Version One

HELIO International

Vulnerability – Adaptation – Energy Resilience (VAR):
Indicators and methodology to identify adaptation projects that reinforce energy systems resilience

HELIO MANUAL: Country Report Preparation – 2009

This document contains the following information:

- An introduction explaining the timeliness and relevance of this work
- The general structure of the country reports
- What is expected from country reporters
- Detailed outline of what each country report should contain
- Supporting documentation/material to assist in report preparation

The Manual—including the indicators and methodology—was prepared by Laura Williamson and Hélène Connor (HELIO International) with the assistance of Axel Michaelowa (Climate Perspectives).

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INTRODUCTION

Climate change isn't happening as a single phenomenon, nor in isolation; there are numerous factors that interact in various ways, creating a new challenge of unprecedented complexity and gravity. Furthermore, climate change, superimposed on poverty, exacerbates existing problems. Whatever threatens the viability of ecosystems also ultimately threatens human societies, starting with people who most directly rely on natural resources for their livelihood.

New insights have been gained over the last ten years about the essential role of energy resilience for the prosperous development of society. A growing number of case studies have revealed the tight connection between resilience, diversity and sustainability of social and ecological systems. Moreover, energy constraints have been identified as one of the serious environmental problems facing past and future societies.

Many climate-sensitive decisions are driven by the need to reduce or manage anticipated climate risks. Decisions also have to address the expected consequences of variability in climate: cold years, flood events, seasonal droughts, storm surges, extreme wind speeds, freezing conditions, heat waves.[1]

Climate change will directly impact both the demand- and supply-side of the energy sector; although how it will effect the latter is more difficult to grasp. Climate change can also impact any part of the energy sector indirectly, e.g., change in electricity supply can effect how a gas distributor supplies its product.

The energy sector can adapt to climate change vulnerabilities and impacts by anticipating possible effects and taking steps to increase its resilience, e.g., by diversifying energy supply sources, siting power sources differently, expanding its linkages with other regions, and investing in technological change, e.g. efficiency, diversification, renewables etc., to further expand the portfolio of options. Given the slow rate of capital stock turnover in the energy sector, the long lifetime of equipment, it is important that energy suppliers, policy makers and citizens be well-informed as to the possible impacts of climate change on the energy sector so that necessary (adaptation) measures can be taken and implemented smoothly.

Ultimately, the resilience of a country's energy systems is underpinned by at least two key elements: its inherent vulnerability to climate events and its intrinsic sustainability, i.e. its level of ecodevelopment. In order to better understand how to trigger and sustain positive synergies, this project will aim to deepen our existing knowledge of resilience—based on previous work by HELIO's in-country reporters[2]—by applying a specific set of indicators to measure the effectiveness of adaptation efforts in the energy sector.

The entry point for this work is at the national level.

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[1] Climate adaptation: Risk, uncertainty and decision-making, UKCIP Technical Report May 2003 see: http://data.ukcip.org.uk/resources/publications/documents/4.pdf

[2] A preliminary assessment of energy and ecosystem resilience in ten African countries, 2007 see: http://www.helio-international.org/energywatch/2007.cfm

REPORT MANUAL

This report manual outlines the structure and anticipated content for country reports. It contains two key sections.

The first section describes the current level of vulnerability of a given country. This should be predominately quantitative, but should also cover qualitative issues, based on the country reporters' knowledge and experience. Information includes a summary of country demographics, key social, economic, environmental, governance and/or political issues that impact the country's overall vulnerability.

The second section looks at key, in-country energy systems. Reporters are asked to present an overview of the country's energy mix and infrastructure, important energy-related policy issues etc. Key energy systems, e.g. hydro, mineral based etc. are to be described. A specific set of simple indicators, based on sustainability criteria are to be applied to each identified energy system. Results from these indicators are then to be used to evaluate each system's level of vulnerability and to identify what measures could be taken to increase the system's resilience.

Based on the analysis of the national energy situation, reporters are then asked to devise and suggest key policies and measures (PAMs) which they think could be applied to improve energy resilience in their country.

EXPECTATIONS

Each reporter is expected to adhere to the outline detailed under **REPORT STRUCTURE and CONTENT.** However as a country reporter your knowledge of your country's energy situation is invaluable. Therefore while we ask you to follow the general outline, reporters are encouraged to include additional, complementary information which they deem relevant and/or enlightening.

The report should be written in either English or French. Referenced pictures and graphs may be included.

All reports will be posted on the HELIO website. It is therefore important that the following technical requirements be followed:

do:

- use Times Roman 12 font, single spaced
- save the ENTIRE report in MS WORD .doc format
- save a second copy of the report in TXT
- use PICTURE to insert any charts, graphics, etc
- test print the report to make sure that texts, equations, etc. appear as they should
- attach both WORD and TXT files when sending electronically

do not:

- use any fields, equations, etc (simple text formatting such as bullets, numbering etc. is acceptable).

REPORT STRUCTURE and CONTENT

Each country report should have the following structure:

1. Executive Summary
2. Reporter Bio/Photo/Contact Info
3. List of acronyms
4. Table of Contents
5. Report Body
6. Annexes
7. Bibliography

At the end of this document you will find a series of Appendices that contain resources that will help you write your report. You should familiarise yourself with these texts so as to have an understanding of the issues. This will contribute to the quality of your report.

It is important that published data should be used whenever possible and referenced accordingly.

SECTION ONE: Executive Summary (suggested length: 1 page)

- Briefly summarise the main findings of the report

SECTION TWO: Reporter Information (suggested length: 1/2 page)

- Provide biographical information on the author(s), including electronic and physical contact information and ID type photo

SECTION THREE: Acronyms (suggested length: 1 page)

- Provide a list of all acronyms used in report

SECTION FOUR: Table of Contents (suggested length: 1 page)

- List major sections of report including bibliography

SECTION FIVE: Report Body (suggested length 15 – 20 pages)

1. Country Overview: current situation (3-5 pages)

1.1. Provide a brief description of your country presenting a geographic, economic and demographic overview, including a brief description of the nation's energy policy.

Below is a list of possible topics to consider when describing the country – see Appendix 1 and 2

- land area
- arable land
- principal crops for local use and export
- area under irrigation
- animal husbandry
- population and rate of growth
- economic growth
- principal imports and exports (energy and non-energy)
- literacy and education
- urbanisation
- income and equity issues (changes in poverty levels, gender etc.)
- principal environmental pressures

- observed climatic trends
- pertinent new legislation
- level of privatisation/concentration of the energy sector
- general effects of globalisation

1.2. Briefly discuss those social concerns that you consider the most important e.g. income gap, gender issues, nutrition, food adequacy for the nation's poorest, public health, human rights freedoms, etc.

1.3. Generate a table that provides the following information – see Appendix 2. Use the most recent year that has the best data possible

Basic Statistics	Year	Unit Value
Physical area		
Area of country		Km^2
Cultivated areas (arable land and area under permanent crops) • as % of the total area of country • arable land • area under permanent cultivation for domestic use • area under permanent cultivation for export		 % ha ha
Population		
Total population • % of which is rural • % of which is under 5 years old		Inhabitants %
Population density		Inhabitants/ km^2
Economically active population • as % of population • female • male		Inhabitants % % %
Population economically active in agriculture • as % of total economically active population • female (%) • male (%)		Inhabitants % % %
Economy and Development		
Gross Domestic Product (GDP) • value added in agriculture (% of GDP) • GDP per capita		Million USD/year % USD/year
Balance of trade (USD) • % change from 1990 to current year		%
Human Development Index (and ranking)		
Human Poverty Index (and ranking)		
Environmental Sustainability Index *		
GHG Emissions		
Access to potable water (less than 500 meters) **		%
Infant Mortality		
Literacy • as % of population • female (%) • male (%)		

* Information available at: UNDP Development Report (UNDP)
** Information available at: UNDP Development Report (UNDP) and World Health Organisation (WHO)

1.4 Identify the country's greatest vulnerabilities (three to five) to serve as baseline for comparison for future reports – see Appendix 3

1.5 apply general indicators to measure level of current vulnerability (this will be used for on-going monitoring) – see Appendix 4

2. Current Energy Situation (5 – 7 pages)

2.1. Discuss country's current energy situation:
- primary fuel sources (domestic or imported)
- energy demand issues (household, transport, industry, agriculture and service sector, public, private)
- energy supply situation (electricity, oil and gas, biomass, etc.) include an overview of specific supply chain challenges, including the structure of the sectoral industries (monopoly of liberalised energy markets, etc.)
- mention any bilateral or international government cooperation on energy and development, major international financial investments and projects
- discuss related legislative and regulatory changes and your country's overall energy policies and objectives

2.2. Generate a table that shows the percentage of each energy system's contribution to the energy mix

2.3. Present key energy systems making sure to describe:
- the energy system itself
- how much it contributes to the overall national energy mix i.e. both supply and demand
- system's geographical location
- its current impacts—both positive and negative e.g. energy security, impact on the land, the environment, and the people who live in the region

2.4. Calculate the vulnerability and resilience of **each** energy system using the energy system specific indicators – see Appendices 5 and 6

3. Recommendations (3-5 pages)

3.1. propose **KEY** policies and measures (PAMs) that could be implemented at the national level to reduce overall vulnerabilities identified in section One – see Appendix 7.

The information and results derived from the various indicator calculations should be used in developing these recommendations. **This section should be targeted at policy makers**

3.2. Propose concrete strategies to increase the resilience of specific energy systems

SECTION SIX: Annexes (as long as necessary)
- List any relevant supporting information **including** the names, organisations and contact information of people consulted in the preparation of the report.

SECTION SEVEN: Bibliography (as long as necessary)
- Follow guidelines when referencing statistics, documents, websites and other informational sources – see Appendix 8

APPENDIX 1: Definitions[3]

Adaptation
In natural or human systems adaptation is a response to actual or expected stimuli (e.g. climate change), or their effects, which moderates harm or exploits beneficial opportunities. In natural systems adaptation is reactive. In human systems adaptation can be both anticipatory and reactive and can be implemented by public (i.e. government bodies at all levels) and private actors (i.e. individuals, households, communities, commercial companies, and NGOs).

Adaptive capacity
It is the ability of people and systems to adjust to environmental change, e.g. by individual or collective coping strategies for the reduction and mitigation of risks or by changes in practices, processes, or structures of systems. It is related to general levels of sustainable development such as political stability, material and economic well-being, and human, institutional and social capital.

Resilience
Amount of change the exposed people, places, and ecosystems can undergo without changing state. That is their ability to *recover* from the stress and to *buffer* themselves against and *adapt* to future stresses and perturbations.

Sensitivity
The degree to which people, places, and ecosystems are affected by the stress, including their capacity to anticipate and cope with the stress. The effect may be direct or indirect.

Vulnerability
Vulnerability is the degree to which a system or unit (such as a human group or a place) is likely to experience harm due to exposure to risk, hazards, shocks, or stresses. In relation to the concept of poverty it is more dynamic since it captures the sense that people move in and out of poverty.

[3] Vulnerability Profile of Burkina Faso, Louise Simonsson, Revised June 2003, Centre for Climate Science and Policy Research, Linköping University and SMHI, Sweden – revised 2008, HELIO

APPENDIX 2: Research Resources

GENERAL COUNTRY STATISTICS:

CIA World Fact Book – country level statistics
https://www.cia.gov/library/publications/the-world-factbook/

FAO: specialised country profiles and information systems
http://www.fao.org/corp/countries/en/

Prevention Web – building the resilience of nations and communities to disasters
http://www.preventionweb.net/english/countries/africa/

UNDP: climate change country profiles
http://country-profiles.geog.ox.ac.uk/

UN Data: statistics by country or sector
http://data.un.org/

World Bank: key data and development statistics
http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20535285~menuPK:1192694~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

PUBLICATIONS:

Adapting to Climate Variability and Change: A guidance manual for development planning
US Agency for International Development - August 2007
www.usaid.gov

Brittle Power. Energy Strategy for National Security
Amory B. Lovins, Rocky Mountain Institute, USA. Brick House Publishing Cy, Mass. 1982

Compensating for Climate Change: Principles and Lessons for Equitable Adaptation Funding
ActionAid USA - 2007
www.actionaidusa.org

Human Tide: The real migration crisis
Christian Aid - 2007
http://www.christianaid.org.uk/aboutus/who/publications/index.aspx

A preliminary assessment of energy and ecosystems resilience in ten African countries
HELIO International - 2007
http://www.helio-international.org/energywatch/2007.cfm

Security via Decentralised Energy
WADE - 2007
http://www.localpower.org/getreport.php?id=1020

Stocktaking of Progress on Integrating Adaptation to Climate Change into Development Co-operation Activities
OECD - 2007
http://www.oecd.org/document/34/0,3343,en_2649_37425_39313186_1_1_1_37425,00.html

Summary for Policy Makers of the Synthesis Report of the IPCC Fourth Assessment Report
IPCC - November 2007
http://www.ipcc.ch/press/index.htm

Two degrees, One Chance – the urgent need to curb global warming
Tearfund, Christain Aid, Practical Action, Oxfam - 2007
http://tilz.tearfund.org/Research/Climate+change+reports/Two+degrees+One+chance.htm

APPENDIX 3: Vulnerabilities

When energy vulnerability is discussed at the national level it is traditionally around issues of energy supply security and how to improve it. There is little policy formation around the broader context of reducing energy system vulnerability through ecodevelopment strategies, e.g., addressing environmental, social, economic, technical and governance issues.

The following table lists vulnerabilities that can impact a country's ability to become more resilient to anticipated climate change impacts.

It is important to identify a country's key vulnerabilities, within the environmental, economic, technical, social and civic pillars, so that policy makers can address them and in turn be able to support adaptation efforts.

The table outlines:

1. Sector
2. Possible vulnerabilities
3. Relevance (impact of the vulnerability)

Appendix 7 provides examples of possible policies and measures (PAMs) that could be used to increase a country's energy resilience and thereby its overall sustainability.

Sector	Vulnerability	Relevance
Environment		
	Biomass dependence	In Africa over 80% of people depend on biomass for: energy needs; crop production and feeding livestock. Biomass also provides groundcover and supports species protection. Any threat to biomass can become a threat to survival.
	Desertification	Renders land unable to support livelihoods (majority of sub-Saharan African population is rural and lives off the land). Also leads to loss of biodiversity.
	Erosion/Soil degradation leading to siltation	Renders land unable to support staple crops. Erosion also can damage infrastructure (siltation in dams). 30% of Africa's coastal infrastructure could be below sea level by 2085.[4]
	Heat waves	Affects water availability and health as well as crop levels (ability of crop to withstand increased heat and decrease moisture).
	Land use and management[5]	Change in land use, especially reduction of forests, contributes to greenhouse gas emissions.
	Level of biodiversity	Habitat loss alters conditions needed for plants and animals to thrive. (25 to 40 percent of species' habitats could be lost by 2085)[6] Biodiversity/ecosystem changes can exacerbate existing environmental degradation.
	Reduction in glacier coverage/Tropical ice cap coverage	Often principal water source for high-altitude communities and those downstream. Run-off will increase then decrease when all ice is melted.

[4] *Tiempo* http://www.tiempocyberclimate.org
[5] World Bank: forest area, agricultural land
[6] *Tiempo* http://www.tiempocyberclimate.org/floor2/data/sahel.htm

Sector	Vulnerability	Relevance
Environment contd.		
	Rainfall patterns • drought • flooding	Affects water availability. Majority of agriculture in Africa is rain-fed • water shortage renders land unable to support humans, agriculture or livestock. • renders land uninhabitable, disrupts/pollutes energy sources and infrastructure, affects industries such as fishing and agriculture, increases exposure to waterborne diseases.
	Salinisation	Harmful to agriculture as it prevents plants from absorbing water from the soil. Contaminates fresh water wells.
	Sea-level rise	Destroys coastal settlements and industries. Heavy social and economic impacts as coasts tend to be densely populated.
	Species migration	Affects flora and fauna distribution and composition; changes availability of food and protection for animals and birds.
	Water pollution	Health impacts.
Economic		
	Oil import/export	Price and exchange rates fluctuations can destabilise both importing and exporting nations.
	Level of debt	High debt means lower investment in public and welfare services and increased overall poverty.
	Limited income streams • Agriculture/Fisheries/ Forestry • Production of value-added commodities	• Africa is predominately an agriculture-based economy. Non-diversified economy (mono-crop or primarily agriculture based) makes the country much more vulnerable to impacts of climate change. • Could be exported, source of revenue aside from livelihood based on the land.

Sector	Vulnerability	Relevance
Economic contd.		
	Lack of diversification of employment opportunities	In sub-Saharan Africa, most common occupations are small-scale farming, fishing and husbandry, all which will be negatively impacted by climate change.
	Energy imports	Many countries are highly dependent on imported fuels for transportation, heating, cooling and lighting of buildings and electric power generation. The threat of supply interruption is real, primarily for unforeseeable political reasons, but also due to pipeline accidents, system vulnerabilities, embargoes, terrorism, and civil strife. The cost of imported fossil fuels is a major burden in most countries.
Technical		
	Lack of diversification of power sources	Home energy sources for cooking and lighting are usually biomass (wood, charcoal, etc) and butane.
	Poor quality of infrastructure • Water • Sewage • Communication • Technology • Training • Buildings • Transport systems	• Functioning water and sewage infrastructure support health and human productivity. • Information sharing (for example drought or flood early warning systems) allows communities to prepare and increases resilience. • Greater access to information increases the likelihood of timely and appropriate adaptation.[7] • Lack of access to modern diversified technologies limits the range of potential adaptation options.[8] • Well trained manpower (power sector, household energy, etc..) is necessary for functioning energy system. • Formerly known and employed techniques like bioclimatic architecture have been neglected.

[7] Smit et al., 2001
[8] Ibid

Sector	Vulnerability	Relevance
Social		
	Limited access to services and resources • Water • Energy • Land	• Lack of access to clean water effects health and productivity. • Energy can improve general well-being through its use in providing heating/cooling, cooking and lighting. • Reliable and affordable access to land and energy is important for community stability. Establishment and enforcement of rights for women and landless is important.
	Low and unequal education levels • Female education levels • Poverty level	Affects economy and overall standard of living. • While education increases the productivity and earnings of both men and women, educating females generates substantial social benefits including healthier, fewer and better educated children. As schooling tends to improve a mother's knowledge and use of health practices, each additional year of schooling is estimated to decrease the mortality rate of children under the age of 5 by up to 10 percent.[9] • Poverty is a major obstacle to sustained economic growth. Poverty makes people highly vulnerable to ill health, socio-economic dislocation and natural disasters.
	Poor community health • Diseases and epidemics • Famine • Level of malnutrition • Life expectancy	Healthier people are better able to cope with climate change-induced hardships. Malaria is especially prevalent in Africa, as is AIDS.

[9] http://www.worldbank.org/afr/findings/english/find06.htm

Sector	Vulnerability	Relevance
Civic (governance and regulation)		
	Energy sector reforms	A centrally controlled energy sector is more likely to be affected by environmental change, global economic shocks and poor governance. A devolved, diversified and open management of the power sector with participation from companies, communities, NGOs and civil society are better positioned to withstand shocks.
	Unbalanced governance	Without sufficient over-sight, decisions on investment, policies, and implementation often do not reflect the actual needs of the people. Plans for re-employment after a drought and assistance to small-scale subsistence farmers could occur more efficiently if the people affected have an early say in the decision-making process.
	Lack or limited citizen participation	Good and early dissemination of information give citizens some ability to influence decisions and improve the implementation of what the population really needs. Processes have to be officially in place to allow participatory decision-making. NGOs have a wealth of information that can thus be shared and used to improve the relevance and effectiveness of decisions made.
	Unequal gender roles	Women are generally poorer and more vulnerable than men. However it is often women who make decisions about purchasing energy-efficient stoves in rural households, for example.
	Corruption	Renders a government less effective at providing for the population and therefore at adapting to climate change. Destroys prospects for future generations.
	Neglected indigenous knowledge	Often valuable methods of adapting/responding to environmental change are an integral part of indigenous cultures and should be used in developing responses.

APPENDIX 4: General Indicator Formulas

When vulnerability is discussed at the national level it is traditionally around issues of energy supply security and how to improve it. There is little policy formation around the broader context of reducing energy system vulnerability through ecodevelopment strategies, e.g., addressing environmental, social, economic, technical and governance issues.

The indicators presented below are to help quantify the country's general vulnerabilities.

1. Using available data, calculate the following indicators
2. For each group of indicators e.g., environmental, economic, etc. provide a short, qualitative summary, highlighting any key issues that may have not been captured by the indicators or that affected the indicator calculations.

NOTE:

- ***Use 1990 or nearest year for which data is available as the base year***
- ***Consult Annual reports, National communications, NAPAs for data***

Sector	Indicator	Calculation
Environmental		
	1. Change in rainfall patterns	% change between current year and 1990 – describe the change in rainfall patterns Additional information that can be included: • Volume and frequency of rainfall • Number of rain days per year • Number of days with heavy precipitation (> 50mm) • Length of seasons • Maxima/minima rainfall
	2. Variation in temperature	Temperature evolution (in C°) between current year and 1990 • Average • Minimum/Maximum per season

Economic		
	1. Proportion of households acquiring access to electricity in the last two decades	% of households who have gained access to electricity between current year and 1990
	2. Level of increased energy autonomy	*Country that is a net importer of oil and gas (non-renewables)* (Importing countries can improve resilience by reducing either imports or consumption of non-renewables, or increasing imports or consumption of renewable energy, and increasing their overall energy efficiency) • ratio between imports of non-renewable energy and the consumption of non-renewable energy (in Joules) in comparison to 1990 *Country that is a net exporter of oil and gas (non-renewables)* • ratio between the export of non-renewable energy and the value of all exports (in monetary value) in comparison to 1990
Technical		
	1. Change in the amount of energy supplied by renewables	1a. Aggregate heat and electric power production from renewables (MW/h) 1b. % change between current year and 1990 of % of power from renewable sources in total power production 1c. Volume of renewable fuel consumption (in TOE) 1d. % change between current year and 1990 of % fuel from renewable sources in total fuel consumption
	2. Level of diversity of renewable energy sources and technologies	% contribution of the following to total renewable energy use, describing what the renewable energy source is. • Electricity • Heating • Transport

Social		
	1. Change in prevalence of diseases	% change in rate of waterborne diseases reported between current year and 1990 • Comment on unreported incidences if possible
	2. Change in employment	% change in unemployment rates reported between current year and 1990 • Comment on unreported incidences if possible
Civic (Governance)		
	1. Land reform improvement	% change of farmers owning or having permanent access to their own land between current year and 1990 and % of women owners Proxy: Presence of land ownership policies and enforcement of legislation
	2. Change in public participation in planning process	a. % participation in national elections or in Agenda 21 planning and implementation processes b. % change between current year and 1990

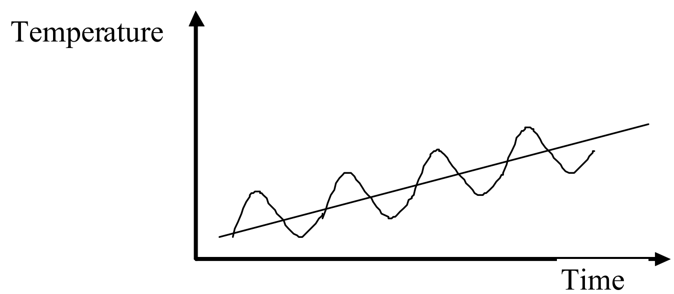
APPENDIX 5: Setting the Context: Overview of climate induced impacts, associated vulnerabilities and possible adaptation measures for energy systems

Climate Induced Impacts on Energy Systems and Related Vulnerabilities

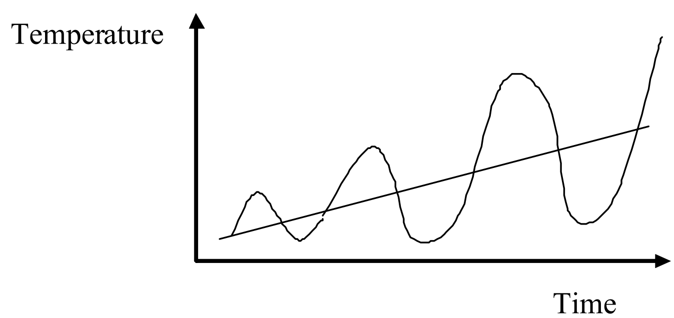
Climate change can cause different impacts. For example, the mean of climatic parameters as well as the intensity of meteorological extreme events can change. The possible changes for temperature are shown in Figure 1. They can be translated to other climatic parameters such as precipitation, windspeed and sunshine. With climate change, temperature and windspeed are likely to increase in most regions whereas trends in precipitation and sunshine can go in either direction.

Figure 1: Changes of Meteorological Parameters Due to Climate Change

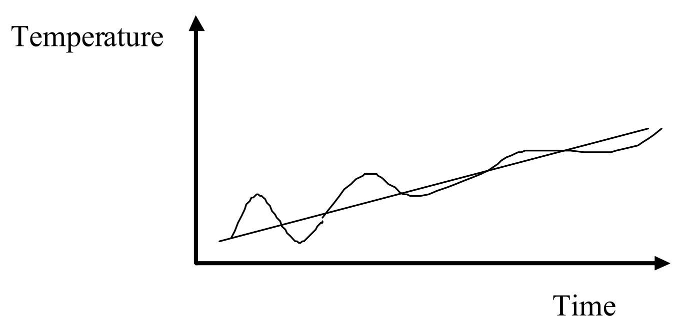
a) Increase of average temperature without change in temperature variability



b) Increase of average temperature with increase in temperature variability



c) Increase of average temperature with decrease in temperature variability



It is obvious that impacts will be larger if variability increases. But even in a situation with decreasing variability, impacts will occur if the meteorological parameter passes the design threshold of an infrastructure.

Of course, impacts can be direct or indirect. Frequently, indirect impacts are much stronger. For example, an increase in temperature alone is extremely unlikely to destroy any energy infrastructure. However, the melting of glaciers induced by temperature increase will have a strong impact on hydropower resources.

Table 1 gives an overview about direct and indirect impacts of change in meteorological variables. It also demonstrates cross-effects, i.e. interactions between different impacts.

Table 1: Direct and Indirect Impacts of Changes in Meteorological Variables

Direct change	Direct impact	Indirect impact	Cross effects
Temperature increase	Heat-wave	Increased electricity demand	
	Glacier melting	Short term increase of water flow, long term reduction	Droughts/floods
		Formation of moraine lakes with outbursts	Floods
		Sea-level rise	Floods
	Increased evaporation	Reduction of stream flow	Droughts
	Stronger cyclones		Floods
Precipitation increase	Floods		
Precipitation decrease	Droughts		
Decrease in cloud cover	Increased evaporation	Reduction of stream flow	Droughts
Increase in cloud cover	Decreased evaporation	Increase of stream flow	Floods
Windspeed increase	More/stronger storms/cyclones		Floods
Windspeed decrease	Less/weaker storms		

Changes in meteorological variables will have an impact on energy transmission and use regardless of how the energy is produced. Extreme events increase the risk of destruction of transmission lines and reduction of electricity demand due to destruction of electricity-consuming entities.

Table 2: Direct and Indirect Impacts of Climate on Electricity Systems

Change in meteorological variable	Impact on electricity transmission	Impact on electricity use
Temperature increase	None	- Increase due to higher cooling needs - Decrease if sea-level rise displaces population and industrial production
Decrease in cloud cover	None	Decrease due to less lighting need
Increase in cloud cover	None	Increase due to more lighting need
Increased frequency and/or strength of storms/cyclones	Destruction of transmission lines	Reduced electricity demand due to destruction of houses and factories
Floods	Destruction of transmission equipment from flooded power plants	Sharply reduced electricity demand due to interruption of production in flooded factories/stop of electricity consumption in flooded houses
Droughts	Risk of destruction of transmission lines due to	Slightly reduced electricity demand due to interruption of production in

Change in meteorological variable	Impact on electricity transmission	Impact on electricity use
	forest fires.	factories that do not get raw materials any more/stop of electricity consumption in houses of people fleeing the drought area

In the following sections, impacts of change of meteorological parameters are assessed for different energy production systems. They are grouped according to generation of energy and transport of the energy to the user.

a. Fuel from Mined Resources

Current energy systems are mainly based on fossil fuels, be it solid fuels like coal, liquid fuel such as oil and gaseous fuels. Extraction of fossil fuels as well as their utilisation will be impacted by climate change, as shown in Table 3.

Table 3: Climate Change Impacts on Fossil-fuel Based Energy

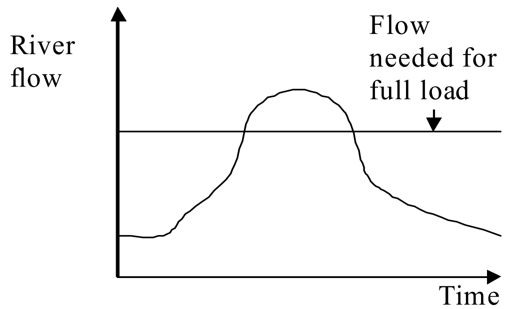
Change in meteorological variable	Impact on fuel availability	Impact on energy generation
Temperature increase	None, unless pipelines get interrupted by melting pergelisol or discontent	Decrease of power plant efficiency due to higher temperature of cooling water.
Average precipitation increase	Reduced coal quality due to moisture content of opencast coal mining. Increased coal availability if coal seam fires are extinguished	None.
Average precipitation decrease	Decrease due to higher probability of coal seam fires	None
Droughts	Decrease due to lack of water necessary for mining air conditioning and operations	Decrease due to non-availability of cooling water
Glacier melting	None	Increase in the medium term (for power plants located close to the glaciers) due to lower cooling water temperature and higher availability of cooling water. Decrease in the long term once glaciers have vanished.
Floods	Decrease if floods affect mines.	Decrease if power plant is flooded or fuel cannot reach the plant.
Increased frequency and/or strength of storms/cyclones	Decrease if storms affect vulnerable mining equipment such as offshore oil platforms or opencast coal mine excavation equipment	Decrease if equipment is destroyed or fuel availability is reduced

b. Hydro

Hydro power can be generated in a wide range of power plant sizes from GW to kW scale. Siting of hydropower plants is usually based on multi-decadal river flow measurements. Changes in average precipitation will change river flow and have an impact on hydro power production, each system which depends on plant-specific characteristics. While plants with large reservoirs can buffer river flow variability, run-of-the river plants are directly dependent on the actual river flow. The actual change in power production strongly depends on the flow regime and utilisation rate of river flow which is shown in Figure 2.

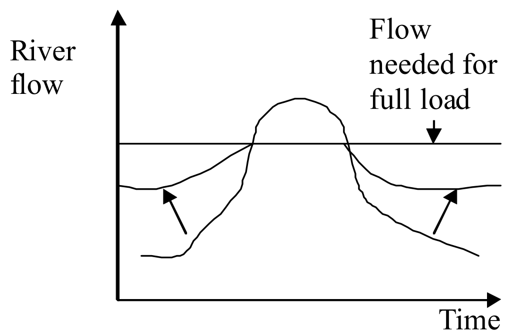
Figure 2: Hydro Power River Flow Utilization and Impact of Changes in the Flow Regime (assuming the glaciers and reservoirs remain stable)

a) Flow regime before climate change



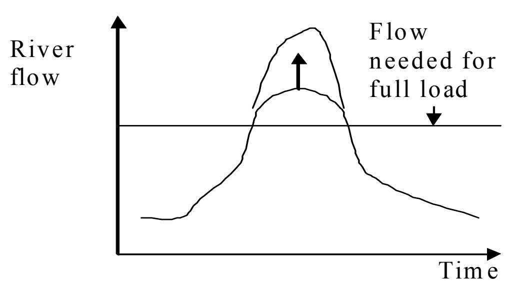
The power plant can only produce at full load during a limited rainy season.

b) Flow regime after climate change: increase of flow in previously lean periods



Now the plant can considerably increase power production

c) Flow regime after climate change: increase of flow in previously strong periods



In this case the plant cannot increase production at all despite the increase in river flow Normally, hydro power plants are able to withstand flooding events by opening floodgates and shutting down turbine operation. Only in rare cases, hydro power plants and/or dams are destroyed by flood events; they are less prone to flooding impacts than other power plant types if well-designed and situated in areas not prone to landslides. However, reservoirs can be filled up by debris and silt and thus long-term power generation capacity be reduced.

Given that hydro plants are normally built in sturdy structures, an increase in the strength/frequency of storms and cyclones only marginally increases the risk of destruction of hydro power plants. Table 4 summarizes the effects.

Table 4: Climate Change Impacts on Hydro Power

Change in meteorological variable	Impact on electricity generation
Average precipitation increase	Increase. Temporal spacing of increase decisive for degree of increase – the better distributed over time, the stronger the increase.
Average precipitation decrease	Decrease
Droughts	Decrease due to reduced river flow
Glacier melting	Short-to medium term increase, long-term decrease (depends on situation of glaciers with regards to the current and future snow line)
Floods	Decrease if reservoir is filled with debris / silted. In rare cases destruction of power plant / dam.
Increased frequency and/or strength of storms/cyclones	Marginal increase of risk of destruction of electricity generation equipment

c. Biomass

Biomass energy comes in many different forms. Biomass can be used for heat generation in small, decentralised devices such as household stoves. It can also be used for power generation in plants of several MW size. Biomass can be sourced from forests or agricultural residues. Dedicated biomass plantations are also possible but rare due to the high costs involved.

Climate change impacts the availability of biomass as well as energy generation facilities, as shown in Table 5.

Table 5: Climate Change Impacts on Biomass Energy

Change in meteorological variable	Impact on biomass availability	Impact on energy generation
Temperature increase	Decrease if plants reach threshold of biological heat tolerance or sea level rise reduces area where plants grow, otherwise increase (provided that no lack of other resources constrains plant growth)	Decrease if power plant is impacted by sea level rise. Otherwise depending on biomass availability.
Average precipitation increase	Increase if increase occurs during the growth season	Increase.
Average precipitation decrease	Decrease unless decrease occurs outside the growing season	Decrease
Droughts	Decrease	Decrease
Glacier melting	If under irrigation: short-to medium term increase, long-term decrease (depends on situation of glaciers with regards to the current and future snow line) Otherwise: none	As per availability
Floods	Decrease if floods affect area where biomass is sourced.	Decrease if power plant is flooded or biomass availability is reduced.
Increased frequency and/or strength of storms/cyclones	Decrease if storms affect area where biomass is sourced	Decrease if equipment is destroyed or biomass availability is reduced

d. Wind

Wind energy is generally harnessed in a decentralised manner and in locations chosen for their high average windspeed in the recent past. Usually, windspeeds are measured for several years before investors decide to set up a wind turbine. Wind turbines start production of electricity at a certain windspeed and increase electricity generation with a power of three as windspeeds increase. At a certain maximum windspeed, the turbine is automatically shut off to prevent damage. Modern turbines withstand windspeeds of 70 m/s before being destroyed.

Climate change can change average windspeeds. An increase in average windspeed would generally increase electricity generation unless the increase is only happening in the highest windspeed categories. A decrease in windspeeds leads to a reduction in electricity generation. An increase in the highest windspeeds increases the periods where wind turbines are stopped and the risk of destruction. Table 6 summarizes the effects.

Table 6: Climate Change Impacts on Wind Energy

Change in meteorological variable	Impact on electricity generation
Temperature increase	Decrease due to flooding of wind turbines on exposed coastal sites
Average windspeed increase	Increase
Average windspeed decrease	Decrease
Increased frequency and/or strength of storms/cyclones	Decrease due to stopping / destruction of wind turbines
Floods	None

e. Solar

As in the case of wind, solar energy is generally harnessed in a decentralised manner and in locations chosen for their high average sunshine duration in the recent past. While photovoltaic cells and solar water heaters can produce electricity even during a certain degree of cloud cover, mirror-based solar thermal applications need full sunlight.

The efficiency of solar power production decreases with the ambient temperature. So an increase in temperature will reduce electricity production.

An increase in the strength / frequency of storms and cyclones increases the risk of destruction of solar energy generation equipment. Table 7 summarizes the effects for grid-connected photovoltaics and concentrating solar power (CSP), Table 8 for stand-alone solar thermal systems.

Table 7: Climate change Impacts on Grid-connected Photovoltaics and Concentrating Solar Power

Change in meteorological variable	Impact on electricity generation
Temperature increase	Decrease due to lower efficiency
Decrease in cloud cover	Increase
Increase in cloud cover	Decrease
Increased frequency and/or strength of storms/cyclones	Destruction of electricity generation equipment

Table 8: Climate Change Impacts on Stand-alone Solar Thermal Systems

Change in meteorological variable	Impact on hot water generation	Impact on hot water use
Temperature increase	Increase	Decrease
Decrease in cloud cover	Increase	None
Increase in cloud cover	Decrease	None
Increased frequency and/or strength of storms/cyclones	Destruction of panels	Destruction of houses

Possible Adaptation Measures for Energy Systems

Adaptation measures can be categorised into infrastructural/technical and behavioural ones. Technical adaptation tries to make infrastructures invulnerable against long-term changes in meteorological variables and extreme events. Behavioural adaptation tries to adjust operation of existing and location of new infrastructures in a way to minimize damages.

a. Fuel from mined resources

Technical adaptation for fossil fuel mining means improving the robustness of mining installations. This is especially important for offshore installations that are vulnerable to storms but also opencast as well as underground mines vulnerable to both flooding and shortage of water to sustain mining operation.

Behavioural adaptation would include siting of future mines in areas that have a limited exposure to flooding or drought risk. Power plants should preferably be sited at places with ample cooling water availability, especially with water of low temperature. They could also replace water with air cooling.

b. Hydro

Technical adaptation for hydro projects can consist in building desilting gates to “flush” silted reservoirs. Moreover, dams can be increased in height and floodgates enlarged to cater for increased river flow extremes and variability. Upstream land management can also reduce possible erosion and resultant siltation of dam.

The change in flow regime might allow the installed capacity to expand. Increased flows from glacier melting should be taken into account if they are likely to persist for the technical lifetime of the extra capacity. Behavioural adaptation would include change of the plant operation regime to take into account changes in river flow patterns.

c. Biomass

Biomass availability can only be increased if crops are bred that have a higher biological heat tolerance and tolerate higher water stresses. Moreover, expansion of irrigation systems or improvement of efficiency of existing irrigation can counteract drought impacts provided sufficient water is available from sources outside the drought-hit area. This might imply tapping unconventional sources such as desalinated seawater or fossil water resources. Protection against floods can be provided by building dikes and improving drainage. Regarding biomass power plants, the robustness of the construction should be increased if located in storm-prone areas.

Behavioural adaptation would include early warning systems for rainfall and temperature anomalies, support of emergency harvesting in case of an imminent extreme event and the provision of crop insurance systems. Biomass power plants should be sited in less flood and storm-prone areas.

d. Wind

Technical adaptation for wind power would mean that turbines are built in a more robust way to operate at and to physically withstand higher windspeeds.

Regarding behavioural adaptation, siting could take into account expected changes in windspeeds during the lifetime of the turbines, as well as sea-level rise and changes in river flooding. Insurance schemes for long-term wind power yields and damages from storms should be developed. This would require a good forecasting skill regarding changes in windspeed and extreme storm events. Moreover, rapid emergency repair teams could be set up to get damaged turbines repaired as quickly as possible.

e. Solar

For all solar technologies, technical adaptation is limited as they cannot be more robust than the building on which they are located. Behavioural adaptation would include siting according to expected changes in cloud cover. Large CSP plants should be designed in a way to make them robust with regards to storms. For distributed systems, mobile repair teams would be key to get them operational again after damage from extreme events.

f. Interaction of adaptation measures between different energy forms

In several cases, adaptation measures of different energy forms influence each other. For example, behavioural adaptation of hydro power plants due to an improved operation schedule may conflict with an improved irrigation schedule of a downstream irrigation system. Likewise, desilting of reservoirs may have negative impacts on water supply for downstream irrigation. All power plant developers will rush for sites that have limited flooding risk and might compete for the limited number of good sites.

APPENDIX 6: Energy System Indicator Formulas

Several criteria have guided the selection of VAR indicators:

1. Each indicator must:
   - be clearly definable, simple to understand, and easily communicated to citizens and decision-makers alike;
   - be relevant to actual or anticipated policies;
   - reflect an important aspect of the social, economic, environmental, or technological elements of the energy system;
   - measure something of obvious value to observers and decision-makers; and,
   - have long-term relevance.

2. The underlying metric —the actual measurement or statistic used— must be generally available for most, if not all, countries. This combines measurability, data availability, and achievability; in other words, data collection and vector calculation must be do-able.

3. If calculation is required to derive an indicator, it must be simple to do.

Below are two sets of indicators: one to measure the vulnerability of a country's energy systems, a second to measure the level of resilience of the energy systems. Each set presents one to three indicators per system. For some energy systems there is a request for additional information if that information is available in-country.

Each indicator should be completed to the best of the reporter's ability. Supporting information based on professional observation and experience is encouraged.

If the indicator is not applicable the reporter should note this with a "0"

Energy System Vulnerability

Vulnerability Indicator	**Research Resources**
Coal	
1. Number of coal mines plants located at less than 1 metre above sea level and within the area that could be flooded by a flood with a current recurrence period of 100 years	• National planning agency • Ministry of Energy • IEA • World Coal Institute http://www.worldcoal.org/
Oil and gas	
1. Share of offshore oil and gas installations likely to be hit by a storm of more than 70 m/s gusts within the next 20 years (%)	• Regional climate models: --Hadley Centre (PRECIS) --Munich Re map of natural hazards
2. Share/number of refineries likely to be hit by a storm of more than 70 m/s gusts within the next 20 years (%)	• l'Institut français du pétrole http://www.ifp.fr

All fossil fuels	
1. Number of thermal (coal, oil and gas) power plants located at less than 1 metre above sea level and within the area that would be flooded by a flood with a current recurrence period of 100 years	
• Additional information: Expected number of droughts that lead to a capacity decrease of thermal power plants by more than 10% within the next 30 years.	
Nuclear	
1. Number of nuclear power plants located at less than 1 metre above sea level and within the area that would be flooded by a flood with a current recurrence period of 100 years	• IAEA http://www.iaea.org/
2. Number of incidents/accidents since the plant was built 2b. Describe the most significant incidents	
Hydro	
1. Expected precipitation change over next 20 – 50 years (%) **and/or** probability of floods in each watershed	• Regional climate models: --Hadley Centre (PRECIS) --IPCC 4th AR WG II
2. Number of multiple-use dams in the country today • Volume of water (m3) of each dam 2b. Describe what % of the water is used for: • Agriculture • Power • Drinking	• FAO • Observatoire du Sahara et du Sahel / Sahara and Sahel Observatory www.oss-online.org • Ministry of Water Resources
• Additional information: Expected additional run-off from glacier melting (million m3)	Not applicable for Africa
Transmission and Distribution Indicators	
1. Length of in-country, above-ground transmission and distribution lines (km) 1b. Distinguish between (2 sub-indicators): ○ High (transmission) ○ Middle + low voltage lines (distribution) 1c. Describe any transnational lines	• National planning agency • Ministry of Energy • Electric utilities

2. Number and length of power cuts (differentiate between failures due to weather or equipment failure and those cuts due to rationing) 2b. Average hours of interruption per year	• Ministry of Energy • Consumer associations
3. Percentage of energy supply requiring regional transport over 50 km 3b. % that is transportation of fossil fuel 3c. % that is transportation of biomass If possible, comment on the informal sector	• National Planning Agency • Ministry of Energy • Local energy cooperatives • NGOs
Biomass	

1. Proportion of biomass used for energy purposes (%) in total biomass production
 	
If possible distinguish between different sources and different applications :
• Agricultural biomass harvest
  o Electricity
  o Heat
• Forest (as defined by FAO) biomass harvest
  o Electricity
  o Heat
	• National Planning Agency
	• Ministry of Energy
	• Ministry of Agriculture
	• IEA
	• FAO
	• Local cooperatives

2. Expected precipitation change over next 20 – 50 years (%)	• Regional climate models: --Hadley Centre (PRECIS) --IPCC 4th AR WG II • Météo France • UNDP: climate change country profiles http://country-profiles.geog.ox.ac.uk/
• Additional information: Probability of temperature increase beyond biological heat tolerance of key biomass crops within the next 20 years (%)	
Wind	
1. Number of wind turbines less than 1 meter above sea level	• National Planning Agency • Ministry of Energy
2. Projected change of average windspeed in the next 20 years based on regional climate models (%)	• IPCC 4th Assessment Report • Regional climate models: --Hadley Centre (PRECIS) --IPCC 4th AR WG II • World Wind Energy Association http://www.wwindea.org/home/index.php

Solar	
1. Capacity of solar installations already in place (m2). 1b. Distinguish between: • PV (MW) • Thermal (m2) 1c. Describe sites (quality of the insulation and of the building on which systems are installed) and what type of ownership (private, government, public/private partnership etc.)	• National Planning Agency • Ministry of Energy
2. Expected temperature increase in the next 20 years (°C) relevant for PV capacity)	• Regional climate models: --Hadley Centre (PRECIS) --IPCC 4th AR WG II • Métèo France
• Additional information: Projected change in rainfall and cloud cover over next 20 years (%)	• Regional climate models: --Hadley Centre (PRECIS) --IPCC 4th AR WG II • Métèo France • UNDP: climate change country profiles http://country-profiles.geog.ox.ac.uk/

Energy System Resilience

Resilience Indicator	Research Resources
Implementation Indicators	
1. Domestic capital formation (million USD per year) • Proxy: Domestic savings (million USD per year)	• World Bank http://devdata.worldbank.org/data-query/ • Domestic banks • NEPAD www.nepad.org/
2. Domestic investment in renewable energy (million USD per year)	• REN 21: Renewables 2007 – global status report
3. Number of technical engineers graduating annually as a percentage of the total population	• National education statistics
4. Availability of hazard maps for floods/droughts	• National Planning Agency
5. Existence and enforcement of power plants siting and construction guidelines taking climate change into consideration If there is no information available, discuss qualitatively how climate change could effect siting and construction guidelines	• National electricity regulator • Ministry of Energy • NAPAs • Country maps
6. Existence of emergency plans to react to meteorological extreme events and availability of local emergency repair teams Comment if possible on the level of implementation	• National Planning Agency • Electricity companies
7. Domestic availability of insurance schemes	• Inquire at local insurance companies
8. Existence of citizens' users groups in the energy governance structure (enforcement of participatory decision-making)	• National Energy Agency • Local NGOs
Coal, Oil, Gas, Nuclear Fuel Sources	
1. Existence and use of a siting map for mines and power plants taking into account projected storms, floods and drought areas	• National Planning Agency • Ministry of Energy
2. Implementation of national regulations for thermal power plant siting at sites with sufficient cooling water availability over the next 50 years	• National Planning Agency • Ministry of Energy

Hydro	
1. Existence of a national plan for optimised operation of hydro plants under projected flow regimes for systems • is such a plan currently in place? • If not, has the government decided to have one at a future date?	• National Planning Agency • National electricity regulator • Transnational River Authorities
2. Number of dams equipped with desilting gates and/or number of up-stream land use management and water catchment plans for each hydro installation	• National Planning Agency • Ministry of Energy • Transnational River Authorities
Biomass	
1. Research, Development and Dissemination budget for heat and drought resistant crops, biofuels, agricultural* waste for energy and vulnerability of forest (million USD/year) If possible, comment on consistency of funding * do not include municipal waste – this is usually considered in mitigation plans	• Ministry of Agriculture • Ministry of Research • FAO www.fao.org
2. In-country utilization of biomass fuels not traditionally used by private enterprises and cooperatives (% of total fuels)	• National Planning Agency • Ministry of Energy
3. % of households using improved woodstoves out of total number of households using woodstoves	
Wind	
1. Existence and enforcement of national regulations requiring storm proofing of wind power plants to withstand highest anticipated windspeed	• National electricity regulator • Ministry of Energy
2. Existence of siting maps that detail projected changes in: windspeed; floodplains; and areas impacted by sea level rise	• National Planning Agency
Solar	
1. Existence of a siting map that detail projected changes in cloud cover	• National Planning Agency
2. Existence and enforcement of national regulation requiring storm proof concentrating solar power plants (CSP) to withstand the highest anticipated windspeed	• National Planning Agency • Ministry of Energy

APPENDIX 7: Suggestions for Policies and Measures (PAMs) [10]

The proposed PAMs should build on the information derived from the indicator calculations. **It is not necessary to propose PAMs for each of the policy areas.** The objective is to present **key** PAMs that would have a significant effect in targeted areas.

Below are examples of PAMs that could be proposed to increase energy system resilience through adaptation.

Policy Area[11]	**Suggestions for Voluntary and Compulsory Measures**
Environment	
	National assessments of climate change impacts and vulnerability
	Sustainable forest management
	Land use planning that takes climate change impacts into account
	Integrated watershed management
Economic	
	Mobilisation of funding and investment finance in new energy infrastructure, including micro-credit and micro-finance (for the bottom billion) for small scale energy investments in a transparent manner
	Improved business climate for investments in the energy sector including the removal of investment barriers and bureaucratic licensing procedures and implementation of efficient and transparent financial resource management
	Improved local insurance service delivery, including micro-insurance for small scale energy business
	Smart subsidies to support the growth of renewable energy and energy efficiency technologies
	Removal of subsidies for centralised urban energy particularly fossil energy supply
	Establishment of local energy-related production facilities, including cooperatives and village power systems
	Investments in adapted/diversified biomass use, emphasizing financing and credit facilities to support women's enterprises related to alternative energy options
Technology	
	Climate-proofing of essential infrastructure by diversification
	Clean energy technology needs assessment
	Improved renewable energy resource database
	National energy efficiency and renewable energy technology targets
	Decentralization and diversification of generation capacity and fuel supplies to promote wider access to modern energy services
	Sustainable dam management
	Fuel switching from widespread reliance on biomass fuels collected by

[10] These PAMs are based on information drawn from a number of sources including, Millennium Ecosystem Report (2005), OECD, UNEP – GEO 4(2007), UNFCCC NAPAs, US EPA and World Resources Institute.

[11] Adaptation measures can also be categorised into infrastructural/technical and behavioural approaches. Technical adaptation tries to make infrastructures invulnerable against long-term changes in meteorological variables and extreme events. Behavioural adaptation tries to adjust operation of existing and location of new infrastructures in a way to minimize damages.

	women and children to cleaner and more modern fuels
Social	
	Ensuring access to affordable and sustainable energy
	National poverty reduction strategy including job creation strategy
	National biomass household energy efficiency program targeting the poor
Energy Governance	
	Planning and capacity building for sustainable energy development and climate changes based on democratic processes and timely inputs from all concerned citizens, including women, landless and traditionally under-represented groups
	Active engagement in regional and international climate treaty and energy-related processes (UNFCCC, CDM, special adaptation funds, etc) and implementation of activities to reach the MDGs and Agenda 21
	Increased participation of women in energy planning and development
	Public education and stakeholder consultation about climate change impacts and responses, including outreach to and input from women, youth, and especially vulnerable groups
	Research and public investments & subsidies for alternative livelihoods and community development compatible with climate variations and sustainable energy production and use
	Formulation of a broader national vision of a zero carbon economy (soft energy paths, like Negawatt, INFORSE, Amory Lovins soft energy path)

APPENDIX 8: Report Dissemination

In order to ensure that the final report is accessed and used by the relevant people in-country, it is important to define the main elements of a dissemination strategy. Ideally the approach should evolve as the report is being prepared so that it can reflect new information gained in the research process.

Below are some recommended steps for the country reporter to follow in developing his/her own dissemination strategy.

First: the reporter should be able to define those organisations that could use/benefit from the country report. Questions to ask include:

- What key policy and decision making bodies, civil society organisations etc., could use (or would benefit from) the information presented in the report?
    - Who is the relevant contact person?
- What other organisations could benefit from the information in the country report?
- What other government bodies should be informed of this work?
    - Who is relevant contact person or department?

Second: the reporter must generate a list of all those people who have been consulted on the report. They should be sent a final copy of the report and kept updated on any changes to the report.

Third: the reporter should outline possible outreach strategies to raise awareness of the report. Possibilities include

- producing relevant press material and holding a press conference
- organising a report launch were key organisations are invited to attend
- visiting (personally) those organisations/government bodies to talk about the report and answer any questions
- making the report available on the reporter’s institutional website.

APPENDIX 9: Bibliography Guidelines

Please follow these guidelines when referencing documentation:

1. Restrict use of footnotes to important additional information.

2. References should be cited within the text:
   - use the Author-Date-Style (Harvard). For example: ...as one writer put it "the darkest days were still ahead" (Weston 1988, p.45).
     Scholtz (1990, p.564) has argued that...

3. Book reference
   - Groenewegen, D. (1997), The Real Thing?: The Rock Music Industry and the Creation of Australian Images, Moonlight Publishing, Golden Square, Victoria

4. Chapter reference
   - Blaxter, P. (1976), Social health and class inequalities, in: Carter, C. & Peel, J. (eds) Equalities and Inequalities in Health, 2nd ed, Academic Press, London

5. Journal reference
   - Withrow, R. & Roberts, L.(1987), "The videodisc: Putting education on a silver platter", Electronic Learning, vol. 1, no. 5, pp.43-44

6. Conference paper reference
   - Anderson, J.C. (1987) 'Current status of chorion villus biopsy', In: Tudenhope, D., Chenoweth, J., (eds) Proceedings of the Fourth Congress of the Australian Perinatal Society, Sept. 3-6 1986, Australian Perinatal Society, Brisbane, Queensland, pp. 190-6.

7. Web reference
   - Hudson, P. (1998, September 16 - last update), "PM, Costello liars: former bank chief", (The Age), Available: http://www.theage.com.au/daily/980916/news/news2.html (Accessed: 1998, September 16).

For more information on referencing see: http://www.lib.monash.edu.au/tutorials/citing/