Incorporating Climate Change Impacts into Environmental Assessments

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Introduction

Environmental Impact Assessments (EIA) can be defined as a "comprehensive and systematic planning process designed to identify, analyze and evaluate the environmental effects of proposed projects and ensure that these impacts and considerations are factored into project decision making". As awareness of projected future climate change grows, so does the recognition that climate change planning must go beyond Greenhouse Gas (GHG) accounting. Climate change planning must also consider the effects of the environment on the projects and consider adaptation measures, so that the project will operate effectively in an uncertain future climate. EIA reviewers are increasingly requiring documentation and detailed discussion of how a changing climate may impact the project. Proponents must understand and present how future weather variability, such as severe and/or extreme weather conditions, and the long term effects of a changing climate, could adversely affect project infrastructure or Valued Ecosystem Components, and document how the project has been designed to be resilient to these changes. This paper discusses this approach of incorporating climate change impacts into EIA's, present adaptation best practices and document the implementation of this process in both North and South America.

Requirements for Climate Change Assessment

Climate change adaptation encompasses "adjustments in natural or human systems in response to actual or expected climatic stimuli on their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2007a). The need to incorporate climate change adaptation has been identified by the International Association for Impact Assessment (IAIA) that stressed the need to address climate change in impact assessments in terms of both mitigation and adaptation (Byers et. al., 2012). Numerous regulatory agencies have also formalized this need in their EIA requirements. For example, the Canadian Environmental Assessment Agency (CEAA) places requirements to assess climate change directly in the EIA guidelines for each project they are to assess and has provided general guidance for practitioners (FPTCCCEA, 2003). The US Environmental Protection Agency (EPA) has guidance on considering climate change in terms of analyzing and preparing for the potential risks associated with the impact of extreme events on project design (US EPA, 2011). In Chile, the Chilean National Adaptation Plans to Climate Change (National Environmental Commission, 2008) promotes, coordinates, and when

appropriate, implements activities that increase the resilience of sectors exposed to climate change. The European Union has produced the Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Union, 2013), which provides guidance on how to integrate climate change and biodiversity in EIAs.

In addition to governmental guidance, the International Finance Corporation (IFC) has issued Performance Standards on Environmental and Social Sustainability that have similar requirements for projects that require World Bank Funding or must demonstrate that they meet the Equator Principles.

Although the requirements to include climate change impacts into environmental assessments exist under various governing bodies; additional guidance is necessary on how to systematically and consistently incorporate these assessments in the EIA process.

Climate Change Impact Assessments as Planning Tools

While there is significant debate surrounding the scientific aspects of climate change, the issue remains a key risk that companies should consider. Weather variability and long term changes in the climate have been recognized as a current reality (IPCC, 2007a). Many companies have responded to stakeholder interests by incorporating the issue of climate change through corporate social responsibility or sustainability programs, as part of the company corporate risk management and business continuity management frameworks. Mitigation actions cannot prevent further warming of the planet due to the inertia of the systems involved (e.g., oceans, the planetary atmosphere, and emissions from other jurisdictions), and the benefits of emission reductions are not likely to become evident for several decades. Therefore, in addition to establishing effective mitigation measures, there is a need for companies to understand the risks of a changing climate and their exposure to extreme weather, as well as to adapt their practices to these changes. Adaptation actions can also help to achieve sustainable development objectives related to local community engagement and social development, biodiversity enhancement and protection of sensitive ecosystems, natural resources stewardship, and strengthen reputation with key external stakeholders. Using the EIA framework as a planning tool to anticipate climate change impacts may well prevent the accrual of major costs if climatic changes become more pronounced.

There are many examples of projects that operate in areas of world with extreme seasonal weather, as well as extremes in shorter-term weather patterns. According to the International Council on Mining and Metals (ICMM, 2013) changes in climatic variables are now projected to occur within the design lifespan (closure phase included) of existing mining project infrastructure and assets. Particularly vulnerable aspects of mining infrastructure can include:

- access to critical climate-sensitive inputs, such as energy and water supply chain reliability, including the delivery of inputs such as fuels, electricity and materials to the facility or site, and the delivery of ore or processed metals to market;
- operational performance and resilience of assets (mine sites, transportation infrastructure, commercial property and industrial process efficiencies) to changes in the water balance over the operating life of mines or facilities;
- long-term management of mine sites and mine wastes post-closure; and

- cost implications that affect the return on investment and the profitable operating life of mines or facilities, company reputation, local community relationships, civil society groups and governments in the areas where companies operate.

A recent study, Assessing the Treatment of Climate Change Impacts and Adaptation in Project-Level EAs in the Canadian Mining Sector (Rodgers, et. all 2014), highlights best practices for climate impacts and adaptation considerations in EIA's. The approach followed by the authors is to prepare an EIA which considers the projected changes in climate in the assessment of the project. This is achieved by answering the five questions presented in the follow sections. The first two questions collect the information necessary to answer the latter three questions which are considered in the impact assessment for the project.

What is the current climate in the study area, and how has this historical climate been changing?

In order to understand the projected changes in climate, the current climate must first be defined. Weather varies from one year to the next; therefore, accepted practice describes climate using climate normals, which are long-term (usually 30-year) averages of observed meteorological data in the project region. The standard period currently used by the World Meteorological Organization (WMO) is 1961 through 1990, but the WMO recommends that member countries create decadal updates as well (Arguez and Vose, 2011). For example, the currently accepted normal period in Canada is from 1981 through 2010. In characterizing the current climate and historic climate trends efforts should be made to select data that corresponds to the accepted normal period in the jurisdiction of the project.

When looking at a project's study area, one of the largest challenges is in the selection of the climate stations used to describe the current climate and to characterizing the trends in the historic data. Selecting the closest station to a project study area may not provide the best description of the current climate due to data availability, distance from the project area and surrounding geographic influences. Historical climate trends should be characterized, using the historical climate data, to identify apparent trends and assess whether those apparent trends are statistically significant or not.

How will the climate in the study area likely change in the future?

Future projections of climate can be obtained from a global climate model (commonly known as the General Circulation Model, or GCM). According to the Intergovernmental Panel on Climate Change (IPCC, 2007b) a GCM is made up of a number of mathematical equations, based on the physics and dynamics of the land, ocean and atmosphere. It is essentially a representation of the earth's processes and is usually constructed according to one of the IPCC emission scenarios. Since no one model or climate scenario can be viewed as completely accurate, climate change analyses should use as many models and climate scenarios as possible. Therefore, the future climate trends of selected climate variables should be described using a multi-model ensemble approach, with the GCMs projecting future climate for a range of IPCC emission scenarios. In keeping with accepted climate practices, future climate description should be presented in the context of change from the accepted baseline period, e.g. in degrees Celsius or millimetres of precipitation.

The climate change assessment must consider the inherent limitations GCMs when evaluating variability and the rate of climate change (i.e., when comparing future projections to historical observations). These limitations should be clearly documented, including spatial and temporal scales, unpredictability, and changes to our understanding of climate change drivers that are dependent on the research institutions' approach to overcoming model uncertainty.

How could the projected changes in climate interact with the infrastructure of the project?

Changes in future climate have the potential to affect the integrity of a project. Interactions between the existing conditions, the proposed infrastructure, and the project-relevant climate factors should be identified for the project by a multi-disciplinary team using a risk based approach. The identified interactions should be assessed for significance by the appropriate discipline team (e.g., hydrology, surface water, mine waste engineering) based on project design elements or mitigation strategies to avoid or manage the potential risks.

What are the greenhouse gas (GHG) emissions associated with the Project, how do they compare to national and international totals, and what is the potential for them to affect climate change?

A project will likely include aspects that contribute to GHG emissions either directly (e.g., fuel combustion) or indirectly (e.g., purchased electricity). The direct and indirect GHG emissions associated with a project should be quantified in accordance with accepted practices and protocols, and then put in context of the GHG emissions nationally (and internationally, if appropriate). Finally, the GHG emissions from a project should be compared to established IPCC emission scenarios to identify the potential for the GHG emissions from a project to contribute to climate change.

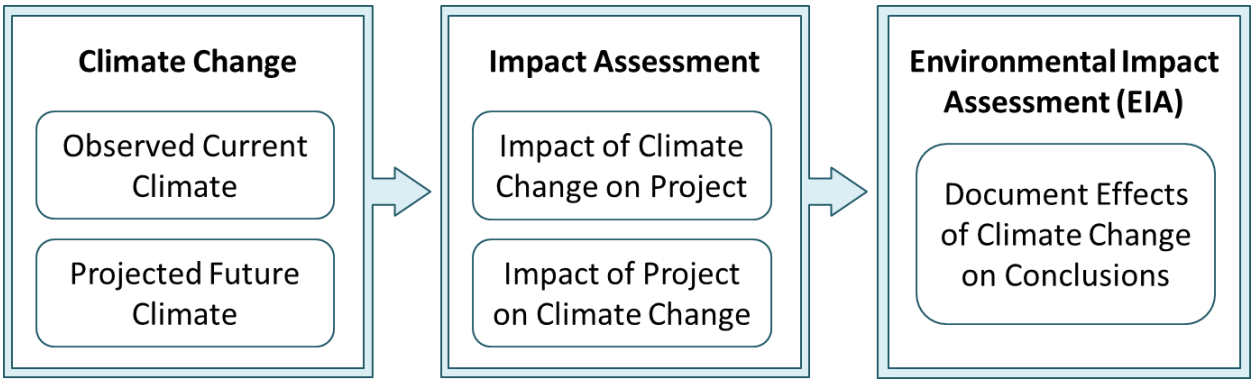
Mitigation measures should be considered to reduce the GHG emissions from a project as part of the assessment and general best-practices for the industry in question.

Will changes in climate affect the conclusions of the findings of the Environmental Impact Assessment?

Based on the answers to the first three questions, a review of the effects assessments from the multi-disciplinary risk assessment should be conducted to identify if the potentially changing climate will affect individual discipline assessments and change any of their assessments of significance for the project. The assessment should document any required additional mitigation or monitoring commitments necessary in order to make the project more robust with respect to the potentially changing climate.

Framework for an Climate Change Impact Assessment

Following this process, a framework can be developed that helps to support the incorporation of climate change into an EIA, based on available guidance and best practices. The framework is described in the stepwise process shown in the figure below.



As a first step, the current climate and projected future climate is described. As indicated above, the current climate is described using historical observations and the projected future climate is described using a multi-model ensemble. This step uses the answers from the first two questions above. In the second step, strategies must be developed to support effective decision-making by infrastructure owners and operators to incorporate adaptation into design, development and management of the planned and existing infrastructure. Vulnerabilities occur where existing or planned infrastructure is not sufficiently robust to deal with the projected changes or monitoring is not in place to observe the changes before they lead to a potential impact. This step relies on answers from the third and fourth questions. The final step documents the decision making process by each discipline to examining the impact of climate change on their findings and the conclusions of the EIA.

This framework has been developed to streamline the interactions between the disciplines, facilitating the discussion of climate change from the early planning stages of the EIA. Each of the steps follows the natural progression of the EIA; as each discipline provides information, the framework can progress forward to the next step.

Summary

A framework for successfully integrating climate change into an EIA has been developed to establish the current climate and future climate projections for an EIA, as well as how to consider climate interactions within the EIA and document the effects of climate change on the conclusions of the EIA. Following this framework a robust climate change impact assessment can be presented within an EIA that documents how future weather variability, such as severe and/or extreme weather conditions and the long term effects of a changing climate has been considered with regard to project infrastructure or Valued Ecosystem Components, and how the Project has been designed to be resilient to these projected changes.

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REFERENCES

Arguez, A. and Vose, R. (2011) "*The Definition of the Standard WMO Climate Normal: The Key to Deriving Alternative Climate Normals*." Bull. Amer. Meteor. Soc., 92, 699–704.

Byer, P., Cestti, R., Croal, P., Fisher, W., Hazell, S., Kolhoff, A., and Kørnøv, L. (2012), "*Climate Change in Impact Assessment: International Best Practice Principles. Special Publication Series No. 8."* Fargo, USA: International Association for Impact Assessment.

European Union (2013) "*Guidance on Integrating Cliamte Change and Biodiversity into Environmental Impact Assessment*"

FPTCCEA (2003) Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment *"Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners."* Canada.

ICMM (2013) "*Adapting to a changing climate: Implications for the mining and metals industry"* International Council on Mining and Metals (ICMM).

IPCC (2007a) *Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*.

IPCC (2007b) "*General Guidelines on the Use of Scenario Data for Climate Impact and Adaptation Assessment."* Version 2. Task Group on Data and Scenario Support for Impact and Climate Assessment (TGICA), Intergovernmental Panel on Climate Change.

National Environmental Commission (2008) "National Climate Change Action Plan", Department of Climate Change, Chile.

Rodgers, C., Eng, S., Sparling, E., Douglas, A., Byer, P., and Auld, H. (2014): "*Assessing the Treatment of Climate Change Impacts and Adaptation in Project-Level EAs in the Canadian Mining Sector*", report submitted to Climate Change Impacts and Adaptation Division, Natural Resources Canada.

US EPA (May 2011) "*EIA Technical Review Guideline: Non-Metal and Metal Mining Volume 1"*, Environmental Protection Agency.