Terms of Reference

Development and Evaluation of Power and Heat Supply Options for Kosovo

Background

Coming out of post-conflict administration by the UN, Kosovo declared independence on February 17, 2008. However, its political stability and international recognition are not yet fully secured. By April 2011, Kosovo had been recognized by 77 countries. As a poor, post-conflict and fragile state, Kosovo is only eligible for International Development Association (IDA) credits and grants. With a GDP per capita of €1,760, it is one of the poorest countries in Europe without easy access to markets. Out of its population of about 2 million people, about 45% were living below the poverty line in 2007. Kosovo has the weakest employment record in Europe: a very high (45%) unemployment rate (76% for the 15-25 year old age group) and a low (29%) employment rate. Health outcomes are extremely low: according to 2007 UNDP data, Kosovo had the highest child and infant mortality rates and the lowest life expectancy (69 years) in Southeast Europe (SEE). Its unreliable power supply is a major impediment to private sector investment, and the associated substantial and continuing fiscal drain, crowds out priority social sector expenditures. Abundant good quality lignite is virtually the only domestic source of primary energy for electricity production. To achieve energy supply reliability, Kosovo needs to replace its aging, unreliable, and highly polluting power plants. It must also urgently commence lignite production from a new mine since existing mines will be depleted in less than two years. The social and political costs of very high unemployment among a young population, caused in part by an unreliable and inadequate power supply and fiscally burdensome power sector, could be very high for Kosovo and the region.

In July 2009, the Government of Kosovo articulated a five-pronged energy strategy comprising: (a) private sector investment in a new lignite-fired power generation project, (b) privatization of the electricity distribution and supply business, (c) private sector participation in rehabilitation and environmental upgrade of the Kosovo B Power Station (derated capacity of about 560 MW), (d) decommissioning of the Kosovo A Power Station by 2016-17, and (e) development of renewable resources (including small hydropower plants, wind, solar, biomass).

The current electricity annual demand in Kosovo is about 5,200 GWh, a high proportion of which is being met by Kosovo A and B. Both power plants are old (Kosovo A more than 40 years and Kosovo B 25 years) and poorly maintained, resulting in unreliable power supply. Electricity demand is expected to rise to about 7,400 GWh by 2020. Kosovo is also connected with Serbia, Montenegro, and Macedonia through a 400-kV transmission line and is soon starting the construction of an additional 400-kV transmission line to Albania. Albania’s electricity generation is predominantly hydro (98%), while Kosovo’s electricity generation is predominantly based on lignite (97%)
making it mutually beneficial for both countries to trade peaking hydropower with base-load thermal generation. There have been recent discussions between Kosovar and Albanian system operators to operate as a single control area. After the decommissioning of Kosovo A in about 2016-17, there will be a considerable supply shortfall. New generation is needed to address this shortage of supply and a portion of the rising demand by adding about 600 MW (560 MW net) of new capacity, with more generation additions in future years if demand grows as expected. The Government has studied two configurations in depth: 1x500 MW or 2x300 MW.

The decision between the two configurations was taken taking into account system stability and reliability, comparative plant efficiencies, relative levelized costs and overall CO₂ emissions. It was concluded that a 2x300 MW configuration would offer significant operational flexibility and lifetime reliability advantages over the larger 500-MW units, and are a more suitable addition to the Kosovo power system taking into account its present and future size, characteristics, number of units, and current unit size and reserve requirement levels.

Kosovo is also a participant of the Energy Community of South East Europe (ECSEE) Treaty (now called Energy Community Treaty) that establishes a regional electricity market governed according to EU directives. As a signatory to the treaty, Kosovo is committed to meet environmental standards of thermal power plants and mining, and mitigate social impacts, as outlined by various EU directives.

In the event that the World Bank Group provides the envisaged financial assistance, the investments will have to comply with the World Bank guidelines on environmental and social safeguards. These guidelines include the Operational Guidance Note for World Bank Group Staff issued in March 2010 that is entitled “Criteria for Screening Coal Projects under the Strategic Framework for Development and Climate Change”. The note broadly defines the following criteria under which the WBG could support its partner countries in developing coal-based power generation projects:

1. There is a demonstrated developmental impact of the project, including improving overall energy security, reducing power shortage or increasing access for the poor;
2. Assistance is being provided to identify and prepare low carbon projects;
3. Energy sources are optimized, looking at the possibility of meeting the country’s needs through energy efficiency (both supply and demand) and conservation;
4. After full consideration of viable alternatives to the least cost (including environmental externalities) options, and when the additional financing from donors for their incremental cost is not available;
5. Coal projects will be designed to use the best appropriate available technology to allow for high efficiency and, therefore, lower GHG emissions intensity;
6. An approach to incorporate environmental externalities in project analysis will be developed.
The recently approved Energy Strategy of Kosovo (2009-2018) is built upon a number of analytical reports funded by the World Bank and other donors in the past ten years. Initially, the World Bank funded an Energy Sector Study leading to preparation of a White Paper on Kosovo’s energy sector, adopted by the Government of Kosovo as its first Energy Strategy after the conflict, and periodically updated and revised. The Government strategy aims to: (a) reduce CO2 emissions per MWh produced, (b) significantly reduce local air pollution, (c) manage end-user demand and create an enabling environment for energy efficiency by instilling payment discipline, and (d) facilitate private sector investment in generation as well as in other sectors of the economy. To that end, the Government has completed a technical analysis of the various technology options for the new lignite-fired thermal power plant. Also, with the help of IDA and Dutch grant funds, the Government has already started environmental encapsulation and clean-up of the old ash dump and a long-abandoned coal gasification plant at Kosovo A. In addition, the EC commissioned a detailed study on Kosovo A which reconfirmed that Kosovo A is a highly inefficient and polluting power plant at the end of its life cycle and that it’s immediate decommissioning would be advisable. In support of Government’s energy strategy, Energy Regulatory Office with support from the World Bank completed an assessment of regulatory and legal framework for incentivizing the development of renewable energy sources through feed-in-tariffs.

A pre-feasibility study was completed for the 300 MW Zhur Hydroelectric Power Plant, while the Government is currently starting a competitive selection process for private sector participation. An assessment of potential of small hydropower plants, carried out through a Danish grant (DANIDA), showed the total potential in Kosovo to be between 60 to 80 MW. The government has started the process of selection of private sector investors in eighteen of these small hydropower projects. Going forward, with additional financing from the Bank, the Government proposes to pursue several low-carbon growth opportunities. It aims to create a low-carbon growth strategy that would include building an energy sector greenhouse gas (GHG) inventory; a study on the potential for wind power generation in Kosovo; a carbon capture and storage (CCS) feasibility study for certain geologic formations in Kosovo; and an energy efficiency study.

**Objective**

The objective of this study is to identify the most cost-effective and environmentally sustainable means for meeting future power demand in Kosovo up to and including 2025. The study will meet this objective by developing and evaluating alternative power supply plans and comparing their economic and environmental costs and benefits against those for the power supply plan based on the development of the proposed Kosova C lignite-fired power and mine complex.

**Scope of Work**

The Consultant will perform the following tasks in order to meet the study objective:

- Update forecasts for the demand for electricity and space heating to 2025.
• Identify all energy supply options for Kosovo that are available and practical for implementation within the planning period.

• Formulate power and heat supply plans that consider all the power supply options.

• Evaluate these plans to identify the plan that meets future power demand by the most cost-effective and environmentally sustainable means.

Task 1. Power and heat demand forecasts

The Consultant will prepare power and heat demand forecasts for Kosovo to 2025 by the following means:

• Review forecasts from previous studies for the demand for electricity and space heating in terms of energy, peak load and the seasonal and annual profiles of load duration on the supply system, drawing on the studies listed in the section on “Information to be provided to the consultant”.

• Produce new annual and seasonal power and heat forecasts to 2025 by using data and analysis from previous forecasts where reliable, strengthening the analysis used in previous studies where necessary, updating the forecast with 2010 as the base year by using estimated total demand in 2010 comprising actual served demand and estimated unserved demand at the prevailing electricity tariffs, and applying current estimates for the variables that drive future power demand in Kosovo.

• The new forecasts will cover a base case that is formed from expected values and future trends in the explanatory variables used in the forecast methodology, together with a higher case forecast and a lower case forecast that encompass the expected range of uncertainty about the expected values and trends in the explanatory variables.

The Consultant will consider energy efficiency and DSM options for reducing energy demand (both annual and peak) and for shifting peak demand to reduce the need for new power generating capacity. In the demand forecasts prepared in the past, including the Energy Sector Study prepared in 2001, the impact of demand-side management and energy efficiency was considered in developing demand scenarios. Such material will be reviewed to ensure that energy efficiency impacts are reflected in the demand forecast. To the extent that heat demand affects the electricity demand profile (e.g., through the use of electricity for heating), it will be taken into account. A preliminary estimate on the costs associated each energy efficiency/DSM option will be made.

Task 2. Power and heat supply options

The Consultant will identify all energy supply options for Kosovo that are available and practical for implementation within the planning period, including but not limited to:
Coal;
Natural gas;
Oil;
Hydro (small, medium and large; also, run-of-river and storage);
Renewables such as wind, solar, biomass and geothermal; and
Electricity imports.

The Consultant will provide estimates of the costs associated with the development of these options and timing of their availability. Oil and gas are imported fuels, but whereas oil is presently imported into Kosovo, natural gas imports are only potentially available in the very long term. The costs of installing pipelines dedicated to importing natural gas into Kosovo to supply power generation plants should be included in this supply option.

Environmental considerations will be included in the identification of supply options. Thermal energy options will comply with Kosovo’s environmental regulations and the World Bank’s Environmental Guidelines.

The Consultant will draw on previous work done on power and heat supply options in Kosovo by reviewing all relevant studies. The Consultant will also review reports prepared on the condition of Kosova A and the rehabilitation of Kosova B plants, as well as on the power transmission system. The Consultant will supplement information from this work and collect data relevant to the analysis particularly about supply options that have not been analyzed in depth in previous studies.

Based on the available studies and reports, the Consultant will prepare a consolidated assessment of energy supply options available to Kosovo, including the potential to produce electricity from wind, solar, biomass and geothermal.

In addition to energy production potential and associated costs, the Consultant will assess the readiness of these resources for development and provide a realistic timetable for their development. If the energy resource potential has not been assessed adequately, the Consultant will propose a roadmap for such an assessment to meet appraisal standards of project preparation.

Electricity import potential will be based on previous studies such as the Generation Investment Study (2007 updated version). To the extent possible, adjustments will be made to reflect recent developments on key projects in the Balkans (e.g., Belene nuclear plant in Bulgaria; availability of thermal plants in Romania; etc.). Transmission capacity for electricity imports will be evaluated; both the presently available capacity and potential additions will be considered.

**Task 3. Formulation of power and heat supply plans**

The Consultant will formulate a range of power and heat supply development plans that can meet the forecast demand for power and heat in Kosovo over the planning period.
The plans will take into account the readiness for development of the supply options, as well as the planned retirement of existing power generation capacity.

These plans will include at least one plan that incorporates each of the supply options listed under Task 2. The plans will therefore include a plan based on lignite-fired power generation capacity, a plan based on fuel oil fired power generation capacity, a plan that incorporates gas-fired generation capacity in association with other supply options when imports of natural gas can be available, a plan or plans based entirely or mostly on a combination of renewable energy options, and various hybrid plans with combinations of lignite supply options with renewable energy supply options and separately non-lignite supply options with renewable energy supply options.

As part of this assessment, the Consultant will derive the economically efficient level of supply from all of the available renewable energy options in the projected total supply of electricity needed to meet the forecast demand in Kosovo. The Consultant will carry out this derivation in the following steps:

- Derive a composite renewable energy production cost curve that shows the relationship between incremental energy produced and incremental cost of production, in which all the available renewable energy supply options are arranged in ascending order of production cost. The cost of production of a supply option is the sum of the levelised capital and fixed operating cost and the variable operating cost of the option. Costs are expressed in economic terms, that is in constant price terms of the base year of the evaluation and without domestic taxes and duties, and they are discounted at a rate that reflects an estimate of Kosovo’s economic opportunity cost of capital.

- Derive the capacity penalty associated with renewable energy supply that is not reliably dispatchable when needed to meet demand of the power system. This penalty is assessed from the relationship between capital investment in a supply facility and the projected annual capacity utilization factor from the amount of energy dispatched from the facility.

- Derive the avoided externality costs of the fossil fuel-fired energy that would be displaced by the renewable energy supply options. In addition to local pollutants (particulates, SO2 and NOx), the external costs of CO2 emissions will be considered based on prevailing values for carbon emissions in Europe.

- Derive the economically efficient level of supply from renewable energy to meet the forecast power and heat demands.

The Consultant will use the values for economically efficient level of supply from renewable energy derived from this supply curve for formulating the power and heat supply plans that include renewable energy options.

**Task 4. Comparative assessment of power and heat supply plans**
The Consultant will evaluate as a base case the costs of the power and heat supply plans developed under Task 3 to assess which plan meets at the lowest cost the base case power demand and expected values for fossil fuel costs and capital costs for supply options, taking into account environmental sustainability.

The Consultant will develop for each supply plan a stream of annual capital and operating costs in which capital costs are charged in the year in which they are incurred and operating costs include the externality costs imposed by supply options. Each stream of costs will be discounted to a present value at an estimate of Kosovo’s economic opportunity cost of capital. The preferred plan has the lowest present value of total costs.

The Consultant will then assess the robustness of the preferred plan’s status as the least cost plan in the base case by repeating the analysis of plan costs under different planning cases that are formed from combinations of lower or higher power and heat demand forecast than the base case, and lower or higher fossil fuel prices and capital costs for supply options than assumed for the base case.

The Consultant will then assess from the results of the analysis of all the evaluated cases which power and heat supply plan is most likely to be the most cost-effective and environmentally sustainable means for meeting future power demand in Kosovo up to and including 2025.

**Deliverables**

A report that consolidates the previous draft report submitted by DH Infrastructure on Options Assessment and the further analysis requested through this terms of reference.