Climate Change and Energy Vulnerability Country dashboard – Quick View

Vietnam - Draft v2

21 September 2012

Quick View Diagnostic

Vietnam

The answers to the Quick View process generated scores for the country's energy sector on three interconnected dimensions: 1) Overall physical vulnerability of the energy sector; 2) Country and sectoral adaptive capacity; and 3) Imperative to adapt the energy sector. The results are summarized in the figure below and described in further detail in later slides.

Exposure of the energy system to climate-related hazards

This depends on the existing climate hazards as well projected future changes in hazards

See Slide 4

Energy system sensitivity to climate change

This depends on the characteristics of the country's energy sector

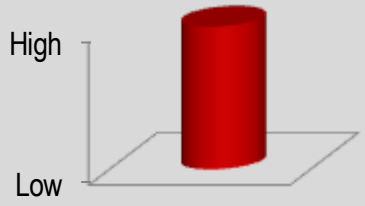
See Slide 5

Country energy sector adaptive capacity

This depends on the potential or capability of the country's energy system to adjust or respond to climate change

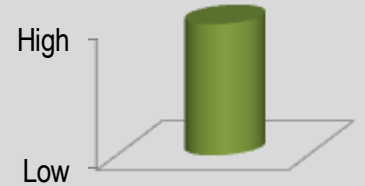
See Slide 8

Vietnam's level of physical vulnerability



See Slide 6

Vietnam's level of adaptive capacity



See Slide 8

Energy system adaptation imperative

HIGH

This indicates how important adaptation is to energy:

- Adequacy
- Reliability
- Cost-effectiveness
- Sustainability

See Slide 9

Energy Sector Overview

Vietnam

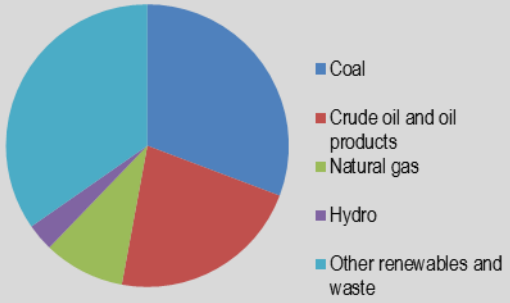
An overview of the country's energy sector is important to understand the context within which climate-related risks will be experienced and how country vulnerability will be assessed.

Key indicators in 2008 (IEA, 2011)	
Total energy production (TEP)	71.3 Mtoe
Total primary energy supply (TPES)	59.4 Mtoe
Energy exports as a percentage of TEP	37%
Total final consumption (TFC)	51.9 Mtoe
Energy supply losses as a percentage of TPES	13%

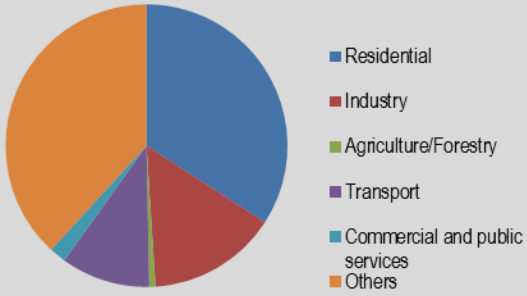
Key recent trends

- High energy demand growth between 2000-09, with power demand growing by over 13% each year, fuelled by the industrial and residential sectors (APERC, 2011)
- Increased share of thermal power and reduced share of hydropower in total electricity production (APERC, 2011)
- Modest reserve margins of 20% in 2006 (Asian Development Bank, 2009)
- Increased coal imports (IEEJ, 2009 and APERC, 2011)

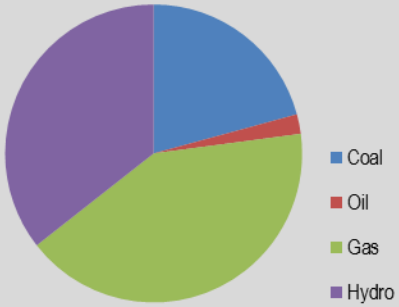
Energy production (ktoe) in 2008 (Source: IEA, 2011)



Final energy consumption (ktoe) by sector in 2008 (Source: IEA, 2011)



Electricity output (GWh) in 2008 (Source: IEA, 2011)



Exposure to Climate-related Hazards Part 1

Vietnam

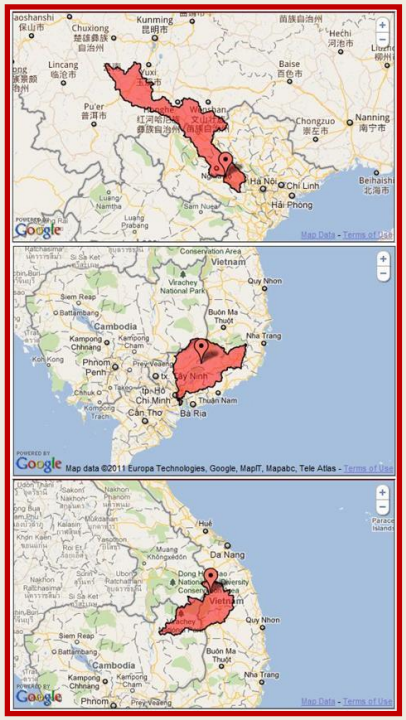
Observed climate-related hazards (country-level). Source: EM-DAT. For more information see the Vietnam Country Adaptation Profile here.

Hazard	Present-day average number of disasters per year	Estimated economic impact in 1980-2010 (in thousand USD)	Country energy sector present-day exposure
Storms	2.52	4, 295, 605	Yes
Yes if the country is affected by tropical cyclone footprints (World Bank Knowledge Portal)			
Flood	1.94	3, 008, 725	Yes
Yes if floods exceed or are equal to 10% of the annual number of natural disasters (World Bank Knowledge Portal)			
Mass movement	0.2	-	No
Yes if landslides exceed or are equal to 10% of the annual number of natural disasters (World Bank Knowledge Portal)			
Drought	0.2	649, 120	No
Yes if droughts exceed or are equal to 10% of the annual number of natural disasters (World Bank Knowledge Portal)			
Wildfire	Very small number reported	-	No
Yes if wildfires exceed or are equal to 10% of the annual number of natural disasters (World Bank Knowledge Portal)			

Exposure to Climate-related Hazards Part 2

Vietnam

Projections for changes in key climate-related indicators by the 2050s: Annual average change (%) for one or more river basin units and for greenhouse gas emission scenario A2 (high). Map(s) showing the river basin(s) concerned can be found below. Source: World Bank Climate Change Knowledge Portal. To see projections for each climate model and per river basin click here.



Indicators (Envelope of GCM ensemble) (A2)	Basin No1706 near Hanoi, Hong or Red river (top map)	Basin No1088 near Ho Chi Minh (middle map)	Basin No 1120 near Nha Trang, Mekong (bottom map)	Country energy sector exposure by the 2050s
Annual precipitation change	-10% / +15.4%	-13% / +15%	-11.5% / +15.7%	**Uncertain**
'Increase' or 'Decrease' if at least 70% out of the available GCMs project an increase or decrease in annual average rainfall exceeding 5% respectively; 'No change' refers to cases where at least 70% of models project a small change (between -5% and +5%); and 'Uncertain' refers to cases where fewer than 70% models agree (World Bank Knowledge Portal).				
Mean annual runoff change	-23.4% / +62.8	-16.3% / +40.4%	-12.4% / +17.8%	**Uncertain**
'Increase' or 'Decrease' if at least 70% out of the available GCMs project an increase or decrease in annual average runoff exceeding 5% respectively; 'No change' refers to cases where at least 70% of models project a small change (between -5% and +5%); and 'Uncertain' refers to cases where fewer than 70% models agree (World Bank Knowledge Portal).				
Drought (low river flows) change	-19.5% / +100%	-15.7% / +46.6%	-13.5% / +20%	**Uncertain**
'Increase' or 'Decrease' if at least 70% out of the available GCMs project an increase or decrease in droughts exceeding 5% respectively; 'No change' refers to cases where at least 70% of models project a small change (between -5% and +5%); and 'Uncertain' refers to cases where fewer than 70% models agree (World Bank Knowledge Portal).				
Flood (high river flows) change	-20.7% / +43.8%	- 17.1% / +32.7%	- 11.1% / +16.2%	**Uncertain**
'Increase' or 'Decrease' if at least 70% out of the available GCMs project an increase or decrease in floods exceeding 5% respectively; 'No change' refers to cases where at least 70% of models project a small change (between -5% and +5%); and 'Uncertain' refers to cases where fewer than 70% models agree (World Bank Knowledge Portal).				

Energy System Sensitivity to Climate Change

Vietnam

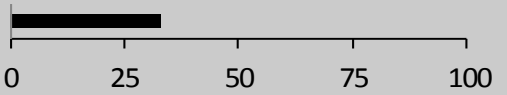
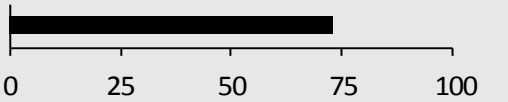
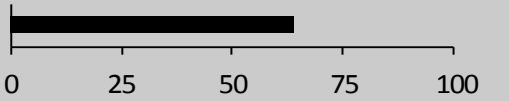
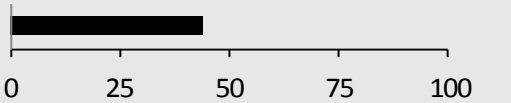
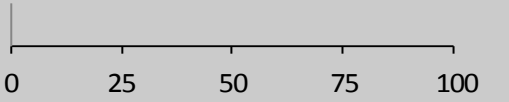
The following table shows areas of climate change sensitivity (in red and orange) in the country's energy system. Orange, white and green represent aspects where there is uncertainty, no obvious sensitivity or opportunity respectively.

Indicators of energy system sensitivity to climate-related changes	Responses and scores
Energy system-level concerns	
Energy sector water intensity	**Unknown**
Energy supply efficiency	**Low**
Country energy intensity	**High**
Fossil fuel resource extraction and processing	
Presence of coastal, offshore or inland extraction/processing plants prone to flooding and storms	**Yes**
Presence of processing plants in water-stressed areas	**Yes**
Energy supply	
Contribution of hydropower to power supply	**Considerable**
Contribution of small reservoirs or run-of-the-river plants to total hydropower output	**Small**
Contribution of thermoelectric facilities to power supply	**Considerable**
Contribution of thermal power plants with open-circuit cooling to total thermoelectric output	**Unknown**
Contribution of woodfuel to household cooking	**Considerable**
Power transmission & distribution and fuel transport	
Energy imports via climatically-sensitive routes over long distances	**Yes**
Proportion of transmission lines crossing areas vulnerable to extreme weather or unstable land	**Considerable**
Energy demand	
Reserve margin adequate to respond to unusually high demand	**Yes**

Physical Vulnerability of Energy System to Climate Change

Vietnam

It is the combination of responses on the 'Exposure of the energy system to climate-related hazards' (Slide 4) and 'Energy system sensitivity to climate change' questions (Slide 5) that gives physical vulnerability scores for each element of the energy service chain. The bar charts below represent the percentage of combinations where a vulnerability was identified. For further information on the indicators used to assess physical vulnerability, refer to the Rapid Assessment process document by clicking here.

Energy service chain	Physical vulnerability scores
Energy system-level concerns *Percent out of 21 possible areas of climate change vulnerability**	
Fossil fuel resource extraction and processing *Percent out of 11 possible areas of climate change vulnerability**	
Energy supply *Percent out of 39 possible areas of climate change vulnerability**	
Power transmission & distribution and fuel transport *Percent out of 18 possible areas of climate change vulnerability**	
Energy demand *Percent out of 9 possible areas of climate change vulnerability**	

* The number of possible areas of climate change vulnerability varies according to the degrees of complexity and sensitivity to climatic parameters of each element of the energy service chain. For example, energy supply is overall more sensitive to climate, and the interactions between climatic parameters and different modes of energy generation are more complex than in the case of fossil fuel resource extraction and processing.

Physical Vulnerability Example

Vietnam

Recent experiences of power shortages due to droughts

In recent years, Vietnam has experienced power shortages due to drought conditions a number of times:

- In May - July 2005, power capacity shortages were estimated at 800 - 1300 MW during peak load.
- For 2011, it has been forecast that Vietnam will lack between 1.2 and 1.6 million MWh during the dry season, due to high demand coupled with low hydroelectric power output.

Details

- In 2005, reduced hydropower generation caused considerable supply shortages due to small reserve margins in Vietnam's electricity system to produce electricity during peak load periods (World Bank, 2006). Rolling load shedding was required in northern Vietnam for weeks, including in Hanoi. Exceptionally low reservoir water levels due to severe drought conditions meant that hydropower production had to be halted at the 1,920 MW Hoa Binh hydropower facility, where water supply for community livelihoods and agriculture receives priority over hydropower.

- In July 2011, due to low river flows, seven small hydroelectric plants in Gia Lai province had to cease operations. The July 2011 water shortages are affecting many other hydroelectric plants across the country, creating concerns about power outages throughout the dry season (Vietnam Business News, 2011).

- Though electricity service quality in Vietnam has significantly improved over the last 10 years, electricity supply continues to be a constraint to economic activity: in a 2006 World Bank Investment Climate Survey for Vietnam, surveyed companies reported an average of 12 power outages or surges per year and, in the case of small and medium-sized companies, sales losses of 2 to 3% (World Bank, 2006).

Energy Sector Adaptive Capacity

Vietnam

The following table shows the contribution of a number of factors to the country's energy sector adaptive capacity. Green, orange and red indicate positive, uncertain or negative contributions respectively. For further information on the indicators used to assess energy sector adaptive capacity, refer to the Rapid Assessment process document by clicking here.

Adaptive capacity factors	Indicators	Responses and scores
Economic	Level of investment in the country *High if Gross Fixed Capital Formation (GFCF) is higher or equal to 30% of GDP*	**High**
Technical	Aging power generation assets and infrastructure *Yes if average age of the country's power generation assets is more of equal to 20 years*	**No**
	Overall quality of country energy assets and infrastructure *Low if average annual number of power cut events is higher or equal to 100*	**Unknown**
	Strong reliance on one form of power generation *Yes if 50% or more of the country's power supply comes from one single form of generation*	**No**
	Member of a regional grid system *Yes if country's power system is part of a transboundary and regional power grid system*	**Yes**
	Presence of an interconnected network transmission system *Yes if customers are connected to several points of power supply rather than to a single point or a loop*	**Yes**
Institutional and informational	Good level of knowledge of location of country's energy assets *Yes if there is geographic information (e.g. maps) available in government or World Bank publications*	**Yes**
	Availability of good quality data on observed climate, climate-related hazards *Yes if observed climate datasets are available in digital, short-time intervals, high spatial resolution formats, and for long baseline periods*	**Yes**
	Good level of knowledge on adaptation of energy sector, and evidence of good intra-government linkages on adaptation issues *Yes if level of knowledge and inter-government linkages are good based on expert knowledge*	**Unknown**
Environmental & social	Priority water rights over other sectors *Yes if government or World Bank publications indicate that energy has priority over other sectors for water*	**Unknown**
	Strong country disaster risk management and reduction *Yes if country has strong mechanisms in place to deal with increased extreme weather events based on expert knowledge*	**No**

Energy System Adaptation Imperative

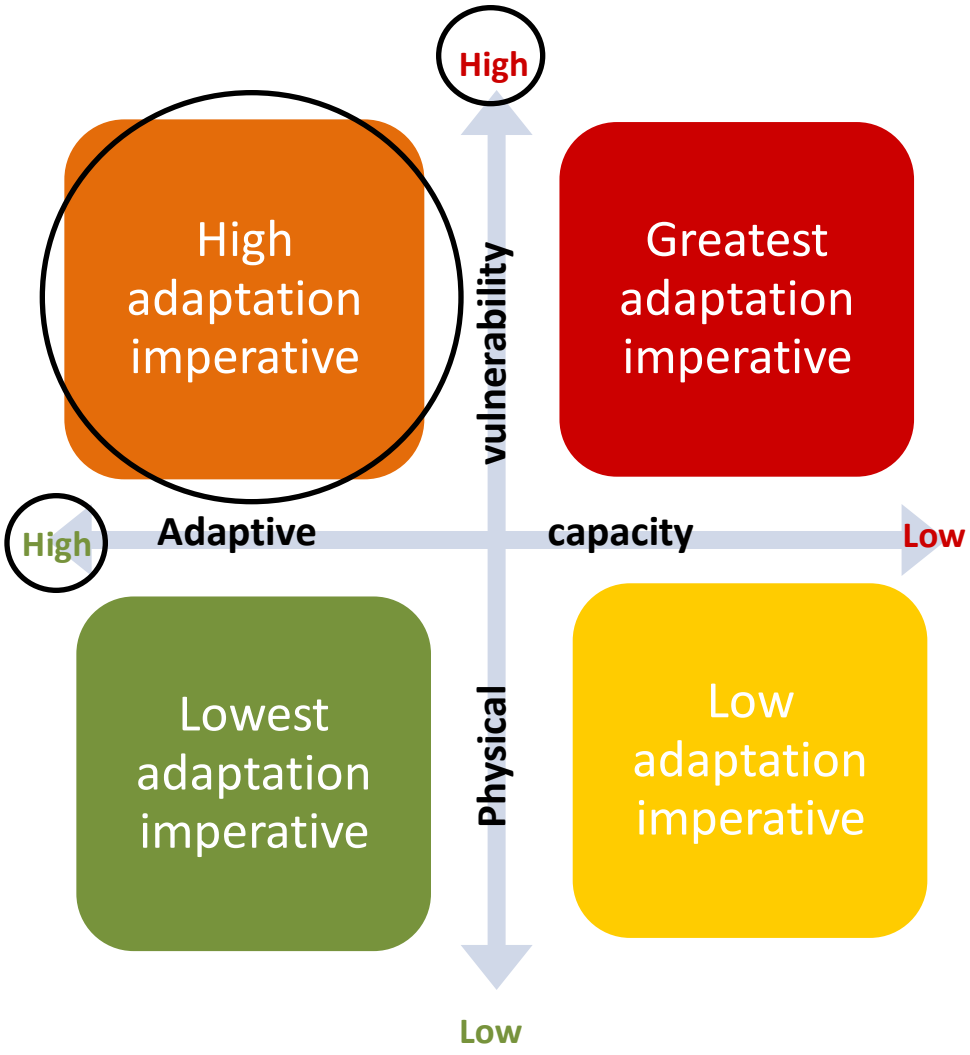
Vietnam

As shown in the diagram on the right, Vietnam's energy system has a high adaptation imperative due to the combination of:

- High physical vulnerability to climate change (see Slide 6).
- High adaptive capacity (see Slide 8).

This result means that adaptation measures should be considered to reduce vulnerability to climate change impacts and exploit opportunities within the country's energy system.

Some actions are already underway in different areas of the energy service chain in the country which help to build climate resilience. Due to climate change, the imperative for these actions is increased. This is further described in the following slides.



High-level Adaptations Options 1/2

Vietnam

The following 2 tables show a typology of actions which provide the building blocks for an energy sector adaptation action plan. This involves:

1. **Building the adaptive capacity of the energy sector:** Data collection, analysis and monitoring, and research on climate-related impacts in the energy sector; changing or developing regulations, tariffs, standards, codes etc.; awareness-raising and organizational development; and working in partnership.
2. **Delivering adaptation on the ground:** Accept impacts and bear (some) loss; spread/share impacts; avoid negative impacts; and exploit opportunities.

Examples of actions to build adaptive capacity

Responsible body	Type of action	Actions to strengthen standard and existing energy policy and measures	New actions
Ministries of energy and finance	Data collection and monitoring, awareness rising and organizational development, working in partnership		Monitor and forecast the impacts of climate change on: • National and regional energy demand, • Electricity production assets reliant on shared water resources which could be affected by upstream users (e.g. hydropower developments on the Mekong river by Laos and Cambodia) Raise awareness on the climate change vulnerability of Vietnam's energy sector Establish climate adaptation partnerships between utilities, the hydromet office, and organizations working on climate adaptation and the energy sector (such as MDBs) to exploit the existing knowledge base and identify needs for further work
	Changing or developing regulations, tariffs, standards, codes etc	Provide greater incentives for energy efficiency measures. Vietnam has a National Energy Efficiency Program for 2006-2015 (PMVN, 2006)	Develop tariffs and incentives to promote resilience to climate change impacts in the energy sector
Utilities	Research and analysis		Develop climate risk assessments and cost-benefit analyses for the energy sector taking account of climate change, and incorporate the results into asset design, operations and decommissioning
	Data collection and monitoring		Monitor the impacts of climate change on energy asset performance
	Changing or developing regulations, tariffs, standards, codes etc	Review and upgrade design codes for energy assets against climate change projections	
Hydromet office	Research and analysis		Develop higher resolution climate change projections

High-level Adaptations Options 2/2

Vietnam

Examples of actions to deliver adaptation

Responsible body	Type of action	Actions to strengthen standard and existing energy policy and measures	New actions
Ministries of energy and finance	Avoid negative impacts	Increase regional energy trade and electricity interconnections between Vietnam, Thailand, China, Laos and Cambodia (Greater Mekong System)	Support implementation of climate-resilient design standards for new energy assets
		Hydropower development, adding about 4,800 MW of new capacity to respond to growing demand (2 large plants, and a number of small-medium size plants) (Gencer et al., 2012)	
Utilities	Avoid negative impacts	Improve demand and supply-side energy efficiency, to bridge the increasing supply and demand gap which may be worsened due to climate change	Identify key energy assets most at risk from climate change and plan proactively for actions be needed to make them climate change-resilient.
		Review contingency plans in light of climate change for better management of extreme climatic events, and ensure resources can be mobilized effectively to respond to them	Develop and implement engineering solutions to ensure that future energy sector development and asset design takes account of the impacts of climate change
	Spread / share impacts		Diversify the locations of new energy assets to avoid concentrating assets in locations at high risk of climate impacts. (For instance, a number of planned and new gas utilization complexes are concentrated in Southeast Vietnam, which is affected by flood risk.)
			Investigate weather insurance for its application to energy sector risk management
Other stakeholders	Avoid negative impacts and exploit opportunities	Ramp up efforts to improve water use efficiency	Exploit opportunities for new engineering technologies that build resilience to climate change Pilot country-, regional-, or asset-level climate change vulnerability and adaptation assessments to identify with more confidence areas of vulnerability and opportunities for adaptation investments

Definitions

Vietnam

Adaptive capacity: Potential or capability of a system to adjust or respond to climate change (IPCC, 2001).

Energy supply losses: Losses incurred between total primary energy supply and final use (TPES-TFC) as a percentage of total primary energy supply (IEA, 2011).

Exposure: Nature and degree of climate stress upon a system; it may include long-term changes in climate conditions, as well as changes in climate variability (IPCC, 2001).

Gross Domestic Product (GDP): Value of all final goods and services produced in a country in one year (World Bank, 2011a).

Metocean: Commonly used in the energy sector to refer to the ensemble of meteorological and oceanographic variables that characterize the physical environment of an asset or a project.

Physical vulnerability: Combination of sensitivity and exposure to climate change of a system; it corresponds to the biophysical effect of climate change on a system (Raleigh et al., 2008).

Reserve margin: Ratio of the difference between installed capacity and annual peak demand to the annual peak demand (World Bank, 2011a).

Sensitivity: Degree to which a system will be affected by or responsive to a change in a climate-related variable. (IPCC, 2001).

Total Energy Production (TEP): Sum of energy production (coal, crude oil and oil products, gas, nuclear, hydro, geothermal, solar, combustible renewables and waste, and others) (IEA, 2011).

Total Final Consumption (TFC): Sum of energy consumption by different end users (industry, transport, residential, commercial and public services, agriculture and forestry, and others) (IEA, 2011).

Total Primary Energy Supply (TPES): Total energy produced and imported minus energy exports and changes in energy stocks (IEA, 2011).

Vulnerability: Degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change (IPCC, 2001).

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Vietnam

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