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# Challenges in Integration of Climate Change Considerations on Environmental Impact Assessment Practices

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**Abstract :** This paper is based on a study of various reports from International Association for Impact Assessment and United Nations Framework Convention on Climate Change (CC). An essential purpose of the Environmental Impact Assessment (EIA) process is “to improve decision making and to ensure that project options under consideration are environmentally sound and sustainable” (World Bank, 1999)<sup>5</sup> CC is one of the key challenges facing by the world today. The Inter governmental Panel on Climate Change (IPCC 2007) has highlighted the risks and how urgently we need to respond. As per the Notification from the Ministry of Environment, Forest and Climate Change. Govt. of India, all Infrastructure projects are subject to EIA. However a relevant question is what purpose an impact assessment has when the project is ‘good for the environment’? One of the topics receiving much attention in EIA is Climate change considerations. This warrants the question, the challenges in integration of climate change related impacts on infrastructure projects.

**Keywords:** Climate Change, EIA, Infrastructure and Environment.

## 1.0 Introduction

Climate change poses a serious challenge to economic development. The nature and type of development that occurs also has implications for greenhouse gas (GHG) emissions as well as the vulnerability of society to climate change impacts. Therefore, it has been widely recognized that there is a need to integrate consideration of climate change and its impacts in development policies and projects. The project level is particularly critical for the consideration of climate change risks and for incorporating suitable adaptation measures. Climate change is one of the key challenges facing in sustainable development. In spite of this well established fact, planners and regulators are not addressing the impacts of climate change adequately in the future plans. This is not just the case with the developing countries but with the developed countries as well. One of the strategies to reflect concerns on Climate Change is to integrate Climate Change considerations in Environmental Impact Assessment. There is a growing interest in the EIA community regarding such mainstreaming. Alberti and Susskind (1996) argue that together with Cumulative Impact Assessment, EIA is a crucial tool for setting and achieving a project’s climate change impacts and other sustainability targets (Jeonghwa and Theophilus 2012)<sup>4,6</sup>.

## 2.0 Climate Change and EIA

The level of progress in integrating CC considerations in EIA varies considerably among countries (Agrawala, et al. 2010)<sup>1</sup>. Countries like Netherlands, Canada, Newzeland and Australia have been the pioneers in implementing incorporation of CC in EIA. While Netherlands includes climate change through a Strategic

Environmental Assessment (SEA), Canada and Australia have taken the route towards CC integration through project level EIAs. The European Commission, in its directive on the assessment of the effects of certain public and private projects on the environment, aims to reflect CC related concerns (European Commission 2012)<sup>2,7</sup>. Table 1 provides a status on adoption of CC considerations into EIAs across countries as well as by multilateral organizations<sup>3</sup>. Although CC related concerns and understanding are growing, incorporation of CC in the EIA process has not seen an acceptance as expected. Project developers in countries like Canada are pioneer in this area; believe that not much climate related information is available to analyze the impacts of climate change on the projects. Besides, data availability and expertise on CC modelling is still an issue.

**Table 1 Progress in mainstreaming Climate Change in EIA**

	Initial Stage	Concept Stage	Implementation Stage
Countries	Spain	Netherlands	Australia
	Brazil	Trinidad	Canada
	India	England (UK)	New Zealand
Institutions	Asian Development Bank		
	Inter-American Development Bank		
	The World Bank		

## 2.1 Role of Climate Change in A Project

To reduce project risks associated with compliance with existing and future GHG reduction targets and legislations such as carbon cap and trade or carbon tax systems, certain projects will need to consider their “carbon footprint”. This includes accounting for GHG emissions through all phases of the project lifecycle including: design, construction, operation and eventual abandonment of the project. In addition, existing carbon sinks such as forests may be lost if these are not considered in the design of a project.

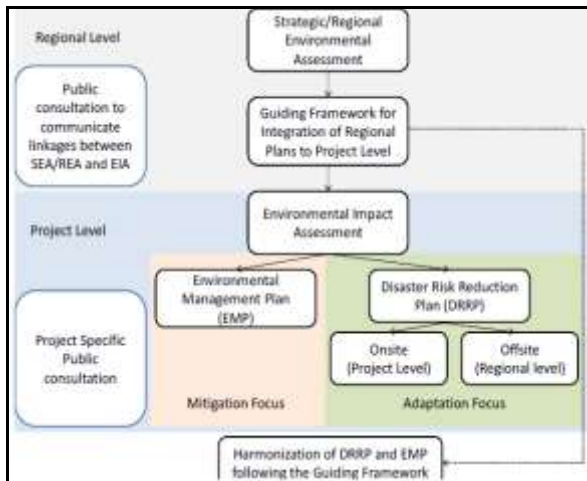
One of the most compelling reasons for considering climate change in EIAs is that climate data play a key role in the planning and design of infrastructure<sup>6</sup>. Under climate change, the use of historic data alone may no longer be appropriate. Conventional uses of historic data such as the exclusive use of climatic normal’s could render infrastructure vulnerable by leading to designs with insufficient load and adaptive capacity, or by leading to planning decisions that situate projects in environments that become unsafe or difficult to maintain over time. There is a potential that design professionals, infrastructure owners and operators may be held civilly liable for property damage or injury for not taking climate change effects into account (Gherbaz, 2008)<sup>7</sup>.

It is important to consider how changing climate will influence the project over its expected lifetime, and how this will affect the environment and the on-going physical (direct impacts such as sea-level rise) and financial (costs such as insurance premiums and maintenance) viability of the project. Considering climate change at the time of Project Registration, in the EA, and early in the decision making process may avoid future costs to the project and related impacts on the environment.

## 2.2 Importance of using Strategic EIA in Integrating CC

CC considerations in EIA typically result into mitigation and adaptation plans. The adaptation plans need to be developed at state level, often beyond the boundaries of an individual project. For designing and implementing adaptation related plans, a simultaneous consideration to multiple projects is required to assess the cumulative impacts over the region. The entry point for developing adaptation plan is thus at strategic level where tools such as Rapid EIA (REIA) and Strategic EIA (SEIA) need to be used. The mitigation plans on the other hand are generally project-limited and influence the project design and operations. Here aspects such as energy mix, water use and conservation, afforestation and erosion control need to be examined. Many of these aspects get addressed in the preparation of Environmental Management Plan (EMP).

To address abnormal and emergent situations, the EMPs need to be accompanied by the Disaster Management Plan (DMP). Once CC considerations are included, adaptation and mitigation elements get factored and the DMP assumes a form of a Disaster Risk Reduction Plan (DRRP). This DRRP needs to address both onsite and offsite risks. Management of onsite risks become a part of the Project EIA while the management of offsite risks need to be integrated with State DRRP. Both EMP and DRRP need to abide by the framework of the SEA with clear institutional and cost sharing arrangements. Again, DRRP needs to be "synchronized" with the adaptation related plans at the state level - especially on matters related to policy, plans and supporting commonly shared infrastructure. Figure 1 shows the relationships between SEA/REA, Project level EIA, EMP and DRRP in the context of CC integration.



**Figure 1 Integration of CC consideration in EIA**

Many developing countries do not have processes and tools such as REA, SEA and CIA as a mandatory part of the environmental clearance process. To integrate CC into the EIA, application of these tools is necessary. Public consultations should be used as an important milestone to link the SEA, REA and Project level EIAs. EIAs are generally processed by State and Central level environmental authorities. Separate departments operate for management of disaster related risks. Often there are no linkages occur between these institutions. SEA with a focus on CC can be utilized to ensure mainstreaming of CC in project EIAs and more critically to ensure coordination between key institutions and the project authorities.

### 2.3 Issues and Constraints Caused by Climate Change

In within next decade we will experience higher temperatures, changing rainfall patterns, rising sea levels and more frequent extreme weather events, ranging from droughts to floods and freezing winters. Our changing climate is likely to have a range of impacts, such as those listed below. During various Stages of the EIA process, the plan-maker will identify environmental problems, and consider how the plan could be affected by the expected climate change impacts, During the environmental management plan, when developing and refining alternatives and assessing effects, the plan-maker will need to consider how the plan will mitigate and adapt to these impacts

**WATER RESOURCES** There may be little change in average annual rainfall, but there may be more rain in winter and less in summer. Coupled with increased temperatures, this may lead to much lower average summer river flows, but there may also be a significantly increased risk of flooding as more rain comes down in heavier bursts. River and lake water temperatures are likely to continue to increase broadly in line with air temperatures. Droughts may also become more common. Climate change will therefore affect the demand for water as well as its availability and quality.

**COASTAL FLOODING AND EROSION** rising sea levels will increase coastal flooding and erosion. Current projections of sea level rise show that the coastal floodplains would be more likely to flood. Coastal environments and morphology are hugely diverse, which will lead to local variations in coastal change. Climate change is very likely to increase erosion rates and the most severe erosion will occur.

**BIODIVERSITY** Animal and plant species are moving and changing in response to increasing temperatures. These changes are clearest in marine and coastal environments. In terrestrial and freshwater habitats the inability of species to move far, coupled with the influence of land and water management, tends to obscure trends. There is some evidence that animals living in both terrestrial and freshwater environments have extended their range upwards.

**BUILDINGS AND INFRASTRUCTURE** Climate change could have significant implications for infrastructure. Infrastructure assets have long operational lifetimes, so they are sensitive not only to the existing climate at the time of their construction, but also to climate variations over decades of use. Higher winter rainfall and more extreme events such as flooding are likely to increase damage to buildings and infrastructure through flood damage and subsidence. Services such as transport and access to medical facilities may be disrupted.

**LAND QUALITY** Climate change may increase pesticide and fertiliser run-off in agricultural catchments, affecting the quality of water bodies. Higher temperatures and lower rainfall in the summer may affect soil structure and moisture content. This will increase the potential risk of sediment run-off into rivers and other water bodies.

## 2.4 Mitigation and Adaptation Measures

There are two necessary responses to climate change.

**MITIGATION MEASURES** are actions that reduce the impact humans have on the climate system by reducing our emissions of greenhouse gases. For example, moving to more sustainable forms of transport, increasing energy efficiency by improving building insulation, and using energy generated from renewable sources. Mitigation measures reduce global greenhouse gas emissions in order to avoid expected climate change impacts in the future.

**ADAPTATION MEASURES** are actions that respond to actual or expected climate change. They have the potential to reduce the adverse impacts and enhance the benefits - for example, by harvesting and storing winter rainfall for use in summer. We need adaptation measures because a degree of climate change is unavoidable regardless of what we do to reduce future emissions.

Mitigation and adaptation measures may be interrelated. For instance, increased temperatures will influence the way buildings are designed, but installing air conditioning will add to greenhouse gas emissions. Our response to climate change needs to include both adaptation and mitigation and their interactions. We should aim to manage the unavoidable, while avoiding the unmanageable

Mitigating against, and adapting to, climate change should be considered at various stages of the EIA process "to prevent, reduce and, as fully as possible, offset any significant adverse effects on [climatic factors] of implementing the plan

## 2.5 Barriers on CC Integration in EIA

As a result of a survey conducted by International Association of Impact Assessment was found that majority practitioners believed that CC is highly relevant in EIA and Strategic Environmental Assessment (SEA). In addition, they suggest that EIAs cannot take lead in incorporating CC. Climate Change considerations must start from SEAs and REIAs. The General Climate Change Considerations in the EIAs Process are shown in Figure 2. The major barriers to EIA being able to address climate change were ranked as follows:

1. Lack of government policy and incentives to address CC
2. Lack of political and agency will to address climate change and other consideration (economic) seen as more important
3. EIA scoping does not address CC i.e. EIAs have a limited scope
4. Lack of expertise and lack appropriate EIA tools to deal with issue.

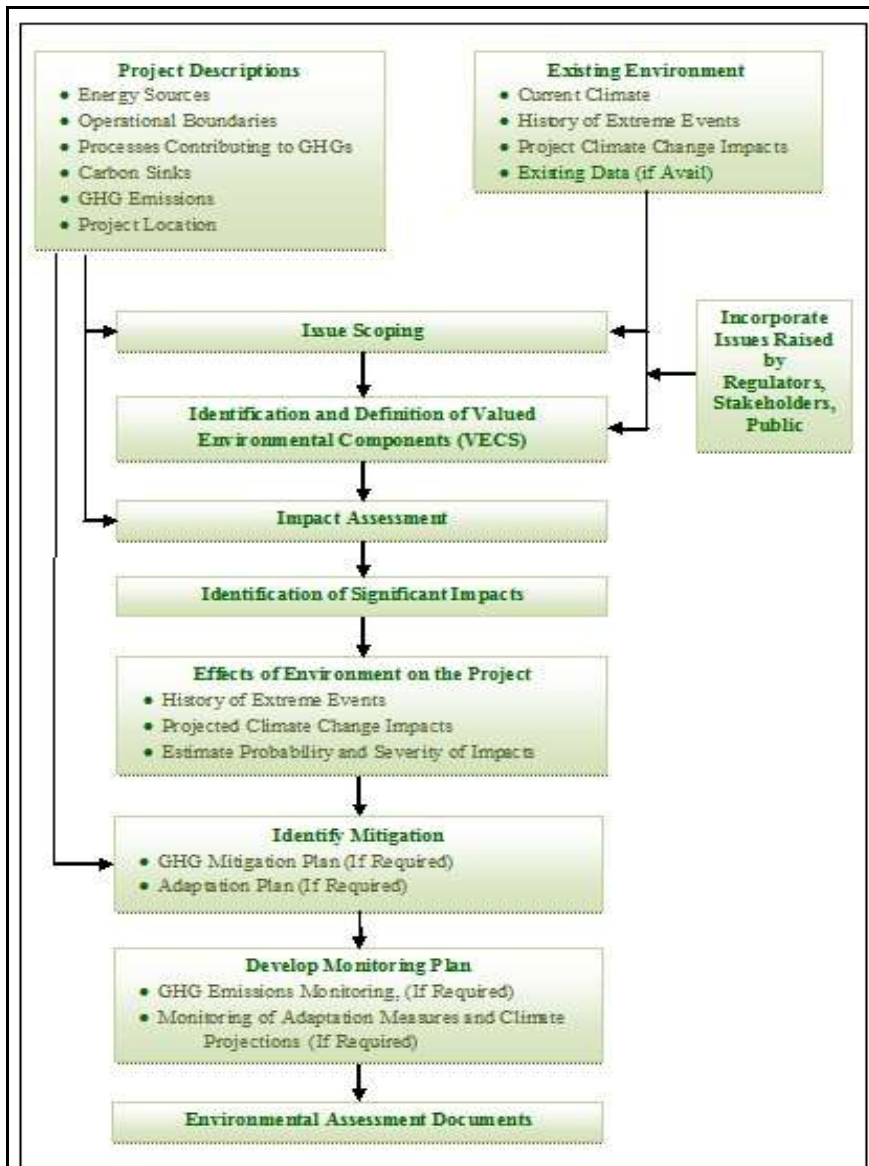


Figure 2 Climate Change Considerations in the EIAs Process

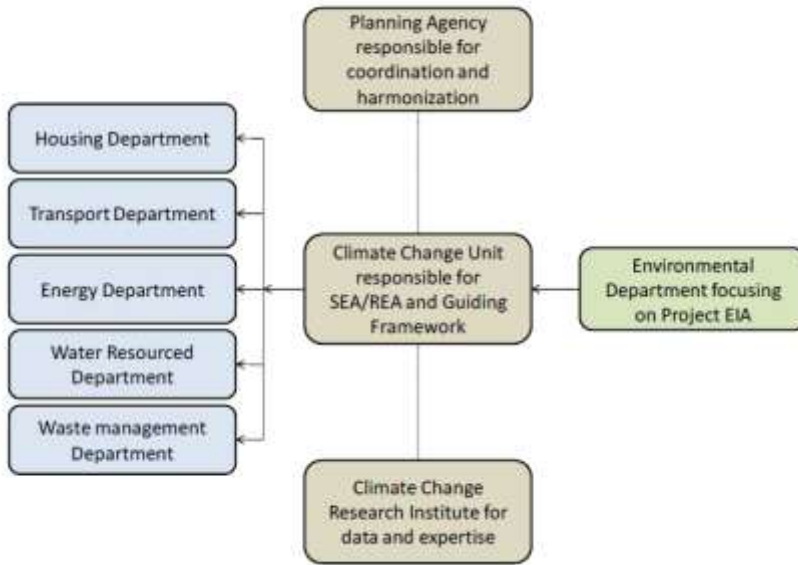
## 2.6 Sharing of Responsibilities

Key stakeholders in the CC integration will be National/State Planning agencies, State Environmental Regulatory Authority and National /State Disaster Management Agencies and the Project Proponent. Table 3 lists roles and responsibilities of key stakeholder institutions in the conduct of SEA, REIA and Project EIAs.

Given the need to have a close cooperation between planning and environmental regulatory agencies, it may be worth to establish a CC cell in every state that does the required coordination. This CC cell may be supported by a CC related research organization that has required databases and expertise on CC related modeling. This concept is shown in Figure 3.

## 3.0 Conclusions & Recommendations

It is important that Climate Change considerations are addressed in the EIAs. REA/SEA assumes an important role to ensure harmonization between EMP and DRRP with the CC adaptation plans. Institutional coordination and cost sharing become key considerations in the implementation of the CC related recommendations. Involvement of the stakeholders is necessary to appreciate the concerns of the CC with Possible indicators as shown in the table, especially its economic, social and environmental implications. Capacity building of the planners, regulators and professionals is required. Finally, Regulators should be implemented to demonstrate how CC could be mainstreamed.



**Figure 3 Institutional Arrangements for Mainstreaming CC considerations in EIA**

Based on the analysis of several reports and review articles the EIA should include the following objectives:

- To ensure that environmental considerations are explicitly addressed and incorporated into the development decision making process
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and
- To promote development that is sustainable and optimizes resource use and management opportunities” (IAIA, 1999).

**Table 2 Possible Climate Change Indicators in mainstreaming of EIA**

Aspects of climate change with Possible Indicators	
<b>Causes</b>	Greenhouse gas emissions: per region, per capita
<b>Weather changes</b>	<ul style="list-style-type: none"> <li>• sea level</li> <li>• precipitation</li> <li>• temperature</li> <li>• flood levels in rivers</li> <li>• extreme events such as heat waves</li> </ul>
<b>Local impacts of weather changes</b>	<ul style="list-style-type: none"> <li>• average annual flood incidence / damage drought orders</li> <li>• ranges of habitats</li> <li>• number of heat and/or cold related deaths</li> <li>• number of cases of subsidence / insurance claims for subsidence</li> <li>• river flows and water quality</li> </ul>
<b>Mitigation measures</b>	<ul style="list-style-type: none"> <li>• household energy use</li> <li>• total electricity and gas use</li> <li>• vehicle-km travelled per person per year</li> <li>• electricity generated from renewable energy sources and Combined Heat &amp; Power (CHP) located in the area</li> <li>• embodied energy in new buildings</li> <li>• average energy efficiency of new buildings</li> <li>• % of new homes conforming to recognized codes for sustainable buildings</li> </ul>

<b>Adaptation measures</b>	<ul style="list-style-type: none"> <li>• % developments with Sustainable Drainage Systems (SUDS)</li> <li>• number or % homes in floodplain / coastal flooding</li> <li>• number or % roads/railway lines in floodplain</li> <li>• number of planning permissions granted against Environment Agency advice on grounds of flood risk</li> <li>• household water use</li> <li>• % of developments subjected to checklist for development</li> </ul>
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**Table 3 Roles and Responsibilities of Key Stakeholder Institutions**

Activity	Developmental Authorities	State Environmental Regulators	Project Proponents
Baseline data of climate parameters like rainfall, temperature, Hydrological maps, infrastructure mapping, natural resource maps	√	√	
Future projections of climate at state level	√	√	
Probable CC related impacts/risks at state level	√	√	
Strategic/Rapid Environmental assessment incorporating CC	√	√	√
Consultation with authorities and stakeholders	√	√	√
Adaptation and mitigation in the development plans and policies	√	√	
Prepare response mechanism plans for disaster risk reduction at state level	√	√	
Monitoring effectiveness of the plan in terms of mitigation and adaptation	√	√	
Impact of climate change on project/programme			√
EMP			√
DRRP			√
EMP, DRRP Integration with outcomes of REA/SEA			√



4.1 Appendix

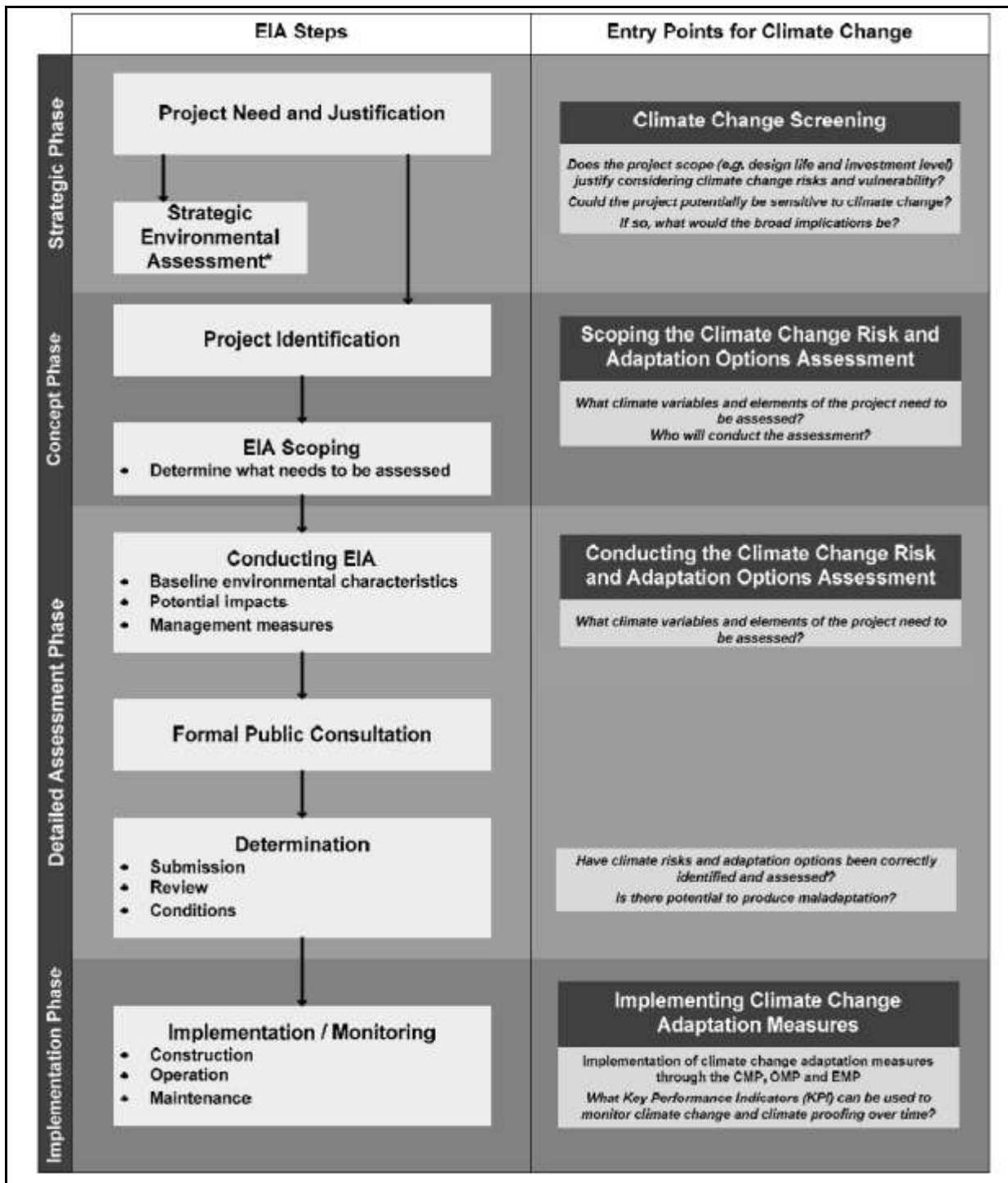


Figure 4 Potential entry points for considering climate change impacts and adaptation in EIA

4.0 References

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