3. CLIMATIC VULNERABILITIES, RISKS, AND OPPORTUNITIES FOR ALBANIA'S ENERGY SECTOR

This section highlights the climate-related vulnerabilities, risks and opportunities for Albania's energy sector, based on the outcomes of the stakeholder-led and desk-based analyses described in Annex 1. A SWOT (strengths, weaknesses, opportunities and threats) analysis developed with stakeholders (see Acclimatise *et al*., 2009a) helped to highlight key current vulnerabilities in the energy system, some of which have already been emphasized in earlier sections of this report. An overview of the specific vulnerabilities for each asset type is summarized in this section.

Looking forward, the risks identified from climate variability and climate change, in the absence of adaptation, are highlighted in Table 3. Some of these risks affect the energy sector in general, such as the impacts of climate change on demand for electricity; others are associated with specific energy asset types. The components of each risk (probability of hazard and magnitude of consequence) are shown on the risk maps in Annex 2, Tables A2-3 and A2-4. It is important to note that the consequence of a particular risk may be manifest in many different ways: there may be financial loss, impacts on energy security, environmental or social impacts, or perhaps a reputational consequence for Government. The risks for each asset type are outlined in Table 3, with further detail provided in Acclimatise *et al*. (2009a).

Table 3: Summary of Climate Risks before Adaptation

Risk Code No.	Description of risk	Magnitude of risk before adaptation	Asset class affected
1	Higher peak demand in summer due to higher temperatures could lead to lack of capacity.	Extreme	All
2	Less summer electricity generation from hydropower facilities due to reduced precipitation and runoff could reduce energy security.	Extreme	LHPP / SHPP
3	EU Carbon trading schemes add cost to thermal power generation.	Extreme	TPP
4	Changes in seasonality of river flows (including more rapid snowmelt due to higher winter temperatures) combined with mismanagement of water resources could decrease the operating time for SHPPs, resulting in decreased production.	Extreme	SHPP
5	Increased CAPEX / OPEX due to climate change could lead to reduced shareholder value.	Extreme	All
6	Higher peak summer demand across the region could increase import prices and reduce supply.	Extreme	All
7	Paucity of hydromet data makes it difficult to manage water resources and optimize operation of hydropower plants.	Extreme	LHPP / SHPP

Risk Code No.	Description of risk	Magnitude of risk before adaptation	Asset class affected
8	Sea level rise could lead to increased coastal erosion, potentially affecting coastal infrastructure such as ports for oil export.	High	Oil Production & other coastal infrastructure
9	Lack of data (impact of climate change on wind patterns) creates uncertainty about optimal sites / design for generation using wind.	High	Wind
10	Climate change increases risk of competition between water users.	High	SHPP, LHPP & river-cooled TPP
11	Dry periods followed by heavy downpours of rain would exacerbate soil erosion from agricultural land, leading to increased sedimentation and reduced output from SHPP and LHPP.	High	LHPP / SHPP
12	Mal-adapted infrastructure design if climate change not built-in could lead to reduced operation / efficiency of assets.	High	All
13	Changes in extreme precipitation lead to higher costs for maintaining dam operations / security.	High	LHPP
14	Changing temperature, ground conditions and extreme precipitation could increase contamination risks associated with oil and coal mining facilities, potentially leading to increased risk of contamination of local water courses.	High	Oil and Coal Production
15	Reduced precipitation and increased temperatures can affect environmental performance of river water-cooled TPP abstracting and discharging water into local water courses.	High	TPP
16	Transmission and distribution losses increase due to summer temperature rise resulting in higher effective demand and reduced energy security.[1]	High	Transmission & Distribution
17	Concerns about unmanaged climate risks causes Albania to be less attractive to foreign investors.	Moderate	All
18	Changes in extreme precipitation and wind lead to transmission disruption.	Moderate	Transmission & Distribution
19	Loss of productivity for thermal plants due to higher air and water temperatures and / or reduced ability to abstract and discharge cooling water.	Moderate	TPP
20	Increases in landslips due to heavy rains resulting from climate change could increase the risk of loss of integrity for gas pipelines.	Low	Gas
Note: The *magnitude of risk* rating system presented here is described in Annex 2, Tables A2.1 and A2.2			

[1] Losses in the transmission network are already relatively high, due to the configuration of the electricity network. The main sources of power generation are in the north of the country, while the main electricity consumers are located in central and southern Albania.

3.1 Cross-cutting Issues

Current Vulnerabilities

As highlighted in earlier sections, energy security has been a major concern in Albania for some years. This is particularly prominent in relation to electricity distribution systems and hydropower plants: Unstable power supplies and lack of access to electricity in some rural communities are constraining economic development, and the productivity of both large and small hydropower plants has been affected by droughts in recent years, leading to frequent load shedding.

Many of Albania's existing energy assets are aged and have seen insufficient investment. They are operating inefficiently or, in some cases, not at all. Technical and commercial losses of energy are a major cause for concern and energy demand is poorly managed. While energy trade could help with energy security, limited interconnectivity with neighboring countries prevents robust trade at present.

Other vulnerabilities related to Albania's low adaptive capacity were discussed in Section 2.3.

Risks and Opportunities

Rising temperatures associated with climate change, together with economic development, are set to increase energy demand in summer, when the water available for hydropower plants is lowest, threatening future energy security. The same effect on demand is likely to occur across South Eastern Europe, which could increase costs of importing electricity. There will however be benefits in terms of reduced heating demand in Albania during warmer winters.

For existing, unadapted energy assets, climate change seems set to reduce efficiencies and increase operating costs (OPEX). Capital expenditure (CAPEX) will be needed to retrofit existing assets so they can cope with new climatic conditions. Private developers of energy assets also have concerns about climate risks.

However, Albania is also on the brink of an exciting opportunity: as highlighted in Section 2.1, major investments in new energy assets are underway or being planned. Integrating adaptation measures into concession agreements, contracts, site selection, and design decisions for these new facilities could help ensure their climate resilience. As KESH privatizes the energy system, it could consider how to structure incentives for adaptation; there could be opportunities for cost sharing between Government and the private sector on adaptation actions. The earlier that climate risks and adaptation are considered, the greater the opportunities to identify financially efficient solutions to build the robustness of the energy system for coming decades.

3.2 LARGE HYDROPOWER PLANTS

Current Vulnerabilities

The output from large hydropower plants is vulnerable to variability in the runoff that feeds their reservoirs. In turn, runoff is affected both by seasonal precipitation and temperature (including the timing of snowmelt). Figure 15 clearly depicts lower production from Albania's LHPPs (shown in blue), linked to low rainfall in the period 2000 to 2002, and resultant associated high-energy imports. Planning for new LHPPs draws on river gauge data gathered for a year prior to application. However, rating curves linking river level to discharge have not been updated. As the calibration is likely to have changed as a result of natural and man-made erosion of riverbeds, river flow remains uncertain in most basins other than the Drin and to some extent the Mati. This lack of information constrains Albania's ability to plan effectively for new assets that are robust to changing climate risks.

Extreme rainfall can also cause spillover at LHPPs and threaten dam security. As outlined in Section 2.1, the World Bank has provided credit to Albania for a dam safety project (World Bank, 2008b) for Albania's five LHPPs, aimed at safeguarding them from dam failure and improving their operational efficiency.

Current levels of sedimentation of LHPP reservoirs are unknown but may be significant.

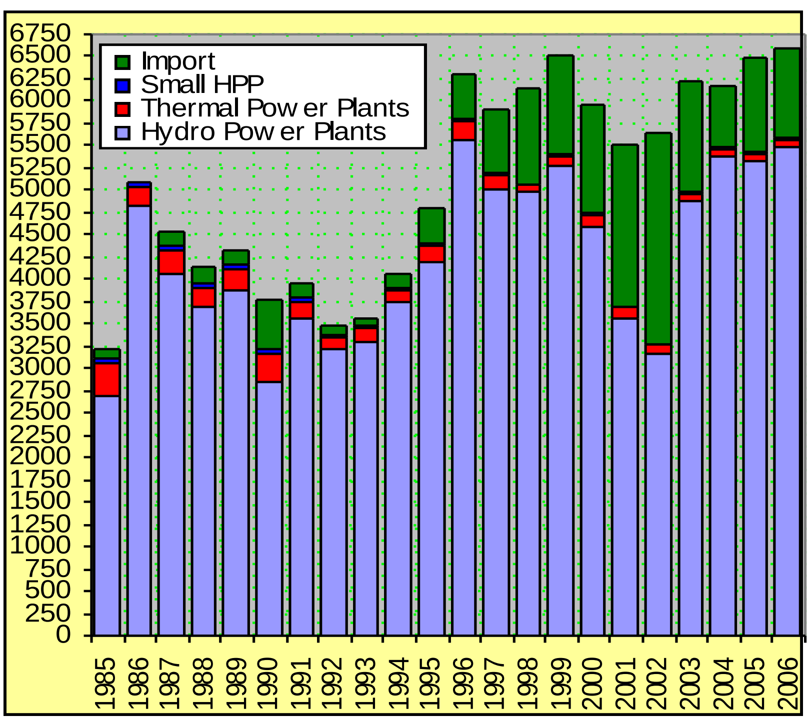

Figure 15: Annual Energy Profile for Albania from 1985 to 2006 in GWh (Islami, 2009)

Risks and Opportunities

As outlined in Section 2.2, the climate change models examined in this study are in good agreement that Albania and the wider eastern Mediterranean region will experience decreases in summer precipitation, projected to be about 20 percent by the 2050s. The models examined are in weaker agreement about the direction of change in winter precipitation (i.e., whether it will increase or decrease) although increases in temperature (which are mutually consistent) will mean that snowmelt occurs more rapidly and evapotranspiration increases. Even if winter precipitation amounts increase in the future, lack of reservoir storage and turbine selection adapted to past hydrology may impose limits on the ability of hydropower facilities to harness increased winter river flows and energy may be wasted through spillover. Furthermore, while seasonal changes can be managed to some extent by improved reservoir management (and indeed this is beginning to be achieved by KESH), this is impeded by the country's lack of hydrometeorological capacity, as outlined in Section 2.3.

Climate change is also projected to increase the intensity of rainfall, which can cause higher spillover at hydropower facilities, put increased pressure on dam reservoirs, and cause landslips. Communities and land close to large dams may be exposed to increased risk of flooding. Increased intensity of precipitation events can also lead to upstream soil erosion and greater siltation of hydropower reservoirs.

As a consequence of these risks, unless risks are proactively managed, climate change is anticipated to impact negatively on the financial performance of LHPPs, leading to loss of revenue and increased OPEX and CAPEX.

High-level Quantitative Estimate of Climate Change Impact on LHPP Production by 2050

An in-depth approach to quantifying the impacts posed by climate change for hydropower plants would involve hydrological modeling using downscaled climate change scenarios, and subsequent modeling of the impacts of changes in river flows on hydropower plant output. Such analysis is beyond the scope of this analysis; instead, to develop high-level quantitative estimates, the following information and data were used:

- Rainfall-runoff modeling of the relationships between projected changes in climate (precipitation and temperature) and changes in river flows for several catchments Albania (Islami *et al*., 2002; Bogdani and Bruci, 2008; Islami and Bruci, 2008).
- A correlation of annual average inflows to Fierze hydropower plant on the Drin Cascade (Annex 8) and consequent electricity generation, together with a similar correlation for power production from LHPPs on the Mati River (Islami and Bruci, 2008).
- Recent research undertaken in Brazil, which used regional climate modeling data to project impacts on output from Brazil's hydropower plants (Andre *et al*., 2009; Schaeffer *et al*., 2009).

Rainfall-runoff modeling undertaken for the Drin, Mati and Vjosa River basins using climate change projections for temperature and precipitation indicates reductions in runoff in these catchments of about 20 percent by 2050 (Islami *et al*., 2002; Bogdani and Bruci, 2008; Islami and Bruci, 2008). It should be noted that this is an approximate estimate, based on a small number of global climate models and hydrological models. As highlighted in Section 2.2, a wide range of models and greenhouse gas emissions scenarios better represents uncertainties, but it was beyond the scope of the current study to undertake new hydrological assessments. Furthermore, climate change is expected to lead to increased rainfall intensity and longer dry periods, which will affect runoff and hence hydropower production. Again, analysis of the implications of these changes, while they may be important, is beyond the scope of this assessment and is an area for future research.

Correlations were developed for both the Drin and Mati Rivers of the relationship between river flows into the reservoirs and electricity production (Connell, 2009; Islami and Bruci, 2008). These are shown in Figures 16 to 18. These correlations indicate that, as a first estimate, if the flows on the Drin and Mati Rivers declined by 20 percent, electricity generation would fall by about 15 percent. This estimate has been applied in the cost–benefit analysis presented in Section 5. Further information on how this estimate was derived is provided in Annex 8.

It is worth noting that Albania's hydropower managers have recently begun to improve their operations to better manage drought risks to production. Working with weather and climate experts, they are planning to expand the network of river-level sensors and rain gauges, and a system for collecting regional weather data. Using this information, managers will be able to forecast the level of the Drin more accurately, timing the filling and release of water from reservoirs so they can draw the most energy from the system without endangering dams that may collapse if the water level rises to over-top dam height.

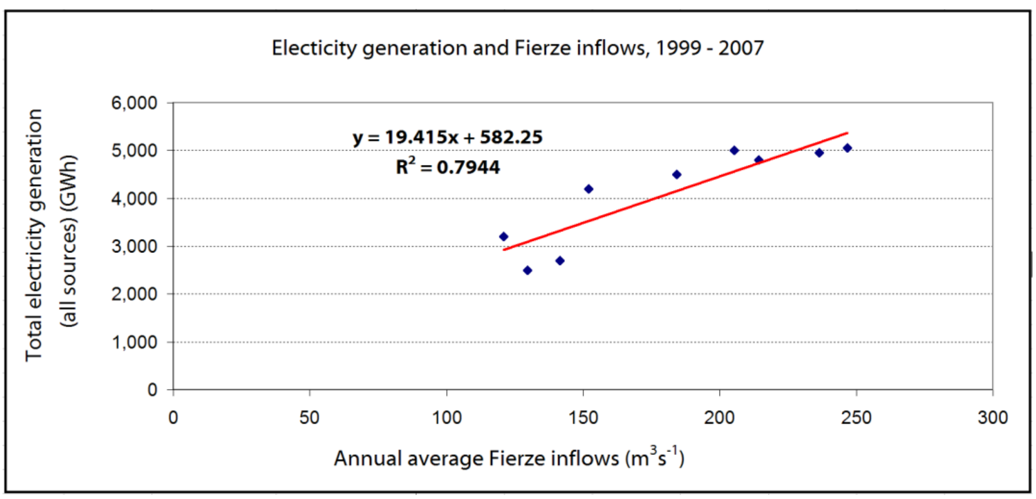

Figure 16: Relationship between Drin River flow and electricity production at Fierze (Annex 8)

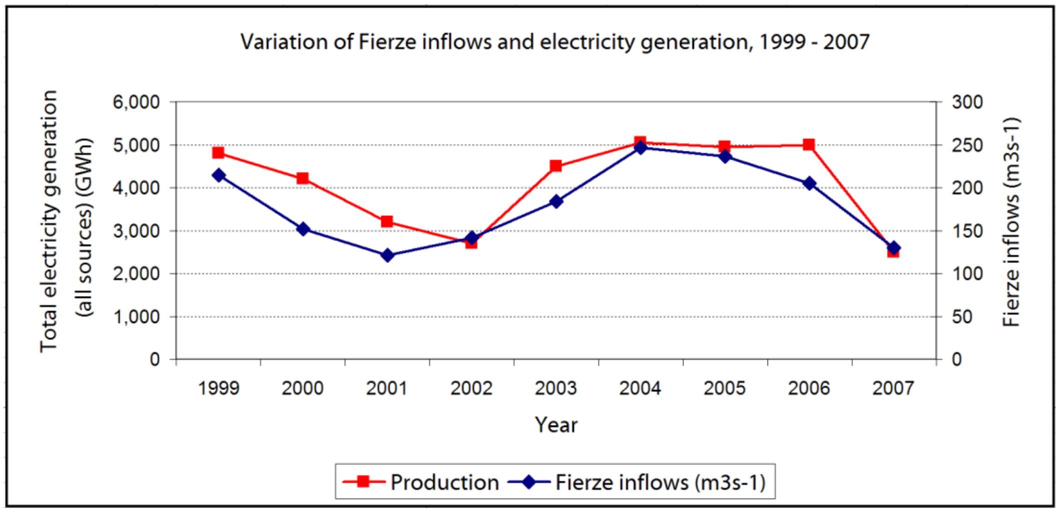

Figure 17: Variation of Fierze inflows and electricity generation, 1999 to 2007 (Annex 8)

3.3 Small Hydropower Plants (SHPP)

Current Vulnerabilities

Existing small hydropower plants in Albania have generally been constructed to serve local communities and sized accordingly. In that sense, they are not necessarily in the best locations or sized optimally for river flows. Many are being rehabilitated, so they will recommence operation in their current locations. As with LHPPs, the key climatic vulnerabilities for SHPPs relate to variability in precipitation and temperature, through their impacts on runoff.

During three consecutive years of drought in Albania (2005, 2006, 2007), some SHPPs were unable to produce the needed power to feed into the grid or even to supply their local communities on a sustainable basis, reducing the total power available. Annual operating periods of some SHPP facilities have reduced in recent years from 8 months to 4, linked to less snow (Acclimatise *et al*., 2009a).

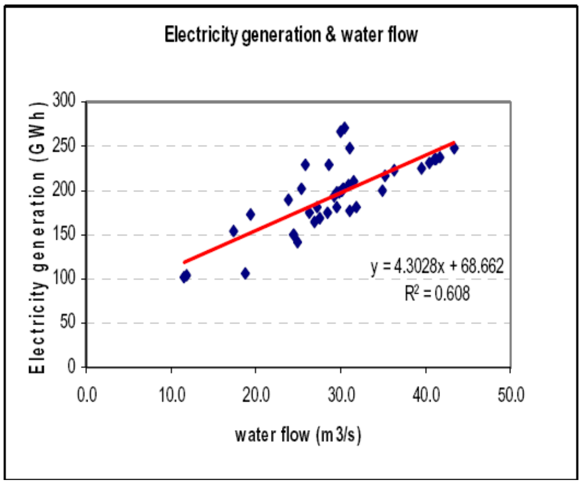

Figure 18: Relationship between Mati River flow and electricity production from Ulëza and Shkopeti HPP (Islami and Bruci, 2008).

Risks and Opportunities

Because SHPPs do not have reservoirs, their performance is linked essentially to the intensity and duration of precipitation. They will therefore be affected by any future decreases in annual average and summer precipitation amounts. Snow affects SHPP production by slowly releasing stored water as it melts, and consequently SHPPs are particularly sensitive to more-rapid snowmelt due to higher winter temperatures.

The irrigation needs of agriculture take precedence over energy production in Albania, so SHPPs could also be affected by farmers' adaptation strategies in response to climate change—namely the need to increase irrigation (World Bank, 2009c). At present, agricultural irrigation is undertaken for about three to four months per year in summer, often in the daytime, when energy demand is lower, thus reducing the chance of conflicts over water use. Energy demand is currently at a maximum in winter. However, as already noted, rising temperatures will cause shifts to greater energy demand in summer, potentially bringing farmers and SHPP owners into conflict over water use, unless actions are taken to manage this. The need for agricultural irrigation in Albania cannot currently be easily forecast before or during the irrigation season, making forward planning by SHPP owners very difficult. Furthermore, water delivery to farmers is not organized in automated delivery schemes that follow defined basin modeling so it is not possible to maximize its effectiveness. However, large areas of agricultural land in Albania have been equipped with efficient irrigation systems in the last couple of years, which has had a dramatic effect on reducing water use in these areas.

Additionally, minimum flow requirements are in place to protect river ecology, so potential lower flows due to climate change could affect the flow available for SHPP utilization. Climate change is also anticipated to lead to increased risks of siltation for SHPPs, when combined with deforestation and poor watershed management, affecting asset performance.

High-level Quantitative Estimate of Climate Change Impact on SHPP Production by 2050

Assumption of a one-to-one relationship between changes in river flows and SHPP power output leads to projection of a 20 percent reduction by 2050, according to the projected decrease in runoff estimated for LHPP generation in the previous section (Annex 9). This estimate has been applied in the cost–benefit analysis presented in Section 5. It is noted that there could be significant indirect impacts of climate change on SHPPs, due to the adaptation actions that may be taken in the agriculture sector. For instance, farmers' demands for irrigation water will increase due to higher temperatures. Hence, the 20 percent reduction may be an underestimate. Assessments of such indirect impacts were beyond the scope of this assessment but could usefully be addressed in additional cross-sectoral climate change risk assessments.

Box 4 overleaf summarizes some of the interlinkages between water resources, energy security, and food security.

3.4 THERMAL POWER PLANTS (TPPS)

Risks and Opportunities

As outlined in Section 2.1, Albania is developing thermal power plants to improve energy security. Optimal TPP performance is slightly vulnerable to climate change impacts, mostly with regards to operating efficiency: rising temperatures have a modest impact on gas turbine performance, and the availability and temperature of cooling water can also affect operations.

Currently, the TPP assets under development or in discussion (at Vlore Port, Fier and Porto Romano) are to be cooled by sea water. However, if Albania were to consider developing river-water-cooled TPPs, then the impacts of climate change on river flows and water temperatures could have significant effects on their operation in warmer, drier months. There could then be insufficient river flow to meet cooling requirements, and abstractions could be prevented for periods of time by regulations designed to protect river ecology during low flows. Thermal power plants in the United States have been subjected to such constraints on a number of occasions during recent droughts (Karl *et al*., 2009).

The Vlore TPP is located near Vlore Port. The Vlore plant has raised the elevation of the site by 2 m above sea level due to its proximity to the Vlore floodplain (Maire Engineering, 2008). Further modifications have been made to equipment installed on site. Nevertheless, it is not possible to estimate in this assessment how much more frequently, if at all, the site might flood in the future due to climate impacts due to limited available information on the reason for the site elevation decision.

In general, coastal energy assets may be significantly affected by rising sea levels and coastal erosion and this should be an important consideration in the siting of future TPPs.

High-level Quantitative Estimate of Climate Change Impact on TPP Efficiency by 2050

The authors estimated the efficiency (output) reduction for TPP based on engineering expertise at 1 percent by 2050, associated with the impacts of rising temperatures.

Box 4: Climate change, water resources, energy, and food security in Europe and Central Asia (ECA)

Rising temperatures and changing hydrology are already affecting forestry and agriculture in many countries in ECA. The region's natural resilience and adaptive capacity have been diminished by the Soviet legacy of environmental mismanagement and the pursuit of economic growth carried out with blatant disregard to the environment. This is evident in agriculture where poor management of soil erosion, water resources, pest control, and nutrient conservation increases the sector's vulnerability to climate change. Inadequate capital investment and watershed management have led to significant water losses and reduced the productivity of irrigation systems as well as hydropower generation capacity.

Over time, the impact of global warming, other nonclimatic factors (such as inefficient use of water), legacy issues and the continuing unsustainable demand will exacerbate water stress in Europe and Central Asia. Global warming will negatively affect water systems in some parts, as reduced precipitation and high evaporation rates decrease water availability for agriculture and hydropower production alike.

ECA countries are expected to help offset the projected decline in world food production due to decreasing agriculture yields in lower latitudes due to climate change. However, there are important caveats: the projected gap between potential and actual yields in ECA is 4.5 times higher than the potential increase in agricultural production from climate change by 2050. Unless current inefficiencies in the agricultural sector are addressed, food insecurity in the region will become a major development concern. The inability of Kazakhstan, Russia, and Ukraine to close the productivity gap and respond to recent crop price increases does not bode well for their capacity to adapt to and benefit from climate change.

Going forward, improved water resource management and better-performing water utilities and energy systems will help reduce climate vulnerability. Gains from improved agricultural practices, including adaptation measures such as better water resource management, could outweigh projected negative impacts. Energy security considerations will be integral to the long-term investment decisions on water resource allocation. Albania currently derives 90 percent of its energy from (both large and small) hydropower plants; plants that are feeling the effect of weather variability and are likely to see further declines in runoff and energy production into the future (estimated at 15 percent and 20 percent respectively by 2050, as outlined in this section of the report). It is a complex picture. Agricultural demand for irrigation water is seasonal and subject to significant variability. Timing is also critical. Today, water demand for agricultural use is low during periods of peak energy demand (winter and night-time) and high when energy needs drop (summer and daytime). But winter demand for energy is expected to drop with climate change and daytime summer demand to rise with increasing temperature and cooling demand.

(World Bank, 2009d)

3.5 WIND POWER

Risks and opportunities

As outlined in Section 2.1, Albania currently has no industrial wind power generation facilities, although it is holding discussions about developing them and seven licenses have been issued. The wind resources of Albania are uncertain. Until recently, the wind field maps available could draw only on data measured at 10 m height above ground (as per World Meteorological Organization standards adhered to by Albania's national measuring stations), rather than the height where the turbines would be located. Especially in Albania's mountainous terrain, there is no consensus model for extrapolation from the measured field to the wind field of interest. These considerations have made wind farm development vulnerable to climate uncertainties that can affect design and operational parameters. Recognizing this, a Wind Energy Resources Assessment for Albania has been conducted by the Italian Ministry for the Environment, Land and Sea, which has resulted in a map of average wind speed for Albania that is an improvement on past data availability. If changes in wind speed and/or direction were to occur, however, reoptimization of the design and operation of wind energy facilities would be could be needed to ensure that installed turbines did not slip out of their optimal operating band.

High-level quantitative estimate of climate change impact on wind power by 2050

The climate change projections are very uncertain with respect to wind, and the data that are available for Albania indicate little or no change. The cost–benefit analysis in Section 5 has therefore assumed no change.

3.6 POWER TRANSMISSION AND DISTRIBUTION

Current vulnerabilities

As outlined in Section 2.1, the power transmission system was recently upgraded, aligning with EU standards, and ongoing investments are focusing on improving regional interconnectivity. Technical losses in the transmission network in 2008 were 213GWh (3.3 percent) (ERE, 2008).

The distribution grid already presents clear climatic vulnerabilities and has high technical and commercial losses (about 33 percent in 2008). Although city networks are generally in good condition, there are significant parts of the distribution grid that need upgrading, especially those serving rural and mountain communities, who already do not have secure energy supplies due to the deterioration of the grid. In periods of high winter precipitation, snow and ice can cut off distribution lines. Repair crews have difficulties repairing damaged networks due to difficult road conditions and local authorities may not always have the resources and expertise to repair damage quickly. High winds can also cause damage to power lines. The capacity of communities to cope with interruptions to supply of power (and other services) is highly dependent on the level of economic development. For instance, small businesses may not have backup generators. Even if the effect of intermittent power can be managed with the use of backup generators, there is an additional capital and operating cost in use of such generators.

Risks and opportunities

Owing to the recent technical upgrades of the transmission system, its performance is not expected to be significantly affected by projected changes in temperature and precipitation. However, it is worth noting that, at present, EU standards do not account for climate change, and the technical specifications may require review in the years to come. Indeed, the EU Adaptation White Paper refers to the need to review and update EU regulations in the light of climate change projections (European Commission, 2009).

Rising temperatures due to climate change will gradually erode the efficiency of the transmission and distribution systems, by reducing the ability of transmission lines to lose heat to their environment.

If climate change leads to increased winter precipitation, damaging events could occur more frequently unless the distribution grid is upgraded, with consequent worsening social impacts. Because projections of future changes in wind are highly uncertain, it is not possible to say with any confidence whether damage to power lines from these events will happen more often. However, increased intensity of precipitation could lead to greater incidence of landslips, affecting distribution lines in hill terrain.

High-level Quantitative Estimate of Climate Change Impact on Transmission and Distribution Efficiency by 2050

Using engineering expertise, the efficiency reduction for transmission and distribution has been estimated as 1 percent by 2050, the consequence of rising temperatures.

3.7 ENERGY DEMAND

Current Vulnerabilities

Energy demand is not managed effectively at present, with old, inefficient equipment and standards being applied in households and the services sector. Many houses have inadequate insulation, leading to wasteful use of energy. Furthermore, electrical power is often the main source of energy for heating. Commercial losses are significant, running at 13.4 percent in 2008 (ERE, 2008).

Risks and Opportunities

The most significant impacts of climate change on energy consumption are likely to be the effects of higher temperatures on the use of electricity and the direct use of fossil fuels for heating in Albania. Higher temperatures are likely to affect the following major electric end uses:

- Space heating Energy demand for space heating will decline
- Air conditioning Energy demand for space cooling will increase
- Water heating Energy demand for water heating will decline slightly
- Refrigeration Energy demand for refrigeration will increase

Of these end uses, air conditioning and space heating are those most likely to be significantly affected by climate change in Albania, since both are functions of indoor-outdoor temperature differences. Compounded by the anticipated reduction in availability of hydropower in summer, this could exacerbate energy security difficulties. There are opportunities, however: climate change is expected to shorten the cold season and reduce the severity of cold weather events, reducing energy demand for heating.

Quantitative estimates of climate change impacts on energy demand are described in Section 5.2.

3.8 OIL, GAS, AND COAL PRODUCTION

Current Vulnerabilities

Although Albania's oil production facilities are not considered to be directly vulnerable to climate risks to any great extent, the ability to import LPG or to export crude oil products depends on shipping ports. At present, extreme weather can delay ships arriving into Vlore Port by one to two days, although wider channels being opened at Vlore Port in summer 2009 will reduce this problem. Furthermore, it is understood that the port has a transgressive geological structure though current rates of erosion are not well understood (Acclimatise, 2009a).

Oil production facilities at Patoz Marinza are one of five European hotspots for contaminated land (UNEP, 2000). Pollution carried via drainage channels into the Gjanica River, which is heavily contaminated by oil operations, and contamination pathways are affected by climatic influences on ground conditions.

The Ballsh oil refinery is vulnerable to electricity disruptions: it relies on the grid, and if a power cut lasts more than an hour, financial losses estimated at $100,000 or above can occur (Acclimatise *et al*., 2009a).

The existing low-pressure gas pipelines from Fier and Ballsh have experienced loss of integrity in the past, due to landslips at valley crossings after storms and heavy downpours. These risks are seen as minimal, however, when compared to the risk of sabotage.

Albania's coal industry is small, employing only about 200 people at present (Acclimatise *et al*., 2009a). Coal is stored outdoors, sometimes on slopes, and is therefore vulnerable to heavy rainfall, which can lead to loss of product and also ground and water contamination.

Risks and Opportunities

Higher temperatures are not anticipated to affect oil production facilities significantly. Indeed, there may be a slight positive effect of warming temperatures on their cost profile.

However, unless steps are taken to adapt new and existing port developments, port operators could face increased risk of flooding and storm damage, with consequent service disruption for oil producers and increased operating costs. Furthermore, it is not clear whether the new design for Vlore Port takes into account projections of rising sea levels, but, given the fact that the coastline is eroding, increased risk of coastal erosion is a potential cause for concern.

The existing problems with contaminated land and watercourses at Patos Marinza could be exacerbated if, as projected, climate change brings increased summer droughts. The consequent changes in ground conditions could create new pathways for pollutants, which would then flush through into water courses during heavy downpours, worsening an already difficult situation.

The low-pressure gas pipelines from Fier and Ballsh could see increased risk of landslips, associated with projected increased incidence of heavy downpours as a result of climate change.

The main climate change impacts on Albania's limited coal facilities are also likely to result from heavy downpours of rain, which could lead to increased loss of product and increased risks of ground and water contamination.

As outlined in Section 1, the focus of this assessment is on how Albania can best manage its future security of energy supply in the face of climate change. Given that oil, gas, and coal production assets are not key factors in Albania's energy security, impacts on these assets were not taken forward as part of the cost–benefit analysis. However, it is clear from the analysis outlined in this section that oil, gas, and coal production are vulnerable to changing climate risks, and the issues identified here merit further consideration by the decision makers responsible for these activities.