Climate Risk Screening Tools for Low-Emission Energy Development

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Climate variability and change can pose risks to the integrity and performance of low-emission development (LED) investments, yet most LED planners don't yet routinely consider the potential effects of climate on their programs and projects. Fortunately, a variety of tools have been developed in the past several years that planners can now use to determine whether, and to what extent, climate variability and change may impact their investments. This paper introduces climate risk screening tools for new or existing energy[1] programs and projects that can be applied by LED planners, as well as project investors and developers, to gain a preliminary indication of climate risks.[2] It also provides a case example illustrating how risk screening helped managers in Vietnam improve the climate resilience of a hydropower energy project.

Why screen for climate risk?

Energy investments are frequently highly capitalized, irreversible engineered structures that will experience shifting climate conditions over their long service lifetimes. The application of climate risk screening to energy sector programs and projects helps to safeguard the targeted development objectives of these investments, ensuring that objectives such as increasing energy access and security, meeting LED objectives, and ensuring service reliability will be sustained over time.

> Unlike with greenhouse gas accounting, there are no internationally accepted and consistent methodologies for assessing and measuring climate risk. Climate risks can be evaluated by a variety of hazards and metrics, and the magnitude and type of risks are likely to differ for the same type of asset given different locations and the level of adaptive capacity.

Similar to resource efficiency screening that identifies project activities with significant carbon footprints, climate risk screening is increasingly becoming a due diligence requirement for new investments. For example, as of 2014, the World Bank's International Development Association fund requires projects to be screened for short- and long-term climate and disaster risks as part of their investment due diligence (Ebinger, 2014). The Asian Development Bank (ADB) requires that all ADB projects are screened for climate risks, and that at-risk projects receive a further, more detailed assessment (Asian Development Bank, 2014). The African Development Bank (AFDB) has screened ~70% of their projects to date for climate risks, with a target to reach 90% (Hellmuth M. , Personal Communication).

Climate-resilient LED strategies—designed to advance a decarbonized energy system through increased distributed generation and renewable resources—carry new benefits and challenges to both greenhouse gas (GHG) mitigation and climate adaptation. For example, while low-carbon energy strategies shift exposure to climate hazards away from fossil fuel resources, renewable energy resources can also be at risk to climate impacts, in part due to their reliance on climate-sensitive natural resources. For example, a climate risk screening of power system assets may identify potential hydrologic changes that would undermine the intended benefits of hydropower, or temperature increases that may curtail bio-fuel crop productivity or reduce solar power efficiency. If not taken into account, such climate impacts can undermine LEDS goals, particularly if electricity grids must turn to traditional, carbon-intensive energy sources such as coal-fired plants

[1] In the context of this paper, the "energy sector" includes all energy extraction, conversion, storage, transmission, and distribution processes (except when those processes themselves provide energy services in end-use sectors.) This does not include end use sectors, which are often taken into consideration for GHG concerns.

[2] Note that the paper provides a broad overview of approaches and practice across development banks and agencies, which may differ from USAID specific definitions and guidance.

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when renewable energy becomes constrained (Hellmuth, Cookson, & and Potter, 2017). Climate risk screening can catch such concerns at the outset of project development and allow for a more careful and informed approach.

What is climate risk screening?

> **Climate risk** refers to the potential for negative consequences due to changing climatic conditions where the outcome is uncertain. Climate risk consists of individual climate risks—potentially severe adverse consequences for development programs resulting from the interaction of climate-related hazards with the vulnerability of societies and systems exposed to climate change. (USAID, 2016)

Climate risk screening provides planners with a high-level understanding of the current and potential future climate risks to existing and planned programs and project investments in energy infrastructure and services. Climate risk screening typically constitutes a first step in the hierarchy of risk assessment, to 'raise the flag' during strategic program design, to give an indication of the type and significance of climate risk during the project conceptualization stage, and to indicate whether more in-depth climate risk analysis or adjustments in program or project design are warranted (see Figure 1). Climate risk screening is not typically combined with GHG emissions screening processes; the screening is often undertaken in parallel. However, some risk screening tools do include the identification of potential GHG mitigation options.

Figure 1. Initial climate risk screening provides relatively quick, preliminary information about risk at a lower effort. More detailed screening, which provides greater insights and more robust recommendations, require increasing levels of time, resources, and effort.

In some cases, climate risk screening is embedded within a larger tiered or decision tree approach to climate risk management, meant to improve time and cost efficiency. For example, the decision tree approach allows planners to exit the climate risk assessment process at certain points if the level of climate sensitivity is deemed minimal, or to conduct more detailed assessment(s) as needed. For example, the World Bank's Hydropower Sector Resilience Guidelines employs the decision tree approach (see Figure 2).

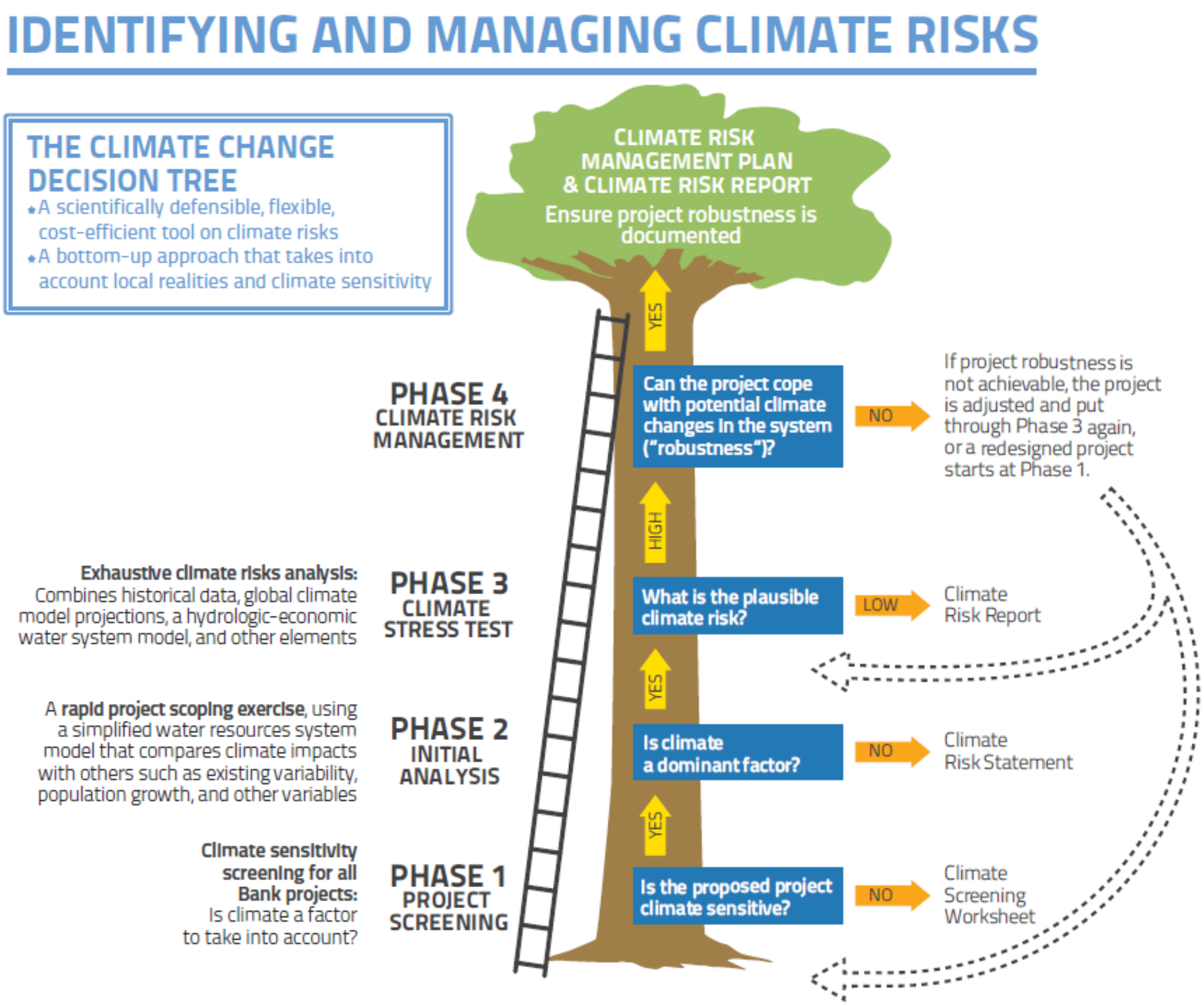

Figure 2. Overview of World Bank Decision Tree Framework (Ray and Brown, 2015)

In some cases, the first step in a climate risk screen constitutes a short checklist of questions that allows planners to see if their project meets criteria that warrant a full climate risk screen/analysis. For example, the ADB's framework starts with a preliminary, rapid checklist; only projects with medium or high risk based on this checklist undergo a further screen via more sophisticated tools (Asian Development Bank, 2014). This checklist asks questions to help users understand whether the location and design of the project have an effect on its exposure to climate hazards, if current and future climate conditions affect the selection of project materials/inputs or project maintenance, and if climate conditions could affect the performance of the project throughout its lifetime (Asian Development Bank, 2016).

Climate risk screening and deeper dive climate risk assessments are both often coupled with steps for climate risk management. For example, the Asian and African Development Banks' risk screening tools require that climate risks be addressed for projects with high risk ratings. USAID's climate risk management process allows moderate- to high-ranked climate risks to be accepted if the tradeoffs for addressing them are deemed to be too high (see Figure 3). In addition, some screening tools provide guidance on identifying and evaluating adaptation measures to address the identified risks. The end goal is to efficiently guide practitioners towards targeted and effective adaptation strategies.

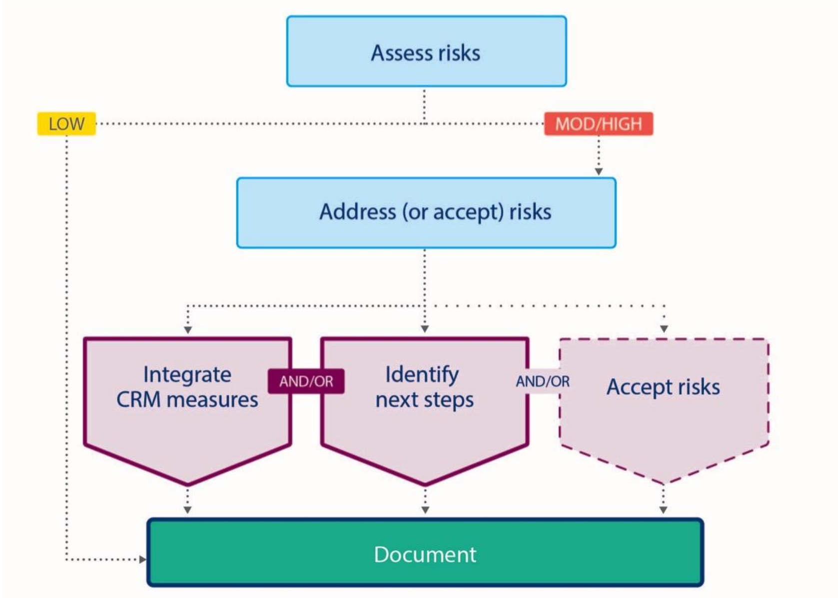

Figure 3. Overview of USAID's Climate Risk Management Process. The assessment of climate risks can result in no further actions for low climate risks, whereas moderate or high climate risks must be addressed in some form.

Applying risk screening to the energy sector

Climate risk screening typically integrates the concepts of **exposure** (i.e., which hazards could affect the energy project components, and to what extent), **sensitivity** (i.e., how would the different project components be impacted by different hazards), and **adaptive capacity** (i.e., how other factors such as broader development context would moderate or exacerbate the potential impacts).

For example, a solar installation project may be exposed to sea level rise, and increased rainfall and temperatures (exposure). The resulting impacts could include physical damage to assets from flooding and, lowered energy output and efficiency due to more cloudiness and higher temperatures (sensitivity). However, there may be planned resilience measures to reduce or mitigate some of these impacts—for example through hardening or project re-location—thereby reducing risk (adaptive capacity). Together, these factors determine the level of vulnerability of the project to potential climate change.

Different energy sub-sectors are likely to be impacted in different ways by climate variability and change, so understanding these specific linkages is essential to successfully managing risk. For example, hydropower-related projects will have a lower tolerance for drought conditions than other sub-sectors that do not rely on water for operation or generation. Extreme wind, precipitation, and fire will all have greater impacts on aboveground assets (such as transmission lines) than belowground assets (such as geothermal pipes). Climate risk screening is an important first step because through exploration of the sensitivity of different project components to different climate hazards, planners can identify critical risks that may need to be further addressed.

Climate risk screening tools

There are several climate risk screening tools that specifically address concerns in the energy sector. These tools vary in level of effort and detail, and scope of analysis. Some of the tools are publicly available, while others are proprietary. For example, the World Bank's Climate and Disaster Risk Screening tools are offered as an open resource for development practitioners worldwide in recognition of their broad application. The publicly available risk screening tools listed in Table 1 offer a useful introduction to project-level climate risks, and in some cases provide additional information on adaptation measures to help address these risks. These tools could be applied during project conceptualization phase, and revisited throughout project design and implementation to ensure that climate risks are properly accounted for, and addressed.

Table 1. Example Climate Risk Screening Tools for the Energy Sector

Resource Name	Provider	Scale	Scope		Summary; Energy Component(s)	Publicly available?	Level of Effort
			Risk Screening	Adaptation			
Climate Safeguards System (CSS)	AFDB	Project-Level	✓	✓	Module 1 is a climate screen using scorecards to assign the project to one of three levels of vulnerability. Energy is one of the sectors included in CSS.	No	Low
Hydropower Screening Tool	USAID	Project-Level	✓	✓	Tool for hydropower developers and investors to evaluate potential climate change impacts on regulatory, reputational, and financial business objectives. Recommends steps for adaptation measures based on identified risks.	Yes	Low
Climate & Disaster Risk Screening Tools: Energy Sector	World Bank	Project-Level	✓		Tool for energy project developers to evaluate potential impacts of current and potential future climate change, with modules for: thermal power, hydropower, other renewables, energy efficiency, transmission and distribution, and energy capacity building.	Yes	Medium
Climate Risk Screening and Management Tools for Strategy, Project, and Activity Designs	USAID	Strategy-, Project-, and Activity-Level	✓	✓	Includes an Annex for Infrastructure, Construction and Energy.	Yes	Medium
Aware for Projects ™	Acclimatize, used by ADB	Project-level	✓		Geography-based multi-hazard analysis; applicable across sectors (without particular detail or information per sector).	No	High
Hands-on Energy Adaptation Toolkit	World Bank	Power Sector-Level	✓	✓	A stakeholder-based, semi-quantitative risk-assessment to prioritize risks to a country's energy sector and identify adaptation options.	Yes	High
Broad screen, as described in the Sustainability Guideline	KfW Development Bank	Project-Level	✓	✓	Risk screen is part of a social, environmental, and climate due diligence appraisal. There are sector-specific sustainability criteria for energy (with a focus on renewables).	No	Unknown
Climate risk management system (under development)	European Investment Bank	Project-Level	✓		EIB recently developed and piloted a climate risk management system that includes consideration of climate risks, focusing on the energy and transport sectors.	No	Unknown
Climate risk scan and screen (under revision)	Inter-American Development Bank	Project-Level	✓		IDB is currently revising its climate-related disaster risk scan and screen and plans to mainstream screening investments in 2018.	Pending	Unknown

Pleikrong Case Study: Application of a Climate Risk Screen to a LEDS project

The Pleikrong Hydropower Plant case example demonstrates the value of a climate risk screening process. The Pleikrong is a conventional storage hydropower plant in the Se San River Basin in the central highlands of Vietnam. In 2015, plant managers and energy sector stakeholders applied the USAID hydropower screening tool to raise awareness and build understanding of current and potential future climate change risks to plant performance (Figure 4).[3] As a starting point, stakeholders identified several critical business performance objectives; these included meeting instream flow requirements, maximizing revenue from power generation and ancillary services, maintaining high operating efficiency, and providing affordable and reliable electricity to consumers.

Stakeholders then identified several climate–related stressors that currently impact business performance, before considering how potential projected climate changes could create new risks or exacerbate existing impacts. Projected climate changes for the Pleikrong include temperature increases, increasing wet season rainfall and runoff, increasing intensity and frequency of extreme rainfall events and flooding, and declining dry season precipitation and runoff.

Stakeholders then identified non-climate stressors to the business performance objectives. Erosion and soil run-off currently cause sedimentation of the Pleikrong reservoir, while deforestation due to planting coffee and pepper has resulted in soil erosion and flash floods (Hong Troung et al. 2013). Population and the rate of deforestation are increasing. During the dry season, competition for water is high between farmers and power generation, frequently causing conflict between users.

Figure 4. Stakeholders apply the Framework during a working session hosted by VietNam Electricity (EVN) (2015).

Stakeholders discussed how and whether their existing adaptive capacity could improve the Pleikrong's business performance. The Pleikrong's storage capacity was considered beneficial in terms of its ability to buffer climate impacts. While insurance and access to quality hydro-meteorological forecasts are not currently available, stakeholders indicated that these capacities will be in place by 2050, and that insurance could improve the plant's capacity to buffer direct financial impacts because of flood related damages, and that high-quality forecasts could improve operational flexibility and management of extremes.

Based on consideration of the combination of climate and non-climate stressors, and adaptive capacity, stakeholders ranked the level of risk for each business performance objective, the results for the year 2050 are presented in Table 2. The primary concerns identified include increasing flood and drought risk, which have a cross cutting impact on the Pleikrong's environmental, financial, and social business performance objectives; and the ability to meet instream flow requirements due to a range of climate impacts. In particular, achieving some of the plant's business performance objectives

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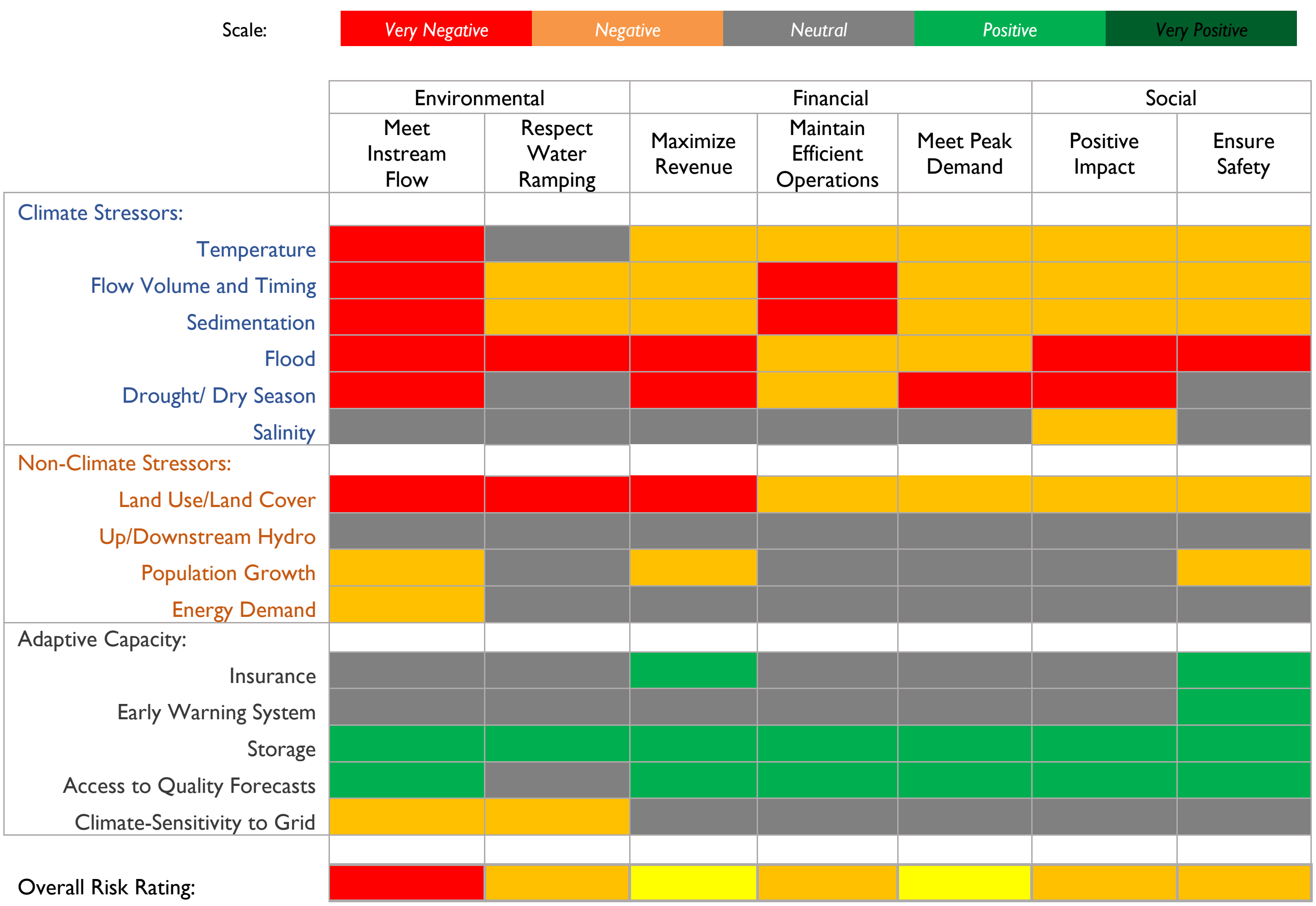
[3] The USAID framework for screening hydropower facilities for climate change risks to business performance was applied by stakeholders during a USAID ASEAN Connectivity through Trade Initiative sponsored event: 'Working Session to Apply the Framework for Screening Hydropower Facilities for Climate Change Risks' hosted by VietNam Electricity (EVN) on March 20, 2015.

is already challenging in the dry season, where the simultaneous effects of high water demands for agriculture, low flows, and high energy demands reduce water availability for hydropower generation. Projected reductions in rainfall and increases in temperature during the dry season may portend higher evaporation, lower water availability, and higher agricultural water demands, potentially diminishing Pleikrong's ability to maintain reliable electricity generation and meet competing water demands for agriculture and instream flows. The climate risk screening tool helped stakeholders to identify and assess risks and provided a series of structural, policy, and planning recommendations that could build resilience for the hydropower plant. For example, potential interventions include improving coordination between competing water users and updating drought risk management plans to reflect climate change. The Pleikrong Hydropower Plant can address current as well as projected dry season challenges by addressing the identified climate risks, thereby reducing the risk of blackouts, higher cost and GHG emissions of electricity due to substitution of higher emitting and more costly fossil fuels, and reducing impact on the agricultural sector and farmer livelihoods.

Table 2. Assessment of future (year 2050) risks to achieving performance objectives at Pleikrong Hydropower Plant



Notes: Overall risk is indicated by None (Grey), Low (Yellow), Moderate (Orange), and High (Red).

Summary

Understanding and addressing the climate risks to energy programs and projects is an essential component to realizing and safeguarding LED objectives—and considering climate risk is rapidly becoming a standard part of the LED investment process. Within the past few years, major development banks have recognized the significant impact climate change may have on the viability of their investments, and they now require climate risk screening as a step in their project development process. In response to the growing awareness of climate risks to development projects, a number of climate risk screening tools have emerged, including some described in this paper that relate specifically to concerns of the energy sector. By providing a relatively quick and broad look into the types and level of climate risk faced by projects, these tools support an important first step in the project planning process to ensure that development practitioners make wise decisions efficiently, and that LED investments ares ready to withstand the tests of climate change.

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