2 (dry), at the outlet of the combustion chamber, the inlet of the Ljungström, and the outlet of the Ljungström, respectively. A combination of different primary measures (low NOx burners, staged combustion, flue gas recirculation, and air staging) will be used to control NO_x emissions.

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Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
35	For PC lignite-fired plants, the combination of different primary measures is a BAT requirement. Examples: use of advanced low NOX burners, flue-gas recirculation, staged combustion, reburning, etc. SCR has not been considered BAT in a general sense for the combustion of lignite.	§4.5.9 p 275	ok	The new blocks are designed to operate at low air excess: 2,4 vol% O_2, 3,2 vol% O_2 and 4,1 vol% O_2 (dry), at the outlet of the combustion chamber, the inlet of the Ljungström, and the outlet of the Ljungström, respectively. A combination of different primary measures (low NOx burners, staged combustion, flue gas recirculation, and air staging) will be used to control NOx emissions.
36	For application of advanced low-NOX burners to existing boilers, the use of modern swirl burners is a BAT requirement (old furnaces are too compact to allow more advanced burners)	§4.5.9 p 275	ok	The refurbished blocks will be equipped with 8 Vortex burners (V-1260, supplier: Saacke) and 4 Jet burners (P-700; supplier Saacke).
37	For small plants without high load variations and a stable fuel quality, SNCR can be seen as an additional technique to further reduce NOX emissions.	§4.5.9 p 275	ok	During the discussions with the investor during site visits 1 and 2, the option of retrofitting the refurbished plants with an SNCR system was addressed. The investor confirmed that he would consider this, should the need arise during operation.
38	The use of primary measures for NOx control for coal or lignite, in line with the BAT requirement, tends to result in a higher level of unburned carbon in the fly ash and some CO emissions. A good design and proper combustion control should avoid these negative impacts to a large extent. The associated BAT level of unburned carbon in ash is < 5%. For most coals this can be achieved by primary measures, but sometimes only with slightly higher NOX levels. Primary NOX reduction also has an impact on energy efficiency, typically in the order of 0,1% - 0,3% decrease of efficiency.	§4.5.9 p 276	nok	An emission limit on CO for the refurbished plant of 250 mg/Nm³ has been proposed. This is not in line with BAT, and based experience in similar facilities, cannot be explained by the use of primary measures for NO_x abatement. A detailed description of this issue has been included in §7.1.2 of the main text. No guarantees from the boiler supplier were obtained for the level of unburned in the slag or fly ash. However, these requirements are covered indirectly by the guarantee on the boiler efficiency. At the same time, initial operating results at the Tušimice power plant show an unburned carbon level in slag of 5%mass and in the fly ash of less than 1%mass. Note that the plant is still in the commissioning phase and that, therefore, these results are tentative. The impact on NOx reduction on energy efficiency is addressed in detail in §7.1.1 of the main text.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
39	BAT ELV for NOX for lignite PC plants with a capacity from 100 - 300 MWth: - technology: combination of primary measures - new plants: 100 - 200 mg/Nm³ - existing plants: 100 - 200 mg/Nm³ (split view on upper limit: industry & 1 MS propose 450 mg/Nm³) BAT requires continuous monitoring of the NOX emission level. . The NOX levels are based on a daily average, standard conditions and 6% O2. . For peak load, start-up and shut-down periods as well as operational problems of the FGC, short-term peak values which could be higher have to be considered.	Table 4.68 p 277 - 278		An emission limit on NO_x for the refurbished plant of 200 mg/Nm³ has been proposed. Each new block will be equipped with an individual and continuous NO_x monitor in the duct between the wet scrubber and the inlet in the cooling tower.
40	The BAT requirement for the minimisation of CO emissions is complete combustion, based on good furnace design, use of high performance monitoring and process control techniques, and maintenance of the combustion system. A well-optimized system to reduce NOX will also keep CO levels down to: - 30 - 50 mg/Nm³ for PC of coal, and - 100 - 200 mg/Nm³ for PC of lignite.	§4.5.10 p 279	nok	An emission limit on CO for the refurbished plant of 250 mg/Nm³ has been proposed. This is not in line with BAT, and based on experience in similar facilities, cannot be explained by the use of primary measures for NO_x abatement. A detailed description of this issue has been included in §7.1.2 of the main text.
41	Cfr 33, wet scrubbers and spray dryers are BAT requirements for SOX reduction. These techniques give a high reduction of HF and HCl (98% - 99%). For a wet scrubber or spray dryer, the associated emission levels are: - for HCl: 1 - 10 mg/Nm³ - for HF: 1 - 5 mg/Nm³ Internal flue gas leakage in the rotating gas/gas heat exchanger may lead to elevated levels of SO2, HF and HCl in the stack. Hence, modern gas/gas heat exchangers have been assumed in the BAT conclusion. This, however, is not a reason to replace the heat exchanger. The best option is flue gas discharge via the cooling tower, since no flue gas reheating would be required in this case.	§4.5.11 p 279	ok	No emission limits on HCl or HF have been proposed, but, based on the wet scrubber technology that will be implemented in the refurbished blocks, compliance with BREF is expected.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
42	With respect to avoiding water contamination, BAT requirements include: - for wet scrubbers: . Water treatment by flocculation, sedimentation, filtration, ion-exchange and neutralisation . Ammonia reduction by air stripping, precipitation or biodegradation (only if SCR / SNCR is used) . Closed loop operation . Mixing of waste water with coal ash - for slag flushing and transport: . Closed water circuit by filtration or sedimentation - for regeneration of demineralisers and condensate polishers: . neutralisation and sedimentation - for elutriation . neutralisation (only with alkalyne operation) - for washing of boilers, air pre heaters and precipitators: . neutralisation and closed loop operation, or use of dry cleaning methods - for surface run-off: . sedimentation or chemical treatment and internal re-use	Table 4.70 p 280	ok	<u>Wet scrubber waste water</u> All waste water from the wet scrubbers is added to the fly ash, slag and gypsum mixture in the mixing centre. This mixture is transported back to the lignite mine and re-use for stabilisation. This use has been approved and certified by the local authorities. After completion of the refurbishment, a small amount of lime will also be added to the mixture to ensure compliance with the new requirements regarding leaching. <u>Slag flushing and transport waste water</u> The waste water from the slag handling and transport equipment is operated in a close-loop system with no discharge. <u>Waste water regeneration of demineralisers</u> This aspect was not verified in detail during the site visits or the discussions. <u>Waste water from washing of boilers, air pre-heaters and precipitators</u> The washing of boilers (and other components) is not widely used. If necessary, only parts of the boiler are washed and this with typical a frequency of once every few years. The associated effluent is collected in temporary storage tanks and subsequently used as suppletion water for the slag handling and transport system. Hence, there is no discharge of water from washing activities. <u>Surface run-off water</u> The surface upon which the lignite stockpiles are placed, are formed of concrete slabs. The state of the slabs is such that they do not prevent run-off water from penetrating in the ground underneath. During site visit 2, the investor ensured that a drainage system below the stockpiles is in place. The drain water undergoes proper treatment to ensure compliance to local legislation. The latter contains a 'P' and an 'M' limit of 35 mg/l and 50 mg/l of solid particles, respectively. Three exceedances are allowed for the 'P'- limit, and none for the 'M'-limit. The investor ensured (during site visit 2) that there is no problem in meeting these legal requirements.
43	Storage of coal and lignite on sealed surfaces with drainage and drain collection is a BAT requirement. The BAT associated emission level for particles in the discharge water is < 30 mg/l.	§4.5.13 p 280	ok	The surface upon which the lignite stockpiles are placed, are formed of concrete slabs. The state of the slabs is such that they do not prevent run-off water from penetrating in the ground underneath. During site visit 2, the investor ensured that a drainage system below the stockpiles is in place. The condition will be inspected during the refurbishment project and - if needed - maintenance and repair will be performed.

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Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
44	Oil separation wells are a sufficient BAT requirement to avoid environmental damage from oil contaminated (washing) water.	§4.5.13 p 280	ok	Oil removal equipment was inspected during site visit 2 and deemed adequate.
45	Wet scrubbing desulphurisation is a BAT requirement when related to the application of a waste water treatment plant, with different chemical treatments to remove heavy metals and to decrease the amount of solid matter in the water. The treatment plant includes: adjustment of the pH, precipitation of heavy metals, and removal of solid matter & precipitate from the waste water. The following parameters are monitored (not necessarily all of them continuously): pH, conductivity, temperature, solid content, chlorine content, heavy metal concentrations (e.g. As, Cd, Cr, Cu, Hg, Ni, Pb, V, Zn), fluorine concentration and chemical oxygen demand (COD). Waste water from a wet scrubber, treated by filtration and neutralisation still has a COD content that needs further treatment.	§4.5.13 p 280	na	All waste water from the wet scrubbers is added to the fly ash, slag and gypsum mixture in the mixing centre, such that there is no discharge of wet scrubber waste water.
46	BAT associated emission levels for waste water from a wet FGD in [mg/l] are: - solids: 5 - 30 - COD: < 150 - N compounds: < 50 - Sulphate: 1000 - 2000 - Sulphite: 0,5 - 20 - Sulphide: < 0,2 - Fluoride: 1 - 30 - Cd: < 0,05 - Cr: < 0,5 - Cu: <0,5 - Hg: 0,01 - 0,02 - Ni: < 0,5 - Pb: < 0,1 - Zn: < 1	Table 4.71 p 281	na	All waste water from the wet scrubbers is added to the fly ash, slag and gypsum mixture in the mixing centre, such that there is no discharge of wet scrubber waste water.

Annex II: BREF LCP Assessment Table (continued)

#	Description / Title	BREF LCP	Opinion	Analysis / Comments
47	In general, waste water treatment techniques in Chapter 3 (§3.10.6) are BAT requirements. Individual waste water streams include: process waste water (particularly waste water from the deSOX unit), rainwater run-off, and sanitary waste water. These streams are usually collected and treated separately, with the first two in an industrial waste water treatment plant, and the latter in a biological waste water treatment plant. The most appropriate waste water treatment can only be decided upon after a thorough assessment of the waste water streams in terms of quality characteristics, volume and required effluent quality. Waste water treatment techniques that can be combined to ensure proper pollutant removal: - filtration - pH correction / neutralisation - coagulation / flocculation / precipitation - sedimentation / filtration / flotation - dissolved hydrocarbon treatment - oil-water separation systems - biological treatment Effluents containing high amounts of suspended solids are normally subject to primary settling, flocculation, final settling, sludge removal, and possible final pH adjustment. Acid / Alkali effluents need to be neutralised before discharge. Oily effluents require a primary oil separation stage (typically in gravity separation tanks equipped with oil retention baffles). Sanitary waste water may be treated in a municipal sewerage system By optimising the recycling, a significant reduction in overall water consumption can be obtained, as well as minimising the final liquid effluent quantities that require further treatment.	§4.5.13 p 281	ok	During site visit 2, the industrial waste water treatment facility was inspected. The last stages of the treatment are conducted in a renewed installation, which was taken into operation less than 3 years ago. The investor ensured that all discharge water was well below the legal requirements. By re-using the waste water from the wet scrubbers for the production of stabilizing product for the lignite mines, and by operating the slag handling & transport as a 'closed loop', the production of waste water has been optimised.
48	Utilisation and re-use of combustion residues and by-products is a BAT requirement.	§4.5.14 p 281	ok	After the refurbishment, the investor expects to be able to bring approx. 50% of its residues to the market for utilisation and re-use. No contracts have been put in place yet, but a series of expressions of interest were discussed. The fact that the supply of these products exceeds the demand of the market prohibits the complete utilisation or re-use.

Annex III: BREF EE Assessment Table

The assessment is based on §3.1, Table 3.2, p117-119 of the BREF EE [2], which lists the cases in which additional information about techniques already covered by BREF LCP [1] has been included in BREF EE [2]. Only these cases have been considered below since all other requirements have been covered already in Annex II (BREF LCP Compliance Assessment Table).

#	Description / Title	BREF EE	Opinion	Analysis / Comments
1	Cogeneration Directive 2004/8/EC defines cogeneration as " the simultaneous generation in one process of thermal and thermal energy and electrical and/or mechanical energy"	§3.4 p 176	ok	Each block will have its own heat exchanger (design capacity 100 MW_{th}) and peak heaters, ensuring a max delivery of 245 MW_{th}. Nominal (statistically most common) heat supply for each block is 23.8 MW_{th}. Contracts for external heat supply as well as the Energy Act were verified Temperatures of the district heating network are 145°/ 55℃.
2	Low excess air Reducing mass flow by reducing excess air; typically, 1-2% excess air for gas, 10% for liquid fuels. Solid fuels are not mentioned. Examples given on p 129 are for cement, lime and waste-to-energy plants, but not for coal plants	§3.1.3 P 128 - 129	ok	The new blocks are designed to operate at 2,4 vol% O_2, 3,2 vol% O_2 and 4,1 vol% O_2 (dry), at the outlet of the combustion chamber, the inlet of the Ljungström, and the outlet of the Ljungström, respectively. This corresponds to an air excess of 13%, 18%, and 24% respectively.
3	Lowering of exhaust gas temperature, by . Reducing flue gas temperature, can be achieved by heat recovery by combining additional process (e.g. economisers) to recover waste heat . Installing an air pre-heater . Cleaning of heat transfer surfaces . Soot blowers . Ensuring combustion output matches (and does not exceed the heat requirements)	§3.1.1 p 122	ok	The design temperature of the flue gas at the exit of the Ljungström for the new blocks is 140℃ and therefore in line with BAT. The units are designed to lower exhaust gas temperature no lower than the acid dew point for operational safety and in line with BAT guidance. Combustion air pre-heating is achieved by means of a flue gas / air heat exchanger and is in line with BAT. Heat transfer surfaces will be cleaned by means of water cannons (type Clyde – Bergemann) instead of steam driven sootblowers. This is state-of-the-art practice and in line with BAT. The blocks will be controlled by an advanced automated control system. This is expected to result in optimal combustion conditions, but also in a load adapted to the actual heat- and electricity requirements).
4	Preheating of fuel gas by using waste heat	§3.1.1 P 122	na	This requirement is for gaseous fuels and is not applicable.
5	Preheating of combustion air	§3.1.1 P 122	ok	The design temperature of the flue gas at the exit of the Ljungström for the new blocks is 140℃ and therefore in line with BAT. Th e units are designed to lower exhaust gas temperature no lower than acid dew point for operational safety and in line with BAT guidance.

Annex III: BREF EE Assessment Table (continued)

#	Description / Title	BREF EE	Opinion	Analysis / Comments
6	Recuperative and regenerative burners Description (p 126): Recuperative and regenerative burners have been developed for direct waste heat recovery through combustion air preheating. A recuperator is a heat exchanger that extracts heat from the furnace waste gases to preheat incoming combustion air. Recuperative burners can be used at higher temperatures.	§3.1.2 p 126	na	Recuperative and regenerative burners are not common practice for this scale and type of project. The heat recovery systems and heat exchangers discussed in §3.1.1 meet the BAT requirements.
7	Burner regulation and control: automatic burner regulation and control can be used to control combustion by monitoring.	§3.1.4 p 129	ok	Advanced computerised control system Part of the refurbishment project is to equip the entire plant with new controls, based on Siemens SPPA T3000 technology. The new system will contain approx. 36700 i/o's and 4710 signals.
8	Fuel choice: higher the heat value of the fuel, the more efficient the combustion process.	§ 3.1.5 p 130	ok	Higher heating value fuel is not available within the region. A study of alternative fuel sources (see Annex VI) shows that this is not an option.
9	Oxy-firing (oxyfuel), i.e. use of oxygen instead of ambient air to reduce total gas flows and to facilitate CCS.	§ 3.1.6 p 131	ok	Oxygen enhanced or use of oxygen instead of ambient air for combustion is not yet proven technology for power generation systems.
10	Reducing heat losses by insulation. Energy savings through proper thickness of insulation	§3.1.7 p 132	ok	The new blocks and all equipment designed using proper industrial standards for insulation.
11	Reducing losses through furnace doors or openings (eat losses through furnace openings can be significant).	§3.1.8 p 133	ok	The new blocks have been designed to minimise heat loss through furnace openings. Operational practices from current operations will be continued to prevent furnace doors or access points from being left open.

Annex IV: Similar installations in Germany

Location	Capacity	Type of	Lignite Specification			Superheated / Reheated Steam		Efficiency	NOx	CO	Start-up	Description
	[MWel] [1]	plant [3]	Origin [5]	LHV [MJ/kg]	W / A / S [2]	T [°C]	P [bar]	[%][4]	[mg/Nm³]	[mg/Nm³]		
Boxberg - Werk III (Vattenfall Europe)	2 x 459	Base load	L	8,7	56 / 4,5 / 0,7	535 / 540	173 / 40	36	-	-	1992 – 1995 (retrofit)	. Forced circul. boiler - ESP – WS [6] . Primary measures for NOx control . 4 stage condensation turbine . Reuse of slag & flyash in the mine / construction material . Reuse of gypsum in construction industry
Boxberg - Werk IV (Vattenfall Europe)	1 x 845	Base load	L	8,7	56 / 4,5 / 0,7	545 / 581	266 / 58	41 - 42	-	-	2000	. Forced circul. boiler - ESP – WS [6] . Primary measures for NOx control . 5 stage condensation turbine . Reuse of slag & flyash in the mine / construction material . Reuse of gypsum in construction industry
Boxberg - Block R (Vattenfall Europe)	1 x 675 (gross)	Base load	L	8,3	56 / 8 / 1,2	600 / 610	285 / 50	43,7	-	-	2011	. Forced circul. boiler - ESP – WS [6] . Primary measures for NOx control . Condenser pressure 32 - 39 mbar . Boiler material: E911 / P92 . 34,8 MWel own consumption
Buschhaus (E.ON Kraftwerke)	1 x 350	-	H	10,5	/ / 2,0 – 3,5	535 / 533	195 / 44		170	199	2002 (retrofit)	. Forced circul/ boiler . 3 stage turbine . single steam re-heat
Jänschwalde (Vattenfall Europe)	6 x 465	Base load	L	8,35 - 8,55	51,5 / 11,5 / 1,1	535 / 540	169 / 43	35 - 36	176	182	1991 – 1996 (retrofit)	. District heating: 110 + 6 x 58 MWth . Primary measures for NOx control . ESP + WS [6] . Yearly avg emission data for whole plant (1999) . Slag + flyash are re-used in the mine / construction material . Gypsum is partially used in construction industry

Annex IV: Similar installations in Germany (continued)

Location	Capacity [MWel] (1)	Type of plant (3)	Lignite Specification Origin (5)	LHV [MJ/kg]	W / A / S (2)	Superheated / Reheated Steam T [℃]	P [bar]	Efficiency [%](4)	NOx [mg/Nm³]	CO [mg/Nm³]	Start-up	Description
Lippendorf (Vattenfall Europe & E.ON, EnBW)	2 x 920 (gross)	Base load	M	10,5	52 / 6,5 / 1,9	554 / 583	268 / 52	42 - 43	-	-	1999 / 2000	. Benson boiler - ESP - WS (6) . Primary measures for NOx control . Boiler material: P91 . 8 step feedwater pre-heating . 6 stage turbine . Slag + flyash are re-used in the mine / construction material . Gypsum for use in construction industry is produced . Efficiency increases to 46% through delivery of district heating . Projected lifetime > 40 yr
Neurath (BoA 2&3) (RWE Power)	2 x 1050	Base load	R	8,8	- / 48 - 60 / -	600 / 605	272 / 56	> 43	< 200	< 200	2010	. Benson boiler - ESP - WS (6) . Primary measures for NOx control . Flue gas T exit boiler 160℃ . Condensor pressure 48 mbar . 9 step feedwater pre-heating
Niederaussem (BoA 1) (RWE Power)	1 x 931	-	R	8,8	- / 48 - 60 / -	580 / 560	252 / 60	> 43	< 200	< 200	2003	. FB lignite pre-drying will be tested
Schkopau (E.ON Kraftwerke)	2 x 450	Middle load	M	10,5	52 / 6,5 / 1,9	545 / 560	285 / 70	ca 40	-	-	1996	. 2 separate blocks for high availability . flexible operation is required . Benson boiler - ESP - WS (6) . Primary measures for NOx control
Schwarze Pumpe (Vattenfall Europe)	2 x 808	-	L	8,3 - 9,2	- / 8,8 / 0,3 - 1,4	547 / 565	268 / 40	40	-	-	1997 - 1998	. District heating: 2 x 60 MWth . Boiler material: P91

(1) Number of units x net capacity (unless indicated otherwise)

(2) Water / Ash / Sulphur content in %mass

(3) Base-load / Middle-load / Peak-load

(4) Net unit efficiency in condensation mode

(5) L : Lusatian Area / H : Helmstedt Area / R : Rhineland Area / M : Central German Area

(6) WS : Wet scrubber

Annex V: Minutes of Meeting with Czech Grid Operating (Čeps)

DET NORSKE VERITAS

MINUTES OF MEETING TO:		**MOM NO.:**	DNVRI EnergyTOLAN100225-2
Participants		**FROM:**	
Copied to:		**DATE:**	24.02.2010
		PREP. BY:	TORE LANGELAND

Ancillary services in the Czech Republic

Time/Place: 24.02.2010/Prague/Thákurova 4, 160 00 Prague 6

Participants: J.Fantík (ČEPS), J.Svec (Ministry of the Environment), P.Holub (Ministry of the Environment), B. Toole O'Neil (DNV), B.Adams (DNV), L.Nemecek (DNV), T.Langeland (DNV)

Introduction
A brief introduction to the 3rd party assessment of the comprehensive refurbishment of the Prunéřov power plant was given by Mr Adams.

Mr. Fantik is Head of the Operation Planning of System Services Department at CEPS. Mr. Adams began the discussion by asking Mr. Fantik to help us understand the ancillary services contracting and impacts on the grid. Mr Fantík presented and overview and the key issues regarding the ČEPS transmission network with special attention to the Grid Code published by ČEPS. Further discussions were mainly based on questions from DNV.

Transmission issues discussed

- In terms of transmission capacity, some congestion exists in the northern part of the Czech Republic. Two reasons were discussed: a) high wind power production in the northern Germany transiting through the ČEPS transmission grid, and b) high concentration of production capacity in the north western part of the Czech Republic. Plans for upgrading and increasing capacity are under consideration. Challenges on obtaining consent for new grid capacity are substantial.
- Today the Czech Republic has a surplus of electricity production and is a net exporter of power
- There are plans for a substantial amount of solar power in the Czech Republic. Balancing of the power system, especially during low load conditions will be challenging. With this in mind, ČEPS looks at it as an advantage with several smaller units compared to larger units.
- In general, ČEPS is in favour of small units (200-300MW) due to their flexibility, but it is more on a 'nice to have basis' rather than a requirement.

Grid Code Discussion

- All new installed production units with a rating above 30MW must have the ability to provide ancillary services described in the grid code, however, they are not obliged to participate in the ancillary service market.
- To obtain enough ancillary services in the transmission system, ČEPS rely solely on a market based approach. Each generation unit approved for supplying ancillary services can give a tender on ancillary services. This is done by:

DNVRI EnergyTOLAN100225-5.doc

Type of contract	Duration	Coverage of ancillary services
Long term contracts	3 years	50 %
Medium term contracts	1 year	40 %
Short term marked	Day ahead	10 %

- ČEPS has no requirements concerning where in the grid the ancillary services are provided.
- Today the largest unit in operation in the Czech transmission grid is the nuclear power plant Temlin with two units rated at 1000MW electric each.
- ČEPS must keep a reserve to maintain grid stability. The amount of reserve is calculated based on the N-1 criteria. Added cost of providing enough reserves in the Czech Republic will probably be higher with a single large unit compared to three small units pursuant to Mr Fantík.
- A substantial amount of producers participate in the market for ancillary services. ČEZ a.s.' market share of the ancillary services is estimated to be less than 50 % which is preferred by ČEPS'. ČEPS' has a contract with ČEZ a.s. for ancillary services. ČEZ a.s. decides what plants provide ancillary services.
- The Grid Code contains strict rules which must be applied regarding island operation. ČEPS was concerned whether or not a single large plant could meet this requirement. A question was raised by ČEPS whether or not a large unit can cope with this demand.

In Summary
This meeting was arranged to sort out whether or not a large unit at the Prunéřov power plant is consistent with the Grid Code in the Czech Republic.

- ČEPS is the system operator for the Czech Republic.
- Ancillary services are provided by 15 suppliers
- The provision of ancillary services occurs on a voluntary basis.
- A unit of 500-600MWel is not expected to significantly increase the cost of ancillary services.
- ČEZ a.s. decides which units they offer on the ancillary service market.
- Island operation could be an issue with large units.

- o0o -

To: "Jan.Svec@mzp.cz" <Jan.Svec@mzp.cz>
From: Fantík Josef <Fantik@ceps.cz>
Date: 03/04/2010 05:57PM
Subject: Minutes of the meeting

Dear Mr. Svec,

I confirm that attached minutes are a fair and complete representation of discussion on the meeting on February 24th.

Best Regards

Josef Fantik

Ministerstvo životního prostředí
České republiky

EMAS

Annex VI: Study of the availability of alternative fossil solid fuel sources

As part of the review of the proposed Prunéřov project, a review of available coal resources was performed to answer the following questions:

- Is there a higher quality coal resource available within the region (100 km)
- What is the estimated supply of coal, e.g. how many years will the supply last?

The review below includes more information on coal in Europe, coal as a resource in the Czech Republic and nearby countries and the estimated reserves. In summary coal is an important source of energy in Europe and will remain important for many more years. The Czech Republic's only indigenous fossil fuel is coal. Lignite is a lower rank coal with typically lower heat content, higher moisture and ash. Lignite is typically not shipped very far because of the lower coal quality. Power plants are typically built at the mine or nearby. Higher quality coal is not available in the northern Bohemia in sufficient quantity to supply the proposed project. Nearby coal resources in Germany and Poland are committed with mine-mouth plants near the coal basins.

The estimates of available resources by the investor and a review of available information are consistent. The remaining recoverable resource in Bohemia is estimated from 184 – 275 million tons.

Coal as a Resource in Europe and Eurasia

In 2006, the major coal-consuming countries of OECD Europe included Germany, Poland, the United Kingdom, Spain, Italy, Turkey, and the Czech Republic. Lower quality coal, e.g. lignite, is an important domestic source of energy for OECD Europe, which also relies heavily on imports of hard(bituminous) coal. In 2006, lignite accounted for 47% of total coal consumption in OECD Europe on a tonnage basis and 24% on a heat basis. Brown coal and lignite coal have similar coal quality characteristics. The term lignite will be used throughout the document for both brown coal and lignite

Of the ~55 countries comprising Europe and Eurasia, 22 countries have recoverable coal reserves. The total recoverable reserves in Europe and Eurasia are 272008 million metric tons according to EIA (2005), and 272245 million metric tons according to BP (2008). [1],[2]. The Czech Republic ranks 7th in recoverable reserves with slightly less than 2% of the total. Germany holds about 2.5% of the recoverable reserves. In comparison, Russia holds 58% of the recoverable reserves with Ukraine next at 12%. (see Table A1 and Figure A1) [A3], [A4]

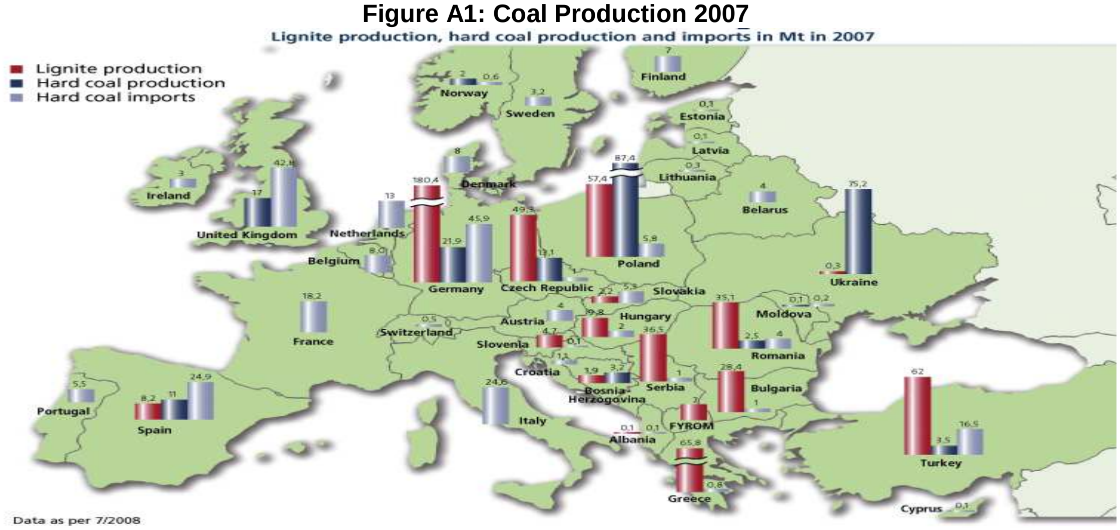
Table A1: Total Recoverable Coal (Million Tons) 2005

Europe (Total)	46058.6		
Eurasia (Total)	225949.0		
Albania	793.8	Portugal	35.9
Bulgaria	1995.6	Romania	421.9
Czech Republic	4500.1	Slovakia	261.9
Former Serbia and Montenegro	13882.2	Slovenia	231.9
Germany	6706.6	Spain	529.9

Table A1: Total Recoverable Coal (Million Tons) 2005 (continued)

Greece	3899.2	Turkey	1813.6
Hungary	3301.3	United Kingdom	155.0
Ireland	14.0	Kazakhstan	31293.6
Italy	10.0	Kyrgyzstan	811.9
Norway	5.0	Russia	156978.0
Poland	7500.4	Ukraine	33866.1
Portugal	35.9	Uzbekistan	2999.4

Figure A1: Coal Production 2007



Energy Resources in Czech Republic

The Czech Republic has minor oil and gas resource and production. They import virtually all of the natural gas and oil used. Coal is consumed within the country and some hard coal (bituminous) is exported from mines in the south-eastern part of the county [A5]. The lignite mined in the country is used within the country for electricity generation.

Coal Fields in Czech Republic

The Czech Republic has both hard (bituminous) and lignite coal resources. Lignite is mined in the north, while hard coal is mined in the east near Poland (see Figure A2) [A3].

Hard coal production is centered on the Ostrava-Karvina district of the Czech section of the Upper Silesian coalfield, although hard coal resources occur in four areas of the country: Ostrava-Karvina coalfield, North Moravia; Kladno, Central Bohemia; Rosice, South Moravia; Plzen, South Bohemia.

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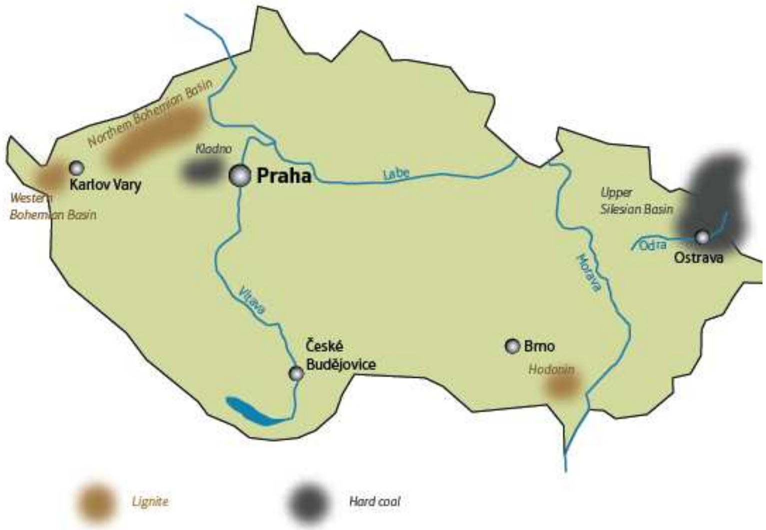
Kladno is the oldest producing coalfield in the Czech Republic, with continuing limited output of high-ash bituminous coal, but hard-coal mining in Trutnov, Rosice and Plzen has been phased out.

Figure A2: Coal Basins in the Czech Republic



The country's principal lignite resources lie in a belt along the southern flanks of the Krušné hory (Ore) Mountains that form the border between the Czech Republic and Germany. The deposits cover an area of approximately 1050 km^2. Of other resources distributed across the country, only those in South Moravia support current mining operations.

Structure and stratigraphy

The northern Czech lignites occur in three separate basins in the Cheb, Sokolov and Most districts. Of these, the Cheb deposits are not available for mining for environmental reasons. The Upper Bohemia basin contains up to three individual seams, hosted in the Miocene Most Formation, ranging from 10 m to 40 m thick, the main seam being locally thickened by folding close to the basin's edge with the Ore Mountains. Seam thicknesses in the Sokolov basin range from 3 m to 15 m. Overburden thicknesses are 20–25 m in the Most area of the Upper Bohemia basin, but can be close to 300 m close to the mountain slopes.

Coal rank and quality

The North Bohemian basin covers an area of about 850 km^2. Seams of 15–30 m thickness occur at depths of up to 400 m, the coal measures being shallow and fairly level. The Sokolov deposit in Western Bohemia covers an area of 200 km^2, and is well developed. The accessible coal has calorific values ranging between 10 and 14 MJ/kg, sulphur contents between 0.5% and 5.6% and ash contents between 18% and 25%. The coal also has unusually high tar content.

Lignite quality is very variable, both on an aerial basis and across the seam profile. Upper Bohemian coals have heating values of 9–19 MJ/kg, ash contents of 7–37%, sulphur contents of 0.7–3.5% and an average moisture content of 30% (although ranging from 6% to 55%). Typical coal quality parameters from the mines operated by MUS SA are 9–19 MJ/kg, 7–37% ash and 0.7–3.5% sulphur

Resources
A coal resource is defined as the demonstrated quantities that cannot be recovered at current prices with current technology but might be recoverable in the future, as well as quantities that are geologically possible resources but not demonstrated or confirmed resources.

A reserve or recoverable reserve is the quantity that can be recovered from a mineral deposit at current prices with current technology.

Hard coal reserves in the Czech Republic are estimated at some 2600 Mt, of which perhaps 1000 Mt were previously considered accessible for mining [3]. The current market economics have reduced this figure substantially, although the resource base remains substantial.

The Doly Nastup Tušimice brown coal mining area is located between the towns of Chomutov and Kadaň and consists of one large surface mine site with an average annual production of 14.3 million t of brown coal. After preparation at the Tušimice crushing plant, most of the product is supplied to power stations operated by the ČEZ Group.

The Chomutov-based brown coal company Severočeske uhelne doly, a.s. (SD), fully owned by the ČEZ Group, operates in the north-western part of the Northern Bohemian Coal Basin and to the east of the town of Most. SD extracts brown coal at two sites, namely Doly Nastup Tušimice and Doly Bilina. A total of 23.8 million t was produced in 2007.

The Bilina brown coal mining area, which consists of one surface mine, Bilina, is located between the towns of Bilina and Duchcov. More than 9 Mt of brown coal produced each year is first transported to the Ledvice preparation plant before being delivered to power stations, industries and households.

Located in western Bohemia, the brown coal basin around the town of Sokolov, which has workable reserves of 230 Mt located in three main seams, is the third most important brown coal mining area in the Czech Republic. Here the brown coal company Sokolovska uhelna, a.s. (SU) mines and processes lignite from deposits in the western part of the coal field below the Krušne hory Mountains and operates the Družba and Jiři opencast mines. Their average total annual production is 10 million t. In 2007 the output was 10.3 Mt

During the 1970s, lignite resources in the North Bohemia and Sokolov basins were estimated at some 5000 Mt, of which half were considered suitable for surface mining. Current EIA estimates are recoverable reserves of some 3575 Mt. In contrast, the estimated proven lignite and sub-bituminous resources for the Czech Republic are 2828 Mt from the BP report [A2]. Recent environmental and land-use constraints imposed by the Czech Government on mine development in North Bohemia and Sokolov have reduced the recoverable reserve to approximately 1370 Mt [A2].

The BGR Annual Report 2009 [A7] lists estimated recoverable reserves at 184 Mt and the available resource at 956 Mt, considerably lower than the BP estimate. The difference is most likely due to different information sources, changes in local laws and slight differences in definition of the term resource.

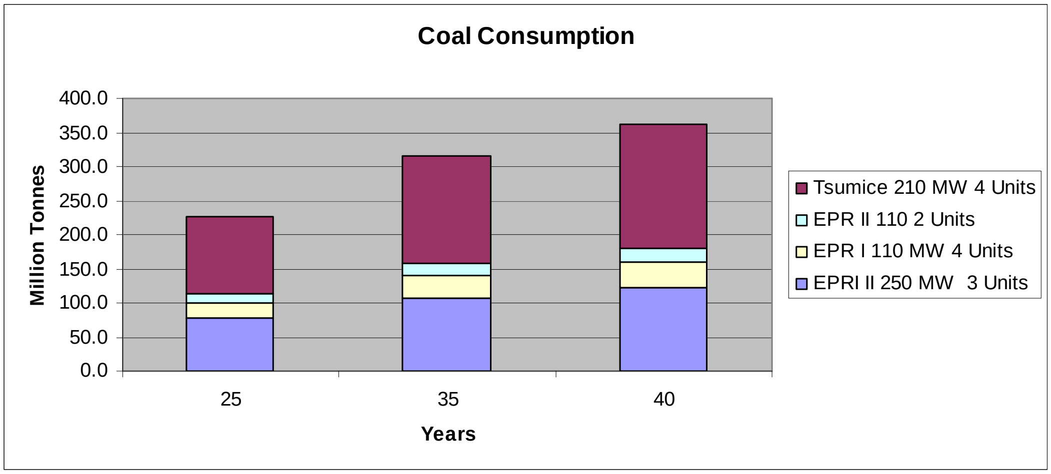
The investor provided the following information on the coal resource in the Libouš mine (organizational unit of the Nástup Tušimice mine of Severočeské doly a.s.) as of January, 2009:

Total lignite coal:	530.9 million tons
Recoverable resource*:	275.4 million tons
Current production:	14 million ton/year

*this includes reductions in mining by national or local law

Using the Table of Equipment list on p. 23 of the report, the estimated coal consumption for the Tušimice and Prunéřov for 25, 35 and 40 years was prepared. The estimated consumption for the total recoverable resource is 225 Mt at 25 years. Figure A3 shows the analysis for 25, 35 and 40 years.

Figure A3: Estimated coal consumption



Conclusion: The BGR report is consistent with the information provided by the investor from the mining company. The BGR report and the information from the mining company are the most recent and deemed more reliable. The estimate of consumption of the recoverable resource is consistent with the information provided.

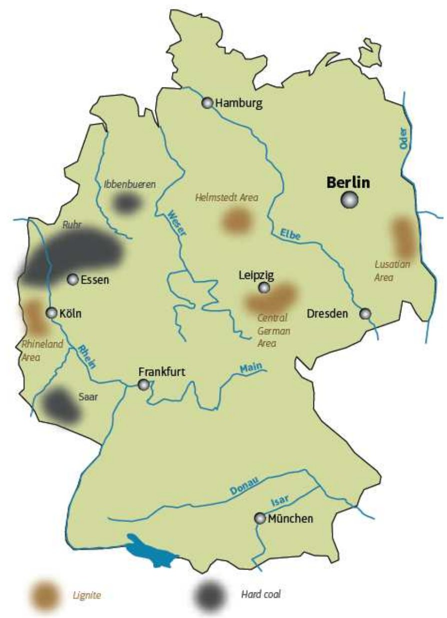
Nearby Energy Resources

The nearest coal resources outside of the Czech Republic are in Germany and Poland.

Germany
The Lusatian mining area in Saxony is the nearest coal resource to Prunéřov (see Figure A4). In 2007, the Lusatian mines produced some 59.5 million t of lignite. The only lignite producer in this area is Vattenfall Europe Mining AG (VE-M). Lignite is extracted in Janschwalde, Cottbus Nord and Welzow Sud in Brandenburg as well as in the Nochten mine in Saxony. The Reichwalde opencast mine is currently not in operation. The coal is of similar quality to the coal from the Libous mine, but is higher in moisture content, up to 50%.

Conclusion: the lignite is sold locally and not exported.

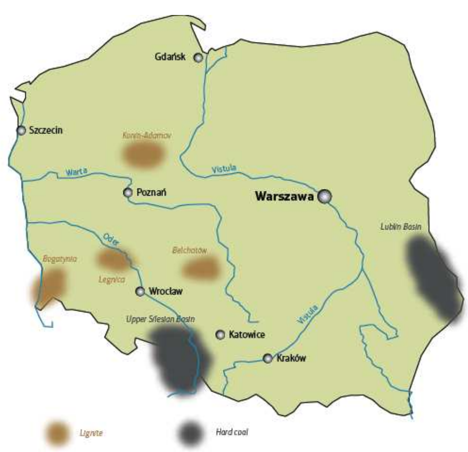
Figure A4: Coal Resources in Germany



Poland

Bituminous and lignite coal are strategic fuels for Polish power generation, which has been expanded on the basis of solid fuels from indigenous sources. Poland's lignite deposits are exclusively mined by opencast methods. Two of these operations are located in central Poland and a third one in the south-western region of the country. The Konin-Adamow basin is the closest to the Czech Republic. (see Figure A5).

Figure A5: Coal Resources in Poland



The Konin-Adamow basin is located in central Poland between Warsaw and Poznan, and has been producing lignite for over 50 years. There are two active combined mines: Konin and Adamow. The

Konin mine has a production capacity of 12 Mt per year. Lignite is produced in four opencast sites at Lubstow, Jozwin IIB, Kazimierz North and Drzewce. Total lignite production reached 10.2 Mt in 2007. The working depth at these pits varies between 25 and 80 m. The extracted fuel has an average calorific value of 9,220 kJ/kg. The lignite reserves at operating mines are 88 Mt while the satellite deposits scheduled for progressive development are estimated to contain about 294 Mt. In 2010, overburden removal in the new Tomisławice lignite mine is planned. The Konin mine supplies lignite to three mine-mouth power plants, Patnow I with a capacity of 1.200 MW, Konin with a capacity 583 MW and Pątnow II with a capacity of 464 MW.

In the Adamow mine, three opencast pits are operated, (Adamow, Wladyslawow and Kozmin), with a lignite production capacity of 5 Mt per year. The depth of mining operation is between 40 and 70 m. The deposits currently being exploited have workable reserves of 62.8 Mt, while the adjacent deposits are estimated at about 725.7 Mt. In 2007, lignite production reached 4.9 Mt, all of which was supplied to the Adamow mine-mouth power station (capacity 600 MW). To maintain the present level of lignite production, the mine is now developing the northern field at Kozmin, which guarantees a production level of about 1 Mt per year until 2008. The entire lignite basin generates 8.9% of Poland's energy requirements. The Adamow mine is expected to remain in operation until 2023 and the Konin mine until 2040.

Conclusion: Lignite mining in Poland provides coal for mine-mouth power plants and is not exported. The coal resource in the Konin-Adamow basin is limited.

References of Annex VI

[A1] IEA Clean Coal Centre http://www.coalonline.org/catalogues/coalonline/81343/5864/html/5864_42.html
[A2] BP Statistical Review of World Energy, June 2009 available at bp.com
[A3] Coal Industry Across Europe, 2008; EuraCoal; European Association for Coal and Lignite
[A4] US DOE EIA, International Energy Statistics, http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=1&pid=7&aid=6,
[A5] US DOE EIA, International Energy Statistics, http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=EZ#
[A6] World Coal Institute Coal Facts 2008, 2009 available at wci.org
[A7] BGR, Reserves, Resources, and Availability of Energy Resources; Federal Institute for Geosciences and Natural Resources, 2008
[A8] Czech Republic Energy Profile, US Energy Information Administration, Independent Statistics and Analysis, accessed 2010
[A9] US DOE EIA, May 27, 2009 http://www.eia.doe.gov/oiaf/ieo/coal.html)
[A10] Letter ČEZ to MOE re: Statement of ČEZ, a.s. on the statement of MV Stavby s.r.o. (dated December 3, 2009) submitted with respect to the expert report on the environmental impact of the project “Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MW_e”December 14, 2009

Annex VII: Review of EIA Process

Covers DNV Project Docs 1-143		Colour Key:
		General
		Notification
		Fact Finding
		Documentation
		Expert Opinion & Supplementation
		Public Hearing
		EIA discrepancy

EIA Step	Action	Date done	Done?	Documentary Evidence Provided (with DNV Document Reference Number)	In accordance with Czech EIA guidance?	Comment
1	Opinion from The Department of the Environment and Agriculture	03-Oct-07	Y	36. The opinion of the authority in charge of the environmental protection on the plan of “Comprehensive Renovation of Prunéřov II Power Plant” in terms of a possible impact on the localities of European significance and bird habitats in accordance with Section 45i of the Act No. 114/1992 Coll., on the environmental and landscape protection		
2	Opinion from Municipality Authority in Kadan on territorial planning documentation	18-Oct-07	Y	35. 18/10/07 - OPINION On the plan “Comprehensive Renovation of Prunéřov II Power Plant” in terms of the territorial planning documentation		
3	Notifier submits notification	06-Jun-08	Y	26. Letter 6/6/08 - Re: Confirmation of acceptance of project notification under Act No. 100/2001 Coll. 38. May 2008 - Part I - Plan Notification 39. C. DATA PERTAINING TO THE STATE OF THE ENVIRONMENT IN THE AFFECTED AREA 40. Image 18 and following of EIA complete version 59. Annex to the notification - SP1 - Acoustic study - part II 01/05/2008 60. Annex to the notification - SP1 - Acoustic study - part I 01/05/2008 63. Annex to the notification - SP2 - Dispersion study	Y	Notifier obliged to submit notification of plan to relevant authority in accordance with Annex 3.

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Annex VII: Review EIA Process (continued)

4	Notification distribution and publishing by MoE for comment	13-Jun-08	Y	29. MoE 13/6/08 - announcement commencement of fact finding procedure	Y	Required to do this within 10 working days of receiving notification
5	MoE commences fact finding procedure	23-Jun-08	Y	142. MoE - Internal Communication - Commencement of the fact finding procedure (23/6/2008)	Y	The relevant authority must commence the fact-finding procedure within 30 days of receiving the notification.
6	Notification Information published on Notice Board	30-Jun-08	Y	120. answers on EIA information request - 260210.doc	Y	The relevant authority shall ensure that that all project information is published on official notice boards.
7	Written opinions on notification given	26-Jun-08	Y	118. Municipal authority of Klasterec and Ohri Statement 3 to the notification 26/6/2008	Y	Opinions need to be given within 20 days of making public the notification to be relevant
		01-Jul-08	Y	138. Regional public health station of Ustni region Request for extension of the deadline for providing a statement (1/7/2008)	Y	
		02-Jul-08	Y	117. Town of Vysluni Statement 2 to the notification 2/7/2008	Y	
		04-Jul-08	Y	143. MoE - Internal Communication - Commencement of the fact finding procedure (4/7/2008)	Y	
		08-Jul-08	Y	116 & 140. Town of Kadan - Vysluni - Usti region - Chomutov - Authority of Kadan - Statement 1 to the notification several dates in July 2008	Y	
		09-Jul-08	Y	141. Municipal authority of the city of Chomutov Statement to the notification (9/7/2009)	Y	
		10-Jul-08	Y	136. Regional inspectorate in Ústí and Labem - Statement on the notification (10/7/2008)	Y	
		11-Jul-08	Y	119. Internal communication Statement 4 to the notification 11/7/2008	Y	
		18-Jul-08	Y	139. Regional Authority of the Ústí region - EIA - statement on fact-finding procedure (13/6/2008)	Y	
		23-Jul-08	Y	137. Disapproving statement to the notification (23/7/2008)	Y	
8	Distribution and publishing of fact-finding procedure	30-Jul-08	Y	37. 30/7/08 - Conclusion of the fact-finding procedure	Y	Fact finding procedure terminated within 35 days of publication of notification.

Annex VII: Review EIA Process (continued)

9	Notifier prepares Documentation	Jul to Dec 08	Y	6. Expert Assessment of the Comprehensive Refurbishment of the Prunerov II Power Plant 3x250MW in terms of BAT - Response to paragraphs 1-3 of the conclusion of the fact-finding procedure 01/11/2008 61. Annex to the notification - SP6 - Evaluation of hydrogeological conditions 62. Annex to the documentation - SP2 - Dispersion study 58. Annex No 5 - Annex to SP2: Assessment of Immission Load in Usti Region 66. Noise Study - SP1 67. Annex Dispersion & Immission Study 65. Annex to the documentation - SP3 - Impact on public health 68. Assessment of the plan Impact on SAC and SPA - Annex SP4 01/12/2008	Y	No specific requirements
10	Notifier issues Authority with documentation	10-Dec-08	Y	25. Letter 10/12/08 - RE: Documentation of the project "Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MWe"		
11	Relevant Authority receives Documentation (EIA)	12-Dec-08	Y	57. Project Documentation 01/12/2008 34. Appendix H9 - Assessment of compliance with the update of the regional Air Quality Improvement Programme	Y	No specific requirements
12	Documentation distribution and publishing by MoE for comment	29-Dec-08	Y	28. MoE 19/12/09 - distribution of documentation to affected authorities	Y	Within 10 working days of the date of delivery of the documentation, MoE shall distribute for comment
13	Expert for expert report chosen	13-Jan-09	Y	126. Request to V Obluk to prepare an expert opinion		
14	Documentation published on Notice Board	14-Jan-09	Y	120. answers on EIA information request - 260210.doc	Y	The relevant authority shall ensure that that all project information is published on official notice boards.

Annex VII: Review EIA Process (continued)

15	Written opinions on documentation given	15-Jan-09	Y	108. MOE - Dept of Water Protection Statement to the EIA documentation 15/1/2009	Y	Opinions need to be given within 30 days of making public the documentation to be relevant
		16-Jan-09	Y	97. Town of Kadan Statement to the EIA documentation 20/1/2009		
			Y	103. Municipal authority of Kadan Statement to the EIA documentation 19/12/2008		
		19-Jan-09	Y	104. Municipal authority of the city of Chomutov Statement to the EIA documentation 21/1/2009		
			Y	99. Municipality of Krimov Statement to the EIA documentation 20/1/2009		
		23-Jan-09	Y	109. MOE - Dept of Landscape Protection Statement to the EIA documentation 23/1/2009		
		26-Jan-09	Y	107. Czech environmental inspection Statement to the EIA documentation 26/1/2009		
16	Notifier agrees to pay for Expert report	27-Jan-09	Y	27. Letter 27/1/09 - Re: Preparation of the expert report on the environmental impact of the project of “Comprehensive Refurbishment of the Prunéřov II Power Plant 3 x 250 MWe”		

Annex VII: Review EIA Process (continued)

17	Written opinions on documentation given	28-Jan-09	Y	98. Municipality of Kovarska Statement to the EIA documentation 28/1/2009	Y	Opinions need to be given within 30 days of making public the documentation to be relevant
		02-Feb-09	Y	101. Municipality of Misto Statement to the EIA documentation 2/2/2009		
			Y	110. MOE Internal Communication Statement to the EIA documentation 2/2/2009		
		03-Feb-09	Y	105. Regional authority of Usti region Statement to the EIA documentation 6/2/2009		
		11-Feb-09	Y	102 & 131. Regional authority of Usti region Statement to the EIA documentation 11/2/2009		
			Y	115 & 133. Statement on project GREENPEACE Statement to the EIA documentation 11/2/2009		
		12-Feb-09	Y	100. Municipality of Medenec Statement to the EIA documentation 12/2/2009		
		13-Feb-09	Y	114 & 128. Dissenting statement from GARDE Statement to the EIA documentation 13/2/2009		
		18-Feb-09	Y	96. Municipality Domasin Statement to the EIA documentation 23/2/2009		
		19-Feb-09	Y	106. Regional public health station of Ustni region Statement to the EIA documentation 19/2/2009		
18	Cez Response to written opinion	19-Feb-09	Y	129. Reply to the Statement of Greenpeace (19/2/2009)		
			Y	130. Expert report on part of the statement of Greenpeace (19/2/2009)		
19	Written opinions on documentation given	25-Feb-09	Y	70. Statement from Dept Integrated Prevention and IPR 25/02/2009	Y	Opinions need to be given within 30 days of making public the notification to be relevant
			Y	132. Extract from resolution - Council of the Ústí Region		
		09-Mar-09	Y	111. MOE Internal Communication Statement to the EIA documentation 9/3/2009		
20	Documentation returned to Notifier for re-working	09-Mar-09	Y	31. MoE 9/3/09 - request for supplementing information	Y	Documentation returned within 40 working days of the date (when the information is made public) for supplementing.
				92. Request supplementation EIA to territorial self-governing units Annex to expert opinion 1 9/3/2009		

Annex VII: Review EIA Process (continued)

21	Written opinions on documentation given	11-Aug-09	Y	112. Internal Communication Statement 11/8/2009	N	Opinions to be given within 30 days of making public the notification
22	Notifier prepares Supplementation	Mar to Sep 09	Y			
23	Expert Report prepared	Jan to Oct 09	Y	5. Assessment of efficiency KO EPRII3 X 250 MWE Project 01/10/2009 7. Expert Opinion regarding the environmental impact of the project Comprehensive reconstruction of the Prunerov II 3 x 250 MWe power plant 19/10/2009 95. Request continuation work on expert report Annex to expert opinion 4 7/10/2009		
24	Notifier submits Supplementation	25-Sep-09	Y	93. Letter Cez as - request continuation EIA Annex to expert opinion 2 25/9/2009		
25	Supplement of documentation received by MoE	29-Sep-09	Y	8. Letter from Cez to MoE. 13. Supplement documentation		
26	MoE requests that Expert continues report	07-Oct-09	Y	127. Request to continue work on expert opinion to V Obluk		
27	Expert Report received by MoE	20-Oct-09	Y	120. answers on EIA information request - 260210.doc	Y	The period for preparing the expert report must not exceed 60 days from the date when the documentation was delivered to the "expert".
28	Expert Report and Supplement Documentation distribution and publishing by MoE for comment	23-Oct-09 30-Oct-09	Y	30. MoE 23/10/09 - distribution of expert report 125. Letter from MoE to Sachsisches Staatsministerium fur Umwelt und Landwirschaft	Y	Expert report distributed within 10 days of it being received by the MoE
29	Expert Opinion and Supplement Documentation published on Notice Board	04-Nov-09	Y	120. answers on EIA information request - 260210.doc	Y	The relevant authority shall ensure that that all project information is published on official notice boards.
30	MoE receives comment on Expert Opinion and Supplement Documentation	06-Nov-09 09-Nov-09 10-Nov-09	Y	45. Kadan Municipal Authority statement 52. Letter 9/11/09 - Dept Water 50. Letter 10/11/09 - Dept Air Protection	Y	Written opinion received within 30 days of information being published.
31	MoE sends invite to public hearing	13-Nov-09	Y	33. MoE 13/11/09 - distribution of notification of public hearing	Y	Negative viewpoint received thus public hearing provided for

Annex VII: Review EIA Process (continued)

32	MoE receives comment on Expert Opinion and Supplement Documentation	18-Nov-09	Y	51. Letter 18/11/09 - Dept Integrated Prevention	Y	Written opinion received within 30 days of information being published.
33	Public Hearing details published on Notice Board	19-Nov-09	Y	120. answers on EIA information request - 260210.doc	Y	Information of public hearing published at least 5 days prior to hearing.
34	MoE receives comment on Expert Opinion and Supplement Documentation	19-Nov-09	Y	44. Chomutov authority statement	Y	Written opinion received within 30 days of information being published.
		26-Nov-09		55. Letter 26/11/09 - Reg Public Health Station agreement with expert report	N	Written opinion not received within 30 days of information being published however opinions received late can be considered at the Public Hearing
		01-Dec-09		53. Letter 1/12/09 - Dept EIA & IPPC	N	Written opinion not received within 30 days of information being published however opinions received late can be considered at the Public Hearing
		01-Dec-09		56. Letter 1/12/09 - Statutory City of Chomutov	N	Written opinion not received within 30 days of information being published however opinions received late can be considered at the Public Hearing
35	Public Hearing on expert report	03-Dec-09	Y		Y	MoE ensures public hearing held at the latest 5 days after expiry of the period of time for stating a viewpoint on the expert report.
36	MoE receives comment on Expert Opinion and Supplement Documentation	03-Dec-09	Y	42. Statement from Green Party	N	Written opinion not received within 30 days of information being published.
				54. Letter 3/12/09 - MV Stavby		
				64. Letter 091203 - Request for a transboundary EIA		
		04-Dec-09		41. Statement pursuant to Section 9 (8) of Act No. 100/2001 Coll., on supplementation of the documentation and expert report for the project of “Comprehensive Refurbishment of the Prunerov II Power Plant 3 x 250 MWe”		
		11-Dec-09		134. Extract from resolution - Council of the Ústí Region (2/12/2009)		
				135. Extract from resolution - Council of the Ústí Region (3/12/2009)		

Annex VII: Review EIA Process (continued)

37	Minutes of Public Hearing prepared & distributed	14-Dec-09	Y	32. MoE 14/12/09 - Minutes of public hearing	Y	
38	The Official term for issuing the statement on the EIA of the project implementation expired	04-Jan-10				
39	MoE receives comment on Expert Opinion and Supplement Documentation	07-Jan-10	Y	43. Statement from G-Team (component supplier)	N	Written opinion not received within 30 days of information being published.
		08-Jan-10		47. Letter 08/1/10 - support from Nuclear Research Institute		
				48. Letter 08/1/10 - support from Vitkovice		
				49. Letter 08/1/10 - support from ZVVZ Enven Engineering		
		12-Jan-10		46. Letter 12/1/10 - support from Ing M Kucera		
40	Cez writes to MoE re postponement of final EIA statement?	18-Jan-10		9. Letter 18/1/2010		
41	Opinion from Peter Roderick of Climate Justice Programme	19-Jan-10		18. In the matter of the EU IPPC Directive, Best Available Techniques and the Prunerov II power station - Opinion	N	Written opinion not received within 30 days of information being published.

Annex VIII: Power plant simulations

A) Verification of predicted net unit efficiency of the refurbished blocks – 'Base' Case

MAIN INPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Fuel Properties:
Fuel Name: EPR II Coal Design
Fuel Source: eprii.fdb
Coal Rank: Lignite
Heating Value (Btu/lb):
Value: 5224
Carbon (wt% as received):
Value: 26.40
Hydrogen (wt% as received):
Value: 2.320
Oxygen (wt% as received):
Value: 9.550
Chlorine (wt% as received):
Value: 1.000e-2
Sulfur (wt% as received):
Value: 2.000
Nitrogen (wt% as received):
Value: 0.5000
Ash (wt% as received):
Value: 28.29
Moisture (wt% as received):
Value: 31.00

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Net Electrical Output (MW):
Value: 223.9 (calculated)
Ambient Air Temperature (Avg.) (℃):
Value: 20.00
Ambient Air Pressure (Avg.) (MPa):
Value: 9.928e-2
Relative Humidity (Avg.) (%):
Value: 50.00
Ambient Air Humidity (Avg.) (kg H2O/kg dry air):
Value: 7.413e-3 (calculated)
Oxygen Content in Air/Oxidant (vol %):
Value: 20.71 (calculated)

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Unit Type:
Value: Sub-Critical
Steam Cycle Heat Rate, HHV (kJ/kWh):
Value: 7165 (calculated)
Boiler Firing Type:
Value: Wall
Boiler Efficiency (%):
Value: 90.63 (calculated)
Excess Air For Furnace (% stoich.):
Value: 13.00 (calculated)
Leakage Air at Preheater (% stoich.):
Value: 6.000 (calculated)
Gas Temp. Exiting Economizer (℃):
Value: 371.1
Gas Temp. Exiting Air Preheater (℃):
Value: 140.0
Percent Water in Bottom Ash Sluice (%):
Value: 39.30 (calculated)
Base Plant Power Requirements
Coal Pulverizer (% MWg):
Value: 1.296 (calculated)
Steam Cycle Pumps (% MWg):
Value: 0.3100 (calculated)
Forced / Induced Draft Fans (% MWg):
Value: 3.574 (calculated)
Miscellaneous (% MWg):
Value: 0.9900 (calculated)

Tab 'Furn. Factors':
Percent Ash Entering Flue Gas Stream (%):
Value: 80.00 (calculated)
Sulfur Retained in Flyash (%):
Value: 25.00 (calculated)
Conc. of Carbon in Collected Ash (%):
Value: 4.000
Percent of Burned Carbon as CO (%):
Value: 0.2300
Tab 'Performance':
Steam Energy Added in Boiler (kJ/kg):
Value: 2849 (calculated)
Boiler Blowdown (*1) (%):
Value: 6.000
Miscellaneous Steam Losses (*2) (%):
Value: 0.4000
Demineralizer Underflow (*3) (%):
Value: 8.500
Cooling Water Temperature Rise (℃):
Value: -7.811 (calculated)
Aux. Heat Exch. Load (*2) (%):
Value: 1.410 (calculated)
(*1) % Recirculating Water
(*2) % Primary Steam Cycle
(*3) % Demineralizer Inlet

Tab 'Config':
In-Furnace Controls:
Value: LNB & OFA

Tab 'Performance':
Combustion NOx Controls
Actual NOx Removal Efficiency (%):
Value: 66.65 (calculated)

Process Type 'Cold-Side ESP':

Tab 'Performance':
Particulate Removal Efficiency (%):
Value: 99.87 (calculated)
Cold-Side ESP Power Requirement (% MWg):
Value: 0.5851 (calculated)

Tab 'Config':
Reagent:
Value: Limestone

Tab 'Performance':
Maximum SO2 Removal Efficiency (%):
Value: 98.00
Scrubber SO2 Removal Efficiency (%):
Value: 92.00 (calculated)
Scrubber SO3 Removal Efficiency (%):
Value: 50.00
Particulate Removal Efficiency (%):
Value: 50.00
Reagent Stoichiometry (mol Ca/mol S rem):
Value: 1.030 (calculated)
Total Pressure Drop Across FGD (cm H2O gauge):
Value: 25.40 (calculated)

Tab 'Config':
Configuration Menus
Air Flow Draft Control Type:
Value: Forced

Tab 'Performance':
Wet Cooling Tower
Ambient Air Temp (Dry Bulb Avg.) (℃):
Value: 20.00
Air Wet Bulb Temperature (Avg.) (℃):
Value: 13.92 (calculated)
Cooling Water Inlet Temperature (℃):
Value: 32.22
Cooling Water Temperature Drop (℃):
Value: -7.811 (calculated)

Annex VIII: Power plant simulations (continued)

A) Verification of predicted net unit efficiency of the refurbished blocks – 'Base' Case

MAIN OUTPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Tab 'Plant Perf.':
Performance Parameter: Value:
Net Electrical Output (MW): 223.9
Primary Fuel Input (GJ/yr): 1.246e+7
Total Plant Input (GJ/yr): 1.246e+7
Gross Plant Heat Rate, HHV (kJ/kWh): 7906
Net Plant Heat Rate, HHV (kJ/kWh): 8829
Annual Operating Hours (hours): 6305
Annual Power Generation (BkWh/yr): 1.411
Net Plant Efficiency, HHV (%): 40.78

Plant Electricity Requirements: Value:
Gross Electrical Output (MWg): 250.0
Base Plant Use (MW): 15.42
In-Furnace NOx Use (MW): 0.0
Cold-Side ESP Use (MW): 1.463
Wet FGD Use (MW): 3.663
Cooling Tower Use (MW): 3.525
Net Electrical Output (MW): 223.9

Tab 'Mass In/Out':
Chemical Inputs: Flow Rate (kg/kWh):
Coal: 0.7265
Oil: 0.0
Natural Gas: 0.0
Total Fuels: 0.7265
Lime/Limestone: 3.498e-2
Sorbent: 0.0
Ammonia: 0.0
Urea: 0.0
Dibasic Acid: 0.0
Misc. Chemicals: 6.933e-6
Activated Carbon: 0.0
Total Chemicals: 3.498e-2
Total Water Withdrawal: 1.979
Makeup Water: 1.979

Solid & Liquid Outputs: Flow Rate (kg/kWh):
Bottom Ash Disposed: 7.172e-2
Fly Ash Disposed: 0.1739
Scrubber Solids Disposed: 6.256e-2
Particulate Emissions to Air: 1.139e-4
Captured CO2: 0.0
Byproduct Ash Sold: 0.0
Byproduct Gypsum Sold: 0.0
Byproduct Sulfur Sold: 0.0
Byproduct Sulfuric Acid Sold: 0.0
Total: 0.3083
See Tab 5 for Gases:
Wastewater Discharge: 0.4331
Water Evaporated (Consumptive): 1.547
Cooling Water Discharge: 96.72

Annex VIII: Power plant simulations (continued)

B) Influence of fuel composition – 'Low' Case

MAIN INPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Fuel Properties:
Fuel Name: EPR II Coal Design
Fuel Source: eprii.fdb
Coal Rank: Lignite
Heating Value (Btu/lb):
Value: 4686
Carbon (wt% as received):
Value: 26.40
Hydrogen (wt% as received):
Value: 2.320
Oxygen (wt% as received):
Value: 9.550
Chlorine (wt% as received):
Value: 1.000e-2
Sulfur (wt% as received):
Value: 2.000
Nitrogen (wt% as received):
Value: 0.5000
Ash (wt% as received):
Value: 28.29
Moisture (wt% as received):
Value: 31.00

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Net Electrical Output (MW):
Value: 222.0 (calculated)
Ambient Air Temperature (Avg.) (℃):
Value: 20.00
Ambient Air Pressure (Avg.) (MPa):
Value: 9.928e-2
Relative Humidity (Avg.) (%):
Value: 50.00
Ambient Air Humidity (Avg.) (kg H2O/kg dry air):
Value: 7.413e-3 (calculated)
Oxygen Content in Air/Oxidant (vol %):
Value: 20.71 (calculated)

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Unit Type:
Value: Sub-Critical
Steam Cycle Heat Rate, HHV (kJ/kWh):
Value: 7165 (calculated)
Boiler Firing Type:
Value: Wall
Boiler Efficiency (%):
Value: 90.63 (calculated)
Excess Air For Furnace (% stoich.):
Value: 13.00 (calculated)
Leakage Air at Preheater (% stoich.):
Value: 6.000 (calculated)
Gas Temp. Exiting Economizer (℃):
Value: 371.1
Gas Temp. Exiting Air Preheater (℃):
Value: 140.0
Percent Water in Bottom Ash Sluice (%):
Value: 39.30 (calculated)
Base Plant Power Requirements
Coal Pulverizer (% MWg):
Value: 1.444 (calculated)
Steam Cycle Pumps (% MWg):
Value: 0.3100 (calculated)
Forced / Induced Draft Fans (% MWg):
Value: 3.985 (calculated)
Miscellaneous (% MWg):
Value: 0.9900 (calculated)

Tab 'Furn. Factors':
Percent Ash Entering Flue Gas Stream (%):
Value: 80.00 (calculated)
Sulfur Retained in Flyash (%):
Value: 25.00 (calculated)
Conc. of Carbon in Collected Ash (%):
Value: 4.000
Percent of Burned Carbon as CO (%):
Value: 0.2300
Tab 'Performance':
Steam Energy Added in Boiler (kJ/kg):
Value: 2849 (calculated)
Boiler Blowdown (*1) (%):
Value: 6.000
Miscellaneous Steam Losses (*2) (%):
Value: 0.4000
Demineralizer Underflow (*3) (%):
Value: 8.500
Cooling Water Temperature Rise (℃):
Value: -7.811 (calculated)
Aux. Heat Exch. Load (*2) (%):
Value: 1.410 (calculated)
(*1) % Recirculating Water
(*2) % Primary Steam Cycle
(*3) % Demineralizer Inlet

Tab 'Config':
In-Furnace Controls:
Value: LNB & OFA

Tab 'Performance':
Combustion NOx Controls
Actual NOx Removal Efficiency (%):
Value: 66.65 (calculated)

Process Type 'Cold-Side ESP':

Tab 'Performance':
Particulate Removal Efficiency (%):
Value: 99.88 (calculated)
Cold-Side ESP Power Requirement (% MWg):
Value: 0.6007 (calculated)

Tab 'Config':
Reagent:
Value: Limestone

Tab 'Performance':
Maximum SO2 Removal Efficiency (%):
Value: 98.00
Scrubber SO2 Removal Efficiency (%):
Value: 92.00 (calculated)
Scrubber SO3 Removal Efficiency (%):
Value: 50.00
Particulate Removal Efficiency (%):
Value: 50.00
Reagent Stoichiometry (mol Ca/mol S rem):
Value: 1.030 (calculated)
Total Pressure Drop Across FGD (cm H2O gauge):
Value: 25.40 (calculated)

Tab 'Config':
Configuration Menus
Air Flow Draft Control Type:
Value: Forced

Tab 'Performance':
Wet Cooling Tower
Ambient Air Temp (Dry Bulb Avg.) (℃):
Value: 20.00
Air Wet Bulb Temperature (Avg.) (℃):
Value: 13.92 (calculated)
Cooling Water Inlet Temperature (℃):
Value: 32.22
Cooling Water Temperature Drop (℃):
Value: -7.811 (calculated)

Annex VIII: Power plant simulations (continued)

B) Influence of fuel composition – 'Low' Case

MAIN OUTPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Tab 'Plant Perf.':
Performance Parameter: Value:
Net Electrical Output (MW): 222.0
Primary Fuel Input (GJ/yr): 1.246e+7
Total Plant Input (GJ/yr): 1.246e+7
Gross Plant Heat Rate, HHV (kJ/kWh): 7906
Net Plant Heat Rate, HHV (kJ/kWh): 8903
Annual Operating Hours (hours): 6305
Annual Power Generation (BkWh/yr): 1.400
Net Plant Efficiency, HHV (%): 40.44

Plant Electricity Requirements: Value:
Gross Electrical Output (MWg): 250.0
Base Plant Use (MW): 16.82
In-Furnace NOx Use (MW): 0.0
Cold-Side ESP Use (MW): 1.502
Wet FGD Use (MW): 4.083
Cooling Tower Use (MW): 3.525
Net Electrical Output (MW): 222.0

Tab 'Mass In/Out':
Chemical Inputs: Flow Rate (kg/kWh):
Coal: 0.8169
Oil: 0.0
Natural Gas: 0.0
Total Fuels: 0.8169
Lime/Limestone: 3.932e-2
Sorbent: 0.0
Ammonia: 0.0
Urea: 0.0
Dibasic Acid: 0.0
Misc. Chemicals: 7.029e-6
Activated Carbon: 0.0
Total Chemicals: 3.932e-2
Total Water Withdrawal: 2.019
Makeup Water: 2.019

Solid & Liquid Outputs: Flow Rate (kg/kWh):
Bottom Ash Disposed: 8.067e-2
Fly Ash Disposed: 0.1956
Scrubber Solids Disposed: 7.033e-2
Particulate Emissions to Air: 1.148e-4
Captured CO2: 0.0
Byproduct Ash Sold: 0.0
Byproduct Gypsum Sold: 0.0
Byproduct Sulfur Sold: 0.0
Byproduct Sulfuric Acid Sold: 0.0
Total: 0.3467
See Tab 5 for Gases:
Wastewater Discharge: 0.4393
Water Evaporated (Consumptive): 1.580
Cooling Water Discharge: 97.54

Annex VIII: Power plant simulations (continued)

B) Influence of fuel composition – 'High' Case

MAIN INPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Fuel Properties:
Fuel Name: EPR II Coal Design
Fuel Source: eprii.fdb
Coal Rank: Lignite
Heating Value (Btu/lb):
Value: 5761
Carbon (wt% as received):
Value: 26.40
Hydrogen (wt% as received):
Value: 2.320
Oxygen (wt% as received):
Value: 9.550
Chlorine (wt% as received):
Value: 1.000e-2
Sulfur (wt% as received):
Value: 2.000
Nitrogen (wt% as received):
Value: 0.5000
Ash (wt% as received):
Value: 28.29
Moisture (wt% as received):
Value: 31.00

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Net Electrical Output (MW):
Value: 225.4 (calculated)
Ambient Air Temperature (Avg.) (℃):
Value: 20.00
Ambient Air Pressure (Avg.) (MPa):
Value: 9.928e-2
Relative Humidity (Avg.) (%):
Value: 50.00
Ambient Air Humidity (Avg.) (kg H2O/kg dry air):
Value: 7.413e-3 (calculated)
Oxygen Content in Air/Oxidant (vol %):
Value: 20.71 (calculated)

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Unit Type:
Value: Sub-Critical
Steam Cycle Heat Rate, HHV (kJ/kWh):
Value: 7165 (calculated)
Boiler Firing Type:
Value: Wall
Boiler Efficiency (%):
Value: 90.63 (calculated)
Excess Air For Furnace (% stoich.):
Value: 13.00 (calculated)
Leakage Air at Preheater (% stoich.):
Value: 6.000 (calculated)
Gas Temp. Exiting Economizer (℃):
Value: 371.1
Gas Temp. Exiting Air Preheater (℃):
Value: 140.0
Percent Water in Bottom Ash Sluice (%):
Value: 39.30 (calculated)
Base Plant Power Requirements
Coal Pulverizer (% MWg):
Value: 1.175 (calculated)
Steam Cycle Pumps (% MWg):
Value: 0.3100 (calculated)
Forced / Induced Draft Fans (% MWg):
Value: 3.241 (calculated)
Miscellaneous (% MWg):
Value: 0.9900 (calculated)

Tab 'Furn. Factors':
Percent Ash Entering Flue Gas Stream (%):
Value: 80.00 (calculated)
Sulfur Retained in Flyash (%):
Value: 25.00 (calculated)
Conc. of Carbon in Collected Ash (%):
Value: 4.000
Percent of Burned Carbon as CO (%):
Value: 0.2300
Tab 'Performance':
Steam Energy Added in Boiler (kJ/kg):
Value: 2849 (calculated)
Boiler Blowdown (*1) (%):
Value: 6.000
Miscellaneous Steam Losses (*2) (%):
Value: 0.4000
Demineralizer Underflow (*3) (%):
Value: 8.500
Cooling Water Temperature Rise (℃):
Value: -7.811 (calculated)
Aux. Heat Exch. Load (*2) (%):
Value: 1.410 (calculated)
(*1) % Recirculating Water
(*2) % Primary Steam Cycle
(*3) % Demineralizer Inlet

Tab 'Config':
In-Furnace Controls:
Value: LNB & OFA

Tab 'Performance':
Combustion NOx Controls
Actual NOx Removal Efficiency (%):
Value: 64.71 (calculated)

Process Type 'Cold-Side ESP':

Tab 'Performance':
Particulate Removal Efficiency (%):
Value: 99.86 (calculated)
Cold-Side ESP Power Requirement (% MWg):
Value: 0.5715 (calculated)

Tab 'Config':
Reagent:
Value: Limestone

Tab 'Performance':
Maximum SO2 Removal Efficiency (%):
Value: 98.00
Scrubber SO2 Removal Efficiency (%):
Value: 92.00 (calculated)
Scrubber SO3 Removal Efficiency (%):
Value: 50.00
Particulate Removal Efficiency (%):
Value: 50.00
Reagent Stoichiometry (mol Ca/mol S rem):
Value: 1.030 (calculated)
Total Pressure Drop Across FGD (cm H2O gauge):
Value: 25.40 (calculated)

Tab 'Config':
Configuration Menus
Air Flow Draft Control Type:
Value: Forced

Tab 'Performance':
Wet Cooling Tower
Ambient Air Temp (Dry Bulb Avg.) (℃):
Value: 20.00
Air Wet Bulb Temperature (Avg.) (℃):
Value: 13.92 (calculated)
Cooling Water Inlet Temperature (℃):
Value: 32.22
Cooling Water Temperature Drop (℃):
Value: -7.811 (calculated)

Annex VIII: Power plant simulations (continued)

B) Influence of fuel composition – 'High' Case

MAIN OUTPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Tab 'Plant Perf.':
Performance Parameter: Value:
Net Electrical Output (MW): 225.4
Primary Fuel Input (GJ/yr): 1.246e+7
Total Plant Input (GJ/yr): 1.246e+7
Gross Plant Heat Rate, HHV (kJ/kWh): 7906
Net Plant Heat Rate, HHV (kJ/kWh): 8769
Annual Operating Hours (hours): 6305
Annual Power Generation (BkWh/yr): 1.421
Net Plant Efficiency, HHV (%): 41.05

Plant Electricity Requirements: Value:
Gross Electrical Output (MWg): 250.0
Base Plant Use (MW): 14.29
In-Furnace NOx Use (MW): 0.0
Cold-Side ESP Use (MW): 1.429
Wet FGD Use (MW): 3.321
Cooling Tower Use (MW): 3.525
Net Electrical Output (MW): 225.4

Tab 'Mass In/Out':
Chemical Inputs: Flow Rate (kg/kWh):
Coal: 0.6544
Oil: 0.0
Natural Gas: 0.0
Total Fuels: 0.6544
Lime/Limestone: 3.152e-2
Sorbent: 0.0
Ammonia: 0.0
Urea: 0.0
Dibasic Acid: 0.0
Misc. Chemicals: 6.858e-6
Activated Carbon: 0.0
Total Chemicals: 3.152e-2
Total Water Withdrawal: 1.948
Makeup Water: 1.948

Solid & Liquid Outputs: Flow Rate (kg/kWh):
Bottom Ash Disposed: 6.460e-2
Fly Ash Disposed: 0.1566
Scrubber Solids Disposed: 5.635e-2
Particulate Emissions to Air: 1.131e-4
Captured CO2: 0.0
Byproduct Ash Sold: 0.0
Byproduct Gypsum Sold: 0.0
Byproduct Sulfur Sold: 0.0
Byproduct Sulfuric Acid Sold: 0.0
Total: 0.2778
See Tab 5 for Gases:
Wastewater Discharge: 0.4286
Water Evaporated (Consumptive): 1.521
Cooling Water Discharge: 96.07

Annex VIII: Power plant simulations (continued)

C) Influence of steam parameters – 'Supercritical' Case

MAIN INPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Fuel Properties:
Fuel Name: EPR II Coal Design
Fuel Source: eprii.fdb
Coal Rank: Lignite
Heating Value (Btu/lb):
Value: 5224
Carbon (wt% as received):
Value: 26.40
Hydrogen (wt% as received):
Value: 2.320
Oxygen (wt% as received):
Value: 9.550
Chlorine (wt% as received):
Value: 1.000e-2
Sulfur (wt% as received):
Value: 2.000
Nitrogen (wt% as received):
Value: 0.5000
Ash (wt% as received):
Value: 28.29
Moisture (wt% as received):
Value: 31.00

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Net Electrical Output (MW):
Value: 225.4 (calculated)
Ambient Air Temperature (Avg.) (℃):
Value: 20.00
Ambient Air Pressure (Avg.) (MPa):
Value: 9.928e-2
Relative Humidity (Avg.) (%):
Value: 50.00
Ambient Air Humidity (Avg.) (kg H2O/kg dry air):
Value: 7.413e-3 (calculated)
Oxygen Content in Air/Oxidant (vol %):
Value: 20.71 (calculated)

Tab 'Performance':
Gross Electrical Output (MWg):
Value: 250.0 (calculated)
Unit Type:
Value: Supercritical
Steam Cycle Heat Rate, HHV (kJ/kWh):
Value: 7000 (calculated)
Boiler Firing Type:
Value: Wall
Boiler Efficiency (%):
Value: 90.63 (calculated)
Excess Air For Furnace (% stoich.):
Value: 13.00 (calculated)
Leakage Air at Preheater (% stoich.):
Value: 6.000 (calculated)
Gas Temp. Exiting Economizer (℃):
Value: 371.1
Gas Temp. Exiting Air Preheater (℃):
Value: 140.0
Percent Water in Bottom Ash Sluice (%):
Value: 39.30 (calculated)
Base Plant Power Requirements
Coal Pulverizer (% MWg):
Value: 1.229 (calculated)
Steam Cycle Pumps (% MWg):
Value: 0.2000 (calculated)
Forced / Induced Draft Fans (% MWg):
Value: 3.373 (calculated)
Miscellaneous (% MWg):
Value: 0.9700 (calculated)

Tab 'Furn. Factors':
Percent Ash Entering Flue Gas Stream (%):
Value: 80.00 (calculated)
Sulfur Retained in Flyash (%):
Value: 25.00 (calculated)
Conc. of Carbon in Collected Ash (%):
Value: 4.000
Percent of Burned Carbon as CO (%):
Value: 0.2300
Tab 'Performance':
Steam Energy Added in Boiler (kJ/kg):
Value: 2849 (calculated)
Boiler Blowdown (*1) (%):
Value: 6.000
Miscellaneous Steam Losses (*2) (%):
Value: 0.4000
Demineralizer Underflow (*3) (%):
Value: 8.500
Cooling Water Temperature Rise (℃):
Value: -7.811 (calculated)
Aux. Heat Exch. Load (*2) (%):
Value: 1.410 (calculated)
(*1) % Recirculating Water
(*2) % Primary Steam Cycle
(*3) % Demineralizer Inlet

Tab 'Config':
In-Furnace Controls:
Value: LNB & OFA

Tab 'Performance':
Combustion NOx Controls
Actual NOx Removal Efficiency (%):
Value: 66.65 (calculated)

Process Type 'Cold-Side ESP':

Tab 'Performance':
Particulate Removal Efficiency (%):
Value: 99.87 (calculated)
Cold-Side ESP Power Requirement (% MWg):
Value: 0.5851 (calculated)

Tab 'Config':
Reagent:
Value: Limestone

Tab 'Performance':
Maximum SO2 Removal Efficiency (%):
Value: 98.00
Scrubber SO2 Removal Efficiency (%):
Value: 92.00 (calculated)
Scrubber SO3 Removal Efficiency (%):
Value: 50.00
Particulate Removal Efficiency (%):
Value: 50.00
Reagent Stoichiometry (mol Ca/mol S rem):
Value: 1.030 (calculated)
Total Pressure Drop Across FGD (cm H2O gauge):
Value: 25.40 (calculated)

Tab 'Config':
Configuration Menus
Air Flow Draft Control Type:
Value: Forced

Tab 'Performance':
Wet Cooling Tower
Ambient Air Temp (Dry Bulb Avg.) (℃):
Value: 20.00
Air Wet Bulb Temperature (Avg.) (℃):
Value: 13.92 (calculated)
Cooling Water Inlet Temperature (℃):
Value: 32.22
Cooling Water Temperature Drop (℃):
Value: -7.811 (calculated)

Annex VIII: Power plant simulations (continued)

C) Influence of steam parameters – 'Supercritical' Case

MAIN OUTPUT PARAMETERS

All Settings:
Configuration: <User Defined>
Fuel Type Coal
NOx Control In-Furnace Controls
NOx Control None
Particulates Cold-Side ESP
SO2 Control Wet FGD
Mercury None
CO2 Capture None
Cooling System Wet Cooling Tower
Wastewater Chemical Treatment
Flyash Disposal Mixed w/ FGD
Wastes

Tab 'Plant Perf.':
Performance Parameter: Value:
Net Electrical Output (MW): 225.4
Primary Fuel Input (GJ/yr): 1.217e+7
Total Plant Input (GJ/yr): 1.217e+7
Gross Plant Heat Rate, HHV (kJ/kWh): 7724
Net Plant Heat Rate, HHV (kJ/kWh): 8566
Annual Operating Hours (hours): 6305
Annual Power Generation (BkWh/yr): 1.421
Net Plant Efficiency, HHV (%): 42.03

Plant Electricity Requirements: Value:
Gross Electrical Output (MWg): 250.0
Base Plant Use (MW): 14.43
In-Furnace NOx Use (MW): 0.0
Cold-Side ESP Use (MW): 1.463
Wet FGD Use (MW): 3.579
Cooling Tower Use (MW): 3.125
Net Electrical Output (MW): 225.4

Tab 'Mass In/Out':
Chemical Inputs: Flow Rate (kg/kWh):
Coal: 0.7052
Oil: 0.0
Natural Gas: 0.0
Total Fuels: 0.7052
Lime/Limestone: 3.395e-2
Sorbent: 0.0
Ammonia: 0.0
Urea: 0.0
Dibasic Acid: 0.0
Misc. Chemicals: 6.661e-6
Activated Carbon: 0.0
Total Chemicals: 3.395e-2
Total Water Withdrawal: 1.884
Makeup Water: 1.884

Solid & Liquid Outputs: Flow Rate (kg/kWh):
Bottom Ash Disposed: 6.963e-2
Fly Ash Disposed: 0.1688
Scrubber Solids Disposed: 6.069e-2
Particulate Emissions to Air: 1.105e-4
Captured CO2: 0.0
Byproduct Ash Sold: 0.0
Byproduct Gypsum Sold: 0.0
Byproduct Sulfur Sold: 0.0
Byproduct Sulfuric Acid Sold: 0.0
Total: 0.2992
See Tab 5 for Gases:
Wastewater Discharge: 0.4162
Water Evaporated (Consumptive): 1.469
Cooling Water Discharge: 91.65

Annex IX: Statement on completeness of the provided information

Ministry of the Environment
of the Czech Republic

Mgr. Aleš Kuták
Deputy Minister
Director of the Climate and Air Protection Section
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Mr. Bart Adams
DNV Certification B.V.
Branch Belgium
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2060 Antwerp
Belgium

Č.j. 19881/ENV/10, 343/800/10 **Prag, date 8.3 2010**

Dear Mr. Adams,

As agreed on the meeting on Ministry of Environment of the Czech Republic at February 24th, please find below the statement of information transfer.

I confirm that all of the listed documents (list in attach) have been transmitted to the DNV as English translations without material abbreviations or omissions. As far as I`m aware, this list of documents contains all relevant information on the project. I would like to mention that maps, photographic pictures, schemes, drawings, certificates of authorized persons or informative abstract (e.g. abstract from real estate register) contained in the documentation relating EIA-procedure weren't translated. All this untranslated documents have been transmitted to the DNV in original version on CD.

Ministry of Environment of the Czech Republic does not take responsibility for potential errors or inaccuracies that could result from the translation of the documents.

Yours sincerely

Enclosure: Overview Project Documents 100304 v12

Note: the referred to enclosure is identical to the list provided in Annex I, but can be reproduced upon request.

Annex X: Answers to specific questions raised in the RFP

Part A

1. *Are all potentials for maximising energy efficiency according to BREF adequately addressed in the proposed project?*

   No.
   The technical grounds precluding the implementation of a unit that could comply with the BAT-efficiency requirement on net unit efficiency have been insufficiently explored.
   Although these aspects are outside of the scope of the current assessment (which is limited to technical and environmental issues), there are significant economical and/or strategic considerations that must be taken into account in this regard also.

   See also §7.1 and §7.1.1 in particular for more information.

2. *What is the gravity of deviations from the BREF requirements – not limited to energy efficiency or CO_2?*

   For stable operation during 6,300 hours per year at nominal capacity of all three of the refurbished blocks (i.e. a total electrical capacity of 3 x 250 MW_{el}), the impact in terms of CO_2 emission related to the deviations of the proposed project from the BAT-requirements, is calculated as 205,082 tons of CO_2 per year. In relative terms, on a total annual CO_2 emission of more than 4,000,000 ton, the impact is less than 5%.

   See also §7.3 for more information.

3. *Are the deviations from the BREF requirements justifiable based on technical and / or environmental grounds according to limitations of the present project as declared by the investor (e.g. quantity and quality of fuel, necessity of heat supply and corresponding back-up capacity, impact on the stability of the electricity grid)?*

   Two deviations from the BAT-requirements were identified.
   A) An emission limit for CO of 250 mg/Nm³ is proposed. The corresponding BAT-requirement is 200 mg/Nm³. DNV agree with the approach to prioritise primary measures to control NOx and to operate at low air excess to increase unit efficiency. At the same time, DNV's experience and operational data from similar plants show that meeting both BAT-requirements of 200 mg CO/Nm³ and 200 mg NOx/Nm³ simultaneously should be possible.
   B) The proposed net unit efficiency of the project in condensation mode is 40.00%. This figure was verified by means of an independent simulation by means of an acknowledged power plant model, developed in the US. The corresponding BAT-requirement lists a net unit efficiency of at least 42%. DNV found the technical discussion provided by the investor to explain the deviation from this BAT requirement and possible alternatives insufficient. See also Question 1

   See also §7.1 and for more information.

4. *How does the calculation of the heat efficiency of the unit in the project compare to the BREF definitions and values?*

   The calculation of the net unit efficiency (in line with the guidance provided in [3]) of the proposed project was verified by a simulation by means of an independent and well accepted model.

Sufficient agreement was achieved between the proposed net unit efficiency and the simulated value to conclude that the result proposed by the investor is in line with the BREF definitions and values.
See also §7.1.1 for more information.

Part B

5. *Is it possible to accept in the EIA process the fact that an option is presented that does not meet all BREF requirements?*

   As clearly explained in the preface of each BREF document, the included BAT-requirements provide guidance for the assessment on whether or not best available techniques are proposed for a given project. At the same time, local conditions should always be taken into account and evaluated to see whether or not they could necessitate or justify a deviation from specific BAT-requirements. Examples of such local conditions are metrological data, climate, material availability and quality.
   Hence, it is possible to accept an option in the EIA process that does not meet all BAT-requirements of the relevant BREF documents.

6. *Is it common and acceptable in an EIA process that only one alternative is proposed by the project developer / investor?*

   Section E of the EIA Documentation contains only basic assessment of the other alternatives before ruling them out. This is not good practice, but is consistent with what is generally seen in many EIA's regarding industrial projects. However, at the request of the MoE, more detailed information is provided within Annex SP5 and the Supplement to EIA Documentation to justify why a higher efficiency alternative is not considered further. This more detailed information would normally in terms of its extent and type satisfy the requirements of EIA for the justification of submitting only one alternative. However, the adequacy of ČEZ' arguments in terms of their content and quality is appraised in detail in the first part of this assessment.
   Hence, it is common in an EIA process that only one alternative is proposed. ČEZ' detailed information additions make this acceptable in the Prunéřov II refurbishment case.

7. *Is it possible to finalise, taking into account available information concerning the technical feasibility provided by the investor, the EIA process and to issue an EIA statement?*

   It is possible to conclude that the technical assessment information for the proposed project provided by the investor within the EIA Documentation is sufficient (subject to DNV's comments in §8 Conclusions – Part B), as the EIA Documentation demonstrates that (for most impact receiving areas) the proposed project leads to improved environmental quality compared against the existing situation.

   However, DNV's detailed BREF Compliance Review (Part A) concludes that the information provided by the investor with regard to the choice of combustion unit (super-critical vs. sub-critical) boilers is currently not sufficiently robust. This detailed review information is not normally available when assessing the EIA Documentation, and if it is considered when reviewing the EIA Documentation, it can be concluded that the impacts of this alternative super-critical option should have been assessed in more detail within the EIA Documentation. Unless sufficiently robust arguments against the super-critical option are demonstrated satisfactorily in the future, further EIA work may be required. As environmental impacts from a super-critical boiler are anticipated to be similar to the project that has been proposed, this might take the form of a relatively simple addendum to the existing EIA Documentation.

Part C

8. *What would be the difference in CO_2 emissions from the proposed project as compared to full BREF compliance in each year of operation, and during the whole lifecycle?*

   For stable operation during 6,300 hours per year at nominal capacity of all three of the refurbished blocks (i.e. a total electrical capacity of 3 x 250 MW_{el}), the impact in terms of CO_2 emission related to the deviations of the proposed project from the BAT-requirements, is calculated as 205,082 tons of CO_2 per year. In relative terms, on a total annual CO_2 emission of more than 4,000,000 ton, the impact is less than 5%. The calculation yielding this result was based on the EU ETS MRG Annex II [8], complemented with emission and oxidation factors as prescribed by the NIR for the Czech Republic (2009) [9].

   A value over the lifetime of both options, i.e. the proposed project and a BREF compliant facility, is not meaningful to make, given the potential difference in lifetime between both options.
   More relevant is to consider a period over which electricity would be produced by the given facilities.

   See also §7.3 for more information.

9. *Have the specific emissions of the whole plant and the cap on CO_2 emissions for the entire lifecycle of the project been calculated correctly?*

   It is DNV's interpretation that the specific emission factor as provided by the investor in /9/ on 18/1/2010 relates to the entire Prunéřov site, i.e. including EPR I, the non-refurbished blocks of EPR II, as well as the refurbished blocks of EPR II.
   Below, this value is compared to the result that was obtained for the refurbished EPR II blocks by means of the method prescribed by the EU ETS MRG – Annex II [8]:

   - Provided by the investor in /9/ 1.10113 ton CO_2/MWh el
   - Calculated by means of [8] 0.911 ton CO_2/MWh el

   Note that the latter does not include the contribution of the use of natural gas to start-up the boilers. At the same time, as shown in §7.3, this contribution is very small.

   At least part of the difference between both values could be explained by the fact that the first value takes operation of EPR I and the non-refurbished blocks of EPR II into account. As these are operating at significantly lower unit efficiency, it will result in a higher specific emission factor.

   The total CO_2 emission from the refurbished blocks over the course of their lifetime has also been provided by the investor in /9/.
   Again, the same value, assuming a lifetime of 25 years, has been determined based on the guidance provided in the EU ETS Annex II [8].
   Below, both values are compared:

   - Provided by the investor in /9/ 121.23 million ton CO_2
   - Calculated by means of [8] 107.69 million ton CO_2l

   In order to explain the difference between both values, the calculation method behind the first one should be verified in more detail.

   See also §7.3 for more information.

10. *Does the proposed cap on CO_2 emissions represent a sufficient guarantee to limit the operation of the plant to 25 years or availability of fuel from Libouš?*

    The annual CO_2 emission of a facility depends – among other things – on the operating time and on the load at which it is operating. In the calculation included in §7.3, it is assumed that the three refurbished blocks of the Prunéřov II Power Plant would be in stable operation at full load (250 MW_{el} each) for 6,300 hours per year. A variation in either of these parameters will result in a difference in annual CO_2 emission. In turn, if a fixed cap on the total CO_2 emission of the facility would be implemented, this would lead to a difference in the total operating time of the facility.

    A further consideration in this regard concerns the use of emission and oxidation factors as per the National Greenhouse Gas Inventory Report [9]. The use of site specific emission and oxidation factors should be considered.

11. *Is it necessary to set additional conditions in relation to the project's impact on CO_2 emissions (to ensure i.a. that the operation of the plant will be limited to 25 years or availability of fuel from Libouš)? If so, what could be relevant additional conditions?*

    Yes.
    The current proposed cap on CO_2 does not suffice to limit the plant's operational time to 25 years (e.g. if it would run at lower load or for less hours per year, as also explained in the previous question).
    If possible, the use of a permit with a time limit could be considered.

    Furthermore, if a condition based on CO_2 emissions will be applied, the use of site specific emission and oxidation factors should be considered.

Annex XI: Details of CO_2 impact calculation

	Proposed Project		***Full BREF Compliance***			
A) Combustion of lignite						
	750	MWel			generated power for 3 blocks	
	40%		42%		net unit efficiency	
	1.875	MWth	1.786	MWth	thermal power input	
	6.300	hr	6.300	hr	hours of operation at nominal power per year	
	42.525	TJ	40.500	TJ	annual thermal energy input	
	4.361.538	t lignite/yr	4.153.846	t lignite/yr	annual lignite consumption	
	99,90	t CO2/TJ	99,90	t CO2/TJ	emission factor [9], Table 3.3, p 44	
	0,98	-	0,98	-	oxidation factor [9], Table 3.3, p 44	
	4.163.283	t CO2/yr	3.965.031	t CO2/yr	annual CO2 emission from lignite combustion	
B) Process emissions from wet scrubber						
	0,075	t limestone/t lignite	0,075	t limestone/t lignite	specific limestone consumption (based on /57/ p50-51)	
	325.996	t limestone/yr	310.473	t limestone/yr	annual consumption of limestone	
	0,44	t CO2/t limestone	0,44	t CO2/t limestone	emission factor [8], Table 1, p 76	
	143.438	t CO2/yr	136.608	t CO2/yr	annual CO2 emission from wet scrubber	
C) Combustion of natural gas						
	369000	Nm^3/yr	369000	Nm^3/yr	estimated annual natural gas consumption (/57/ p 52)	
	34,09	TJ/Mm^3 (*)	34,09	TJ/Mm^3 (*)	LHV [9], Table 3.3, p 44	(*) : at 15°C & 1 atm
	56,10	t CO2/TJ	56,10	t CO2/TJ	emission factor [9], Table 3.3, p 44	
	0,995	-	0,995	-	oxidation factor [9], Table 3.3, p 44	
	741	t CO2/yr	741	t CO2/yr	annual CO2 emission from natural gas	
D) Total annual emissions						
	4.307.462	t CO2/yr	4.102.380	t CO2/yr	total annual emissions	
	107.686.541	t CO2 / lifetime	102.559.493	t CO2 / lifetime	25 yr lifetime	
			143.583.290	t CO2 / lifetime	35 yr lifetime	

Annex XII: Confirmation DG Environment

----- Postoupil Jan Dusik/400/ENV/CZ v 10.03.2010 19:35 -----

Od: <Karl.Falkenberg@ec.europa.eu>
Komu: <Jan.Dusik@mzp.cz>
Kopie: <Petr.Holub@ecn.cz>, <Mary.Kerschen@ec.europa.eu>, <Laurence.MELEGARI@ec.europa.eu>, <Soledad.Blanco@ec.europa.eu>, <Marianne.Wenning@ec.europa.eu>
Datum: 09.03.2010 16:05
Předmět: RE: request for opinion on defining new/existing installation under the IPPC Directive
Odeslal: <Bettina.Doeser@ec.europa.eu>

Dear Mr Dusik,

Karl Falkenberg has asked me to inform you that according to the assessment of DG Environment, the proposed position of the IPPC Department of the CZ Environment Ministry is in line with the requirements of the IPPC Directive.

Sincerely,

on behalf of Karl Falkenberg

Bettina Doeser
Assistant to the Director-General
Directorate-General Environment
European Commission
Tel. 0032-2-2967050

From: Jan.Dusik@mzp.cz [mailto:Jan.Dusik@mzp.cz]
Sent: Monday, March 01, 2010 10:41 AM
To: FALKENBERG Karl (ENV)
Cc: Petr.Holub@ecn.cz
Subject: request for opinion on defining new/existing installation under the IPPC Directive
Importance: High

Dear Karl,

I hope you had a safe trip to Brussels from Bali!

Following my request from Friday, I am attaching the opinion the Czech Environment Ministry (IPPC Department) declared as concerns subjecting the refurbishment of the power plant Prunerov to conditions of new or existing installation under the IPPC Directive. I would be grateful if you and your colleagues would provide us (formally or informally) with your comments on the accurateness of MoE position in this regard. The issue whether the plant should be subject to parameters of new, rather than existing, installation, is key to assessment of what levels of BAT standards that should apply.

If we could have some response by the end of this week, it would be most appreciated. If your colleagues need further consultation, please do not hesitate to contact Mr Petr Holub, Director of the Sustainable Energy and Transport Department in the Ministry - petr.holub@mzp.cz, or Mr Jan Svec from the same department.

Thank you very much in advance!

Jan

Annex XIII: Kingsnorth Power Station

The following briefly considers a comparable controversial study (as a result of concern over CO_2 emissions) of a recent proposed coal fired project in the United Kingdom, with an EIA submitted by the operator, E.ON UK plc. The proposal has been postponed as a result of the recession and the associated fall in demand for electricity, but the company say the plant could still be built if economic conditions permitted. If built, it would be the first new coal-fired power station in Britain for decades.

The proposal was for new 2 x 800 MW high efficiency supercritical units to be built adjacent to the existing plant, which comprises 4 x 485 MW sub-critical coal fired units built in the 1960/70's, that must be closed in 2015.

The new units have an efficiency of > 45%, i.e. 20% more efficient than the existing units (efficiency 36 to 38%), and would include FGD (SO_2 control), ESP (particulate matter control) and SCR (NOx control).

Deployment of Carbon Capture and Storage (CCS) will be considered as an option at a later date (subject to law, incentivisation and overcoming technological hurdles) and the plant would be designed as "capture ready" to allow retrofit at a later date.

The Environmental Statement publicly available on the web (http://www.eon-uk.com/images/Environmental_Statement_Kingsnorth.pdf) has little consideration of alternatives (although it is possible this might have been considered at an earlier stage). The EIA report covers the compartments below, many of which as expected are the same as covered in the Prunéřov II EIA Documentation:

- Air quality
- Water
- Flood risk
- By-products and waste
- Ecology
- Landscape & Visual Impact
- Traffic
- Noise
- Socio-Economic effects
- Cultural heritage
- Contaminated land.

Annex XIV: Initial scenario comparison of BAT compliant units

For simplicity's sake, the contracted amount of lignite for the Prunéřov II power plant is assumed independent of the scenarios (i.e. the same for all of them). One could refine the analysis by including also the Tušimice site in the comparison.

Scenario Comparison of BAT compliant units of variable size					
Reference Case					
Total capacity	750	MWel			
Net unit efficiency	40%				
Operating hours	6.300	hours/year		middle-load unit	
Fuel LHV	9,75	MJ/kg			
Lignite reserve	25	years			
	4.361.538	ton lignite/year			
	109.038.462	ton lignite reserve			
Scenarios					
Net unit efficiency	42%				
Operating hours	92%			base-load unit	
	8.059	hours/year			
Capacity	450	550	650	750	[MWel]
Lignite consumption	3.188.255	3.896.756	4.605.257	5.313.758	[ton lignite/year]
Operational lifetime	**34,2**	**28,0**	**23,7**	**20,5**	**[years]**