Greenhouse Gases and Climate in Environmental Impact Assessment – Practical Guidance

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There is very little guidance available in world regulatory regimes or the literature on how to assess the release of greenhouse gases (GHGs) from a project being considered in an environmental impact assessment (EIA). In practice, a valued component (VC) related to climate and GHGs is frequently established for assessment as one of the following: climate, a change in greenhouse gas emissions, or simply greenhouse gases, or effects of the environment on the project. The project-environment interaction is then considered in this context. In Canada, the federal requirements (CEAA, 2003) are to identify mitigation measures, quantify GHG emissions from the project, categorize emissions as low, medium, or high (these are not clearly defined), and compare to releases from the industrial sector, the region, province, country, and the global total. Climate change considerations are also described. In the guidance, it is stated that, "the contribution of an individual project to climate change cannot be measured". This has been frequently interpreted to mean that a determination of significance is not required. In this paper, this view is challenged on the basis of assessment experiences with regulatory agencies, public information sessions, and the legal community, on projects ranging from hydroelectric power generation to large petroleum refineries in Canada, and beyond. New ideas on significance are presented that include consideration of thresholds, the magnitudes of releases and emission intensities. While this new approach, presented here for industrial projects, is reasonably clear, for specific projects with releases of GHGs that are estimated to be high (with mitigation measures included), the potential environmental effect may be rated as significant.

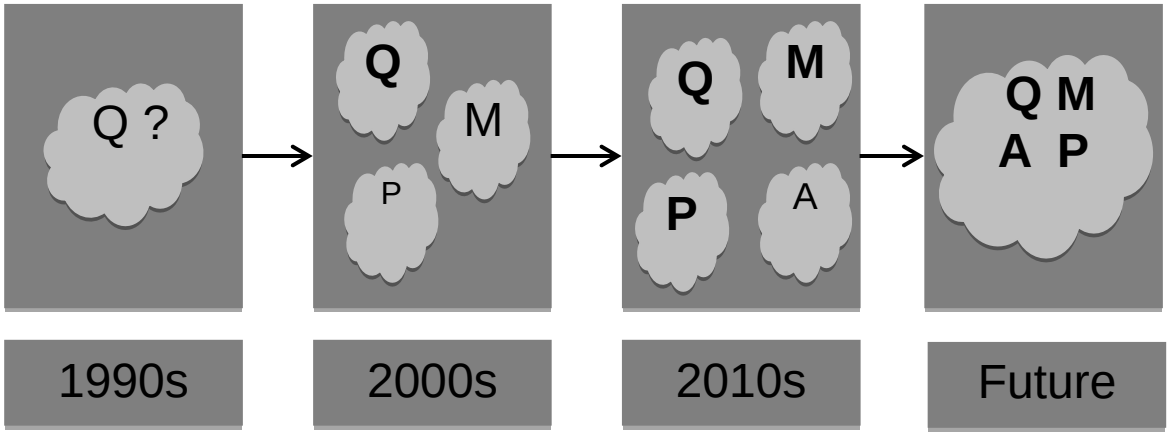
Introduction

The objective of this paper is to provide practical guidance to address GHGs and climate change in EIA for industrial projects by considering four aspects: GHG emissions; climate change; mitigation; and adaptation. While strongly interlinked, these aspects are kept separate here for analysis purposes. There is considerable information available relating to each of these categories; however, there is a disconnect between regulators, legal departments, proponents, and EIA practitioners on how to address each of these during the assessment process. Currently, the practice is evolving. Where at one point very little was done, now all four aspects are being addressed, in some way. The treatment is often fragmented, where mitigation is considered in some detail, and often little is done on adaptation. It is clear from both the literature and from experienced practitioners that an integrated approach is needed to achieve the objective of a more climate-proof project (Figure 1).

In this paper, guidance from the literature and from regulatory agencies is used, together with specific experiences from practitioners working on larger industrial projects, to generate a practical procedure that practitioners may draw upon when faced with making an assessment of GHGs in an EIA.

Synthesis of Available Guidance

A number of countries have been identified as having the intent to assess climate considerations in their respective environmental assessment programs. Responses from surveys suggest that guidelines and regulations at screening level are needed in order for EIA systems to effectively address climate change (Sok *et al.,* 2011).



Q = Quantification (note, the degree of **bold** in Q,M,A,P suggests the evolution over time)
M = Mitigation
A = Adaptation (climate impacts, vulnerability, resiliency, options)
P = Plans (GHG Management Plan)

Figure 1 – Greenhouse Gases and Climate in EIA - Changing Quickly

A literature review was conducted to assess the status of incorporating climate change impacts and adaptation in EIAs and indicated that consideration of climate change in EIA is in the early stages, both in developed and developing countries (Agrawala *et al.*, 2012). Environmental impact assessment is an important decision-making tool, and is now a legal requirement in many countries. While many documents describe the intent to incorporate GHGs and climate change into EIA, only two countries have consistently considered these in their assessment process (*i.e.*, Canada and Australia). There is a large gap between the desire to incorporate climate change considerations in EIA, and what happens in actual practice.

The Netherlands Environmental Assessment Agency (NCEA) has presented climate change adaptation tools and methods at a regional workshop (Kolhoff, 2011). Two promising areas described are: visualization tools for impacts - including vulnerability and adaptation options, and support methods to incorporate adaptation in planning processes at local, national, and regional levels. Examples of tools include downscaling data sets, modeling of climate and hydrology, vulnerability assessment, and evaluation and selection of adaptation options.

The Danish Centre for Environmental Assessment prepared a synthesis report of a special symposium on climate change and impact assessment (Kornov *et.al.,* 2010). There is a need to integrate mitigation and adaptation measures in EIA, to capture both the risks and the benefits of the project. Adaptation needs to be addressed in impact assessment to ensure the project delivers on what it is designed to do, and to avoid losses in investments.

In the United Kingdom, the Institute for Environmental Management and Assessment (IEMA) has published two short but useful documents in the IEMA Principles Series; one on mitigation and one on adaptation and EIA (IEMA, 2013). Guidance is provided on assessment principles, quantification, significance, and follow up and monitoring. Related to emissions and significance, it is stated that, “all new GHG emissions contribute to a significant negative environmental effect” and a directive to, “reduce the residual significance...at all stages”.

In the United States, the Council on Environmental Quality (CEQ) published a draft guidance memorandum on the consideration of the effects of climate change and GHG emissions. Under the authority of the National Environmental Policy Act (NEPA), the CEQ advises federal agencies reducing GHG emissions and adapting their actions to climate change impacts. It is stated that agencies should use a scoping process to set reasonable spatial and temporal boundaries, and consider these in terms of impacts, sustainability, and design of the action or project (Sutley, 2010). In a review of policies from six areas in the United States that required consideration of climate change in EIA, three key challenges were identified: addressing uncertainty, establishing significance, and addressing cumulative effects (Slotterback, 2011).

In Canada, the methodology for incorporating climate change in environmental assessment has been prescribed in guidance provided by the Canadian Environmental Assessment Agency (CEAA, 2003). This guidance requires an estimate of the GHG emissions expected from the project and a comparison with emissions from other facilities in the same industrial sector. If the emissions are found to be "medium" or "high", a GHG Management Plan must be developed. The magnitudes of low, medium, or high in terms of GHG emission volumes or intensity are not defined. There is also a requirement to consider the effects of climate change on the project. Each of the provinces is varied in their guidance.

On Thresholds of GHG Emissions

There were few statements found in the literature on thresholds related to assessment of GHGs in EIA. There is mention of low, medium, and high in guidance from Canada; however, these are not defined quantitatively. Historically, Large Final Emitters were considered to be those industrial facilities that released more than 100,000 tonnes of carbon dioxide equivalent (CO_2e) per year.

In the United States federal regulations, it is noted that, "If a proposed action would be reasonably anticipated to cause direct emissions of 25,000 tonnes CO_2e / year or more, agencies should consider this as an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public" (Sutley, 2010). It is emphasised that this is not a threshold for significance, but a level that may warrant some analysis.

In the state of California, the law provides that climate change is an environmental effect subject to the California Environmental Quality Act (CEQA). Therefore, the regulatory agencies must determine whether a project's climate-change related effects may be significant. It is thought by the California lawmakers that any contribution may be deemed significant, and two sectors are considered: industrial projects and residential/commercial projects. In the industrial sector, an annual threshold of 7,000 tonnes of CO_2e is proposed based on a technical benchmark of GHG emissions from a 10 million Btu/hr boiler fired with natural gas. The South Coast Air Quality Management District (SCAQMD) argues that the threshold should be 10,000 tonnes CO_2e per year (CARB, 2008).

Experiences with GHGs in EIA

In recent mining EIAs in North America, the requirements were different depending on location and jurisdiction. In one assessment, there was a need to quantify the emissions, prepare a sector profile, and place emissions in context. In another, additional requirements included doing a water balance to ensure predicted changes in river flows could be safely handled at the mine site.

In two EIAs for hydroelectric facilities in North America, the requirements shifted to add consideration of "embodied emissions". These may be thought of as emissions generated during activities from cradle to site, meaning to include production of construction materials, sourcing of raw materials, and conversion to

usable form. Emission factors based on the type of materials are combined with the quantities of materials to estimate the embodied emissions. The driver in these cases was the need to be “iron-clad” in comparing the project’s emissions with those from other types of power generation.

In recent EIAs for large refineries (300,000 barrels per day capacity), the requirements were also different. In North America, there were requirements to quantify the emissions from “well to wheel” in order to consider every possible aspect of mitigation, including sequestration, carbon capture, and storage. The total emissions were placed in the context of a refinery sector profile, although this was not easy. The climatology of the area was researched and reported, largely based on government data. Effects of the environment on the project, mainly climate and seismic, were assessed with respect to project function and ability to deliver product as planned. Adaptation (looking at vulnerability and resilience) was contemplated but not conducted. Offsets were considered, but in the end not required for approval. In EIA’s conducted in the Middle East, the GHGs released were quantified, in light of a full set of mitigation measures and compared with other facilities. The climatology was reported and effects of the environment on the project were assessed. In these instances, total emissions, excluding embodied emissions, ranged from 5 to 8 million tonnes CO_2e/year. In the assessments, thresholds of 100,000 and 1 million tonnes CO_2e/year were used to distinguish medium and high releases.

A number of discussions about significance of GHGs in EIA occurred directly between practitioner(s) and legal representation for proponents of large industrial facilities. The desire of the legal community is to declare that from a practical standpoint, there is “no significant adverse environmental effect” as a result of the GHG analysis. This is often conflicting for a practitioner as guidance suggests that for a single project on its own this “cannot be measured “, and cumulatively the effect of the project in combination with all other sources of GHGs is significant.

In a recent decision by the Federal Court of Canada (Pembina, 2008) on the significance of GHG emissions, justification for the use of regulatory thresholds, in this case emission intensities, was requested by the Court. Once provided, a large oil and gas project was allowed to proceed. Following this court decision, a review of significance in the context of the Canadian Environmental Assessment Act (CEAA) and global climate change (Kruger, 2009) suggested that, while waiting for regulatory thresholds to be published, the environmental assessment process should consider a, “more robust evaluation of alternatives in the courts”. Regulatory thresholds have not been published at the time of writing.

The way forward – practical guidance

The consideration of GHGs in EIA has evolved from barely being mentioned to a detailed consideration of mitigation, quantification, with preparation of the GHG Management Plan. Currently, adaptation plans are being completed, but this is often exterior to the EIA.

The scientific link between the release of GHGs to the atmosphere and a change in climate is strengthening (NRC 2011); hence, the need to consider and adapt to those changes is becoming more acute. While there is no simple cause and effect relationship between GHGs and adaptation, the prudent path is to consider the potential changes and prepare for them ahead of time.

Mitigation and adaptation are almost always treated separately. In our experience, when it does happen, adaptation is brought in to the EIA in the form of assessing the potential effects of the environment on the project. This focuses on climate and seismic histories and predictions of how future changes or events may cause effects, such as change in precipitation volumes in a certain area. The two are closely linked, and an integrated approach is desired, where the EIA practice looks at these other initiatives and incorporates the results into the EIA to better inform the decision makers.

Practical guidance is proposed on the basis of the literature review, discussions with practitioners, and experience on several types of projects (Table 1). A value representing the total direct emissions of a project on an annual basis is the reference point for entry into the process.

Conclusions

Practical guidance on how to address GHGs and climate in EIA is proposed on the basis of literature review, discussions with practitioners, and experience on several types of industrial projects. Mitigation and adaptation should be addressed in EIA to ensure both risks and benefits are identified, and to ensure the project will deliver on what it is designed to do. Thresholds, presented as tonnes of CO_2e per year, are proposed as one basis for specific consideration of the specific elements to be assessed in the EIA.

Table 1. Greenhouse Gases and Climate in EIA - Elements to Consider

GHG emissions (tonnes CO_2 e/year)	What's considered re GHGs, climate change?	Qualitative Rating	Elements of the Assessment
GHGs < 10,000	None	Nominal, but not zero	none
10,000 < GHGs < 25,000	Quantification of GHGs	Low	Quantify, present data
25,000 < GHGs < 100,000	Quantification, mitigation	Low	Look at possible mitigation, quantify, sector profile, place in context; decide on further elements
100,000 < GHGs < 1,000,000	Quantification, mitigation, effects of environment on project (one part of adaptation)	Medium	As above, AND Prepare GHG Management Plan; in the context of local program requirements, consider embodied emissions and potential for offsets; describe existing climate conditions; summarize available downscaling information; use impact models as needed; consider how changes in sea level rise, precipitation, winds, and temperature may affect project and surroundings nearby;
GHGs > 1,000,000	As above, AND adaptation with project vulnerability and resilience analyses	High	As above, AND consider by way of design features, adaptation analyses, including vulnerability and resilience, (consider PIEVC Protocol or equivalent, PIEVC 2011) in light of type of project, where it's located and how nearby infrastructure may be affected.

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