Climate and Disaster Risk Screening Report for Energy Project in Nepal: Hypothetical Energy Project[1]

[1] This is the output report from applying the World Bank Group's Climate and Disaster Risk Screening Project Level Tool(Global website: climatescreeningtools.worldbank.org; World Bank users: wbclimatescreeningtools.worldbank.org). The findings, interpretations, and conclusions expressed from applying this tool are those of the individual that applied the tool and should be in no way attributed to the World Bank, to its affiliated institutions, to the Executive Directors of The World Bank or the governments they represent. The World Bank does not guarantee the accuracy of the information included in the screening and this associated output report and accepts no liability for any consequence of its use.

1. Introduction

Building resilience to climate and geophysical hazards is a vital step in the fight against poverty and for sustainable development. Screening for risks from these hazards improves the likelihood and longevity of a project's success. The project level **Climate and Disaster Risks Screening Tool** provides due diligence on climate and disaster risks at an early concept stage. The tool uses an **exposure – sensitivity –adaptive capacity framework** to consider and characterize risks from climate and geophysical hazards, based on key components of a project and its broader development context (Annex 1).

This report summarizes the results of the screening process for the "Hypothetical Energy Project/Nepal, which was applied to the following selected sub-sectors/components:

- [ ] Oil, Gas and Coal Mining
- [ ] Thermal Power Generation
- [x] Hydropower
- [ ] Other Renewable Energy
- [ ] Energy Efficiency in Heat and Power & End Use
- [ ] Transmission and Distribution of Electricity

The potential risks flagged in this report were identified through four screening stages by connecting information on climate and geophysical hazards exposure with the user's subject matter expertise and understanding of the project components and sensitivity to rate the impacts. The tool does not provide detailed risk assessments, rather it flags risks to inform consultations, enhance dialogue with local and other experts, and define further analytical work at the project location.

This early stage due diligence can be used to strengthen the consideration of climate and disaster considerations in key components of the project design, including the physical (e.g., transmission lines, plants/facilities etc.) and non-physical aspects (e.g., capacity building of energy managers, institutional strengthening, early warning systems, maintenance schedules, etc.). The broader sectoral (e.g., backups and system redundancy in place, strategic planning that considers how climate and geophysical hazards may affect key assets, system reliability, and demand, etc.) and development context conditions (e.g., influence on energy demand from population growth,legal enforcement of proper building codes and zoning regulations, etc.), could help modulate the risks to the delivery of the outcome/service level.

The results of the screening are presented below, with supporting narrative to guide their interpretation.

2. Climate and Disaster Risk Screening Results Summary

2.1 Project Information Summary

Table 1 below provides key project information including the location and key project development objectives. This information is provided by the task team. The activities within the components are important as their sensitivity to the climate and geophysical hazards will determine the level of potential impact from these hazards.

Table 1: Project Information

Project Information	
Title	Hypothetical Energy Project
Number	Hypothetical
Region	South Asia
Country	Nepal
Type of Assessment	Energy Projects
Funding Source	IDA
Keywords	Hydropower
Sub Sectors	Hydropower
Location	Kali Gandaki River
GPS Coordinates	This is optional information which may be useful when searching for geospatial climate and hazard information from data sources. It is not directly used in the screening process.

* Please note that this is based on user inputs and the coverage may not be comprehensive.

2.2 Summary of Exposure to Climate and Geophysical Hazards

Table 2 presents a summary description of exposure to climate and geophysical hazards at the project location for the Historical/Current and Future time frames[1]. Exposure to climate hazards is evaluated in two timeframes, because past records are not necessarily indicative of future conditions.

The descriptions provide a summary of the key characteristics and some indication of the trends in exposure from each hazard, drawing on global, quality controlled data sets from the Climate Change Knowledge Portal (CCKP). It is useful, for example to understand the temperature range and the rate of annual or decadal increase in a region; or precipitation patterns for historical and future time frames and seasonality shifts. Understanding the trends of hazards is important as they act individually and collectively on components/sub-sectors of the project. Because geophysical hazards (such as earthquakes, tsunamis, landslides, and volcano eruptions) do not have associated future projections, exposure for those hazards is assessed only in the Historical/Current timeframe.

Table 2: Summary of Exposure to Climate and Geophysical Hazards at Project Location

HAZARD	TIME FRAME	DESCRIPTION OF HAZARDS FOR YOUR LOCATION
Extreme Temperature	Current	Historical/past trends: Insufficient understanding. Past data on mean annual temperature is consistent. Shrestha et al. (1999), Dhakal(2003), and Liuand Chen (2000) suggest that temperatures between 1977 and 1994 rose between 0.5°C-0.6°C per decade, particularly in the northern mountains, while McSweeney et al. suggest that temperatures between 1960 and 2003 decreased slightly during the warm and dry season.
	Future	Future (2050): High Potential Impact as mean annual temperature is projected to increase between 1.3 to 3.8°C.
Extreme Precipitation and Flooding	Current	Historical/past trends: Mean rainfall has significantly decreased on an average of 3.7mm (-3.2%) per month per decade, and this decrease is particularly significant during the monsoon period between June September. Between 1900 and 2014, 44 flood events have occurred, which have killed 6563 and affected 3,628,854 people. Lately, the number of casualties from floods and related landsides has increased. 1314 lives were lost between 2000 and 2005.
	Future	Future (2050): Insufficient understanding as projections remains inconsistent. It is not possible to get a clear picture of precipitation change, due to large model uncertainties. However, increases in rainfall are more consistent for south-east Nepal.
Drought	Current	Historical/past trends: Six severe droughts have struck Nepal between 1900 an 2014. These droughts have affected 4,903,000 people.
	Future	Future (2050): Moderate impact is envisaged as droughts are becoming more frequent occurrences in Nepal, particularly during the winter months and in the western Terai plains, which are already characteristically quite dry because of the late arrival of the monsoons.

[1]The Future time frame is based on changes projected to occur between the 1980-1999 average and a future average. This future average is most likely the 2040-2059 average (i.e., the default in the Climate Change Knowledge Portal - CCKP). Users can choose to select another time frame, or choose to use national/local data sets, but if so, this should be reflected in the notes section of the tool (and summarized in Annex 2). The CCKP draws on global, quality-controlled datasets and is continually updated as new data become available. In some cases, the CCKP is supplemented with other sources of information. For more detail on the data used in this step, please refer to the Data Annex. Climate Change Knowledge Portal (http://climateknowledgeportal.worldbank.org).

HAZARD	TIME FRAME	DESCRIPTION OF HAZARDS FOR YOUR LOCATION
Sea Level Rise	Current	Historical/past trends: No Impact as Nepal is a landlocked country
	Future	Future (2050): No Impact as Nepal is a landlocked country
Storm Surge	Current	Historical/past trends: No Impact as Nepal is a landlocked country
	Future	Future (2050): No Impact as Nepal is a landlocked country
Strong Winds	Current	Historical/past trends: Insufficient understanding
	Future	Future (2050): Insufficient understanding
Earthquake	Current	Historical/past trends: Moderately exposed to earthquakes and landslides. Between 1900 and 2014, six seismic events occurred, which killed 9,936 and affected 729,950 people. During the same period, 22 landslides occurred and killed 1,884 and affected 619,217 people.
Landslide	Current	Historical/past trends: Moderately exposed to earthquakes and landslides. Between 1900 and 2014, six seismic events occurred, which killed 9,936 and affected 729,950 people. During the same period, 22 landslides occurred and killed 1,884 and affected 619,217 people.

Insufficient Understanding	Not Exposed No Potential Impact No Risk	Slightly Exposed Low Potential Impact Low Risk	Moderately Exposed Moderate Potential Impact Moderate Risk	Highly Exposed High Potential Impact High Risk

Please note that the colors shown in Table 2 are only for exposure at the project's location. Overall risk to project's outcome/service delivery, taking into account sensitivity of physical investments and adaptive capacity(non-physical components and development context), is depicted in Tables 3A and 3B.

2.3 Summary of Overall Project Risk

Tables 3A and 3B present the same results, with Table 3A highlighting the impact ratings on the project's components/subsectors, and the overall risk to the outcome/service level for both Historical/Current and Future time frames. Table 3B draws attention to how the climate impacts and risks shift from the Historical/Current to the Future time frame.

The ratings are derived on the basis of the hazard information, subject matter expertise, contextual understanding of the project, and modulated on the basis of adaptive capacity and the larger development context of the energy sector and country. The results indicate what components are most at risk. The actual ratings themselves, while instructive, should inform further consultations, dialogue, and future planning processes. Keep in mind that the greatest value of the tool is that it provides a structured and systematic process for understanding climate and disaster risks.

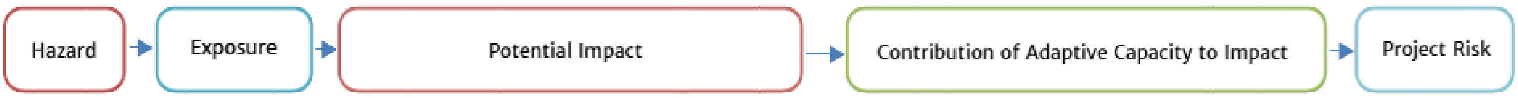
2.3.1 Results Summary - by Component / Subsector

Table 3A provides a characterization of risks caused by climate and geophysical hazard on project subsector/components for both Historical/Current and Future time frames.

The results indicate where risks may exist within one or multiple components and where further work may be required to further understand these climate and geophysical risks. An ongoing process of monitoring risks, refining climate and other information, and regular impact assessment may also be appropriate.

The potential impact on key components due to exposure from hazards is modulated by the project's non-physical components (enabling and capacity building activities). The right kind of capacity building measures could increase preparedness and longer-term resilience and reduce the risks. An understanding of larger sector and development context with respect to key modulating factors helps to assess the climate risks in terms of adaptive capacity.. For example, in the energy sector, a significant system redundancy may help reduce risks; while population growth and increasing peak demand may aggravate the risks.

Table 3A: Results Summary - by Component / Subsector



Hazard	Project Components						Development Context				Outcome / Service Delivery	
	Location		Hydropower		Non-Physical Components (Overall)		Energy Sector		Broader Context(Overall)			
Time Frame	**Current**	**Future**	**Current**	**Future**	**Current**	**Future**	**Current**	**Future**	**Current**	**Future**	**Current**	**Future**
Extreme Temperature	(yellow)	(orange)	(yellow)	(yellow)	Overall: Significantly Reduces Impact		Slightly Reduces Impact		Insufficient information provided		(yellow)	(orange)
Extreme Precipitation and Flooding	(yellow)	(orange)	(red)	(red)							(orange)	(orange)
Drought	(green)	(green)	(green)	(green)							(green)	(green)
Sea Level Rise	(green)	(green)	(green)	(green)							(green)	(green)
Storm Surge	(green)	(green)	(green)	(green)							(green)	(green)
Strong Winds	(hatched)	(hatched)	(green)	(green)							(yellow)	(yellow)
Earthquake	(red)	X	(red)	X							(red)	X
Landslide	(red)	X	(red)	X							(red)	X

2.3.2 Results Summary by Time-Frame

The results in Table 3B display the results by time frame. Potential impacts to the components are evaluated separately for the Historical/Current and Future time frames to capture changes in the exposure from climate hazards over time. For example, recent trends may indicate that temperatures are rising in such a way that they may make cooling of electricity generation facilities difficult, significantly escalating the impact on energy production over time.

For investments with long operational lifetimes, such as physical infrastructure, considering future climate variability and change is critical to avoid "locking in" designs and features that are only suited to current climate. For example, coastal energy infrastructure may be more vulnerable if it is located in areas that will be more exposed to sea level rise, storm surge, and coastal flooding in the future, or if the infrastructure is not designed to withstand more frequent or severe flooding.

Table 3B: Results Summary - by Time Frame

Time Frame	Current					
	Project Context			Development Context		
Hazard	Locat-ion	Hydropo - wer	Non-Physical Components (Overall)	Energy Sector	Broader Context (Overall)	Outcome / Service Delivery
Extreme Temperature	(yellow)	(yellow)				(yellow)
Extreme Precipitation and Flooding	(yellow)	(red)				(orange)
Drought	(green)	(green)				(green)
Sea Level Rise	(green)	(green)	Overall Significantly Reduces Impact	Slightly Reduces Impact	Insufficient information provided	(green)
Storm Surge	(green)	(green)				(green)
Strong Winds	(hatched)	(green)				(yellow)
Earthquake	(red)	(red)				(red)
Landslide	(red)	(red)				(red)

Time Frame	Future					
	Project Context			Development Context		
Hazard	Location	Hydropo-wer	Non-Physical Components (Overall)	Energy Sector	Broader Context (Overall)	Outcome / Service Delivery
Extreme Temperature	(orange)	(yellow)				(orange)
Extreme Precipitation and Flooding	(orange)	(red)				(orange)
Drought	(green)	(green)				(green)
Sea Level Rise	(green)	(green)	Overall Significantly Reduces Impact	Slightly Reduces Impact	Insufficient information provided	(green)
Storm Surge	(green)	(green)				(green)
Strong Winds	(hatched)	(green)				(yellow)
Earthquake	X	X				X
Landslide	X	X				X

Insufficient Understanding (hatched)	Not Exposed No Potential Impact No Risk (green)	Slightly Exposed Low Potential Impact Low Risk (yellow)	Moderately Exposed Moderate Potential Impact Moderate Risk (orange)	Highly Exposed High Potential Impact High Risk (red)

2.4 Key Drivers of Risks

Based on the results above, Table 4 highlights the key drivers of risk for each project component/subsector ratings, in terms of hazards that are likely to pose the greatest challenge.

The ratings for the potential impact for each component/subsector reflect the aggregate rating across multiple hazards, drawing on all of the exposure information and their own expert judgment. For example, high temperature may reduce the efficiency of major equipment and cooling in oil, gas, and coal mining, whereas flooding may cause physical damage to mining, drilling, and processing facilities.

Specific consideration should be given to those hazards which have high ratings, or are moving from moderate to high ratings over time. For example, sea-level rise may not be a key risk driver in the Historical/Current time frame; but may emerge as a key driver across multiple sectors in the future time frame. Understanding which hazards are key drivers may help flag follow-on work to manage climate risks within the design and delivery of the project.

Table 4: Key Drivers of Risk

	Historical/Current Drivers	Future Drivers
Hazards and Location	Landslide Earthquake	Extreme Temperature Extreme Precipitation and Flooding
Physical Components	Hydropower-Earthquake Hydropower-Landslide Hydropower-Extreme Precipitation and Flooding	Hydropower-Extreme Precipitation and Flooding
Outcome / Service Delivery	Extreme Precipitation and Flooding Earthquake Landslide	Extreme Temperature Extreme Precipitation and Flooding

Key: High Risk   Moderate Risk

* If a cell is blank it implies there is 'No high or moderate risks' identified for this aspect of the project.

- Overall, the Non-physical Components : **Significantly Reduces Impact**
- The Energy Sector : **Slightly Reduces Impact**
- The Broader Development Context : **Insufficient information provided**

3. Next Steps

By understanding which of your energy project components is most at risk from climate change and other natural hazards on the basis of the screening, you can begin to take measures to avoid their impacts by:

- Enhancing the consideration of climate and disaster risks early in the design stage of the project.
- Using your risk screening analysis to inform follow-up feasibility studies and technical assessments.
- Encourage local stakeholder consultations and dialogue to enhance resilience measures and overall success of the project.

Table 5A provides some general guidance based on the risk ratings for the Outcome/Service Delivery, and Table 5B lists some climate risk management measures for your consideration. Visit the "Next steps" page of the tool on the website for guidance and a list of useful resources.

Note: Please recall that that this is a high-level due diligence tool, and the characterization of risks should be complemented with more detailed work.

Table 5A: General Guidance Based on Risk Ratings for Outcome/Service Delivery

Insufficient Understanding	Gather more information to improve your understanding of climate and geophysical hazards and their relationship to your project.
No Risk	If you are confident that climate and geophysical hazards pose no risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented.
Low Risk	If you are confident that climate and geophysical hazards pose low risk to the project, continue with project development. However, keep in mind that this is a high-level risk screening at an early stage of project development. Therefore, you are encouraged to monitor the level of climate and geophysical risks to the project as it is developed and implemented. You may also consider gathering additional information to increase your level of confidence in your rating.
Moderate Risk	For areas of Moderate Risk, you are encouraged to build on this screening through additional studies, consultation, and dialogue. This initial screening may be supplemented with a more detailed risk assessment to better understand the nature of the risk to the project.
High Risk	For areas of High Risk, you are strongly encouraged to conduct a more detailed risk assessment and to explore measures to manage or reduce those risks.

Table 5B: Types of Climate Risk Management Measures for typical Energy Projects

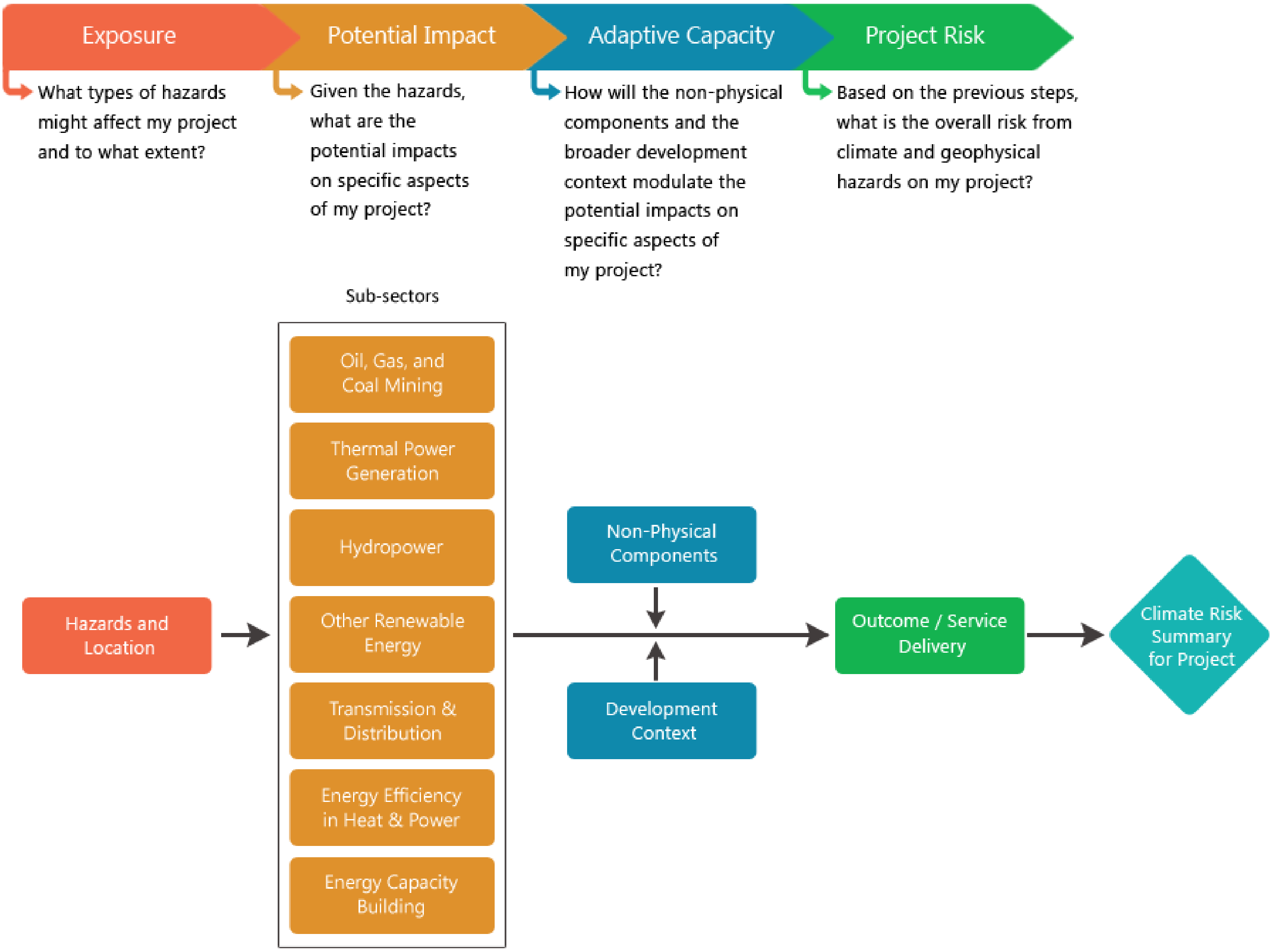
CATEGORY	PROS	CONS	EXAMPLES
Accommodate and Manage	• Flexible • Typically low-cost • Useful when risk is low, but projected to rise in the future	• Temporary solution • Can be insufficient in preventing losses	• Increase repair and maintenance budgets • Consider future fuel and generation demands and costs in planning • Incentivize demand-side management • Conduct monitoring through data collection and analysis
Protect and Harden	• Can be used for existing and new assets • Responds to immediate risks	• High cost • Inflexible • Effectiveness may decrease over time	• Upgrade existing cooling systems • Add reinforcements to walls and roofs • Build dikes to contain flooding • Incorporate structural improvements to transmission • Increase drainage of energy facilities
Retreat and Relocate	• Long-term solution • Responds to immediate risk	• High cost • Inflexible	• Integrate sea level rise projections and storm surge in coastal siting • Move infrastructure further inland or on higher ground

Annex 1: Tool Approach

Tool Approach

The framework below describes the approach taken to screen the project. Climate and natural hazards information used to screen the project is most likely obtained from the World Bank's Climate Change Knowledge Portal, which houses numerous global data sets with historical records and future projections as well as country-specific adaptation profiles.

Figure A1: Project Level Climate and Disaster Risk Screening Tool: Approach for Energy projects



Annex 2: Notes

Table A2-1 summarizes the sub-national locations of high risk noted during the assessment, if the user entered these sub-national locations. Table A2-2 summarizes all the notes entered by user for each section while completing the assessment, if the user elected to enter notes. These notes can help shed light on specific ratings as well as considerations and limitations of the user's expertise.

Table A2-2 Summary of Comments by Section

Section		Notes
Hazards and Location	Extreme Temperature	Agriculture, Energy, and health are highly exposed sectors. Increasing extreme temperature will further exacerbate midseason dry spells that damage young plants and cause severe crop loss are recurrent threats to local livelihoods.Increase in extreme temperature may substantially increase evapotranspiration causing a severe impact on hydropower generation. Increase in extreme temperature can increase heat island effects, which in turn can cause heat stroke and may lead to physiological disruption, organ damage, and even death – especially in vulnerable populations such as the elderly. Heat island phenomenon can also impact communities by increasing peak energy demand, air conditioning costs, and air pollution levels.
	Extreme Precipitation and Flooding	Extreme flooding in south-east would adversely impact agriculture sector. Nepal Extreme flooding may deposits debris in channels, changing the flow of water within irrigation channels.