Hands-on Energy Adaptation Toolkit (HEAT)

THE WORLD BANK

The full on-line version of this toolkit and accompanying documentation and examples are available on ESMAP's web site www.esmap.org

ESMAP
Energy Sector Management Assistance Program

Energy Sector Management Assistance Program
The World Bank
1818 H Street, NW
Washington, DC 20433 USA
email: esmap@worldbank.org
web: www.esmap.org

ESMAP Copyright Disclaimer

Energy Sector Management Assistance Program (ESMAP) reports are published to communicate the results of ESMAP's work to the development community with the least possible delay. Some sources cited in this report may be informal documents that are not readily available.

The findings, interpretations, and conclusions expressed in this report are entirely those of the author(s) and should not be attributed in any manner to the World Bank, or its affiliated organizations, or to members of its board of executive directors for the countries they represent, or to ESMAP. The World Bank and ESMAP do not guarantee the accuracy of the data included in this publication and accepts no responsibility whatsoever for any consequence of their use. The boundaries, colors, denominations, other information shown on any map in this volume do not imply on the part of the World Bank Group any judgment on the legal status of any territory or the endorsement of acceptance of such boundaries.

About the Toolkit

(i) Overview

- Many countries are increasingly vulnerable to destructive weather events—floods, droughts, windstorms, or other parameters. The vulnerability is driven in part by climate but also by countries' sensitivity to events exacerbated by past practices, socioeconomic conditions, or legacy issues. The degree to which vulnerability to weather affects the countries' economies is driven by their coping or adaptive capacities.

- Seasonal weather patterns, weather variability, and extreme events can affect the production and supply of energy, impact transmission capacity, disrupt oil and gas production, and impact the integrity of transmission pipelines and power distribution networks. Climate change also affects patterns of seasonal energy demand. It is important to explore these vulnerabilities for the energy sector given its major contribution to economic development, the long life span of energy infrastructure planning, and the dependence of energy supply and demand on weather.

- **HEAT– A Hands-on Energy Adaptation Toolkit** is designed to lead you through as assessment of climate vulnerabilities and adaptation options in the energy sector of your country. **HEAT** can help you raise awareness among key stakeholders and initiate dialogue on energy sector adaptation.

- **HEAT** uses a bottom-up, stakeholder-based, qualitative/semi-quantitative risk-assessment approach to discuss and identify risks, adaptation measures, and their costs and benefits. It draws on experience and published guidance from the United Kingdom and Australia, as well as existing research and literature.

- **HEAT**'s climate vulnerability assessment framework puts stakeholders at the heart of the decision-making process and involves:
  - Climate risk screening of the energy sector to identify and prioritize hazards, current vulnerabilities, and risks from projected climate changes out to the year 2050.
  - Identification of adaptation options to reduce overall vulnerability.
  - A high-level cost benefit analysis of key physical adaptation options.

- **HEAT** has been successfully piloted in Albania and Uzbekistan. This experience has demonstrated how **HEAT** can help countries and energy sector stakeholders develop policies and projects that are robust in the face of climatic uncertainties, and assist them in managing existing energy concerns as the climate changes. **HEAT** identifies key direct risks to energy supply and demand and options for adaptation to establish where to focus subsequent in-depth analyses. It also identifies additional research needed to better understand the implications of extreme climatic events for the energy sector as well as potential indirect impacts—such as possible adaptation actions in the agriculture sector that may affect energy supply.

About the Toolkit (cont.)

(ii) The Assessment Process

This toolkit has been designed to support hands-on climate vulnerability and adaptation assessments of the energy sector. It provides a risk-based process to inform high-level decision-making by governments about how to adapt the energy sector to improve its resilience to climate variability and climate change.

The **outputs** of the process are:

- A greater awareness and deeper understanding among stakeholders,
- High-level (semi-quantitative) assessments of key risks and adaptation options for the energy sector,
- Clarity on where subsequent more in-depth analyses should be focused.

The risk-based process is broken down into **eight stages**, shown in the **Framework Diagram**. It is based around two participatory workshops and related meetings, designed to engage energy sector stakeholders in thinking about climate resilience:

- A **first workshop and series of meetings** on 'Climate risks & vulnerabilities',
- A **second workshop and meetings** on 'Climate risk management and cost-benefit analysis'.

For each of the eight stages, the toolkit provides instructions on:

- ***Who's involved*** in undertaking the stage,
- ***Timing*** for when to do each stage and the time required to undertake each stage,
- ***Key questions*** that should be answered at each stage,
- ***Tools*** to help,
- ***Guidance*** describing what should be done at each stage,
- ***Outputs*** of each stage,
- ***Examples*** of how the process was undertaken in Albania (2009) and Uzbekistan (2010).

About the Toolkit (cont.)

(iii) Stages and Timing

The following table summarizes all the stages of the process, timing and time required for their completion :

Stage	Stage description	Timing	Time required
1.1	Define scope of the assignment	**Before** *'Climate risks and vulnerabilities'* workshop	5–10 days
1.2	Identify and mobilize stakeholders	**Before** *'Climate risks and vulnerabilities'* workshop	Approx. 10 days
1.3	Undertake preparatory work on the risks and vulnerabilities of energy sector	**Before** *'Climate risks and vulnerabilities'* workshop	10-15 days
2.1	Prepare risks and vulnerabilities evaluation framework for energy sector	**Before** *'Climate risks and vulnerabilities'* workshop	2 days
3.1	Run plenary workshop session to set the scene for the workshop and engage stakeholders	**During** '*Climate risks and vulnerabilities'* workshop	2 hours
3.2	Undertake participatory vulnerability assessment and identify risks	**During** '*Climate risks and vulnerabilities'* workshop	6 hours
3.3	Gain views of key vulnerabilities & risks	**During meetings after** the '*Climate risks and vulnerabilities'* workshop	2-3 days
3.4	Analyze & evaluate priority risks	**Between** '*Climate risks & vulnerabilities*' workshop and '*Climate risk management and cost-benefit analysis*' workshop	2-4 weeks

About the Toolkit (cont.)

Stage	Stage description	Timing	Time required
4.1	Undertake preparatory work on adaptation options	**Between** '*Climate risks & vulnerabilities*' workshop and '*Climate risk management and cost-benefit analysis*' workshop	1-2 days
4.2	Validate risk register with stakeholders	**At start of** '*Climate risk management and cost-benefit analysis*' workshop	1 hour
4.3	Introduce CBA & agree CBA objectives & boundaries	**During** '*Climate risk management and cost-benefit analysis'* workshop	3.5 hours
4.4	Discuss & confirm adaptation options & parameters for CBA	**During** *'Climate risk management and cost-benefit analysis'* workshop	3.5 hours
4.5	Identify data gaps	**During and immediately following** the *'Climate risk management and cost-benefit analysis'* workshop	0.5 days
5.1	Obtain data for CBA	**During meetings after** the '*Climate risk management and cost-benefit analysis'* workshop	1 day
5.2	Discuss climate change risks associated with adaptation options	**During meetings after** the '*Climate risk management and cost-benefit analysis'* workshop	1 day

About the Toolkit (cont.)

Stage	Stage description	Timing	Time required
5.3	Undertake CBA	**Following** '*Climate risk management and cost-benefit analysis'* workshop and collection of data	Over a period of about 6 weeks
5.4	Discuss & confirm CBA with stakeholders	**Six to eight weeks after** '*Climate risk management and cost-benefit analysis'* workshop	4 hours
6.1	Is there enough information to design and implement adaptation measures?	**About eight weeks after** '*Climate risk management and cost-benefit analysis'* workshop	1 day
7.1	Undertake adaptation measures as per timetable	Work can commence **once adaptation measures have been confirmed**	Time required will vary depending on the adaptation measures
8.1	Monitor climate impacts on the energy sector	On an **ongoing** basis	As part of routine operations
8.2	Monitor the performance of the adaptation measures	On an **ongoing** basis	As part of routine operations
8.3	Monitor new scientific information on climate change & its impacts on the energy sector	**Following publication of** major new international and **national reports** on climate change and its impacts	Typically 1-2 days per major report

The Assignment Management Team

- The process should be led by Assignment Management Team who will need to engage with other energy sector stakeholders at various stages.

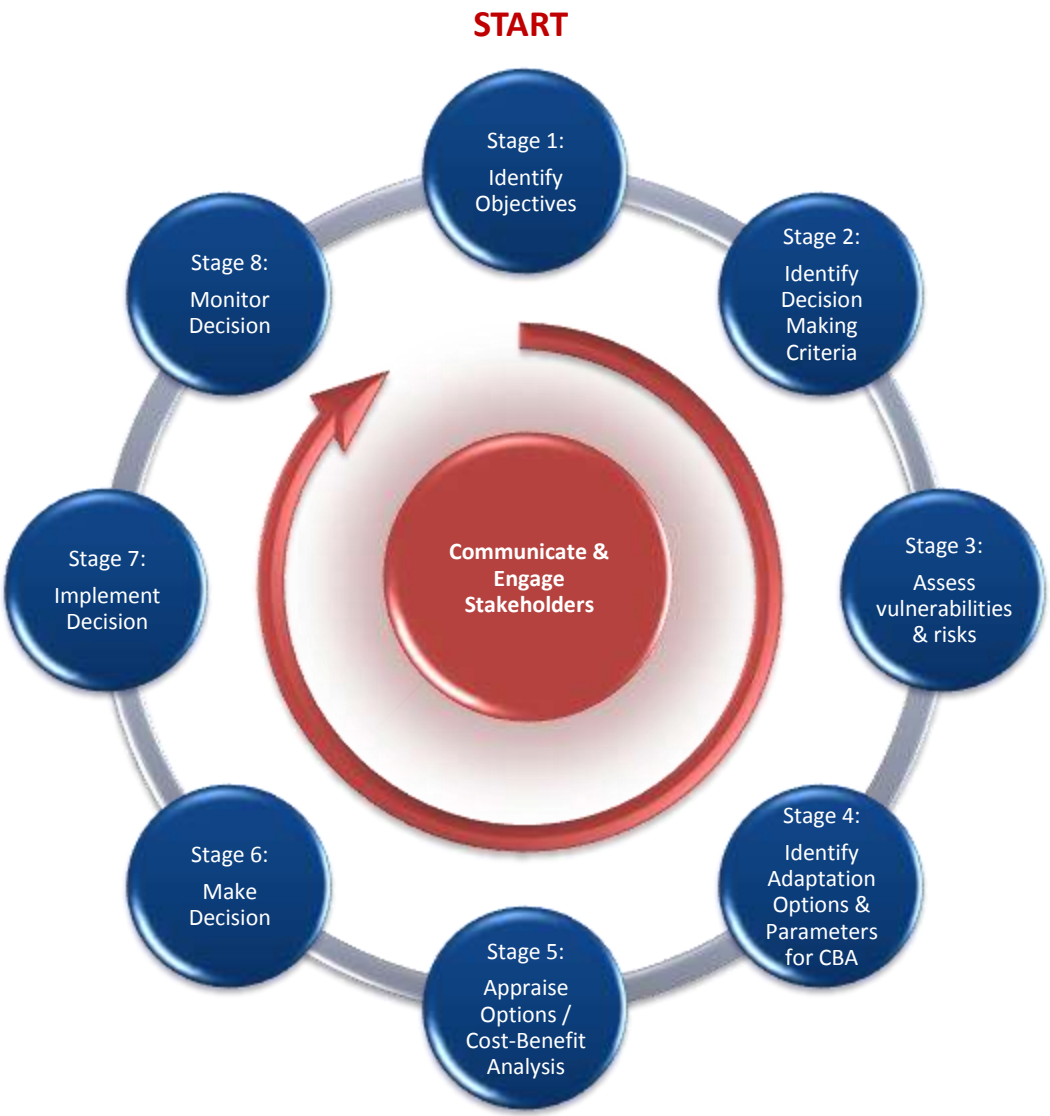
- **This toolkit has been designed to guide the Assignment Management Team through the process.**

- The Assignment Management Team should include experts with the following knowledge and skills:
  - Knowledge of the country's energy sector, including national energy strategies, energy sector stakeholders, energy assets and demand,
  - Knowledge of the technical, financial, environmental and social performance of energy assets and how these are affected by climatic and hydrological conditions,
  - Scientific expertise in climate change, its impacts and adaptation, and in the appropriate use of climate change data in decision-making,
  - Expertise in cost-benefit analysis, preferably specifically related to the energy sector,
  - Skills in delivering participatory assessments with stakeholders,
  - Administrative support for organizing workshops, meetings etc.

- Where all the cores skills are not available within the Assignment Management Team, it may be necessary to employ specialist consultants – for instance, to assist in delivering technical assessments.

- Delivering the assessment successfully will involve engaging senior decision-makers and technical experts in the energy sector. It is therefore important that the Assignment Management Team has credibility and good working relationships with those stakeholders.

- Furthermore, it is essential to have the support of a local 'champion' for the assignment, a senior decision-maker who can assist in initiating the process with other energy sector stakeholders, ensuring that they are fully engaged and supportive.



BEFORE WORKSHOP 1

DURING WORKSHOP 1

DURING MEETINGS 1

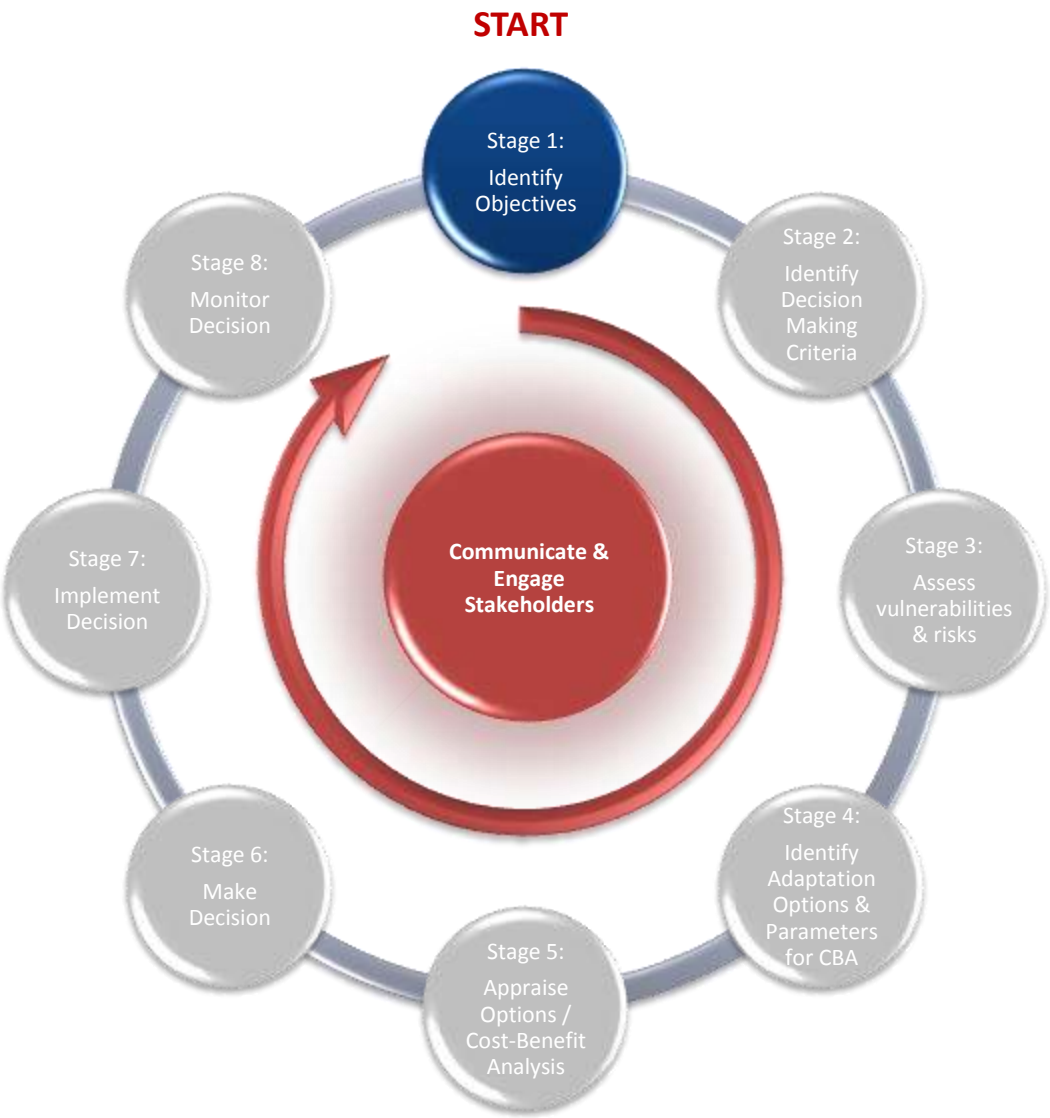
BEFORE WORKSHOP 2

DURING WORKSHOP 2

DURING MEETINGS 2

AFTER MEETINGS 2

IMPLEMENTATION & MONITORING



BEFORE WORKSHOP 1

- **STAGE 1.1**: Define scope of the assignment
- **STAGE 1.2**: Identify & mobilize stakeholders
- **STAGE 1.3**: Undertake preparatory work on climate risks and vulnerabilities of energy sector

DURING WORKSHOP 1

DURING MEETINGS 1

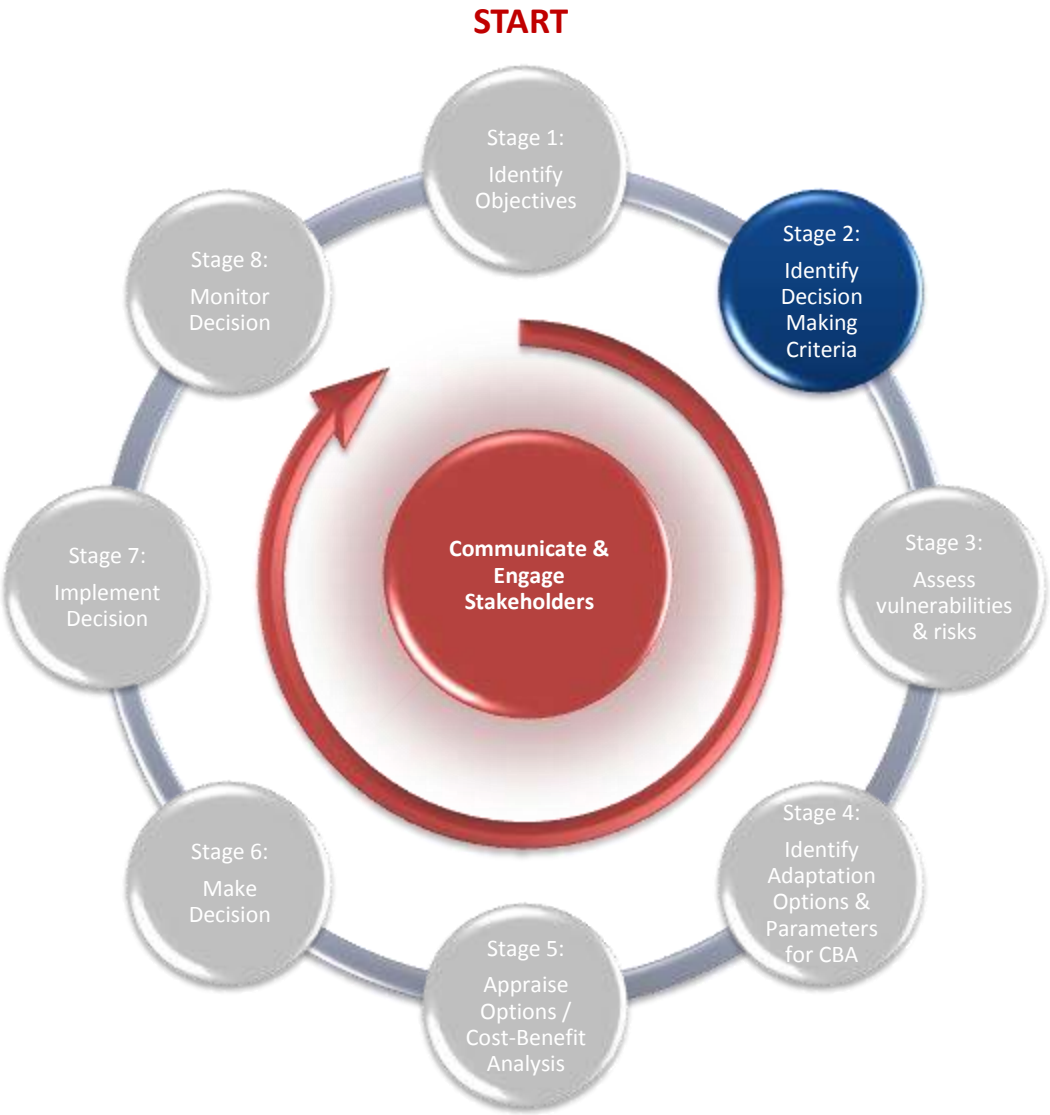
BEFORE WORKSHOP 2

DURING WORKSHOP 2

DURING MEETINGS 2

AFTER MEETINGS 2

IMPLEMENTATION & MONITORING



BEFORE WORKSHOP 1

- **STAGE 2.1**: Prepare risks & vulnerabilities evaluation framework

DURING WORKSHOP 1

DURING MEETINGS 1

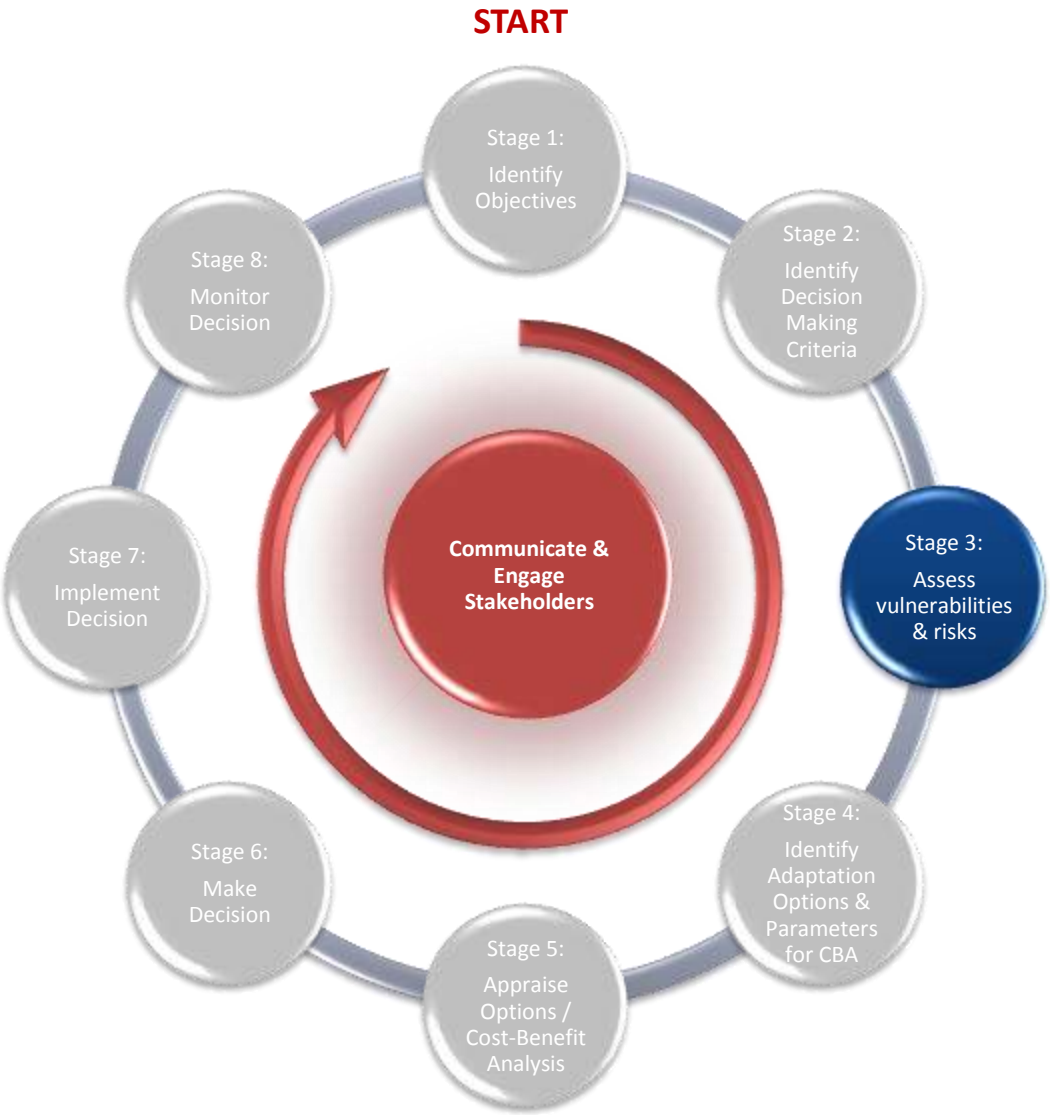
BEFORE WORKSHOP 2

DURING WORKSHOP 2

DURING MEETINGS 2

AFTER MEETINGS 2

IMPLEMENTATION & MONITORING



BEFORE WORKSHOP 1

DURING WORKSHOP 1

- **STAGE 3.1**: Run plenary workshop session
- **STAGE 3.2**: Undertake participatory vulnerability assessment & identify risks

DURING MEETINGS 1

- **STAGE 3.3**: Gain views of key vulnerability & risks

BEFORE WORKSHOP 2

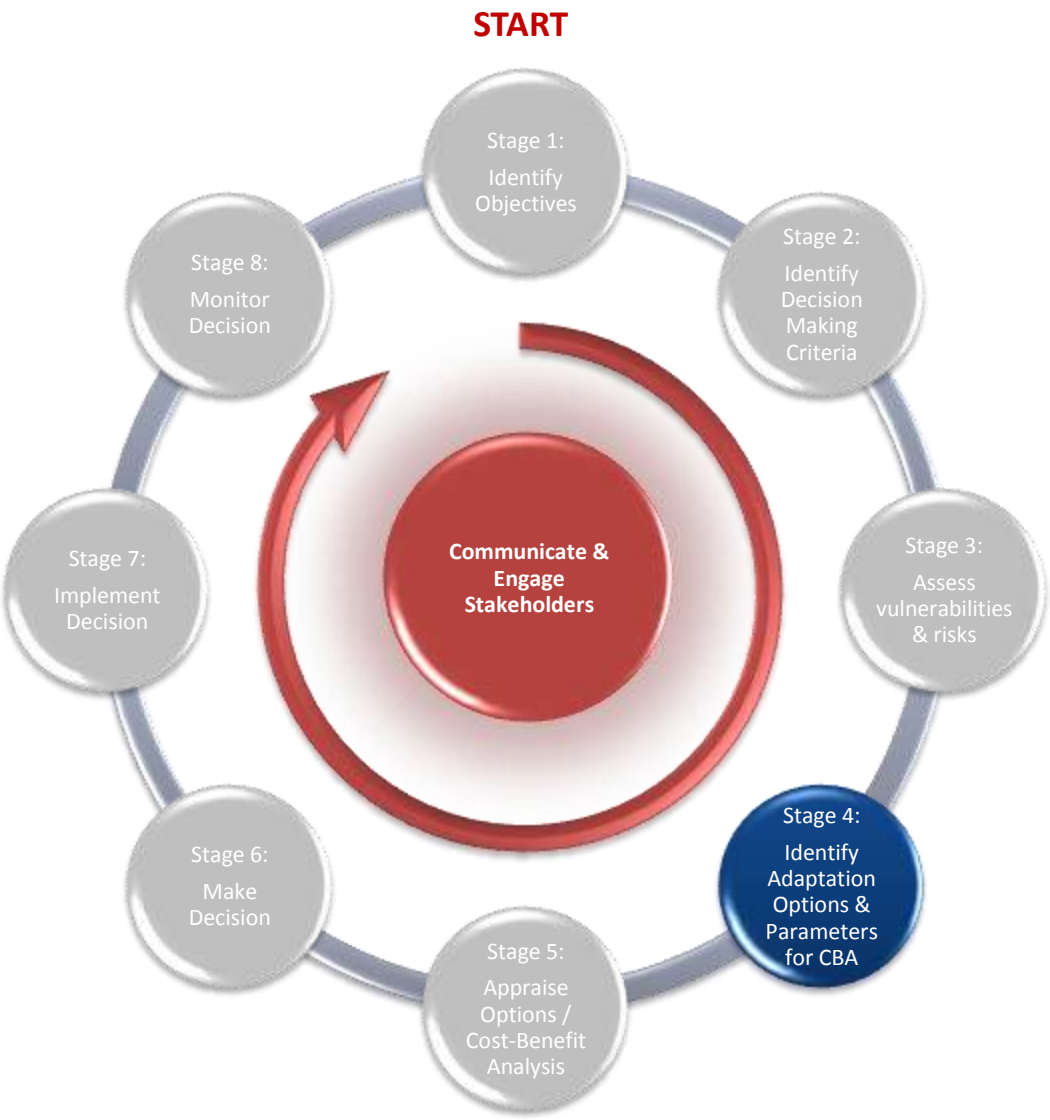
- **STAGE 3.4**: Analyze & evaluate priority risks

DURING WORKSHOP 2

DURING MEETINGS 2

AFTER MEETINGS 2

IMPLEMENTATION & MONITORING



BEFORE WORKSHOP 1

DURING WORKSHOP 1

DURING MEETINGS 1

BEFORE WORKSHOP 2

- **STAGE 4.1**:Undertake preparatory work on adaptation options

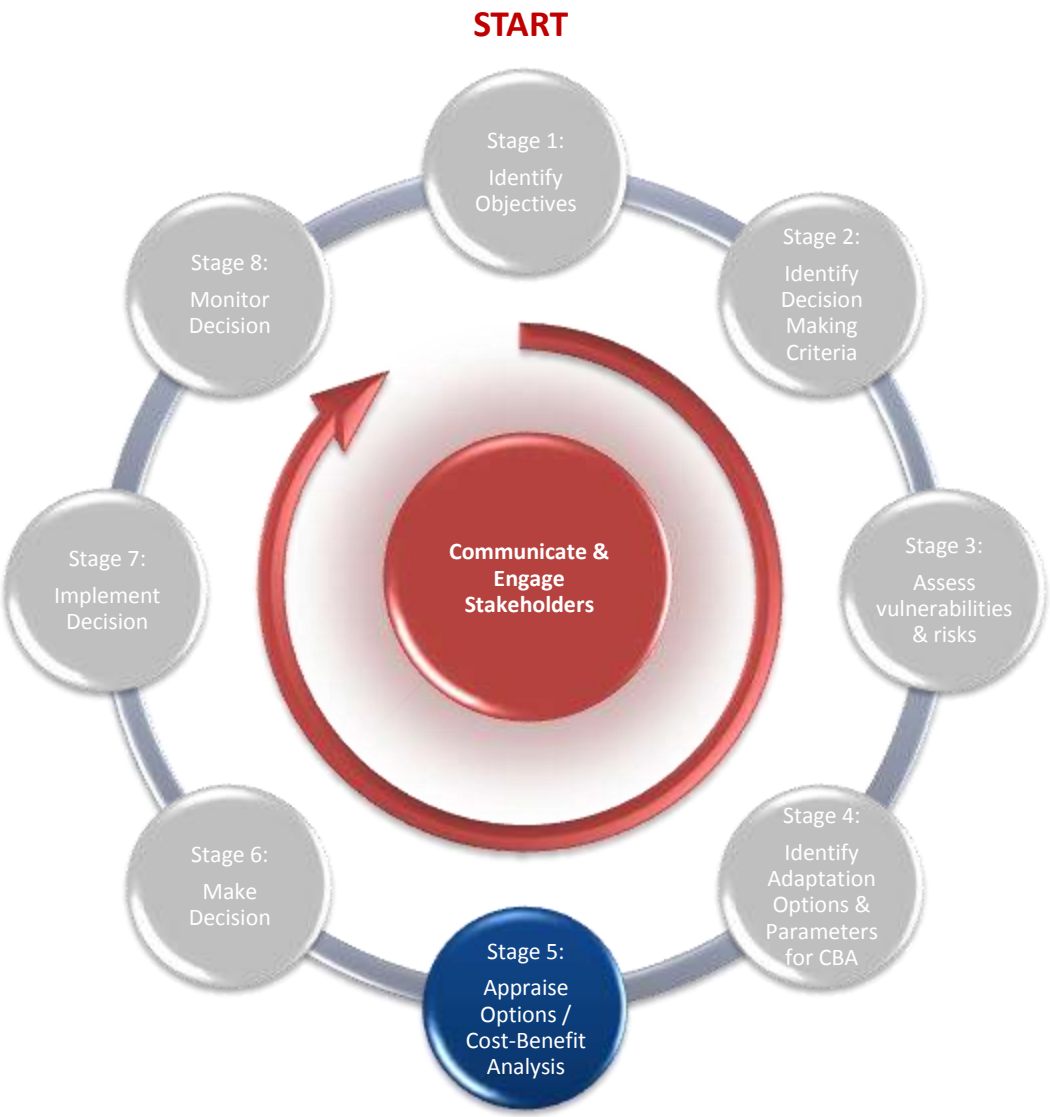
DURING WORKSHOP 2

- **STAGE 4.2**: Validate risk register with stakeholders
- **STAGE 4.3**: Introduce CBA & agree CBA objectives & boundaries
- **STAGE 4.4**: Discuss & confirm adaptation options & parameters for CBA
- **STAGE 4.5**: Identify data gaps

DURING MEETINGS 2

AFTER MEETINGS 2

IMPLEMENTATION & MONITORING



BEFORE WORKSHOP 1

DURING WORKSHOP 1

DURING MEETINGS 1

BEFORE WORKSHOP 2

DURING WORKSHOP 2

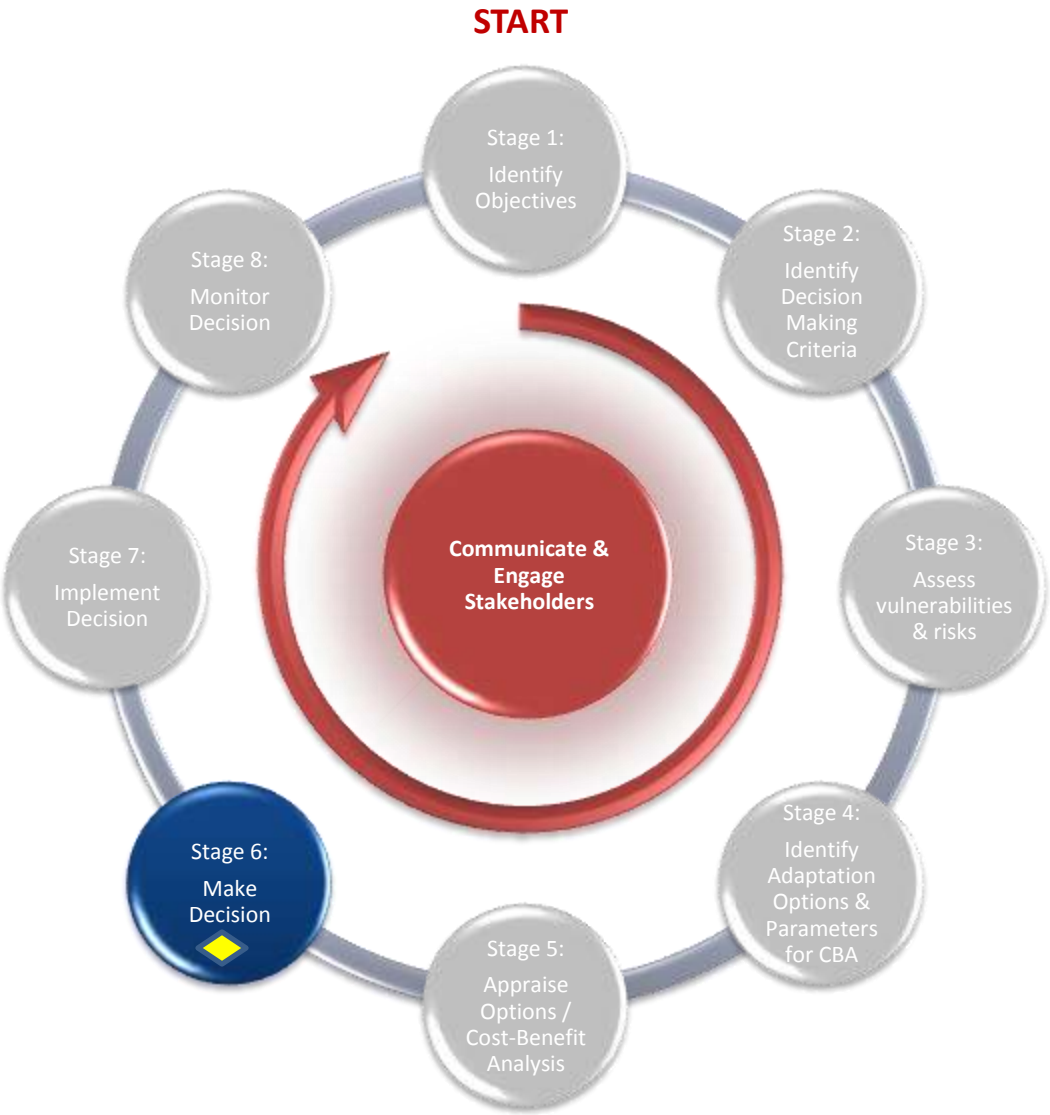
DURING MEETINGS 2

- **STAGE 5.1**: Obtain data for CBA
- **STAGE 5.2**: Discuss climate change risks associated with adaptation options

AFTER MEETINGS 2

- **STAGE 5.3**: Undertake CBA
- **STAGE 5.4**: Discuss & confirm CBA with stakeholders

IMPLEMENTATION & MONITORING



BEFORE WORKSHOP 1

DURING WORKSHOP 1

DURING MEETINGS 1

BEFORE WORKSHOP 2

- **STAGE 3.4**: Analyze & evaluate priority risks

DURING WORKSHOP 2

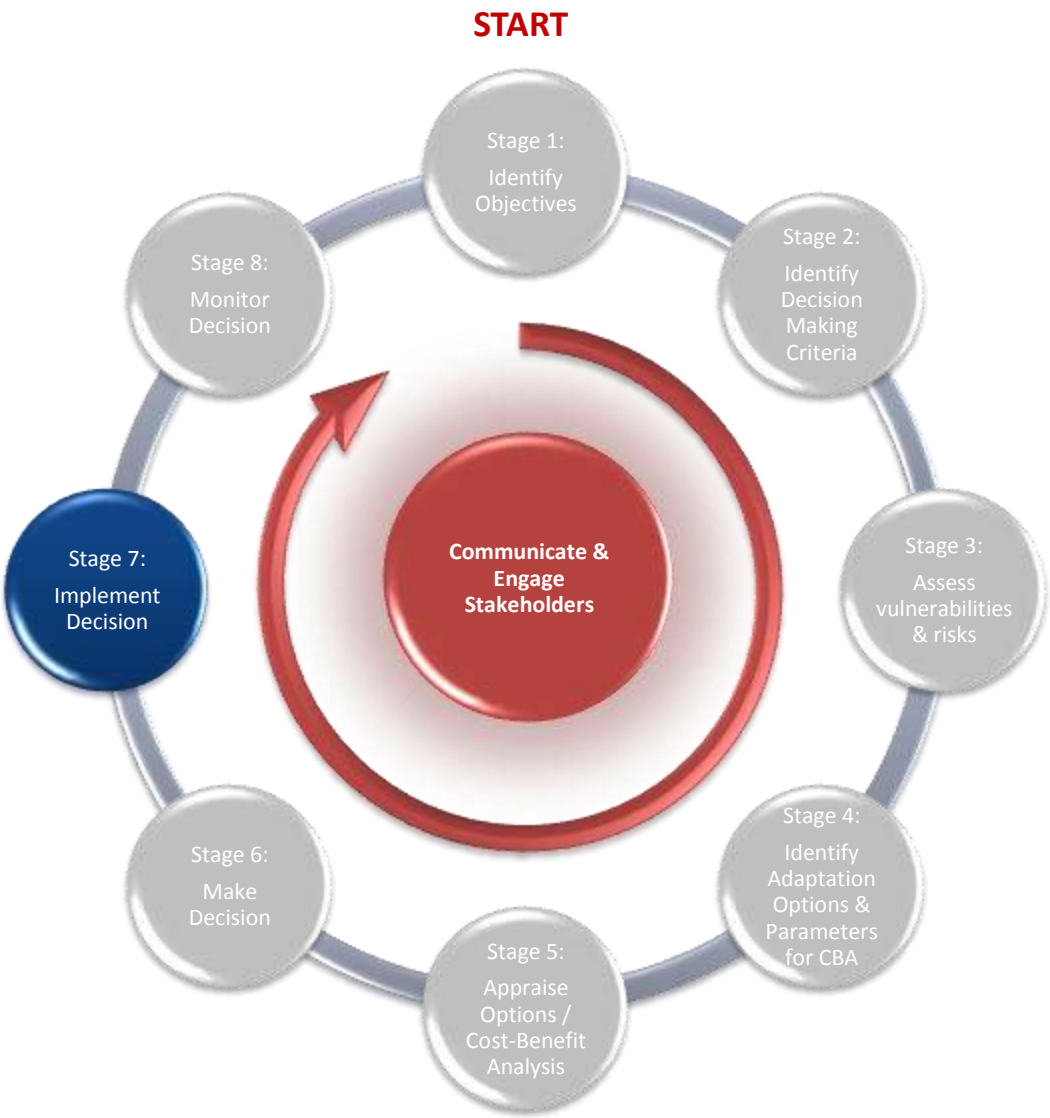
DURING MEETINGS 2

AFTER MEETINGS 2

- **STAGE 6.1**: Is there enough information to design and implement adaptation measures?
  - If **YES**, Continue to **STAGE 7.1**
  - If **NO**, Return to **STAGE 3.4**

IMPLEMENTATION & MONITORING

- **STAGE 7.1**: Undertake adaptation measures as per timetable



BEFORE WORKSHOP 1

DURING WORKSHOP 1

DURING MEETINGS 1

BEFORE WORKSHOP 2

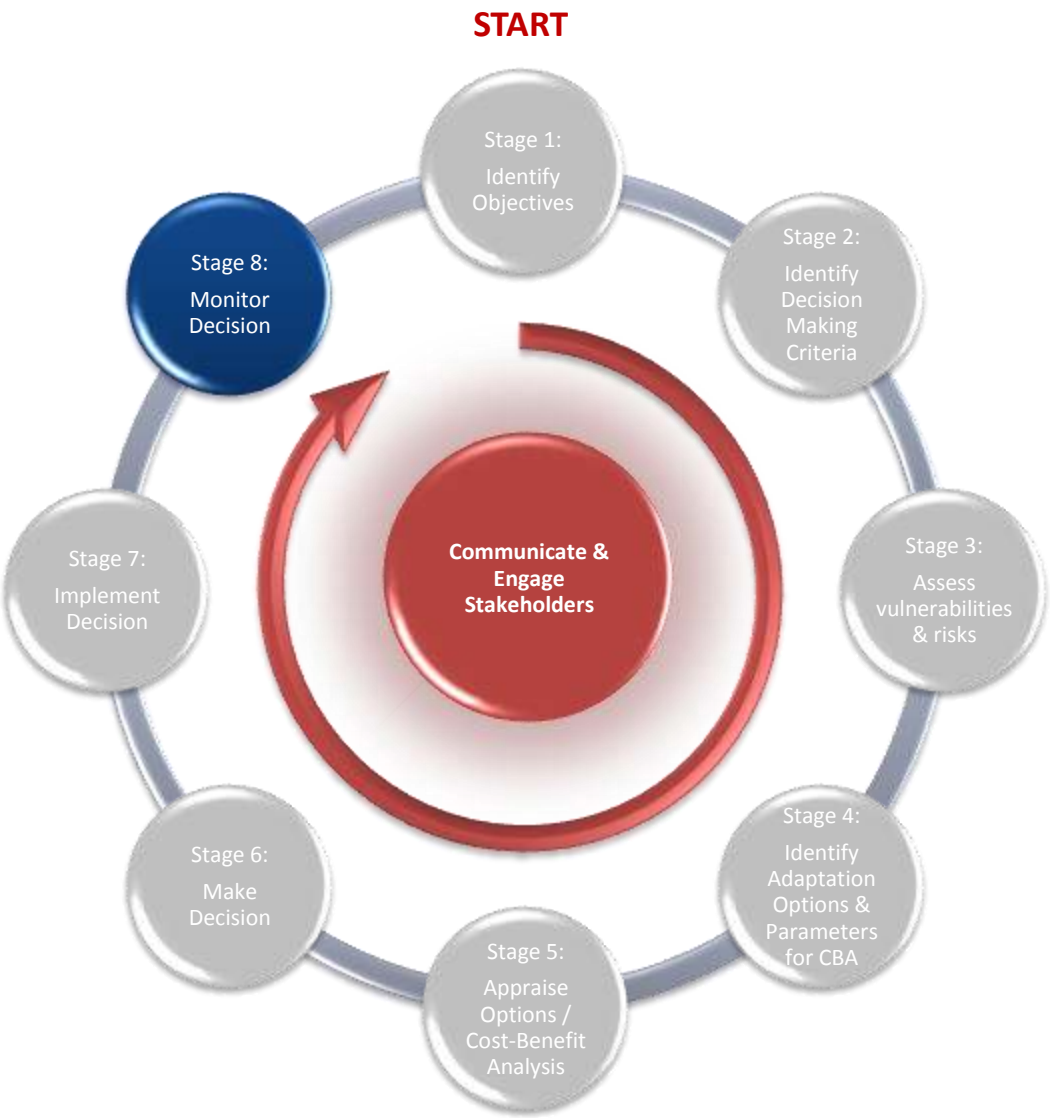
DURING WORKSHOP 2

DURING MEETINGS 2

AFTER MEETINGS 2

IMPLEMENTATION & MONITORING

- **STAGE 7.1**: Undertake adaptation measures as per timetable



BEFORE WORKSHOP 1

DURING WORKSHOP 1

DURING MEETINGS 1

BEFORE WORKSHOP 2

DURING WORKSHOP 2

DURING MEETINGS 2

AFTER MEETINGS 2

IMPLEMENTATION & MONITORING

- **STAGE 8.1**: Monitor climate impacts on the energy sector
- **STAGE 8.2**: Monitor the performance of the adaptation measures
- **STAGE 8.3**: Monitor new scientific information on climate change & its impacts on the energy sector

Stage 1.1: Define scope of the assignment

Who's involved

- Assignment Management Team

Timing & time required

- Before '*Climate risks & vulnerabilities*' workshop
- 5 – 10 days

Key questions

1. What are the objectives for the country's energy sector?
2. How does this assignment contribute to making these objectives climate change-resilient?

Tools

- Information on climate change and its energy sector impacts available globally and for the region:
  - reports on global and regional climate change Projections
  - data from global and regional climate change projections
  - data and reports on climate change and its impacts for the region

Guidance

1. Agree on the boundaries for the assignment, by considering:
   a. Overall objectives for the country's energy sector
   b. Objectives and scope of this assignment
   c. Energy activities covered by the assignment, e.g. fuel production; energy generation; transmission; distribution; energy demand; public and/or privately owned assets
   d. Geographical area concerned, e.g. country or sub-national scale
   e. Time horizons, e.g. 2020s, 2050s
2. Confirm roles, deliverables and timetable within the assignment team.
3. Undertake a literature review covering:
   a. International and national reports describing observed climate and hydrological data, and projected climatic changes;
   b. Country's National Communications on Climate Change to the UNFCCC
   c. National energy strategy documents.

Outputs

- Briefing paper describing:
  - overview of the information on observed and projected climatic changes
  - potential impacts of climate change on the country's energy sector
  - glossary of key climate change terms

ALBANIA	UZBEKISTAN
Albania Briefing Paper	Uzbekistan Briefing Paper

Stage 1.2 Identify and mobilize stakeholders

Who's involved

- Assignment Management Team

Timing & time required

- Before '*Climate risks & vulnerabilities*' workshop
- Approximately 10 days

Key questions

1. Who could contribute to, or benefit from, the assignment, and help to achieve its objectives?
2. How best can stakeholders be engaged in the assignment from the start?
3. Who should be invited to speak at the '*Climate risks & vulnerabilities*' workshop?
4. What plenary session speakers will most engage stakeholders?
5. Who should be invited to attend the workshop?
6. Who should be invited for detailed follow-on meetings?

Tools

- Briefing paper describing:
  - overview of information on observed and projected climatic changes for the country
  - potential impacts of climate change on the country's energy sector
  - glossary of key climate change terms

Guidance

1. Determine whose views need to be taken into account, who can contribute to the assignment and who needs to know its outcomes

2. Identify individual stakeholders to engage through workshops and detailed follow-on meetings among the following groups: government departments, ministries and agencies responsible for or related to the energy sector (covering energy, environment, water, climate and hydrometeorology, large energy users, finance and spatial planning); private energy companies; organizations representing large energy and water users (e.g. industry, agriculture, residential, commercial) professional institutes; academics/ research institutes; energy sector experts; and NGOs. The workshop can involve quite a large number of people – between 50 to 100.

3. Ensure that the stakeholders engaged include high-level decision-makers and technical experts

4. Hold telephone conferences / exchange emails with key stakeholders to:
   a. introduce the assignment and its objectives
   b. discuss the workshop and follow-on meetings and their objectives
   c. gain their commitment to being involved
   d. ask for their views on what the workshops should cover
   e. identify any work they have done on climate change risks and adaptation
5. Select workshop speakers and brief them on their roles
6. Prepare and send out invitations, agendas and briefing papers

Outputs

- List of energy sector stakeholders
- Records of telephone discussions with key stakeholders
- '*Climate risks and vulnerabilities*' workshop invitations, agenda and briefings for speakers
- Agendas for detailed follow-on meetings

ALBANIA	Workshop participants	
Meetings agenda	Meeting plan	Template workshop
Workshop invitation	Workshop agenda	Facilitators agenda

UZBEKISTAN
Workshop agenda

Return to Framework Diagram

Stage 1.3 Undertake preparatory work on climate risks and vulnerabilities of energy sector

Who's involved

- Assignment Management Team

Timing & time required

- Before '*Climate risks & vulnerabilities*' workshop
- 10 – 15 days

Key questions

1. Where are the country's existing and planned energy assets located?
2. What are the current and recent historic climatic conditions in the country?
3. How is the country's climate projected to change over coming decades?

Tools

- Briefing paper describing:
  - overview of information on observed and projected climatic changes for the country
  - potential impacts of climate change on the country's energy sector
  - glossary of key climate change terms

Guidance

1. Identify and map existing energy assets
2. Prepare a report that identifies and describes climatic hazards affecting the energy sector, covering:
   a. observed trends in climate and climate-related factors, and
   b. climate change projections for the country
3. Prepare a short presentation for the '*Climate risks and vulnerabilities*' workshop, describing observed and projected climatic hazards in the country
4. Prepare a short presentation on the vulnerability of the energy sector to climatic hazards
5. Pre-prepare materials for use in workshop discussions (see Stage 3.2)

Outputs

- Maps showing climate change projections and energy assets
- Report describing observed climatic conditions and projected future climate change
- Presentation material on climatic hazards
- Presentation on climatic vulnerabilities of the energy sector

ALBANIA	Climate change report	Energy sector vulnerabilities
Climate variables handout	GIS map sample	Climate hazards

Return to Framework Diagram

Stage 2.1 Prepare risks and vulnerabilities evaluation framework for energy sector

Who's involved

- Assignment Management Team

Timing & time required

- Before '*Climate risks & vulnerabilities*' workshop
- 2 days

Key questions

1. What are the indicators of a successful energy sector?
2. How do we evaluate climate-related risks and vulnerabilities to energy sector performance?

Tools

- Generic 'Energy Risks Pathways Model'
- Briefing paper describing:
  - overview of information on observed and projected climatic changes for the country
  - potential impacts of climate change on the country's energy sector

Guidance

1. Determine success criteria for the country's energy sector through consultation with stakeholders
2. Review and amend the generic 'Energy Risks Pathways Model' to reflect energy sector success criteria
3. Prepare empty table categorizing likelihood of climate-related hazards to energy sector success criteria
4. Prepare empty table categorizing magnitude of climate change consequences
5. Based on the above, prepare empty table of risk prioritization (hazard x consequence) for discussion during Stage 3.3 and completion during Stage 3.4

Outputs

- List of energy sector success criteria
- 'Energy Risks Pathways Model' amended for the assignment
- Table categorizing likelihood of hazards
- Table categorizing magnitudes of consequences
- Table of risk prioritization for completion during Stage 3.4

ALBANIA	Energy risk pathways	Empty Risk Prioritization Table

Return to Framework Diagram

Stage 3.1 Run plenary workshop session to set the scene for the workshop and engage stakeholders

Who's involved

- Assignment Management Team plus invited speakers

Timing & time required

- During '*Climate risks & vulnerabilities*' workshop
- 2 hours

Key questions

Plenary speeches should address the following:

1. Why is this assignment important for the country's energy sector?
2. Why does climate change matter?
3. What is the purpose of the workshop?
4. What will come out of it and how will the outputs be used?
5. What happens next?

Tools

- Presentation material on:
  - climatic hazards
  - climatic vulnerabilities of the energy sector
- Maps showing climate change projections and energy assets

Guidance

1. Have opening speech(es) by senior level decision-maker(s) to introduce and emphasize the importance of the assignment, and state the objectives of the workshop
2. Present the observed climatic hazards in the country and the maps showing climate change and energy assets
3. Give an overview of the climate vulnerabilities of the energy sector
4. Describe the structure of the working groups and the workshop process

Outputs

- Plenary workshop speeches and presentations

ALBANIA	NGO presentation	Plenary presentation
Working session intro	Workshop presentation	Climate variables
Energy sector vulnerabilities	Climate hazards	

UZBEKISTAN
Plenary presentation

Return to Framework Diagram

Stage 3.2 Undertake participatory vulnerability assessment and identify risks

Who's involved

- Workshop participants (can be between 50 – 100 people), facilitated by Assignment Management Team

Timing & time required

- During '*Climate risks & vulnerabilities*' workshop
- 6 hours

Key questions

1. How do climatic conditions currently affect the country's energy sector?
2. What are the effects of current climatic variability?
3. How could climate change affect the performance of energy sector assets?
4. If extreme climate events occur more frequently / more severely, what impacts could occur?
5. What are the effects of changes in average climatic conditions?
6. Could critical thresholds be exceeded due to climate change?

Guidance

1. Break into working groups of about 10 people each, covering all the energy activities included in the assignment, organized according to the country priorities and assets, e.g.
    a. fuel production
    b. energy generation (sub-divided into asset type)
    c. transmission and distribution
    d. energy demand.
2. Provide the following materials to each working group to aid the discussion:
    a. Maps showing climate change projections and energy assets
    b. Business Risks Pathways Model
    c. Handouts showing full set of climate hazards
    d. Photos and diagrams of energy assets.
3. Record all discussions on pre-prepared flipcharts divided up into four quadrants: 'Strengths, Weaknesses, Opportunities and Threats' (SWOT).
4. Discuss overall strategies and objectives for the country's energy sector
5. Discuss existing climatic sensitivities, vulnerabilities and critical climate-related thresholds for the energy sector. Record the discussions in the 'Strengths' and 'Weaknesses' sections of the flipcharts. Use the Energy Risks Pathways diagram to help stimulate the discussion, covering the following issues:
    a. Availability of natural resources & raw materials
    b. Reliability of transport, supply chain and logistics
    c. Site location and ground conditions
    d. Asset design, performance and integrity
    e. Performance of operations and processes
    f. Emergency planning and business continuity
    g. Workforce health and safety
    h. Environmental performance
    i. Social performance
    j. Seasonality of energy demand and supply-demand imbalance.

Stage 3.2 (Cont.)

Tools

- Agenda for workshop facilitators
- Maps showing climate change projections and energy assets
- 'Energy Risks Pathways Model' amended for the assignment
- Handouts showing full set of climate hazards
- Photos and diagrams of assets to help stimulate discussions in working groups

Guidance *continued*

6. Discuss views of impacts of climate change on the energy sector and identify likely opportunities and risks. Record the discussions in the 'Opportunities' and 'Threats' sections of the flipcharts.
7. Ask the participants to vote on the priority issues and summarize the main messages for brief presentation in the final plenary session.
8. After working groups have finished, reconvene in plenary for brief feedbacks from each working group on the priority issues identified, followed by a final discussion session.
9. The closing comments at the workshop should explain the next steps in the vulnerability and adaptation assessment process.

Outputs

- Workshop report with SWOT ('Strengths, Weaknesses, Opportunities and Threats') analysis of the vulnerabilities and resilience of the energy sector to climate change:
  - 'Strengths and Weaknesses' describes the current energy situation and how it is affected by weather / climate,
  - 'Opportunities and Threats' describes the identified risks and opportunities for the energy sector from future climatic variability and climate change.

ALBANIA		
Energy risk pathways	Climate hazards	Climate variables
Risk workshop report	Facilitators agenda	Diagrams energy assets

UZBEKISTAN
Risk workshop report

Return to Framework Diagram

Stage 3.3 Gain views of key vulnerabilities & risks

Who's involved

- Experts from the energy sector, experts in climate change and hydrology and representatives of large energy users, interviewed by the Assignment Management team

Timing & time required

- During meetings after the '*Climate risks & vulnerabilities*' workshop
- 2-3 days

Key questions

1. What do you consider are the key climate-related vulnerabilities, risks and opportunities for the energy sector?
2. How efficient is energy generation, transmission, distribution and use?
3. What are your critical success criteria? How do these relate to climatic factors?
4. Could climate change affect the balance of different types of energy generation assets?

Tools

- '*Climate risks & vulnerabilities*' workshop outputs

Guidance

1. To build on the workshop discussions and gain deeper understanding of key climate-related vulnerabilities and risks, discuss interviewees' opinions on how climate can affect the following: energy security and services; financial performance of the energy sector; reputation of the energy sector; contractual risks; regulatory and legal risks.
2. Present the empty tables categorizing the likelihood of climate-related hazards to energy sector success criteria and magnitude of climate change consequences (developed at Stage 2.1), and amend them, to take on board the experts' views of them. This may include adjusting the scales and / or the consequence categories. Based on this, revise the empty risk prioritization table.
3. Ask for views about which energy sector assets are most at risk from climatic factors – either by virtue of location (e.g. coastal assets vulnerable to rising sea levels) or asset type (e.g. hydropower plants vulnerable to changes in water flows).
4. Establish who are the main energy users and what climatic factors affect energy demand at different times of the year.
5. Discuss the current and future importance of regional energy trade, as neighboring countries will also be affected by climate change and may take adaptation actions which could affect the country.
6. Discuss what extra information and data can be provided on how the performance of the energy sector (both supply and demand) is affected by climatic factors. Aim where possible to obtain information and data that will enable risks to be quantified. Ensure that you obtain information on the impacts of climate change on the energy sector that has been already been produced in-country, and check that it is based on a range of the best available, most up-to-date climate models. If not, it should be treated with caution.

Outputs

- Meeting notes
- Reports and data provided by interviewees

ALBANIA	Meeting plan	Meetings agendas
Albania report Table A2.1	Albania report Table A2.2	Empty risk map

Return to Framework Diagram

Stage 3.4 Analyze & evaluate priority risks

Who's involved

- Assignment Management Team

Timing & time required

- Between '*Climate risks & vulnerabilities*' workshop and '*Climate risk management and cost-benefit analysis*' workshop
- 2-4 weeks

Key questions

1. What are the key climate-related risks and opportunities for the energy sector (supply and demand)?
2. Will critical energy sector thresholds (which represent the boundary between tolerable and intolerable levels of risk) be crossed due to climate change?
3. What are the main uncertainties in the risk assessment?

Tools

- *"Climate risks & vulnerabilities*' workshop report
- Reports and data provided by in-country experts
- Wider literature on climate change and its impacts of relevance to the energy sector.

Guidance

1. The aim at this stage is to undertake high-level assessments to enable prioritization of climate-related risks to the performance of the energy sector. The assessments should cover all of the country's important energy assets, along with risks / opportunities related to energy demand, and should consider risks associated with changes in average and extreme climatic conditions, drawing on a wide range of the latest climate change model outputs.
2. An essential element of the risk analysis is to begin to understand the potential impacts on future energy security. First, this involves obtaining or developing baseline scenarios for energy supply and demand covering the timescales of the assessment (as agreed at Stage 1.1), ignoring the effects of climate change. Then, the impacts of climate change on energy supply and demand should be analyzed. This may reveal a future energy demand-supply gap due to climate change.
3. As well as utilizing the information from Stages 3.1 to 3.3, the assessments should also draw upon observed data and research undertaken in-country, such as that linking water flows to hydropower output, or energy demand as a function of climatic factors. Where this information is not available or is not of sufficient depth or quality, it should be supplemented with information from the wider international literature.
4. Because this is intended to be a high-level analysis, it should not involve undertaking detailed new quantitative modeling, but rather should draw upon pre-existing information or should develop simple correlations between climate and energy sector performance, where appropriate. Using the future climate change scenarios, it should then be possible to generate high-level estimates of climate change impacts.
5. Risk is a function of the probability of a hazard and the magnitude of its consequences. Risks should be rated on the empty risk prioritization table produced at Stage 3.3 and should be recorded on a risk register.
6. Reliable information on future changes in low probability climatic events (i.e. extreme events) is usually not available, so it may not be possible to rate the significance of future risks associated with extreme events. This should be acknowledged as an area of uncertainty in the risk assessment.

Outputs

- Sections for report describing the high-level assessment of climate change risks to energy sector performance (supply and demand), quantified where possible.
- Completed risk table and risk register.

ALBANIA	Albania Report section 3	Albania report Annex 7
Albania report Annex 8	Albania report Table A2.3	Climatic vulnerabilities, risks, and opportunities
Albania Report Annex 9	Albania report Table 3	

Return to Framework Diagram

Stage 4.1 Undertake preparatory work on adaptation options

Who's involved

- Assignment Management Team

Timing & time required

- Between '*Climate risks & vulnerabilities*' workshop and '*Climate risk management and cost-benefit analysis*' workshop
- 1-2 days

Key questions

1. What options are available to manage the risks identified at Stage 3.4?
2. What are the likely consequences of the 'do nothing' option?
3. Can options be identified that are more robust to climate change?
4. Are there opportunities to address climate change resilience as part of:
   - •Design of new assets?
   - •Rehabilitation of existing assets?
   - •Privatization of the energy sector (if relevant)?

Tools

- Sections for report describing assessment of climate change risks to energy sector performance (supply and demand)
- Completed risk register and risk table
- Checklist of adaptation options.

Guidance

1. When starting to identify adaptation options, it is important to think widely, considering the full range of ways that energy sector decision-makers can act, including informational, institutional, and physical / technical measures.
2. For instance, they can help to build adaptive capacity by creating better linkages between providers of climate data and energy sector managers, or by upgrading design standards for new energy assets to take account of climate change. They can also undertake physical adaptation actions to build climate resilience of existing energy assets as part of rehabilitation, or provide funding for energy efficiency measures. If the risk assessment has identified an energy demand-supply gap opening up due to climate change, then it is sensible to identify a diverse range of new energy generation assets, opportunities for regional trade, and ways of reducing energy demand, which could contribute to filling the gap.
3. Check the country's national energy strategy to see if it already includes actions that help to build climate resilience.
4. In the face of uncertainties about future climate change and its impacts, there are several types of options that are particularly useful:
   - > 'No regret' options, which deliver benefits that exceed their costs, whatever the extent of climate change.
   - > 'Low regret' options are low cost measures with potentially large benefits under climate change and are most often available at the design stage for new assets.
   - > 'Win win' options contribute to climate adaptation and also deliver other benefits.
   - > Flexible approaches, which involves keeping open options, or implementing options that can be increased in the future, to provide additional adaptation when the need for it, and the performance of adaptation measures is less uncertain.
5. It is important to avoid so-called 'maladaptive' actions, i.e. actions which will make it more difficult to cope with climate change risks, such as development of long-lived energy assets in an area at high risk of flooding or coastal erosion.

Outputs

- Initial set of adaptation options

ALBANIA	Albania Report Annex 3	Albania report Section 5.3
Climate change report	Albania report Section 6	Checklist for Adaptation options

Return to Framework Diagram

Stage 4.2 Validate risk register with stakeholders

Who's involved

- Assignment Management Team with workshop participants (a sub-set of the key experts who attended the first workshop, between 15 to 20 people)

Timing & time required

- At start of '*Climate risk management and cost-benefit analysis*' workshop
- 1 hour

Key questions

1. Is there agreement among stakeholders on the prioritization of key climate-related risks and opportunities undertaken at Stage 3.4?
2. If not, which risk ratings need to be changed and what is the justification for this?

Tools

- Sections for report describing assessment of climate change risks to energy sector performance (supply and demand)
- Risk register and risk table from Stage 3.4

Guidance

1. It is important to discuss the prioritization of risks undertaken at Stage 3.4 with energy sector stakeholders, to ensure that agreement is reached on the key risks.
2. At the start of the risk management workshop, present the Risk Register from Stage 3.4 and discuss the relative rankings of the risks, until stakeholders are in agreement on them.
3. Given the uncertainties around some aspects of climate change impacts on the energy sector, particularly in relation to extreme events, it will not be possible to assess every risk objectively. There may be an inclination among some stakeholders to prioritize extreme-event related risks, so the facilitator of the discussion may need to remind participants about the two dimensions of risk ('probability of hazard' and 'magnitude of consequence') and check that incremental effects from changes in average climatic conditions are given due weight.

Outputs

- Agreed final risk register and risk table.

ALBANIA		
Albania report Table 3	Complete risk table and risk register	Albania report Table A2.3

Return to Framework Diagram

Stage 4.3 Introduce CBA & agree CBA objectives & boundaries

Who's involved

- Workshop participants, facilitated by Assignment Management Team

Timing & time required

- During *'Climate risk management and cost-benefit analysis'* workshop
- 3.5 hours

Key questions

1. Why is a CBA process to be followed?
2. How does CBA assist in decision-making?
3. Why is it important to include environmental and social costs and benefits in the analysis?
4. What is the underlying objective that the CBA should address (e.g., a policy level objective or a technology level objective)?
5. What are the technical, political, financial or other limits and boundaries of the study?

Tools

- Sections for report describing assessment of climate change risks to energy sector performance (supply and demand)
- Risk register and risk table from Stage 3.4
- Presentation materials on CBA Process

Guidance

1. The introduction to the Cost Benefit Analysis (CBA) should be delivered by the Assignment Management Team.
2. The Assignment Management Team should consider possible objectives for the CBA prior to the workshop, in case they need to stimulate discussion. However, ideally, the objectives should be generated and discussed by the workshop participants themselves.
3. Setting the objective for the CBA is a critical task and may require reconsideration or review during the workshop. It is likely that the identification of adaptation options (Stage 4.1) will have resulted in a long-list of adaptation options, ranging across a very broad set of issues. If so, it will not be achievable to undertake a cost-benefit analysis for every single option. Instead, it will be necessary to develop a focused objective for the CBA, with an associated smaller number of options for analysis (typically between 5 to 8).
    - For instance, if the risk assessment has identified an energy demand-supply gap opening up due to climate change, then it may be sensible to define the objective for the CBA as answering the question: 'What is the optimal approach to supply the shortfall in energy that is caused by climate change?'
4. The boundaries for the CBA may include: subject areas that are outside the knowledge or authority of the workshop participants; technical or physical limitations; or, limitations to managing the complexity of the CBA achievable within the scope of the study.
5. It is important that the facilitator draws workshop attendees away from technical details, to focus on the broad picture.

Outputs

- An objective for the CBA, written down in one sentence, and a list of boundaries for the CBA

ALBANIA	Second workshop presentation	Workshop invitation
Cost benefit analysis	Workshop invitees and data requests	

UZBEKISTAN	
Workshop case study	Workshop 2 presentation

Return to Framework Diagram

Stage 4.4 Discuss & confirm adaptation options & parameters for CBA

Who's involved

- Workshop participants, facilitated by Assignment Management Team

Timing & time required

- During *'Climate risk management and cost-benefit analysis'* workshop
- 3.5 hours

Key questions

1. What are the options to achieve the agreed objective?
2. What are the components of each option?
3. What are the financial, social and environmental parameters (costs and benefits) associated with each option?
4. How will climate change affect each of the options?
5. Which parameters should be included in the CBA?

Tools

- Checklist of potential parameters

Guidance

1. Approximately 5 to 8 distinct options need to be developed in discussion with workshop participants.
2. The options may achieve the objective in different ways.
   - For instance, if the objective of the CBA is to address the question: 'What is the optimal approach to supply the shortfall in energy that is caused by climate change?' then the options could be a diverse range of new energy generation assets, opportunities for regional energy trade, and ways of reducing energy demand.
3. Options should be generated through discussion which range from 'Business-As-Usual' through to novel or far-fetched ideas. Only an outline of the options is required at the workshop.
4. It is important to agree with participants the financial, social and environmental parameters against which the options will be appraised. These may include:
   - Capital and Operational Costs (CAPEX and OPEX)
   - Energy and fuel pricing
   - Value of water
   - Greenhouse gas emissions
   - Land value
   - Disturbance/ relocation of people
   - Ecological value
5. Other parameters to be agreed for the CBA include:
   - The time horizon over which the assessment is to based
   - Discount rate and Internal rates of return to be considered (ranges can be used).

Outputs

- Summary description of options for CBA and parameters

ALBANIA	Albania report Annex 5	Albania report Section 5.3 and 5.4
Summary for Stakeholder parameter priorities	Handout for Workshop 2	

Return to Framework Diagram

Stage 4.5 Identify data gaps

Who's involved

- Assignment Management Team and some of workshop participants

Timing & time required

- During and immediately following the '*Climate risk management and cost-benefit analysis'* workshop
- 0.5 days

Key questions

1. Is the objective clearly defined and can all the agreed options meet the objective?
2. What are the key cost and benefit 'aspects' of the options, in relation to the agreed list of evaluation parameters?
3. What information is best sourced from the workshop attendees?
4. What information is best sourced from international best practice / design / experience?

Tools

- *Climate risk management and cost-benefit analysis'* workshop summary form

Guidance

1. It is important to obtain and utilize as much data as possible from the workshop attendees and local stakeholders. This is to ensure greater buy-in to the analysis and more accurate assessment of the parameters.
2. Data gaps to consider include:
   - Specific performance capacities and efficiencies of energy assets,
   - Capital and operational cost data,
   - Details of technical and physical limitations on specific energy assets,
   - Land value,
   - Fuel and power pricing,
   - Impacts of climate change on the performance of the energy sector (supply-side assets and demand),
   - Impacts of adaptation options on the performance of specific energy sector assets.

Outputs

- Table of data required, including the proposed source of the data

ALBANIA

CBA Options framing example

Return to Framework Diagram

Stage 5.1 Obtain data for CBA

Who's involved

- Assignment Management Team and some of workshop participants

Timing & time required

- During meetings after the '*Climate risk management and cost benefit analysis'* workshop
- 1 day

Key questions

1. What would be required to implement each adaptation option?
2. How long would each take to be implemented?
3. What would each option achieve?
4. How much would each option cost to implement?
5. How much fuel would be used?
6. What external costs and benefits would be realized by implementing each option?
7. What are the constraints on implementing each option?

Tools

- '*Climate risk management and cost-benefit analysis'* workshop summary form

Guidance

1. Face-to-face meetings should be held following the workshop to try and obtain as much data as possible that can be utilized in the CBA.
2. The required data are listed under Stages 4.4 and 4.5.
3. A written list of formal data requests may need to be sent following the face-to-face meetings in order to obtain specific data.
4. Where ever possible, local data related to the adaptation options should be obtained and utilized in the CBA. Cross-referencing or benchmarking with international best practice should also be carried-out.

Outputs

- Completed narrative description of each adaptation option and tabulation of data to be used in the CBA (to be included in final study report).

ALBANIA
Examples of the parameter-aspect data required for options
CBA options framing example

Return to Framework Diagram

Stage 5.2 Discuss climate change risks associated with adaptation options

Who's involved

- Assignment Management Team and some of workshop participants

Timing & time required

- During meetings after the '*Climate risk management and cost benefit analysis'* workshop
- 1 day

Key questions

1. What are the direct climate-related risks to each option?
   For example, risk of a change in average temperature impacting the efficiency of a power plant.
2. What are the indirect climate-related risks associated with each option?
   For example, risk of higher temperature leading to more irrigation and less water available for hydropower generation?
3. Are there critical thresholds associated with climate change which could impact the options?
4. Are risks likely to occur progressively or after a particular point in time?

Tools

- Sections for report describing assessment of climate change risks to energy sector performance (supply and demand)
- Completed risk register and risk table

Guidance

1. The adaptation options may themselves be vulnerable to the impacts of climate change, and so it is important that these considerations are incorporated into the CBA.
   - For instance, if the adaptation options are a range of new energy generation assets to fill an energy demand supply-demand gap, then these new assets may also be affected by climate change
2. Face-to-face meetings following the workshop should be held to try and obtain as much data as possible about how climate change could affect the adaptation options, where relevant.
3. This should include assessing both direct and indirect risks. It is important that there is a broad consideration of indirect risks as these may be more significant to some adaptation options than direct risks (e.g., if water has to be diverted for higher priority uses, then this could result in inadequate water supplies to a power plant and temporary shutdown during dry periods).
4. A list of agreed assumptions about climate risks and engineering / scientific references should be documented.

Outputs

- A summary of how the performance of each adaptation option will change over the period of assessment as a result of climate change.

ALBANIA	
Albania report Annex 7	Albania report Section 3
Albania report Annex 8	Albania report Annex 9

Return to Framework Diagram

Stage 5.3 Undertake CBA

Who's involved

- Assignment Management Team

Timing & time required

- Following '*Climate risk management and cost-benefit analysis'* workshop and collection of data
- Over a period of about 6 weeks

Key questions

1. What are the financial, social and environmental costs and benefits of each adaptation option, and how will these be realized?
2. What are the appropriate monetary indicators for each of the parameters to be included in the CBA?
3. Does the monetary value of a particular parameter need to be 'transferred' from international values to local/national values?
4. What are the uncertainties related to the costs and benefits and what is the sensitivity of the CBA to these uncertainties?

Tools

- CBA and environmental economics methodologies and tools

Guidance

1. Apportioning costs and benefits to each adaptation option is the key function of the CBA.
2. This task requires specialist environmental economics knowledge and experience.
3. It is important to ensure consistency of analysis from one adaptation option to the next.
4. Contractors may have their own tools and processes for undertaking CBA, but the key element is to ensure that social and environmental costs and benefits are quantified and monetized, along with financial costs and benefits.
5. There may be uncertainty about the valuation of certain parameters. Sensitivity analysis is essential to assess how changes in parameter values affect the results of the CBA i.e. to ascertain how robust the adaptation options are, to sources of uncertainty.

Outputs

- Draft CBA section of the final report, including discussion of relative merits of each adaptation option and sensitivity of the CBA results.

ALBANIA	
Albania report Annex 5	Albania report Section 5

Return to Framework Diagram

Stage 5.4 Discuss & confirm CBA with stakeholders

Who's involved

- Assignment Management Team and workshop participants

Timing & time required

- Six to eight weeks after '*Climate risk management and cost benefit analysis*' workshop
- 4 hours

Key questions

1. Are stakeholders in agreement with the way in which options have been defined in the CBA?
2. Are stakeholders in agreement with the input parameters utilized within the CBA?
3. Are stakeholders in agreement with the parameters considered, and range of values assessed, in the sensitivity analysis?
4. Do stakeholders understand the key findings of the CBA and the key parameters / sensitivities in the analysis?

Tools

- Video Conference and PowerPoint presentation

Guidance

1. Presentation of the results of the CBA and the opportunity for stakeholders to review and comment on the analysis is important in order to ensure their endorsement of the outcomes.
2. The ways in which climate risks and adaptation have been addressed within the CBA should be presented.
3. Key assumptions in the analysis should be also highlighted.
4. The way in which sensitivity analysis has been conducted and embraced in the CBA should be emphasized and demonstrated.
5. Participants should be reminded of the constraints of the CBA, as agreed at the '*Climate risk management and cost-benefit analysis*' workshop, to avoid deviating from the agreed scope and expectations of the CBA.

Outputs

- Summary of amendments to any of the adaptation options and input parameters required before finalization of the CBA.

ALBANIA	
Albania report Annex 5	Albania report Section 5

Return to Framework Diagram

Stage 6.1 Is there enough information to design and implement adaptation measures?

Who's involved

- Assignment Management Team and senior energy sector decision-makers

Timing & time required

- About eight weeks after '*Climate risk management and cost benefit analysis'* workshop
- 1 day

Key questions

1. Is there enough information to make decisions about which adaptation measures should be implemented?
2. Does the manner in which risk and uncertainty was accounted for allow for robust decision-making?
3. Do the adaptation measures have implications for other decision-makers?
4. Have any 'no-regrets' adaptation measures been identified?
   - No regret' options deliver benefits that exceed their costs, whatever the extent of climate change. While they are unlikely to be cost-free, implementing them will help with managing present-day risk and should provide increasing benefits as climate change intensifies.

Tools

- Report describing outputs of risk assessments, identification of adaptation options and CBA

Guidance

1. As stated under the Overview and toolkit instructions, working through this risk-based process should provide high-level (semi-quantitative) assessments of key risks and adaptation options for the energy sector.
2. Stage 4.1 will have identified a wide range of possible adaptation measures, including informational, institutional and physical / technical actions.
3. The cost-benefit analysis will have compared a number of these options, though it is unlikely to have assessed every one of them. For instance, it may have focused on comparing options to fill the energy demand-supply gap due to climate change, such as new energy generation assets, opportunities for regional trade, and ways of reducing energy demand.
4. At this point, senior energy-sector decision-makers should meet to discuss and make decisions about which measures will be implemented.
5. If there is insufficient information available from the high-level assessment, it may be necessary to return to Stage 3.4 and undertake more in-depth analysis before final decisions can be reached.
6. Remember that certain measures, namely 'no regret', 'low regret', 'win win' and flexible measures (see Stage 4.1) are particularly useful in the face of climate change uncertainties.
7. For some risks, the decision may be taken that no adaptation will be undertaken at the present time. This may be because of lack of availability of funds, because the measure can not be justified economically, or because there is insufficient evidence to justify adaptation. In these cases, it will be important to continue to monitor climate impacts on energy sector performance, as adaptation measures may be needed in the future (see Stage 8.1).
8. At the conclusion of this stage, decision-makers should produce an Adaptation Strategy and Workplan for implementation of the agreed adaptation measures.

Outputs

- Adaptation Strategy and Workplan for implementing adaptation measures.

ALBANIA	CESVAP Climate Vulnerability Assessment Albania ALB
Full Albania Report	CESVAP Climate Vulnerability Assessment Albania ENG

Return to Framework Diagram

Stage 7.1 Undertake adaptation measures as per timetable

Who's involved

- Senior energy sector decision-makers, guided by Assignment Management Team

Timing & time required

- Work can commence once adaptation measures have been confirmed
- Time required will vary depending on the adaptation measures

Key questions

1. Has responsibility and budget been assigned to those responsible for undertaking adaptation measures?
2. Has the implementation of the adaptation measures been agreed with other decision-makers who are affected by them?

Tools

- Adaptation Strategy and Workplan for implementing adaptation measures

Guidance

1. Implementing some adaptation measures can be accompanied by significant policy and project management risks. This is particularly the case if the measure is technically or managerially complex, is contentious with some stakeholders or involves significant financial expense.
2. If the measures are new to the country and levels of expertise in implementing them are low, it will be useful to learn from experience where they have been implemented in other countries.

Outputs

- Measures implemented.

ALBANIA	Albania report Section 6

Return to Framework Diagram

Stage 8.1 Monitor climate impacts on the energy sector

Who's involved

- Energy sector managers, guided by Assignment Management Team

Timing & time required

- On an ongoing basis
- As part of routine operations

Key questions

1. Are climate-related risks to the energy sector acceptable?
2. Are critical climate-related thresholds being approached?
3. Does monitoring indicate that the risks are changing over time?

Tools

- Risk Register
- Monitoring methods

Guidance

1. For risks where the decision has been taken *not* to implement adaptation measures (see Stage 6.1), SMART (Specific, Measurable, Attainable, Relevant, Time-bound) indicators should be developed and monitored, linking energy sector performance to climatic factors. The risk assessment (Stage 3) will help in deciding which indicators are most important to monitor.
2. The purpose of monitoring is to develop better understanding of the effects of climatic factors on energy sector performance, so as to be able to detect when climate-related success criteria are threatened by changing climate conditions and therefore when adaptation measures will be needed.
3. Where implementation of adaptation measures requires a long planning time horizon, it is important that sufficient time is available to implement measures.
    - For instance, planning and delivery of a new reservoir to provide additional water storage capacity for a hydropower plant can be a lengthy process, taking many years.
4. Based on the monitoring, the Risk Register should be reviewed and updated as required.

Outputs

- SMART targets
- Updated Risk Register.

ALBANIA	
Albania report Table A 2.3	Albania report Table 3

Return to Framework Diagram

Stage 8.2 Monitor the performance of the adaptation measures

Who's involved

- Energy sector managers, guided by Assignment Management Team

Timing & time required

- On an ongoing basis
- As part of routine operations

Key questions

1. Did the adaptation measures deliver the expected benefits?
2. Were the costs of the adaptation measures as anticipated?
3. What lessons can be learned that could be usefully applied elsewhere?

Tools

- Adaptation Strategy and Workplan for implementing adaptation measures

Guidance

1. Monitoring should be undertaken to ensure that the actions in the Adaptation Strategy and Workplan are being carried out and that the adaptation measures are proving effective in managing climate-related risks.
2. SMART indicators (see Stage 8.1) should be developed to monitor the performance of adaptation actions.
3. Where flexible adaptation options have been selected (see Stage 4.1), monitoring can help to decide when the options need to be increased, in line with observed changes in climate-related risks.
4. Based on the monitoring, the Adaptation Strategy and Workplan should be reviewed and updated as required.

Outputs

- SMART targets
- Updated Adaptation Strategy and Workplan

ALBANIA	Albania report Section 6

Return to Framework Diagram

Stage 8.3 Monitor new scientific information on climate change & its impacts on the energy sector

Who's involved

- Assignment Management Team

Timing & time required

- Following publication of major new international and national reports on climate change and its impacts
- Typically 1-2 days per major report

Key questions

1. Has new information about climate change and its impacts emerged, requiring the assessment of climate risks and adaptation measures to be revisited?

Tools

- Risk Register
- Adaptation Strategy and Workplan for implementing adaptation measures

Guidance

1. Reviews of climate-related risks and adaptation should be undertaken periodically, as knowledge about climate change, its impacts and adaptation is evolving rapidly.
2. Where there was significant uncertainty, it may have been decided that no adaptation measures could be justified. However, new research may provide the stimulus for revisiting the decision.
3. Typically, the Intergovernmental Panel on Climate Change (IPCC) publishes its assessment reports every five years or so. National assessments of climate change (e.g. National Communications to the UN Framework Convention on Climate Change or National Adaptation Programmes of Action) (NAPAs) are also published every few years.

Outputs

- Updated Risk Register, Adaptation Strategy and Workplan

ALBANIA	
Albania Report Table 3	Albania report Section 6

Return to Framework Diagram

Glossary

- **Adaptation**

Actions to reduce the vulnerability of natural and human systems to climate change effects. For instance, an adaptation action that can be taken to reduce the damaging effects of rising sea levels is to build higher sea defences. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned.

- **AR4**

The Fourth Assessment Report of the IPCC, released in 2007.

- **Baseline**

The reference against which change is measured, e.g. 'baseline climate' is normally defined as the period 1961-1990.

- **Carbon dioxide (CO_2)**

CO_2 is a naturally occurring gas, and a by-product of burning fossil fuels or biomass, of land-use changes and of industrial processes. It is the main greenhouse gas produced by man that is driving climate change.

- **Climate change**

Climate change refers to any change in climate that lasts for an extended period, typically decades or longer, whether due to natural variability or as a result of human activity.

- **Climate hazards**

Climate variables which have consequences for the system being studied (in this case, Albania's energy sector). The main climate hazards to be discussed at the workshop are temperature, precipitation, relative humidity, sunshine, winds, sea level rise and extreme events such as storms.

- **Climate impacts**

The effects that climate hazards have on a given system (in this case, Albania's energy sector), e.g. reductions in rainfall have impacts on hydropower generation.

- **Climate variability**

Climate variability refers to variations in the average state of climate. Rainfall, for instance, has high natural variability, which makes it difficult to detect a climate change signal.

Glossary (cont.)

- **General Circulation Models / Global Climate Models (GCMs)**

A computer-based numerical model of the climate system. GCMs are developed and run by climate modelling centres around the world and are used to project changes in climate.

- **Greenhouse Gases (GHGs)**

Greenhouse gases absorb and emit infrared radiation. This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the earth's atmosphere.

- **Intergovernmental Panel on Climate Change (IPCC)**

The Intergovernmental Panel on Climate Change was formed in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), and is the international advisory body on climate change.

- **Mitigation**

Actions to reduce man-made effects on the climate system. These include actions to reduce emissions of greenhouse gases (such as energy efficiency measures or the use of renewable energy resources), as well as actions to increase greenhouse gas sinks (such as planting forests).

- **Risk**

Risk is the product of the *likelihood (or probability) of an event* occurring and the *magnitude of its consequence*.

- **Scenario**

A plausible description of how the future may develop. Scenarios are not predictions or forecasts, but are useful to provide a view of the implications of actions.

- **Sensitivity**

Sensitivity is the amount by which a system is affected, either adversely or beneficially, by climate variability or climate change. For instance, the efficiency of gas turbines is sensitive to temperature. As temperatures rise, efficiency falls.

Glossary (cont.)

- **Special Report on Emissions Scenarios (SRES)**

To provide a basis for estimating future climate change, the IPCC prepared the Special Report on Emissions Scenarios in 2000. It provides 40 greenhouse gas and sulphate aerosol emission scenarios based on different assumptions about demographic, economic and technological factors. The emissions scenarios are fed into Global Climate Models, to project future changes in climate.

- **Threshold**

A property of a system where the relationship between the input and the output changes suddenly. For example, the height of a flood defence represents a critical threshold – if water levels exceed the defence height, flooding will occur. It is important to identify climate-related thresholds as they indicate rapid changes in the level of risk.

- **Timeslice**

Projections of climate change are usually given for three timeslices – the 2020s, 2050s and the 2080s. The projections are a 30-year average, centred around each of the given timeslices, (i.e. the 2020s is 2010 – 2039). Climate models cannot predict what the specific climate will be in any given year, due in part to the inter-annual variability of climate variables, so the projections are 30-year averages of future climate.

- **Uncertainty**

An expression of the degree to which a value is unknown (e.g. the future state of the climate system). Uncertainty can result from lack of information or from disagreement about what is known or even knowable.

Acknowledgements

HEAT, a Hands-on Energy Adaptation Toolkit, documents the lessons, experience and process followed in implementing a pilot Climate Vulnerability Assessment program in Albania and Uzbekistan (2009-10). HEAT is designed to lead you through a stakeholder based semi-quantified risk assessment of climate vulnerabilities and adaptation options in the energy sector of your country. HEAT was developed by Jane Ebinger and Andres Londono (ESMAP), Richenda Connell (Acclimatise) and Stuart Arch (WorleyParsons). Support was provided by Heather Austin, Oluwafemi Faleye and Vanessa Lopes (ESMAP).

HEAT documents the experience from a core team led by Jane Ebinger, Simon Croxton and Daryl Fields. Team members included Heather Austin, Iskander Buranov, Magnus Gehringer, Lucy Hancock, Martha Jarosewich-Holder, Antonio C. Lim, Andres Londono, Aferdita Ponari (World Bank), Richenda Connell, Mark Kelleher, Olivia Palin, Nina Raasakka (Acclimatise), Stuart Arch, Alastair Baglee, Jerome Bowen, Ivaylo Mirchev, Liudmila Nazarkina, Ben Pope (WorleyParsons), and Besim Islami and Shukhrat Khamidov (consultants). The team was assisted by Ana Gjokutaj, Kozeta Haxhiaj, Josephine Kida, Elena Klementyeva and Anara Tokusheva (World Bank).

The team benefited greatly from a wide range of consultations with stakeholders in Albania and Uzbekistan in the course of implementing this pilot program.

Meetings and workshops were held in Albania with (in alphabetical order): Petrit Ahmeti, Neritan Alibali, Sokol Aliko, Ramadan Alushi, Ymer Balla, Indrit Baholli, Leonard Bardhoshi, Irma Berdufi, Daniel Berg, Taulant Bino, Miriam Bogdani, Agim Bregasi, Eglantina Bruci, Kujtime Caci, Eduart Cani, Marjana Coku, Marialis Çelo, Endri Çili, Leonidha Çobo, Erion Cuni, Engjell Dakli, Stavri Dhima, Luan Dibra, Nazmi Diku, Dorjan Duka, Eduart Elezi, Lavdosh Ferrunaj, Arben Gazheli, Ilia Gjermani, Ardit Gjeta, Gani Gjini, Kole Gjoni, Konalsi Gjoka, Edmond Goskolli, Martin Graystone, Lorenc Gura, Sazan Guri, Suzana Guxholli, Marjola Hamitaj, Skender Hasa, Alfred Hasanaj, Ervin Hatija, Aheron Hizmo, Eida Hoxha, Fatmir Hoxha, Farudin Hoxha, Zhuljeta Hoxha, Rajmonda Islamaj, Hajri Ismaili, Qerim Ismeni, Marinela Jazoj, Ilir Kaci, Erion Kalaja, Mirela Kamberi, Shaban Kamberi, Zeki Kaya, Eniana Kociaj, Nevton Kodheli, Molnar Kolaneci, Lavdie Konjari, Niko Kurila, Hysni Laçi, Artan Leskoviku, Bashkim Lushaj, Sherif Lushaj, Margarita Lutaj, Bikore Mala, Afrim Malaj, Perparim Mancellari, Robert Manghan, Sokol Mati, Xhemal Mato, Merita Mansaku-Meksi, Niklas Mattson, Dorina Mehmeti, Olgert Metko, Marieta Mima, Donald Mishaxhi, Driada Mitrushi, Piro Mitrushi, Arben Mukaj, Alken Myftiu, Genc Myftiu, Agim Nashi, Bujar Nepravishta, Ndue Preka, Nikolin Prifti, Erikan Proko, Elton Qendro, Eduart Reimani, Anastas Risha, Kristo Rodi, Daniela Ruci, Mitat Sanxhaku, Alma Saraçi, Denisa Saja, Aleksander Shalsi, Erlet Shaqe, Sherefedin Shehu, Angjelin Shtjefni, Dritan Shutina, Mimoza Simixhiu, Muharrem Stojku, Kliti Storja, Konti Tafa, Peter Troste, Fatjon Tugu, Teuta Thimjo, Piro Trebicka, Endrit Tuta, Andi Vila, Anisa Xhitoni, Lufter Xhuveli, Petrit Zorba.

Meetings and workshops were held in Uzbekistan with (in alphabetical order): S. Abdinabiev, R. Abdullin, N. Abidjanov, B. Abzalov, N. Agaltseva, D. Akramov, K. Alimov, P. Antheunissens, A. Arslanov, S. Artikov, A. Azimov, O. Basov, M. Beilinson, U. Buranov, E. Djumagulov, R. Dovletov, A. Drobova, A. Dusaev, U. Egamberdiev, V. Eolian, R. Ergashbaev, O. Ertsenkin, B. Eshmuradov, A. Fritz, B. Ganikhodjaev, Gapparov, Y. Giyasov, D. Gumerov, G. Ikramov, D. Isakulov, K. Juraev, A. Kalashnikov, L. Kan, A. Karimov, A. Khasanbaev, A. Khamidov, M. Khodjaev, I. Kondratieva, R. Lee, V. Lee, V. Li, I. Lutfullaev, E. Mahkamov, N. Makhmudov, O. Makhmudov, S. Makhmudov, S. Maksudova, R. Mannonov, R. Mansurov, H. Marufkhodjaev, Miralieva, A. Morozov, B. Mukhammadiev, S. Muksinov, M. Muminova, B. Muradov, R. Murzakhanov, T. Nevzorova, A. Normuminov, T. Ososkova, B. Pak, G. Pavlova, R. Rajabov, I. Rapoport, A. Reznik, D. Rozubaev, A. Sagaidachniy, T. Salikhov, M. Samatov, B. Serikbaev, A. Shabanov, L. Shapovalova, A. Sharipov, I. Shepovalov, N, Shevaldova L. Skripnikova, T. Spectorman, G. Sokolovskaya, A. Sorokin, T. Spectorman, L.Tashkhodjaeva, B. Tashpulatov, I. Tilokhodjaev, G. Trofimov, I. Tsoy, L. Tsoy, V.Tsoy, N. Umarov, A. Yunusov, L. Zavyalova.

The work was conducted under the general guidance of Loup Brefort, Charles Feinstein, Ranjit Lamech, and Camille Nuamah (World Bank). Ron Hoffer and Demetrios Papathanasiou (World Bank) and Amarquaye Armar (ESMAP) also provided valuable guidance. Additional input was provided by Drita Dade, Gazmend Daci, Giuseppe Fantozzi, and Salvador Rivera (World Bank). The Albania report benefited from peer review by Mohinder Gulati and Walter Vergara (World Bank), Roberto Schaeffer (Federal University of Rio de Janeiro) and Vladimir Stenek (International Finance Corporation).

The financial and technical support by the Energy Sector Management Assistance Program (ESMAP), the Trust Fund for Environmentally and Socially Sustainable Development (TFESSD) made available by the Governments of Finland and Norway, and The World Bank is gratefully acknowledged.