



Climate Change Mitigation and Resilience

This guideline expands on what is expected by the criteria statements in the Hydropower Sustainability Tools (HST) for the Climate Mitigation and Resilience topic, relating to assessment, management, conformance/compliance, stakeholder engagement and outcomes. The good practice criteria are expressed for different life cycle stages.

In the Hydropower Sustainability Assessment Protocol (HSAP), this topic is addressed in P-24 for the preparation stage, I-21 for the implementation stage and O-20 for the operation stage. In the Hydropower Sustainability ESG Gap Analysis Tool (HESG), this topic is addressed in Section 12.

This guideline addresses the estimation and management of the project's greenhouse gas (GHG) emissions, analysis and management of the risks of climate change for the project, and the project's role in climate change adaptation. The intent is that the project's GHG emissions are consistent with low carbon power generation,

and that it is resilient to the effects of climate change and contributes to wider adaptation to climate change.

Climate change, as defined by the Intergovernmental Panel on Climate Change, is a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.

Mitigation

Climate change mitigation is defined as human intervention to reduce the sources or enhance the sinks of GHG and other substances which may contribute directly or indirectly to climate change. For hydropower, climate change mitigation potential rests in the ability to provide clean energy with lifetime low GHG emissions.

Hydropower developments can contribute to reducing grid emissions by displacing fossil fuel generation and improving the feasibility of variable renewables through grid reliability services: flexible generation, ramping capability and energy storage. Nonetheless, the decision to significantly alter a river catchment by introducing a reservoir is not one to be taken lightly. The flooding of terrestrial land dramatically alters the natural state of the catchment and with it, the natural GHG cycle.

When land is inundated to create a reservoir, part of the flooded organic matter is decomposed by bacteria in the sediments and water column, releasing carbonic GHGs – carbon dioxide (CO₂) and methane (CH₄). Natural lakes, rivers and wetlands as well as some other land types also naturally emit or absorb GHG as part of their natural carbon and hydrological cycle. When estimating GHG emissions from a project, it is therefore important to assess the difference between pre- and post-impoundment emissions from the portion of the river basin influenced by the reservoir (including emissions from construction and operations activities), as well as the natural emissions that are displaced to or away from the reservoir site due to hydrological and other changes.

Resilience

Hydropower systems are characterised by their longevity and are traditionally designed on the basis of long-term historical hydrological data and forecasts. Hydropower projects are, nonetheless, susceptible to the impacts of climate change due to their dependency on precipitation and runoff, and exposure to extreme weather events. For example, changes in the timing or seasonality of rainfall and subsequent stream flows could impact operations and expected revenues, depending on the seasonal pattern of energy demand or competing water uses.

Hydropower climate resilience is the capacity of a hydropower project or system to absorb the stresses imposed by climate change, and in the process evolve into greater robustness, maintaining the capacity for adaptation.

Climate resilience analysis in hydropower connects climate science and engineering to incorporate climate risk management into hydropower project appraisal, design, construction and operation, resulting in more robust and resilient processes. However, measuring the impacts of climate change at local level still carries high uncertainty inherent to actual climate change predictions. Therefore, the sector is building new approaches and methodologies to guide hydropower companies to address climate-related risks, and to propose measures to address these risks during the lifecycle of a project.

Hydropower systems, with their ability to store water behind dams in freshwater reservoirs, can provide a number of services (e.g. water supply, irrigation, and flood and drought management) that allow for a higher systemic resilience and capacity to adapt to climate change. **Climate change adaptation** is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm, or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Overall, planning hydropower systems from a long-term, climate-resilient perspective will ensure that future generations inherit infrastructure that will not be compromised by climate change and will be able to provide a range of climate adaptation services.

Assessment

Assessment criterion - Preparation Stage: For climate mitigation: power density has been calculated; if power density is below 5 W/m², net GHG emissions (gCO₂e) of electricity generation have been estimated and independently-verified; if power density is below 5 W/m² and estimated emissions are above 100 gCO₂e/kWh, a site specific assessment of GHG emissions has been undertaken; and an assessment of the project's fit with national and/or regional policies and plans on mitigation has been undertaken.

For climate resilience: an assessment of the project's resilience to climate change has been undertaken, which incorporates an assessment of plausible climate change at the project site, identifies a range of resulting climatological and hydrological conditions at the project site, and applies these conditions in a documented risk assessment or stress test that encompasses dam safety, other infrastructural resilience, environmental and social risks, and power generation availability; and an assessment of the project's potential adaptation services and fit with national and/or regional policies and plans for adaptation has been undertaken.

Assessment criterion - Implementation Stage: For climate mitigation: power density has been calculated; if power density is below 5 W/m², net GHG emissions (gCO₂e) of electricity generation have been estimated and independently-verified; if power density is below 5 W/m² and estimated emissions are above 100 gCO₂e/kWh, a site specific assessment of GHG emissions has been undertaken.

For climate resilience: an assessment of the project's resilience to climate change has been undertaken, which incorporates an assessment of plausible climate change at the project site, identifies a range of resulting climatological and hydrological conditions at the project site, and applies these conditions in a documented risk assessment or stress test that encompasses dam safety, other infrastructural resilience, environmental and social risks, and power generation availability.

Assessment criterion - Operation Stage: power density has been calculated; if power density is below 5 W/m², estimates of net GHG emissions (gCO₂e) of electricity generation are calculated and independently verified, and periodically updated; if power density is below 5 W/m² and estimated emissions are above 100 gCO₂e/kWh, a site-specific assessment of GHG emissions is undertaken and periodically updated.

For climate resilience: an assessment of the project's resilience to climate change is undertaken and periodically updated; this assessment of project resilience incorporates an assessment of plausible climate change, identifies a range of resulting climatological and hydrological conditions at the project site, and applies these conditions in a documented risk assessment or stress test that encompasses dam safety, other infrastructural resilience, environmental and social risks, and power generation availability.

Mitigation

The first step towards good practice for climate change mitigation is to assess GHG **emissions intensity** – this is the grams of carbon dioxide equivalent per kilowatt-hour of electricity generated allocated to hydropower over the lifetime of the hydropower asset, assumed to be 100 years. A project with low emissions should have **less than 100 gCO₂e/kWh**. For projects commissioned before 2004, the current emissions

intensity of the project (i.e. not including emissions in the past when the reservoir was initially formed) should be compared with systems emissions intensity (i.e. greenhouse gas emissions associated with the local, regional or national grid to which the project is connected).

GHG emissions from reservoirs could evade to the atmosphere through various pathways:

- **Diffusive flux:** in water bodies, CO₂ and CH₄ will diffuse slowly from the sediment, up through the water column, and eventually be emitted;
- **Bubbling:** because of the higher insolubility of CH₄, bubbles of CH₄ can accumulate in the sediment when production rates are high enough. Those bubbles are then periodically liberated in the water column and to the atmosphere. This phenomenon tends to occur in shallow littoral areas;
- **Degassing:** many reservoirs exhibit a thermal stratification, where warmer surface water and colder deep water create a strong physical barrier called the thermocline, which substantially slows the diffusion of gases from the deeper part of the reservoir to the surface. As deep and anoxic water layers and sediments will lead to higher methane production, these bottom layers can sustain high dissolved methane concentrations. Therefore, when dams release water from low-level outlets, degassing occurs (i.e. excess methane is released to the atmosphere by the sudden pressure drop after the water leaves the outlet).

A number of factors that may influence GHG emissions from reservoirs include the following:

- **Water quality** (phosphorus content). The GHG dynamics of aquatic systems is highly influenced by the metabolic activity, which is in turn a function of the nutrient availability, in particular phosphorus, because it is the nutrient most-often limiting biological production in aquatic ecosystems;
- **Reservoir age.** Carbon in soil and biomass decreases as it is transformed into GHG and released to the atmosphere. Therefore, the rate of emissions generally decreases with age of the reservoir.
- **Reservoir location, environmental conditions and climate;**
- **Temperature.** Higher temperatures directly increase the bacterial activity leading to decomposition of organic matter. Also, higher air temperatures may influence the development of a thermal stratification;

- **Carbon stock** (i.e. the quantity of carbon present in the soil, in flooded biomass or that which is transported to the reservoir from upstream river catchment) and type of landscape flooded. For example, peatland would most likely have higher methane emissions than woodland or grassland on mineral soil.
- **Depth and shape of the reservoir, flow rate and water residence time.** Deep and anoxic water layers and sediments provide the conditions for methane production. In shallow areas, methane can be released directly from the sediments to the atmosphere through bubbling. Moreover, inflow and bathymetry influences the water retention time in the different parts of the reservoir, which determines the time available for biological processes to occur (including decomposition of organic matter).
- **Depth of the intake structure.** Reservoir outflows can draw water from various depths of the water column, depending on the particular configuration of a dam. When the intake is located in the deeper layer of a stratified reservoir, degassing may occur.

Power density (i.e. the watts of capacity per square meter of flooded area) is a predictor of emissions intensity. The recognised relationship between power density and emission intensity indicates that projects with a power density above 5 W/m² will exhibit emissions intensity below 100 gCO₂e/kWh.

The power density calculation should include the average reservoir area (the area of flooded land, net of the pre-impoundment water body) and the capacity of the power facilities in the project fed by this water body. A number of facilities should be included where they are part of one project or scheme being developed (for example, a scheme of two facilities in a cascade, or a project with main and ecological power plants).

To quantify the net emissions from a reservoir, emissions before, during and after the reservoir's formation have to be estimated. In other words, **net GHG emissions** in gCO₂e per kWh per year should be estimated using a recognised tool such as the G-res Tool or through site-specific calculations. In order to make claims on the results of estimations, these need to be independently-verified. For example, G-res Tool results should have to be verified by the G-res Expert Committee. Recognised tools or site-specific calculations should take into account:

- Pre-impoundment GHG emissions from the catchment, which represent the emissions balance from the landscape before the impoundment of the reservoir. Site-specific assessments or a pre-impoundment baseline should be based on measurement across sufficient spatial and temporal extent and resolution;
- Post-impoundment GHG emissions from the catchment, through diffusive flux from the lake, bubbling in littoral areas, degassing downstream of the outlet, and construction activities.
- Unrelated anthropogenic sources (UAS). These result from human activity occurring within or outside the reservoir, which is unrelated to the creation of the reservoir itself. The purpose of considering UAS is to separate the anthropogenic sources of nutrients, carbon and direct GHG emissions via inflow water (e.g. industrial effluents, wastewater treatment plants effluents, directly discharged sewage and drainage water, fertiliser leachate, and organic wastes (e.g. from a farm or a sawmill)) from those occurring directly from inundating the landscape. The estimation is based on land use, population, and known point sources in the catchment area;
- Emissions from construction and ongoing operational activities. These account for fuel and power use in transportation, manufacture of supplies (e.g. cement), and construction of the dam, associated facilities and transmission lines.
- The life cycle of the water body of at least 100 years;
- The allocation of emissions between electricity generation and other services provided by multipurpose projects. These services include flood control, fisheries, irrigation, navigation, recreation and water supply. They can be ranked as primary (i.e. operating rules are designed to maximise these services for part or all of the year), secondary (i.e. places operational constraints on the operating level of the reservoir for part of or the whole year) or tertiary (provides benefits, but has little or no impact on the operation of the reservoir).

Overall, the conceptual equation to determine net GHG footprint can be:

$$[\text{Net GHG footprint}] = [\text{Post-impoundment emissions}] - [\text{Pre-impoundment emissions}] - [\text{Unrelated anthropogenic sources emissions}] + [\text{Construction emissions}]$$

If estimated emissions are above 100 gCO₂e/kWh, a **site-specific assessment** is required. This should include soil and water sampling using strategically located monitoring stations to capture the reservoir's heterogeneity (upstream reach; along the longitudinal axis of the reservoir, in vegetated and non-vegetated littoral zones; in embayments in the reservoir; close to the reservoirs outlets and from water passageways; and in the river downstream of the reservoir outlets). Moreover, the sampling frequency should take into account seasonality, the timing of the operations, and the timing of anthropogenic sources.

Finally, a project should **fit with national or regional policies and plans** by providing generation with similar emissions as cited in policies and plans or the project is below baseline power sector emissions. In some jurisdictions there may be more stringent requirements for emissions than values in the scoring statements, and the project should fit with the requirements applying currently.

National or regional policies and plans relevant to mitigation may include NDCs (nationally determined contributions), national climate change strategies, NAMAs (nationally appropriate mitigation actions), or national climate change mitigation plans.

Resilience

For climate resilience, good practice should include an assessment that combines analytical climate science and hydropower engineering to incorporate climate risk management into hydropower project design, construction and operation.

A resilience assessment should look for plausible climate change scenarios using all available secondary information, and following a sequential approach such as:

- Baseline information. Obtain all relevant historical climatological and hydrological data for the project area, and identify observed climatological and hydrological trends, including extreme events at a river basin scale;
- Obtain data from global, regional or basin-scale climate models relevant to the project area for all available scenarios, and assess the degree of consistency between them;

- Based on a) and b), establish plausible climatological and hydrological scenarios for the project site.

An assessment shall comprise a stress testing and future climate change scenarios development in an approach of decision-making under uncertainty. A **risk register** that documents the risks by climate change impacts enhances the process. The outcomes of the **stress test** will set out the range of potential risks and hazards, and assess the probability and magnitude of the impacts. The results will be the basis to identify and prioritise measures to avoid, minimise and mitigate the risks and impacts of the plausible climate change scenarios.

The risk assessment shall use the following project characteristics as inputs: meteorology and hydrology (e.g. potential higher floods); geology/seismic/geotechnical/geohazard (e.g. major landslides at the project site); final site selection and type of project (e.g. access roads); dam height and reservoir size (communities living around the development area which may limit reservoir size); installed capacity (long term energy needs of the country may be unclear); health, safety, environment and social aspects (e.g. limited baseline data).

Environmental and social risks refer to the increased risk for the local environment and communities that result from the project within a context of a changing climate. For example, downstream environmental flows may not be feasible with decreased in-flows resulting from climate change.

Climatological conditions at the project site refers to annual averages, seasonal averages, and ranges of temperatures and precipitation, changes in the type and seasonal distribution of precipitation, and extreme weather events. Changes in these conditions will have effects on **hydrological and other conditions** including:

- precipitation and stream flows;
- altered seasonal patterns of precipitation and of run-off due to temperature changes;
- glacial melt or altered timing of glacial melt;
- intensity of floods and droughts;
- presence of ice (resulting in ice jams or affecting infrastructure such as power lines);

- frequency or magnitude of landslides;
- sediment transport.

The project may have opportunities to provide **adaptation services** to the local environment and communities. For example, these services may include the provision of water for irrigation, drought and flood preparedness programmes, flood early warning systems, and community infrastructure such as water supplies. To achieve good practice, such services should be assessed. Moreover, in this regard the project should fit with national policies, plans and commitments on adaptation (for example national adaptation plans).

Management

Management criterion - Preparation Stage: For climate mitigation: if GHG emissions estimates assume design and management measures, there are plans to put these measures in place.

For climate resilience: the project design is based on plausible climate change scenarios; and structural and operational measures are planned for design, implementation and operation phases to avoid or reduce the identified climate risks.

Management criterion - Implementation Stage: If GHG emissions estimates assume design and management measures relevant to the implementation stage, these measures are in place; measures relevant to the implementation stage are in place to avoid or reduce the identified climate risks.

Management criterion - Operation Stage: For climate mitigation: if GHG emissions estimates assume management measures, these measures are in place.

For climate resilience: measures are in place to avoid or reduce identified climate risks.

Mitigation

For projects with emissions estimated at more than 100 gCO₂e per kWh, design, construction and operational measures should be identified to lower emissions below this figure. Examples of such measures include:

Design measures:

- Reservoir siting and design to minimise water retention time, the extent of the shallow area, the degree of flooded organic matter or stratification;
- Selective or multi-level offtakes incorporated for projects with deep reservoirs to limit the amount of water drawn into the power station from cold, anoxic depths (i.e. below thermocline, where methane production may occur);
- Increase oxygen concentrations through reservoir design to minimise water residence time;
- Air injection facilities in the power station;
- Increasing power density with further expansion.

Construction measures:

- Optimising construction vehicle use and movement, particularly for large scale excavation and filling;
- Driver training in efficient vehicle operation;
- Optimising transport efficiency for materials delivery, waste disposal and construction workers travel;
- Minimise energy used in temporary site buildings;
- Procurement policies accounting for the CO₂e footprint – both embodied and operational. For example: requiring, as a condition of tendering, all suppliers to state the carbon footprint of their materials, products and services.
- Water use management: water quantity and quality needs are thoroughly identified in the design and feasibility studies;
- Waste management and reduction: mitigate sewage, solid waste and polluted run-off from worker camps, workshops, buildings;
- Well-designed drainage collection points: run-off and wastewater treatment plants are of an appropriate capacity with discharge points in high velocity flow areas away from water users.
- Biomass clearance should be carefully assessed before being used as a default mitigation measure for preventing GHG emissions. A large part of GHG emissions stems from carbon trapped in soil, whereas tree trunks do not decay rapidly thus retaining the embedded carbon. Apart from the possible GHG emission reduction, the biomass removal assessment should take into account the commercial value of the biomass as well as possibly improved water quality and future use of the reservoir for fishing and other ecosystem services.

Operational measures:

- Seasonal management of reservoir operations to ensure releases of oxygenated water at seasonally appropriate temperatures.
- Water quality management measures, such as: catchment management measures such as reforestation, protected areas, check dams, drainage works, rehabilitation, fertiliser use reduction strategies.
- Mitigate sewage and solid waste from increased population attracted to the area through dialogue with the local municipality about capacities of existing solid and wastewater collection and treatment facilities; and partnership on upgrade or augmentation measures in a timely manner.

Resilience

Climate resilience is relevant to both existing and new projects. As such, resilience should be built into hydropower developments at the planning, implementation and operation stages. Examples of **design or structural measures** are listed below (following a possible construction sequence):

- Access roads and camps: suitable pavement materials and additional construction joints for temperature variations; increased drainage systems to cope with increased runoff; additional landslide hazard assessment and slope protection for increased risk of slope instability; revised route selection; more robust assessment of camp location.
- River diversion works: ensuring temporary structures, such as cofferdams, diversion tunnels are designed for higher return period, or for estimated increase inflow.
- Dam structure: additional flushing, sediment management facilities, and raising of dam crest to increase live storage, for increased sediment load; increase spillway capacity (considering increased probable maximum flood); additional spillways; reassess dam design to allow overtopping with provision of dam toe erosion protection (in concrete dams); additional upstream parapet or wave wall on dam crest; provision for future increase of storage capacity and full supply level raising; additional construction joints, change of concrete mix, and concrete temperature control to cope with increasing temperatures.

- Powerhouse: increased flood defences for the powerhouse; relocation of powerhouse; relocation of spillway to ensure floods are discharged downstream of powerhouse; increased civil works to be adaptable for future additions of electro-mechanical equipment (e.g. space in the powerhouse for additional turbines and generators);
- Electro-mechanical equipment: installations of variable speed turbines or turbines with higher efficiency for a wide range of discharges; install corrosive-resistant turbine blades (corrosion is more aggressive at high temperatures).
- Downstream flows: design environmental flow capacity with potential for varying discharge rates; design fish passage systems with potential varying discharge rates.
- Reservoir management: detailed reservoir rim stability assessment for slope stabilisation in areas more vulnerable to landslides due to changes in precipitation and runoff patterns.
- Transmission lines: reassessment of transmission towers location; design tower foundations for greater stability uncertainty; amend specification of conductors to be more resilient for a range of temperatures.

For new and existing projects, non-engineering or functional measures should be considered. Examples of such measures may include the following:

- Operations: plan for revised optimal minimum operating level; change operating rules such as revised reservoir level limits in order to provide an increased flood storage buffer; revise monthly operating rule curves.
- Reservoir management: restricting the development of land within the zones susceptible to flooding; protect or remove vulnerable areas.
- Multipurpose services: identifying the impacts of climate change upon the various users of water within a watershed (e.g. less rainfall in the watershed could increase water demand from the reservoir for irrigation, leading to reduced electricity generation); modifying legal agreements between various governments, stakeholders and other identities that have an impact upon the operation of the watershed; improving technologies used to coordinate the interaction of various hydro projects as well as

the global operation of complexes involving several watersheds; modifying rules that have an influence upon recreation, irrigation, water supply and industrial water abstraction; reassess type of scheme (base load/ peaking and run-of-river/ storage) to address changing water and energy demand levels.

- Environmental and social risks: disaster preparedness and response plans for affected communities, guaranteed downstream flows, enhanced flood management or drought-response programmes.

Stakeholder Engagement

Stakeholder Engagement criterion - Preparation Stage: For climate mitigation: power density calculations, estimated GHG emissions, and / or the results of a site-specific assessment have been publicly disclosed.

For climate resilience: plans for the management of climate risks have been discussed with stakeholders.

Stakeholder Engagement criterion - Implementation Stage: For climate mitigation: power density calculations, estimated GHG emissions, and / or the results of a site-specific assessment have been publicly disclosed.

For climate resilience: ongoing processes are in place for stakeholders to raise issues and get feedback on the management of climate risks.

Stakeholder Engagement criterion - Operation Stage: For climate mitigation: power density calculations, estimated GHG emissions, and / or the results of a site-specific assessment are publicly disclosed.

For climate resilience: ongoing processes are in place for stakeholders to raise issues and get feedback on the management of climate risks.

In stakeholder engagement, it is important that plans for the management of increased dam safety, environmental and social risks, and adaptation services have been discussed with stakeholders. For example, the provision water supply, irrigation, flood preparedness programs, or early warning systems.

Public disclosure of emissions calculations is important for credibility. Public disclosure of power density refers to the disclosure of the details of the calculation, demonstrating how the calculation conforms to the definition of power density above and public information on the project design.

Processes in place for stakeholders to raise issues at any point in the life of the project or operating facility may be through a formal grievance mechanism, or through less formal means. These could include, for example: a contact person and/ or a 'contact us' space on the company website; periodic public briefings or question/answer opportunities; participation of company staff on stakeholder or catchment committees; and regular meetings and issue-raising mechanisms developed in liaison with local government authorities.

Feedback on stakeholder issues could be demonstrated by means such as emails, records of telephone conversations, written correspondence, meeting minutes, media releases, or provision of responses to frequently asked questions on the company website. A widely used good practice for developers and owners/operators is to keep a register of source, date and nature of issues raised, and how and when each was addressed and resolved. Closure of issues back with the stakeholder who raised them is essential.

Conformance/Compliance

Conformance/Compliance criterion - Implementation and Operation Stages: processes and objectives relating to climate change mitigation and resilience have been and are on track to be met with no significant non-compliances or non-conformances, and any mitigation-related and resilience-related commitments have been or are on track to be met.

During implementation and operation, the project should be in conformance with the objectives and commitments set out in the management plans, and any broader corporate commitments. For example, if the license for the project or the lender's requirements refer to mitigation or resilience measures, then these measures are followed.

Evidence of adherence to commitments could be through, for example, internal monitoring and reports, government inspections, or independent review. Variations to commitments should be well-justified and approved by relevant authorities, with appropriate liaison with stakeholders.

Significance of not meeting a commitment is based on the magnitude and consequence of that omission, and will be context-specific. For example, a failure to demonstrate delivery of a resilience commitment such as increasing flood defences for the power house is a significant non-compliance, whereas a slight delay in delivery of a monitoring report could be a non-significant non-conformance.

Outcomes

Outcomes criterion - Preparation Stage: For climate mitigation: the project's GHG emissions are demonstrated to be consistent with low carbon power generation, and the fit of the project with national and regional policies and plans for mitigation can be demonstrated.

For climate resilience: plans will deliver a project that is resilient to climate change under a range of scenarios; and the fit of the project with national and regional policies and plans for adaptation can be demonstrated.

Outcomes criterion - Implementation Stage: For climate mitigation: the project's GHG emissions are demonstrated to be consistent with low carbon power generation.

For climate resilience: plans will deliver a project that is resilient to climate change in under a range of scenarios.

Outcomes criterion - Operation Stage: For climate mitigation: the project's GHG emissions are demonstrated to be consistent with low carbon power generation.

For climate resilience: findings of the climate change assessment indicate that the project is resilient to climate change.

Consistency with low carbon power generation

may be demonstrated by alignment with national plans for mitigation, and: a power density greater than or equal to 5 W/m²; or net emissions intensity that is less than internationally-recognised thresholds at the time of the assessment (such as less than 100 gCO_{2e}/kWh); or emissions reductions at the system level. Projects commissioned prior to 2004 can demonstrate consistency with low carbon generation by showing that current emissions intensity is lower than current emissions at the system level. **System emissions** shall mean greenhouse gas emissions associated with the local, regional or national grid to which the project is connected.

In the preparation stage, a project's fit with national or regional policies and plans is demonstrated when, for example, its generation's emissions are similar to emissions cited in policies and plans, or the project is below baseline power sector emissions. In some jurisdictions, there may be more stringent requirements for emissions than values in the scoring statements, and the project should fit with the requirements applying currently.

Good practice requires that the above should be demonstrated with the following evidence: power density calculation; results of G-res Tool application or other tool; verification report on G-res Tool application; climate change studies in the region; analysis of plausible climate change, and conditions at the project site; risk assessment or stress tests; national and regional policies and plans on mitigation and adaptation; feasibility study; operational plans; environmental and social management plans; results of the assessment of climate change adaptation services; disaster preparedness and response plans; minutes of meetings with stakeholders; and evidence of public disclosure.