Advisory guidelines for the environmental impact statement on a 600 MWe coal-fired power station in Amsterdam

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CONTENTS

SUMMARY OF THE ADVICE

This advice of the Commission for environmental impact assessment (EIA) contains recommendations for the content of the environmental impact statement (EIS) for a coal dust fired electricity power plant with a capacity of 600 MWe (net) in Amsterdam.

Definition of the problems and objectives (chapter 2)
The EIS should answer the following questions:
- what is the contribution of the power plant to the electricity supply in the Netherlands. Argue the prognoses for the electricity demand.
- on the basis of which criteria Amsterdam is selected as suitable location for a large scale coal fired power station?

Decision-making process (chapter 3):
The EIS must motivate why certain alternatives have been discarded in an earlier stage.

Proposed activity and the alternatives (chapter 4):
The following aspects of the proposed activity must be described:
- fuel choice and fuel composition;
- reception, transshipment, storage and transport of coals;
- design and processing data of the power plant, insofar as relevant for the environmental impacts;
- the flue gas desulphurization installation;
- reduction of the NO_x emission;
- treatment of ashes and slags;
- use of seepage water;
- waste water flows;
- facilities to prevent calamities.

At the project level, to which this EIS is directed, the following alternatives have been formulated.
- The zero alternative assumes prolonged functioning of existing power plants in view of an eventual postponement of the decision to construct the new plant. The zero alternative is meant to be a frame of reference to review the other alternatives.
- For the alternative most favourable to the environment the following variants are required:
  - The EIS must indicate whether coal gasification is a real option.
    A description of coal gasification must be included to enable comparison with the environmental impacts of a coal dust fired power plant. The possibility of phased construction of a so called integrated KV-STEG installation (Coal gasification integrated with a steam and gas turbine) must be part of the EIS.
  - An environmentally favourable variant of a conventional coal power plant must be elaborated. The proponent must design this variant on the basis of the project-design most favourable to the environment of the various parts of the plant.

- An alternative based on the total energy principle (use of combined heat and power) must be elaborated.

Current state of the environment and autonomous development (chapter 5):

- The current state of the environment must be described insofar as relevant for the expected environmental impacts.
- Special attention must be paid to sensitive objects, such as houses/recreation accommodations, agricultural and horticultural crops, flora/-vegetation/fauna and ecotypes in nature reserves (soils with low calcium contents), cultural and historical objects, drinking water basins and dust sensitive industries.
- abiotic environmental aspects must be described: air quality, quality of surface water, background noise levels.

Environmental impacts (chapter 6):

- Special attention is asked for the environmental living conditions of the people living in the surroundings, for soil and surface water, vegetation and crops.
- Possible positive environmental aspects of exploitation of the new power plant should be discussed.

Comparison of the alternatives (chapter 7):

- How can the impacts of the various alternatives on the environment be judged and to what extent can these alternatives be appreciated in a mutual comparison per environmental aspect.

Gaps in information (chapter 8):

- Which gaps in knowledge and information remain?
- What is the importance of these gaps in knowledge for the decision-making process?
- Research on the gaps in knowledge and the actually occurring environmental impacts must be included in an evaluation programme.

1. INTRODUCTION

The municipality of Amsterdam proposes to establish a coal fired electricity power plant with a net capacity of 600 MWe net, with the possibility of external heat supply. The EIS obligation is coupled to the licensing procedure. The daily board of the province of North Holland and the Minister of Transport, Public Works and Water Management are the competent authorities.

While drafting their advice, the Commission took into consideration the reaction of the general public, received through the competent authority.

2. DEFINITION OF THE PROBLEMS AND OBJECTIVES

Environmental Protection Act, section 7.10, subsection 1, sub a:
An EIS shall contain at least: *" a description of the purpose of the proposed activity".*

The EIS must indicate the contribution of the power plant to the national electricity supply. Prognoses for the electricity demand must be discussed.

The objectives of the project must be precisely formulated in the EIS. This in order to facilitate formulation of alternative ways to realise the objectives.

It must be elucidated why the location is selected as one of the most suitable locations for large-scale coal power and to what extent this location is a suitable location from an environmental point of view. Is this location for the plant a constraint for development of the residential function of the area?

3. DECISION-MAKING PROCESS

Environmental Protection Act, section 7.10, subsection 1, sub c:
An EIS shall contain at least: *"an indication of the decisions in the preparation of which the environmental impact statement is to be drawn up, and a review of the decisions previously taken by government bodies relating to the proposed activity and the alternatives described".*

Former governmental decisions and policy intentions will influence or impose restrictions on the decision for which the EIS is to be compiled. The EIS should clearly explain which restrictions and influences exist.
Review criteria for the activity and the alternatives such as environmental standards must be rendered.

The backgrounds of the decision to build the coal power plant must be clearly explained in the EIS from an environmental point of view.
The EIS must argue why certain alternatives for the construction of the dust coal fired power plant have been discarded at an earlier stage of the decision-making process, such as:

- stimulating saving on electricity use;
- use of other fuels, such as natural gas;

- decentral generation with for instance fluid bed combustion units;
- KV-STEG, possibly carried out in stages;
- capacity expansion of current production units (for instance by means of pre-switched gas turbines);
- more efficient use of existing production capacity by means of storage of energy or by manipulation of the demand (by changing tariffs?);
- increase of electricity import;
- prolongation of the exploitation period of existing power plants;
- realization of a larger contribution of industrial and other decentral heat/-power capacity.

It is meant that an historical overview is given of the decision-making process until now without rediscussing the decisions made.
In addition, it must be indicated in the EIS which decisions will still (have to) be made at a later stage in order to be able to carry out the project.
One can think of decisions with regard to transshipment of coal, processing of residues, etcetera.

4. PROPOSED ACTIVITY AND ALTERNATIVES

Environmental Protection Act, section 7.10, subsection 1, sub b:
An EIS shall contain at least: *"a description of the proposed activity and the manner in which it will be carried out, and of the alternatives which should reasonably be taken into consideration".*

Environmental Protection Act, section 7.10, subsection 3:
"The alternatives to be described in accordance with subsection one, under b, shall in any case include the alternative which makes use of the best means available for protecting the environment".

Based on a number of preconditions concerning:
- availability, reliability and controllability;
- cost effectiveness and efficiency;
- safety, noise emissions and emission of toxic substances;
- re-use of residues;

the initiator intents to build a coal fired installation equipped with (electrostatic) fly ash filters, flue gas desulphurization and low NO_x burners with adapted furnace. The impacts on the environment will be reduced as much as possible and the best existing techniques will be used.

This proposed activity and the alternatives/variants which should reasonably be taken into consideration must be described and elaborated. The motivation of the choice of alternatives must be described in the EIS, as well as the selection process which has led to the choice of the preferred activity.

4.1 Proposed activity

In describing the proposed activity, with all its activities, a distinction must be made according to construction, exploitation and management of the power plant and the accompanying facilities such as the flue gas desulphurization, storage of the residues etc.. In particular the elements of both installation and the site possibly causing the most important environmental impact should be described in detail. In any case attention must be paid to the following points.

- The choice of fuel: how are use of coal and natural gas related? How do emissions change when input of gas is increased?
- Fuel data: which requirements the coal must meet (amongst others: moisture content, granular composition, ash content, chemical composition, such as nitrogen and sulphur content and content of heavy metals)? Which coal composition gives which average emissions?
- Supply, transshipment, storage and transport of coal:
  - From where, how and how frequently will coal be supplied: which waterways, roads/railroads and which means of transport are used?
  - Will the capacity of existing infrastructure be expanded in view of coal supply?
  - Will an established transshipment company be used or will a new transshipment facility (landing stage and the like) be constructed or an existing stage be enlarged?
  - With the help of which facilities will loading and unloading take place from the coal transport carrier?
  - Will any noise and dust limiting measures be taken for loading and unloading?
  - How does the coarse sieving and the deferrization take place? Where and how will these residues be stored?
  - How does the mixing of coal types take place?
  - How is the design of the coal bunkers (bottom and upper sealing, capacity)?
  - Which dust emission controlling facilities have been installed for storage (location in relation to the predominant wind direction, wind screens, covering; does spraying take place, are agentia added to the spraying water?
  - How does transport take place from the coal silos? Are any dust and noise limiting measures taken?
  - How does crushing of the coal take place? What is the granular composition of the powder coal?
  - Will a beneficiation process be applied?

- The description of the design of the power plant must include the following subjects.
  - Process data of the boiler installation (amongst others temperature).
  - The air and flue gas flow.
  - The coal crushing installations (eventual noise and dust limiting facilities).
  - The burner installation. Its dimensions, temperature divisions that occur and the way temperature and oxygen concentration are tuned to each other? What is the magnitude of the emission of nitrogen oxides in

relation to the type of burner installation to be chosen? In what manner will the design anticipate any future standards, for instance the additional placement of facilities afterwards (denitrification)?
  - Dust filters. Which type of filter system will be chosen: cloth filters or electrostatic flue gas cleansing? Which reduction of emissions will be achieved? What is the final emission level of the chimney, taking into account the follow-up cleansing of the flue gases in the flue gas desulphurization installation?
  - What is the capacity of the (fly-ash filters) catchers in case of pulse pressure (soot); which incidental emissions does this boiler cleansing entail?
  - The design of the chimney(s) (height, diameter, outflow velocity).
- The flue gas desulphurization installation (FDI).
  - According to which process does the desulphurization take place ?
  - Where will the FDI be placed?
  - Which capacity will it have and which emission reductions will be obtained? What is the final emission level from the chimney?
  - Of how many units will the installation consist?
  - In which way can emissions be limited in case of malfunctioning ?
  - What quantity of gypsum will be produced? What is the quality of the gypsum and what are the prognoses for sale? How will the gypsum be removed? What is the storage capacity for gypsum?
  - What is the temperature of the exhaust gases (in relation to plume rising and dew point)?
  - Does re-heating of the exhaust gases take place and if so, up to what temperature and in what manner? (Adding of untreated warm exhaust gases, heat exchangers etcetera). What are the expected developments in this field? What are the consequences of eventually not adopting this re-heating?
- In which way will the current standards for NO_2 emission be satisfied? In which way can sharper standards in future be met? (One can think of constructing a furnace allowing for future modifications and of reserving space for eventual denitrification.)
- Treatment of ash and slags.
  - Which quantities of ash and slags are released on the average per day and in which way and in which form (configuration) are these materials separated?
  - What are the marketing prognoses in the long term?
  - Which quality do the ash and the slags have? Which loss of quality (higher percentage unburned) occurs as a result of eventual adjustment of the burners to limit the nitrogen oxide emission?
  - Which storage facilities will be created for the various kinds of fly ash and slags? What is the capacity and for how long will the capacity suffice? Does storage take place on the site proper or (also) on other sites? In which manner are residues removed?
- Cooling water.
  - How much cooling water is necessary and how much is available from the various sources, in particular during extremely dry summers?
  - Has construction of a cooling tower been anticipated?
  - Place of intake and of discharge: constructions.

- The temperature of intake water and temperature rise of discharged water. The frequency distributions of these data.
- Additives to the cooling water, such as chlorine and ferrosulphate, the frequency at which additives are applied, total quantities and maximum concentrations occurring.
- Measures to neutralise or limit the adverse impacts of these additions.

- Waste water flows both continuous and incidental from:
  - the demineralisation installation;
  - the condensate cleansing installation;
  - cooling of bottom ashes;
  - discharge installations;
  - the flue gas desulphurization device;
  - the feeder installation of the boiler;
  - the boiler cleansing and maintenance activities;
  - the air pre-heaters and flue gas channels cleansing and maintenance activities;
  - effluents emanating from the processing of slags;
  - drainage and leakage water from the storage of coal, fly ash and other raw materials or products;
  - domestic waste water;
  - rain water running off from installations and paved surfaces.

  The statement must include: flow rates, composition, place of discharge, treatment-technical and other measures to reduce their magnitude and/or harmful effects.

- Which provisions are made for the various parts of the installation in case of normal and serious operational disturbances and in case of test-running and starting of the power plant?

- Which other installations are planned to be part of the power plant? (for instance demineralisation installation, condensate cleansing installation, waste water treatment installation, own electrical installation, compressed air facilities, auxiliary boiler, facilities for district heating).

4.2 Alternatives

The alternatives must be described at an equal level of detail.
The possibility to develop alternatives is limited by former decisions. Therefore the alternatives which might be developed for the coal fired unit should be at the project level. On a project level implementation alternatives and environment-saving measures are conceivable. These will be elaborated in following sections.

4.2.1 Zero alternative

The zero alternative is the alternative in which the realisation of a coal heated unit of 600 MWe would not take place, and current power plants are kept operational longer, in view of a possible postponement of the decision to build the power plant. This alternative is particularly important as a frame of reference for the other alternatives/variants. The development of the environment for the situation the activity will not be carried out (see section 5) must be described both locally and nationally.

4.2.2 Implementation alternatives and mitigating measures

For a conventional power plant the implementation alternatives and mitigating measures can in particular relate to:

- the method of coal supply: means of transport (slurry transport), transshipment facilities (continuous transshipment and covered conveyor belts).
- selection of coal: in relation to nitrogen and heavy metals contents.
- the method of storage and mixing: open-air storage (location in relation to dominant wind direction, screening), covering, spraying with agentia, storage in silos.
- crushing/pulverisation: reducing particle size of powder coal with regard to the temperatures of combustion to be adopted and the related production of NO_x.
- pre-cleansing (beneficiation): the pre-cleansing of the fuel with physical (for instance magnetic removal of pyretic sulphur) and mechanical techniques.
- lay-out of the furnace, burners and power plant: in addition to the essentials, such as burner type, furnace design and emission reducing measures, some details, such as aspects of physical planning (design, maximum building height, height of chimney), safety aspects (valves, reserve provisions) and noise aspects (valves, ventilators, grinding installation) are of environmental relevance.
- pre-switching of a gas turbine to increase energy efficiency and (possibly) decrease NO_x emission.
- for burner type/design of furnace and burner many combinations of alternatives are possible which result in a low NO_x emission:
  - low burner zone load;
  - low NO_x burners;
  - flue gas recirculation;
  - off-stoichiometry;
  - two-step combustion;
  - in furnace reduction of NO_x.
- use of denitrification techniques: conversion of NO_x into nitrogen without catalyst (thermic denox) and with catalyst (selective catalytic reduction, SCR).
- method of desulphurization of flue gases: various techniques are possible, which can be divided into the following groups:
  - non-regenerative (final product gypsum);
  - idem with other final products, amongst others ammonium sulphate;
  - regenerative wet, magnesium oxide, citrate;

- regenerative dry, active coal;
- combined SO_2/NO_x removal;
- prewashing of flue gases: this results in a better quality of gypsum. Application of this technique could be necessary in order to actually be able to sell these products in case standards for construction materials are sharpened in future.

- means to filter fly-ashes from flue gases: the essential choice is the choice between electrostatic filters and cloth filters (the maximum efficiency of cloth filters is somewhat higher [more than 99%], in particular for the smallest, respirable particles, which contain relatively many harmful substances). The flue gas desulphurization process has its impact on further deducting of flue gases.
- effluent treatment: polluted waste water arises where precipitation or spraying water comes in contact with the coal, the slags or the flue gas. Treatment of this effluent must be done in a treatment facility. The way in which the residue of these waste water treatment facility is handled merits equal attention.
- removal of fouling: removal of organisms by means of a temperature shock instead of chemicals.
- storage of solid waste: the size of the storage on the plant site and the necessity of removal to elsewhere is related to the possibilities to process or dump the waste materials. Open or closed storage facilities; separation of types of waste according to the degree of pollution and in view of future processing. Possibilities for extraction of certain materials from the waste (for instance recovery of aluminium). Adoption of other techniques for bottom sealing of dumpsites.
- for the solid waste it will be necessary to present scenarios for the sale, processing and storage, to which also a scenario assuming a decrease in the possibilities to market gypsum, fly-ash and slags must be added; if applicable, the possibilities for sale of sulphur and sulphuric acid must also be addressed.

4.2.3 The alternative most favourable to the environment

As alternatives most favourable to the environment the following two alternatives must be described in the EIS.

Departing from the accomplished choice that the power plant will use coal as fuel, the integrated use of coal gasification could be mentioned as alternative for the conventional coal power plant. This is an integration of a coal gasification with a steam and gas turbine installation, the so-called KV-STEG. From an environmental point of view KV-STEG seems to have important advantages as compared to powder coal combustion. The building of a KV-STEG plant can be carried out in stages. A STEG (steam and gas turbine) unit could be built first. As soon as the technique for coal gasification is available at this scale, a KV (coal gasification) unit can be connected. It must be indicated in the EIS whether coal gasification is a realistic option. A description of coal gasification must be included in order to enable comparison of its environmental impacts with the environmental impacts of a conventional coal fired power plant.

Attention should also be paid to an environmentally favourable variant of a conventional coal power plant. In the EIS this alternative must be composed by joining the environmentally favourable design alternatives as indicated in § 3.2.2. Possibly this could be a combination of coal delivery through a slurry pipe, storage in silos, beneficiation, in furnace reduction of NO_x, prewashing of flue gases, regenerative desulphurization, cloth filters for removal of toxic materials from the fly ash and denitrification of the flue gases.

It is recommended to investigate which possibilities exist to utilise surplus heat by distributing it for industrial and domestic purposes. This total energy alternative must be elaborated both technically and commercially. The difference in emissions to water (heat) and air must be mirrored against the gain in overall efficiency.

5. CURRENT STATE OF THE ENVIRONMENT AND AUTONOMOUS DEVELOPMENT

Environmental Protection Act, section 7.10, subsection 1, sub d:
An EIS shall contain at least: *"a description of the current state of the environment in so far as the proposed activity or the described alternatives may affect it, and the expected developments in the said environment in the event that neither the said activity nor the alternatives are undertaken".*

In addition to the plant site and its direct surroundings, the study area also covers the areas which can be influenced by the activity. Per environmental aspect (air, water, noise and the like) the size of the area that is influenced can differ. In the EIS the study-area must be defined per environmental aspect.

The current state of the environment must be described in the EIS insofar as it is relevant for the prediction of the environmental impacts of the proposed activity and the alternatives. The description of the current state of the environment and of the expected (autonomous) development of the environment (if the activity is not implemented) also serves as a frame of reference for the description of the environmental impacts and the comparison of the alternatives.

The description of the current situation of the environment must in particular pay attention to the following aspects:

- The EIS should give a short description of sensitive objects (sensitive to what and to what extent) in the surroundings, stating their nature, size, number, place and distance to the planned installations. The objects concerned must be indicated on a map. In relation to the existing environmental burden and its increase by industrial establishments, the following objects can be considered as sensitive:
  - residential and recreational areas;
  - agricultural and horticultural crops;
  - flora, vegetation, fauna and ecosystems in nature conservation areas;
  - cultural heritage, recreative objects and valuable elements in the landscape;
  - dust sensitive industries.