5.3 Options to Meet the Projected Power Shortfall Due to Climate Change Impacts

Having identified potential future shortfall in electricity supply due to climate change, and noting that some measures that contribute to building climate resilience are already contained within the active-scenario projection, this assessment looks at the costs and benefits of options for diversification of Albania's electricity supply.

Before discussing these options, it is worth noting briefly the significant benefits of improving energy efficiency. The Asian Development Bank estimates that if 1 million incandescent light bulbs were replaced with compact fluorescent lamps (CFLs) at a cost of about $1.5 million, electricity demand would be reduced by about 50 MW. It estimates that the cost of building a new 50 MW power station would be at least $50 million, and that operating costs would add another $2 million to $3 million per year. This demonstrates how cost-effective energy efficiency measures can be, and further strengthens the argument for ensuring that the energy efficiency measures in the draft NES are implemented.

For the cost–benefit analysis, eight reasonable and practicable technology-based options (asset types) for filling the electricity shortfall were identified during the workshops. These selected options are described in order of increasing estimated capital cost. Assumptions relating to the parameters that were used to assess each option in the CBA are also outlined:

1. **Import.** The import of electricity from neighboring countries is considered to be a realistic potential option. There is a premium associated with the cost of this power and prices fluctuate on a daily basis. To assess the environmental and social effects associated with this option in the CBA, only those global impacts that could potentially affect Albania were considered. Water usage and emissions for this option were considered to be the same as for the combined cycle gas turbine option. Impacts on ecosystems and disturbances to people and property were not considered, as it was assumed that the regulatory authority in the generating country has already taken these into account. It has been assumed that all imported electricity is produced using combined cycle gas turbine (CCGT) technology, although it is recognized that a range of electricity generation technologies are used in South Eastern Europe (see Box 2, Section 2.1), including nuclear power, hydropower, other renewables, and GHG-emitting thermal plants fueled by coal.
2. **Use combined cycle gas turbine (CCGT) technology.** A new-build CCGT-based power plant would use natural gas, which is cleaner than coal but has several disadvantages, such as dependence on foreign sources of fuel and relatively high GHG emissions in comparison with renewable technologies such as hydropower. Supercritical pulverized coal technology was not considered in detail in the CBA, but if supercritical pulverized coal technology were used instead of a gas-fired CCGT, it would have different environmental costs: it has approximately 200 percent of the water usage and 220 percent of the GHG emissions of

CCGT. CCGT is clearly the more sustainable thermal option in spite of costing approximately 10 percent more than coal on a levelized basis.

3. **Improve/update existing large hydropower plants (LHPPs).** There is some capacity for improvement in existing large hydropower assets, including actions such as optimizing data collection and usage, reservoir/dam maintenance and reservoir management.
4. **Improve/update existing small hydropower plants (SHPPs).** Many of the small hydropower assets in Albania are old, and technology and design have improved considerably since they were installed. In many cases, improvements such as optimizing turbine operation with respect to varying river flow regimes, widening intake and outfall channels, resizing turbines/plant, and improving connections to the transmission network are possible.
5. **Install new small hydropower plants (SHPPs).** There are a number of unexploited sites where new run-of-river hydropower plants could be sited. These smaller plants generally serve smaller communities and could be connected to local distribution networks as well as the national transmission grid.
6. **Develop wind power.** At this stage, there is no wind-power electricity generation in Albania, although, as outlined in Section 2, a number of potential projects are currently under consideration in Albania's coastal areas.
7. **Use concentrated solar power.** Concentrated solar power (CSP) captures solar energy through a large array of mirrors, directing light toward a brine solution or other thermal receptor that converts the solar energy into electricity. There are currently no CSP plants in Albania. However, there are several located in the Mediterranean region in areas with similar solar characteristics to those of Albania.
8. **Install new large hydropower plant (LHPP).** This option represents the building of a completely new dam and reservoir to exploit the remaining generation potential in Albania's hydrological system.

In undertaking the CBA, potential constraints on the implementation of technologies have been considered:

- It is considered that, subject to approval, there are no physical constraints on the number of thermal power plants that could be installed.
- With respect to wind power, there are insufficient data at present on wind speeds in Albania at turbine operating heights. However, it is assumed that there is adequate wind potential for the purposes of the CBA.
- In the case of CSP, technology is developing in this area and a number of stakeholders felt that this technology might become more feasible in the future, perhaps by 2040 and beyond. Aspects considered in relation to current use of CSP were:
    - I. The technology is relatively new.
    - II. The capital costs are higher compared to other technologies.
    - III. There is not enough operating experience accrued worldwide to provide real data for operating and maintenance costs.

IV. It involves higher technological, schedule and financial risks.

It is expected that by 2040 the capital costs for CSP would be comparable with other technologies and sufficient experience worldwide would be developed that would reduce the current risks associated with CSP. For the purposes of the CBA, best estimates of technology costs (CAPEX and OPEX) have been used in the analysis, though it is recognized these may be reduced if/when the technology advances.

- With respect to hydropower, much more data are available. METE stated during meetings that the current estimate of Albania's hydropower generation capacity is 3,200MW total for LHPP and SHPP (Tugu, 2009). Of this, there is currently 1,445MW of LHPP and 15MW SHPP installed capacity. The future supply projections developed in this assessment are based on development of a further 1,150MW LHPP and 390MW SHPP, thus giving a total installed capacity of 3,000MW by 2050. These values are estimated before the impact of climate change has been taken into account, which it is predicted would reduce hydropower potential in Albania. Therefore, there may be a significant physical constraint on further potential capacity for hydropower generation, beyond those facilities already included in the future projections. However, given the uncertainty surrounding total potential for hydropower generation in Albania, and that estimates may be substantially modified if additional basin hydrometeorological data and modeling were available, further development of both LHPPs and SHPPs have been considered for the purposes of the CBA.

Importantly, to compare the costs and benefits of all the different assets on a like-for-like basis, a quantity of power was chosen, 350 GWh, which could meet the estimated climate change-induced shortage for 20 years. All of the generation capacity is not required at once, but rather the need increases over the assessment period. Some assets would probably not be able to fill the entire gap from beginning to end. Additionally, the assets under study have different expected periods of service. Twenty years represents a period of time for which energy needs could be met by the technologies under consideration. For the second 20 years to 2050 (the timescale under consideration for climate change risks in this assessment), the additional generation needs could be reexamined. This analysis thus considers what could be done in the immediate future, providing guidance as to what may be good options.

It is important to note that the use of a normalized quantum of a particular asset that could provide 350 GWh per year is hypothetical and a simplification, in the sense that installing this amount of capacity may be unrealistic in most cases. For instance, economies of scale dictate that a 50 MW thermal plant (which would provide about 350 GWh) would generally be less feasible on a financial basis than a larger unit. Furthermore, to complete a high-level CBA, it has been necessary to make broad assumptions about the specific locations where future assets may be sited and also of the various options, their costs, and their impacts on society and the environment. In addition, it should be noted that the options would themselves be susceptible to climate change. The most notable impacts would be on the SHPP and LHPP options, as these are most sensitive to climate change (see Sections 3.3 and 3.2), though the efficiency of TPP is also slightly reduced as temperatures rise (see Section 3.4). In contrast, there may be benefits for future solar power production due to reduced cloud cover in summer in the future (see Section 2.2). Since the available cost and benefit data are relatively high-level, further analysis of these impacts on the options is not included in the scope of the CBA. Thus, the options considered in this assessment are generic and indicative rather than definitive. However, it is considered useful and informative to undertake a high-level CBA for these technologies, to provide an indication of what the key issues are, and to identify where further data could be used to reduce uncertainty or confirm a chosen course of action.

The eight power technology options were evaluated on the basis of eight parameters that were determined based on the outcome of workshops and discussions with stakeholders. Parameters were chosen that reflect sustainable-development performance aspects—that is, financial, social, and environmental aspects of the different options. The parameters selected are detailed next.