Assessing climate change risk of SREP investments

Scoping note

This note explores the possibility of undertaking an analysis of climate change risks for pilot countries participating in the Program for Scaling-Up Renewable Energy in Low Income Countries (SREP) as part of the investment planning process. The results of this analysis will be compiled and published as an edited book. MDBs and governments will be invited to co-author individual chapters summarizing case studies.

Introduction

The SREP aims to pilot and demonstrate, as a response to the challenges of climate change, the economic, social and environmental viability of low carbon development pathways in the energy sector by creating new economic opportunities and increasing energy access through the use of renewable energy. The SREP assists low income countries to initiate transformational change by exploiting their renewable energy potential in place of fossil-based energy supply and inefficient use of biomass.

In implementing the SREP, pilot countries are requested to prepare an investment plan that achieves national-scale outcomes and meets SREP objectives. Such plans represent a strategic framework for the preparation of programs and projects on renewable energy that include SREP financing. It is expected that the investment plans would be based on energy plans and analysis (e.g. projections of demand for energy, alternatives for energy supply, cost benefit analyses, risks and others) that aim to inform decisions on the scope and direction of near term investments under the SREP.

Low carbon development is one avenue for addressing climate change through mitigation. But even with mitigation efforts in place some level of climate impact is unavoidable. Changes in climate patterns, including the frequency and severity of extreme events and inter-annual variability, have direct implications on the planning and day to day operations of businesses, government agencies and other organizations. Climate impacts vary from place to place and can include higher temperatures, altered rainfall patterns and hydrology, and more frequent and/or intense extreme events (for example, more frequent and severe hot days, drought, floods, cyclones and storms).

From an investment perspective, climate change poses additional risks which should be evaluated and addressed to reduce exposure and future costs. Climate change and variability can have direct impacts on the long term sustainability of renewable energy, and require analysis of climate change, potential impacts and options for their management on time horizons commensurate with climate change (e.g. the medium and longer term, beyond thirty or fifty years time horizons). Such analysis could strengthen planning under SPEP if integrated into the investment planning process.

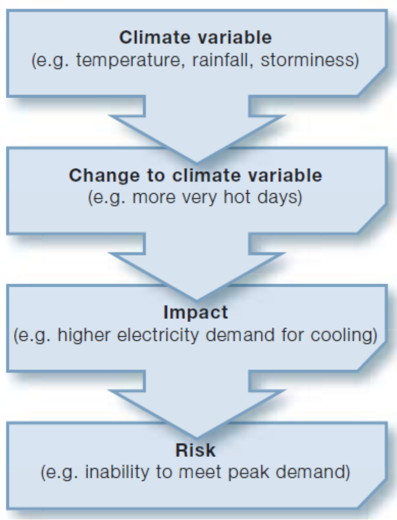
Assessing climate risks to renewable energy investments

Energy services and resources will be increasingly affected by climate change. Direct impacts on energy supply and demand are the most intuitive but there are also direct effects on energy resource endowment (particularly for weather dependent renewables), infrastructure and transportation, and indirect effects through other economic sectors (e.g. water, agriculture). Such impacts may undermine future economic growth by risking energy security, increasing demand for energy and decreasing its supply, and by exacerbating conflicting resource use. Renewable energy investments may be particularly threatened given the dependency of most technologies on weather. Annex I presents a summary of the main impacts and risks faced by renewable energy investments.

Future planning and infrastructure decisions need to consider climate conditions and projections to avoid locking in mal-adjusted and long lived infrastructure and unsustainable consumption patterns. While energy investments typically address climate risks (for example, weather data is essential for planning the selection of sites; forecast of temperature, visibility and others are used to manage fuel transport; and others), less experience is available on the medium and longer term implications of climate change and variability. Information, knowledge and action on energy sector adaptation to climate impacts is nascent, even recognizing that projected climate change is likely to exacerbate current risk and vulnerability, and introduce more uncertainty.

From an investment perspective, impacts of climate change should be treated as an additional risk (Figure 1). Evaluating and addressing this risk is, as with any other source of risk, required to ensure financial, economic, environmental and social performance, especially when relying on long-lived fixed assets as is the case with the energy sector.

Figure 1: From climate change to climate risk



Source: Climate change impacts and risk management:
A guide to business and government (CSIRO)

In practical terms, evaluating and addressing climate change risks can help answer the following questions:

- How significant is the exposure of renewable investments to climate impacts? What is known? Where are the gaps in knowledge?
- What linkages are there with other sectors (for example, with agriculture in terms of water availability, or with the residential sector in terms of energy demand)?
- What are the linkages with other risks, for example the volatility of oil price?
- What are the implications of these impacts for the planning of investments for the short, medium and long term? How can these impacts be managed or addressed?

- What is the experience in dealing with climate risk and uncertainty? Should they be addressed now or later? What is the downside?
- How much will it cost?

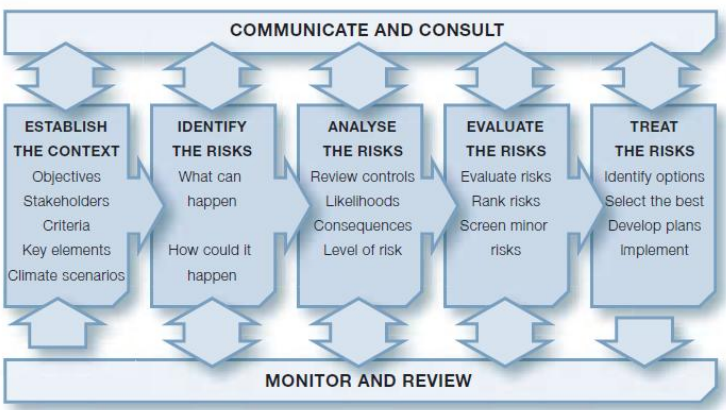
Providing an answer to these questions would strengthen the planning and decision making processes for renewable energy investments by expanding the scope and inventory of risk.

<u>Suggested approach</u>

This note suggests a coordinated and voluntary process to assess the risks associated with climate change on renewable energy investment in the context of the SREP. This process is intended as an integral part of the investment planning process, which targets transformational change. The evaluation and consideration of climate risk would strengthen investment plans by reducing future risk, given the high vulnerability of renewable energy in general and of SREP pilot countries in particular.

Figure 2 presents an approach to address climate change risk, based on the typical components of risk assessment and management. The process includes three main tasks: i) climate risk and vulnerability assessment, ii) climate risk management, and iii) the identification and evaluation of adaptation options (e.g. cost-benefit analysis). It is important at each stage to ensure proper consultation with affected stakeholders and to establish a process to monitor and review the success of the assessments and implementation of identified actions. Climate risk assessment, like other business risk management processes, focuses on the short to long term and requires an iterative approach that allows assumptions and plans to be revisited and updated as new information becomes available.

Figure 2: Evaluating Climate Risks



Given the objectives and nature of SREP, as well as the diversity of pilot countries, a coordinated process to assess climate risk across pilot countries requires a participatory approach and flexibility. As regards flexibility, pilot countries will be able to decide on the objective of the study, that is, whether it will be conducted as a means to decide on the choice of investments (e.g. as one of the initial steps in the planning of investments), or as a means to climate proof pre-identified investments (e.g. as one of the final steps over decisions already taken). Pilot countries will also be able to decide on the scope of the analysis.

A participatory process is required to bring input from various stakeholders, their views and knowledge of the energy sector, its vulnerabilities and links to other sectors, and feasible adaptation actions. The three tasks listed above could therefore by undertaken by a mixture of workshops and preparatory work leading to a thorough assessment of climate change risk and options to address it.

The following paragraphs provide a broad description of the three tasks outlined above. These tasks could be accomplished by a tailored process to be developed by the country in response to its own needs. The Energy Sector Management Assistance Program (ESMAP) has developed a toolkit to assist countries in raising awareness and conducting a semi-quantified risk assessment of energy vulnerabilities and adaptation options anchored in a participatory process. The Hands-on Energy Adaptation Toolkit (HEAT) has been designed to lead practitioners through the assessment of climate vulnerabilities and adaptation options in the energy sector of a given country. This toolkit provides detailed information on the tasks, steps and input required to conduct each of the tasks identified above, including an estimate of the time required. It can also help the user in raising awareness among key stakeholders and initiate dialogue on energy sector adaptation.[1]

Task 1: Climate vulnerability and risk assessment

- *Objective*: to understand the exposure of renewable energy investments to climate change and assess the risk of such impacts. Depending on the approach selected by a country, the risk assessment could be undertaken when identifying potential investments to better understand the design criteria, technologies and/ or locations that are better suited for a given country. Alternatively, if renewable energy technologies and/ or locations have been identified, the risk assessment could be undertaken to assess potential climate vulnerabilities and options for their management (Task 2).

- *Indicative work involved*: identify stakeholders (e.g. energy – public and private, hydromet service provides, academia/ energy institutes engaged in planning, etc), compile climate data and projections, identify current renewable energy (RE) vulnerability to weather and sensitivity to climate change, identify and agree vulnerability criteria and indicators, assess the vulnerability of planned RE investments, and prioritize risks.

- *Modality*: the work could be undertaken through a hands-on workshop supported by bi-lateral meetings with key stakeholders and associated preparatory work

- *Output*: Identification of RE vulnerabilities and potential risks to planned renewable energy investments (quantified if possible). Stakeholder awareness increased.

Task 2: Risk management

- *Objective*: to identify and discuss adaptation options that can help reduce and manage climate risk.

- *Indicative work involved*: identify good practice in adaptation, brainstorm on risk management options, list alternatives, develop matrix of integrated adaptation measures.

[1] More information is available at http://esmap.org/esmap/http%3A/%252Fesmap.org/node/42/edit

- *Modality*: the work could be undertaken by means of a hands-on participatory workshop underpinned bi-lateral meetings with key stakeholders and associated preparatory work

- *Output*: Matrix of integrated adaptation measures (Table 1)

Table 1. Typology of adaptation measures

BUILDING ADAPTIVE CAPACITY
IMPROVED KNOWLEDGE SYSTEM
DATA COLLECTING AND MONITORING, RESEARCH AND AWARENESS RAISING
SUPPORTIVE FRAMEWORK FOR ACTION
ENHANCING THE CAPACITY OF LOCAL INSTITUTIONS, WORKING IN PARTNERSHIPS AND SUPPORTIVE PUBLIC GOVERNANCE
DELIVERING ADAPTATION ACTIONS
PREVENTING EFFECTS OR REDUCING RISKS
RE-LOCATION OF ACTIVITIES
CLIMATE-PROOFING OF INFRASTRUCTURE
INTRODUCTION OF MULTIPLE LAND USE STRATEGIES THAT ACCOUNT FOR CLIMATE RISKS
IMPLEMENTATION OF EMERGENCY, CONTINGENCY AND DISASTER PLANNING
SHARING RESPONSIBILITY FOR LOSSES OR RISKS
INSURANCE
DIVERSIFICATION OF ENERGY SOURCES
EXPLOITING OPPORTUNITIES
DEMAND SIDE MANAGEMENT
DECENTRALIZED ENERGY STRUCTURE
URBAN DESIGN AND LAND USE PLANNING

Task 3: Cost-benefit analysis

- *Objective*: to assess the costs and benefits of different adaptation options with a view to taking a decision on those that are more cost-effective.

- *Indicative work involved*: gathering information on costs of different adaptation alternatives, assessment of constrains/barriers, preparatory work applying rapid cost-benefit analysis, undertaking and discussing cost-benefit analysis.

- *Modality*: the work could be undertaken as part of the risk management workshop with some preparatory work.

- *Output*: results of cost-benefit analysis identifying the most cost-effective adaptation options.

Indicative timing and costs

The costs and timing of a climate change risk assessment and management study will depend on the specific context of the country as well as its interests. Factors such as the number of stakeholders to be involved in the process, the availability and requirements of consultants, local salaries and the availability of data, projections and other information determine the total costs. The table below is intended to gather in broad terms the tasks and costs involved in a typical study and provides a very rough indication of costs and timing based on some assumptions. The values included in this table should not be interpreted as a guide to costs and timing.

Task	***Timing***	***Length***	***Estimated cost***
Agreement to participate	At the scoping mission	N/A	N/A
Definition of scope and approach	At the joint mission	N/A	N/A
Identification of team and consultants	At the joint mission or shortly after	N/A	USD 50.000[2]
Preparatory work for first workshop	Immediately after the joint mission	1 month	Included under "team"
Conduct of first workshop (and smaller meetings with stakeholders)	Two months after joint mission (or together with first workshop of the preparation of investment plans)	2 days	USD 25.000[3]
Analysis of results of first workshop	After the workshop	15 days	Included under "team"
Preparatory work for second workshop	Immediately after the workshop	30 days	Included under "team"
Conduct of second workshop (and smaller meetings with stakeholders)	Two months after the first workshop (or in conjunction with the second workshop)	2 days	USD 25.000, costs could be lower if combined with other workshops
Analysis of results of second workshop	After the second workshop	15 days	Included under "team"
Optional: cost-benefit analysis	After analysis of second workshop	1 month	USD 20.000
Final report		1 week	N/A
Total		4 months	USD 120.000

[2] The team could be composed, for example, by a lead professional (4 months at USD 5.000/month), 1 secretary (4 months at USD 2.000/month), 3 consultants, one per task (1 month at USD 5.000/month if local or regional) and an international specialist (1 month at USD 10.000/month). Costs could be lower if staffs involved in the investment plan undertake some responsibilities.

[3] A workshop of USD 25.000 could cover, for example, USD 1.000 for venue and hospitality; USD 1.000 for logistics; participation of 10 stakeholders from outside the venue city (2 days at USD 300 per day and USD 500 for airfare) and 2 experts from outside the country (2 days at USD 300 and USD 3000 for airfare). Costs could be lower if the workshop is combined with other workshops to develop the investment plan

It should be noted that the Global Support Program could assist with climate data and projections. ESMAP could also contribute with in-kind expertise.

Annex I: Climate change and renewable energy sources

Item	Relevant Climate Impacts			Impacts on the Energy Sector
	General	Specific	Additional	
Climate Change Impacts on Resource Endowment				
Hydropower	Runoff	Quantity (+/-) Seasonal flows high & low flows, Extreme events	Erosion Siltation	Reduced firm energy Increased variability Increased uncertainty
Wind power	Wind field characteristics	Changes in density wind speed increased wind variability	Changes in vegetation might change roughness and available wind	Increased uncertainty
Biofuels	Crop response to CC	Crop yield Agro-ecological zones shift	Pests Water demand Drought, frost, fires, storms	Increased uncertainty Increased frequency of extreme events
Solar power	Atmospheric transmissivity	Water content Cloudiness Cloud characteristics	Pollution/ dust and humidity absorb part of the solar spectrum	Positive and negative impacts reported
Wave and tidal energy	Ocean climate	Wind field characteristics No effect on tides	Strong non-linearity between wind speed and wave power	Increased uncertainty Increased frequency of extreme events
Climate Change Impacts on Energy Supply				
Hydropower	Water availability and seasonality	Water resource variability Increased uncertainty of expected energy output	Impact on the grid Might Overload transmission capacity Extreme events	Increased uncertainty Revision of system reliability Revision of transmission needs
Wind power	Alteration wind speed frequency distribution	Increased uncertainty of energy output.	Short life span reduces risk associated with CC Extreme events	Increased uncertainty on energy output.
Biofuels	Reduced transformation efficiency	High temperatures reduce thermal generation efficiency	Extreme events	Reduced energy generated Increased uncertainty
Solar power	Reduced solar cells efficiency	Solar cells efficiency reduced by higher temperatures	Extreme events	Reduced energy generated Increased uncertainty
Thermal power plants	Generation cycle efficiency Cooling water availability	Reduced efficiency Increased water needs during heat waves	Extreme events	Reduced energy generated Increased uncertainty
Oil and gas	Vulnerable to extreme events.	Cyclones, floods, erosion and siltation.	Extreme events.	Reduced energy generated Increased uncertainty.
Other Climate Change Impacts				
Transmission ,	Increased	Wind and ice	Erosion and siltation.	Increased vulnerability of

Item	Relevant Climate Impacts			Impacts on the Energy Sector
	General	Specific	Additional	
distribution and transfers	frequency of extreme events. Sea level rise.	Landslides & flooding. Coastal erosion, sea level rise.	Weather conditions that prevent transport.	existing assets.
Sitting infrastructure	Sea level rise. Increased extreme events.	Flooding from sea level rising, coastal erosion. Increased frequency of extreme events.	Water availability. Permafrost melting. Geomorphodynamic equilibrium.	Increased vulnerability to existing assets. Increased demand for new good sitting locations.
Energy Use	Increase demand for indoor cooling.	Reduced growth in demand for heating. Increased energy use for indoor cooling.	Associated efficiency reduction with increased temperature.	Increased demand and peak demand taxing transmission and distribution systems
Energy Trade	Increased vulnerability to extreme events.	Cold spells and heat waves.	Increased stress on transmission, distribution and transfer infrastructure.	Increased uncertainty. Increased peak demand on energy system.
Cross-Sector Impacts	Competition for water resources. Competition of adequate sitting locations.	Conflicts in water allocation during stressed weather conditions. Competition for good sitting locations.	Potential completion between energy and non-energy crops for land and water resources.	Increased vulnerability and uncertainty. Increased costs.
Down time and system bottlenecks	Extreme weather events.	Impacts on isolated infrastructure. Compound impacts on multiple assets in the energy system.	Energy system not fully operational when community required it the most.	Increased vulnerability. Reduced reliability Increased social pressure for better performance.