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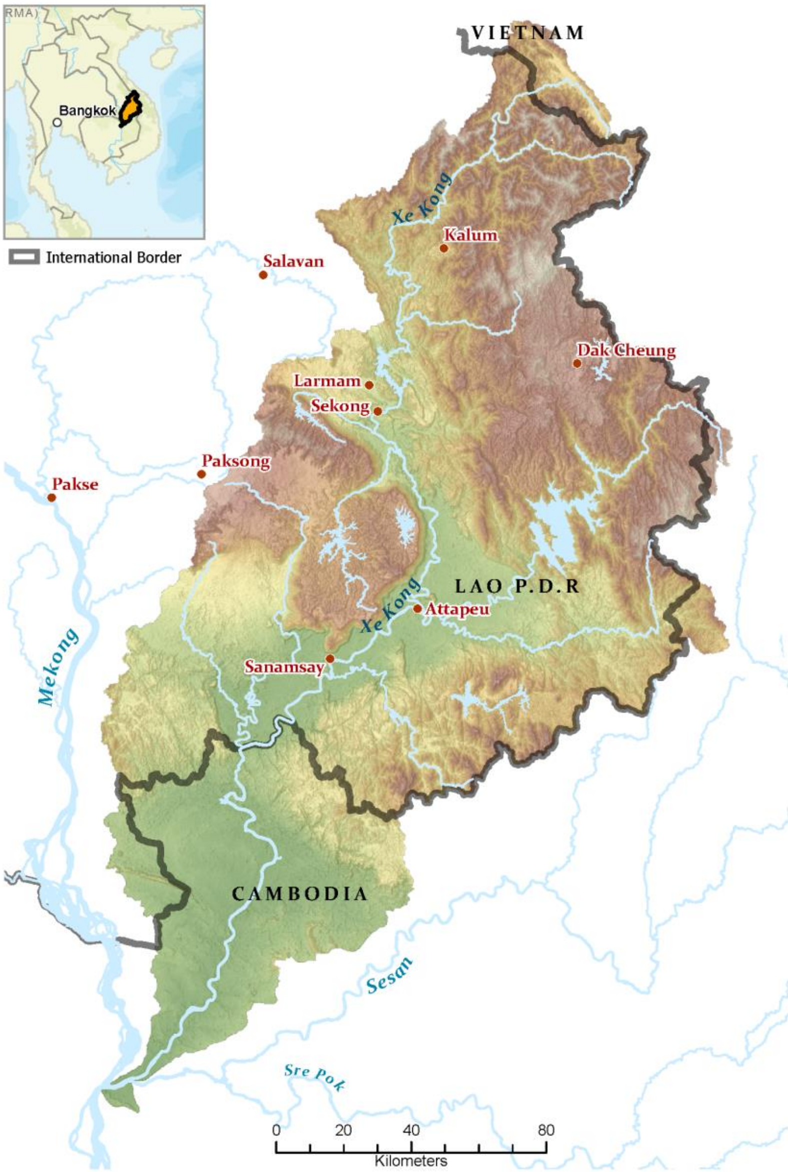
# Final Inception & Scoping Report

## Cumulative Impact Assessment and Management of Renewable Energy Development in the Sekong River Basin, Lao PDR

## Selection#: 1254118




Source : WWF, GMS, FAO, OSM

IN PARTNERSHIP WITH

Australian Aid · Multiconsult · Deltares Enabling Delta Life · LCG LAO CONSULTING GROUP

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## List of Abbreviations

CIA – Cumulative Impact Assessment

CIAG – The Cumulative Impact Assessment Guidelines for Hydropower Projects in Lao PDR

DFAT – Australian Department of Foreign Affairs and Trade

EDL – Électricité du Laos

ESIA – Environmental and Social Impact Assessment

EWN – Energy-Water Nexus Project

GOL – Government of Lao PDR

HPP – Hydropower Plant

IFC – International Finance Corporation

IPCC – Intergovernmental Panel on Climate Change

IUCH – International Union for Conservation of Nature

IWMI – International Water Management Institute

KBA – Key Biodiversity Area

LCG – Lao Consulting Group

LMB – Lower Mekong Basin

MEM – Ministry of Energy and Mines

MONRE – Ministry of Natural Resources and Environment

MRC – Mekong River Commission

MW – Megawatt

PDIES – Procedures for Data and Information Exchange and Sharing

PDP – Power Development Plans

PMFM – Procedures for Maintenance of Flows on the Mainstream

PNPCA – Procedures for Notification, Prior Consultation and Agreement

PWUM – Procedures for Water Use Monitoring

PWQ – Procedures for Water Quality

SEA – Strategic Environmental Assessment

TbEIA – Transboundary Environmental Impact Assessment

VECs – Valued Ecosystem and Social Components

WB – World Bank

WWF – World Wildlife Fund

## Preface

This is the Final Inception & Scoping Report of the Cumulative Impact Assessment and Management of Renewable Energy Development in the Sekong River Basin, Lao PDR. It follows the mobilization of the Consultant team in May 2018 and a stakeholder consultation trip to Vientiane in June 2018.

This assignment is led by the International Finance Corporation (IFC), who are supported by the Department of Foreign Affairs and Trade (DFAT), Australia, in cooperation with Ministry of Energy and Mines, Lao PDR. IFC has hired Multiconsult, Deltares and Lao Consulting Group to carry out the assessment.

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# 1 Background and Introduction

## 1.1 Sustainable River Basin Planning and Hydropower Development

Situated within the energy, water and livelihood (food) development nexus (See Figure 1.1), hydropower development as part of sustainable basin planning can help meet the realities of economic development, population increase, whilst at the same time caretaking for livelihoods and ecosystems with its services. Hydropower and dams investment can also support adaption to an increasingly challenging water resources situation by building in increased infrastructure resilience to climate change.

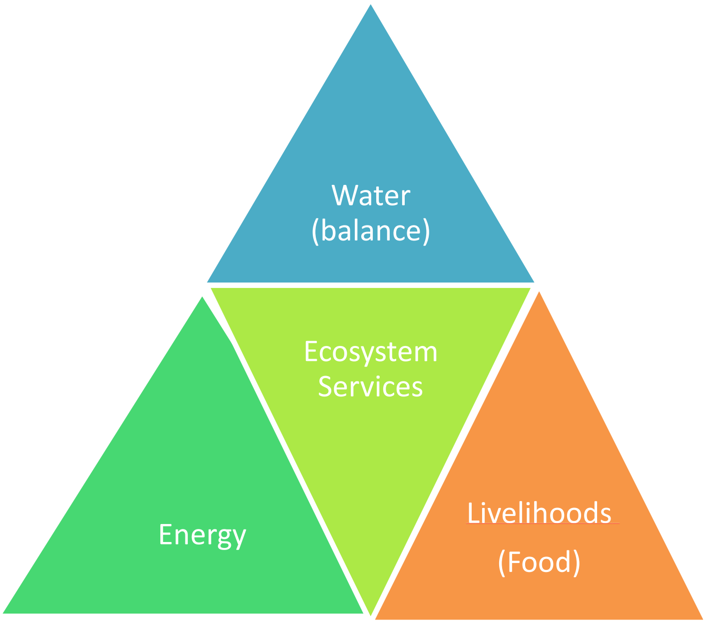


**Figure 1-1:** *The Energy, Water, Livelihoods (Food) Nexus.*

Hydropower development together with other renewables, within the context of sustainable basin planning should be recognized as an important development opportunity for the Lao PDR and the Sekong Basin, and is also embedded in a closely woven social and environmental fabric. The population in the region derive a substantial proportion of their livelihood and nutrition from the Mekong Basin at large, and from the Sekong Basin as part of the system. The basin's ecosystem services support both the livelihood, economy and a unique biodiversity in the area. Hence, the development and implementation of basin plans and pilot projects like this CIA, should aim to ensure that ecosystems are preserved and at the same time economic and social services enhanced, e.g. through optimizing and distributing the benefits from hydropower development and other renewables. This will be important for further hydropower and other renewables development in Lao PDR and beyond.

## 1.2 Hydropower and other Renewables Development in Lao PDR

The People's Democratic Republic of Lao (Lao PDR) is pursuing a strategy of renewable energy sector expansion for domestic consumption and export to support socio-economic development targets. The power sector has grown rapidly over the past 20 years, with installed generating capacity rising from 700 megawatts (MW) in 2006 to 6,264 MW in 2016. Hydropower is the dominant energy source in the country and the Government of Lao PDR has ambitious plans to further expand power generating capacity over the coming years. Several feasibility studies for wind and solar power are underway, but these sectors are currently still in their infancy in Lao PDR (ToR, and subsequent paragraphs).

While renewable energy has the potential to help Lao PDR meet its development targets, the pace of change carries risks of significant environmental and social impacts. Individually, hydropower projects can lead to impacts on the aquatic and terrestrial environment, ecosystem services, communities and peoples' livelihoods. *Cumulatively*, multiple projects within the same watershed can magnify these adverse impacts by altering water quality, sediment transport and biodiversity flows with effects on native biota, agriculture, navigation and other river uses.

In recognition of these challenges, the Government of Lao PDR has in recent years introduced and strengthened the policy and regulatory framework governing the renewable energy sector, further described in Section 2.1.

## 1.3 The Cumulative Impact Assessment and VEC Approach

### 1.3.1 Definitions of CIA

***Cumulative impacts*** are impacts that result from incremental changes caused by other past, present, or reasonably foreseeable actions together with the project (Walker and Johnston 1999). Assessing cumulative impacts requires more than just adding up all impacts from individual projects or developments. Sometimes the total effect is larger than the sum of individual impacts because each project, as well as each impact, can interact with the others (Marchand et al. 2014, WB 2014).

However, one project added to another can also lead to less severe cumulative impacts than expected: for instance, the construction of a second reservoir upstream of a dam can reduce the sedimentation rate of the downstream reservoir, thereby lengthening its useable lifetime (WB, 2014).

Cumulative impacts can occur through different *interactive pathways* (Bain, Irving, and Olsen 1986). Three basic interactions can be discerned:

- Strictly additive – The sum of the individual impacts from the project(s) and other actions equals the total impact.
- Synergistic – Total impact is more than the sum of each individual impact of a project.
- Antagonistic – Total impact is less than the sum of each individual impact of a project.

Cumulative impacts can also be related to passing certain threshold levels. For instance, some habitat loss would not have a large impact on wildlife. But when a certain threshold is passed, the entire population can be wiped out because the habitat becomes too fragmented.

So cumulative impacts can occur in the following conditions:

- Under strictly additive, synergistic, or antagonistic interactions between projects and actions
- When the sum of the impacts exceed a threshold
- When individual impacts interact creating previously unforeseen impacts
- When impacts of multiple interventions are larger than the impact of a single intervention that meets the same objective as the multiple interventions together

An example of the latter is when the total impacts of a cascade of smaller hydropower plants exceed those that would have occurred with a single larger dam with the same capacity.

### 1.3.2 Definitions of VEC's

The term VEC emerged, although with different wording, in Beanlands and Duinker (1983). In most literature, VECs are primarily conceived to be "environmental attributes" selected because of social, economic, aesthetic, or scientific concerns (Olangunju 2012). This biophysical emphasis has been observed by a number of researchers (Szuster and Flaherty 2002; Bérubé 2007; Noble 2010) and has primarily shaped the understanding of VECs in impact assessment, although different definitions are used depending on the context and jurisdiction of use. In contrast, some authors (for example, Shoemaker 1994; Coffen-Smout and others 2001) suggest the scope of VECs should extend beyond ecological issues to include social, economic, cultural, and natural components of the environment (Olangunju 2012).

The IFC Good Practice Handbook on Cumulative Impact Assessment (2013), see also Section 1.4 below, defines VEC's as follows:

VECs are environmental and social attributes that are considered to be important in assessing risks; they may be:

- physical features, habitats, wildlife populations (e.g., biodiversity),
- ecosystem services,
- natural processes (e.g., water and nutrient cycles, microclimate),
- social conditions (e.g., health, economics), or
- cultural aspects (e.g., traditional spiritual ceremonies).

The consultant will adhere to the IFC definition in this assignment.

While VECs may be directly or indirectly affected by a specific development, they often are also affected by the cumulative effects of several developments. VECs are the ultimate recipient of impacts because they tend to be at the ends of (interactive) ecological pathways. VECs thus refer to sensitive or valued receptors of impact whose desired future condition determines the assessment end points to be used in the CIA process.

## 1.4 IFC CIA Initiatives and Guidelines

Over the past years IFC has spearheaded the initiative to put Cumulative Impact Assessment approach into practise and in 2013 also launched the IFC Good Practise Handbook on Cumulative Impact Assessment and Management: *Guidance for the Private Sector in Emerging Markets ('IFC Handbook' hereafter).*

Cumulative impacts are here defined as *those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.*

The *IFC Handbook* recommends limiting the identification and management of cumulative impacts to those effects generally recognized as important on the basis of scientific concerns and/or concerns of affected communities. The objectives for conducting a project related cumulative impact assessment are identified as:

1. Assessment of the potential impacts and risks of existing and proposed projects over time, in the context of potential effects from other projects and natural environmental and social external drivers on chosen Valued Ecosystem Components (VECs);
2. Verification of the proposed project's cumulative social and environmental impacts and risks compared to a threshold that should not be exceeded to avoid compromising the sustainability or viability of selected VECs;

3. Confirmation that the proposed project's value and feasibility are not limited by cumulative social and environmental effects;
4. Supporting the development of governance structures for making decisions and managing cumulative impacts;
5. Ensuring that the concerns of affected communities about the cumulative impacts of existing and proposed project are identified, documented, and addressed; and
6. Management of potential reputation risks in connection with a project.

The IFC Handbook prescribes six steps for conducting a Cumulative Impact Assessment.

- Step 1: Identification and determination of the spatial and temporal boundaries for the Cumulative impact assessment;
- Step 2: Identification of VECs in consultation with affected communities and stakeholders as well as identification of external natural and social stressors that may affect the VECs;
- Step 3: Determination of the present conditions of the VECs;
- Step 4: Assessment of cumulative impacts;
- Step 5: Evaluation of the cumulative impacts' significance over the VECs' predicted future conditions and;
- Step 6: Design and implementation of a) plans, strategies and procedures to mitigate cumulative impacts, b) monitoring indicators, and c) effective supervision and monitoring mechanisms.

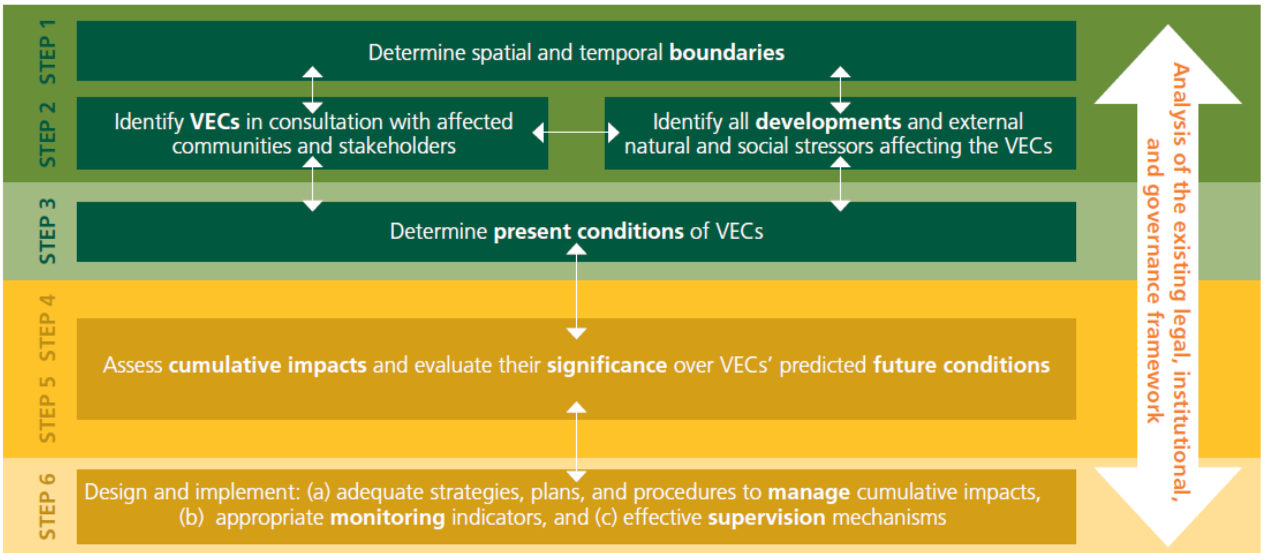


**Figure 1-2:** *General Approach for Conducting Cumulative Impact Assessment (source: IFC Good Practise Handbook, 2013).*

The *IFC Handbook* summarizes the expected outcomes of a good CIA as the comprehensive and successful implementation of all the above listed steps.

Following the hydropower development in Lao PDR reported in Section 1.2, accordingly, the IFC has worked with the Government to develop draft *CIA Guidelines for Hydropower Projects in Lao PDR* in 2017[1] aligned with the *IFC CIA Good Practice Handbook.* The *CIA Guidelines* were developed in consultation with the

[1]https://www.ifc.org/wps/wcm/connect/fbd4691c-2905-4bdd-bc01-cb8c17ec2de5/Lao+PDR+HPP+CIA+Guidelines_English+version.pdf?MOD=AJPERES

Ministry of Natural Resources and Environment (MoNRE), MEM, international development partners, hydropower project proponents and relevant stakeholders including regional and non-government organizations. To pilot the new *CIA Guidelines*, IFC has agreed with the government of Lao PDR to conduct a basin-wide CIA for the Sekong River Basin, henceforth this study is undertaken.

## 1.5 Overall Basin Characteristic of Sekong

The Sekong River Basin is an important transboundary tributary in the Lower Mekong that rises in the Central Highlands of Vietnam and flows through Laos and Cambodia before it joins with the Sesan and the Sre Pok rivers around 7.5 km upstream the confluence with the Mekong. The Sekong River Basin lies to the north of the Sesan and the Sre Pok river basins, and comprises close to 29,000 km$^2$ with 78% of the basin falling within Lao PDR overlapping with the provinces of Attapeu, Champassak, Saravane, and Xekong, while 19% and 5% falls within Cambodia and Vietnam respectively. Together the Sekong, the Sesan and the Sre Pok river basins make up the so-called 3S Basins. These three basins contribute to approximately 23% of the annual flow[2] and possibly up to 25% of the sediment load in the lower part of the Mekong, including the Mekong Delta[3,4]. The Sekong River Basin is the second largest of the 3S Basins, covering 36% of the total 3S Basins area. Its upper parts have a steep topography and a relatively high forest cover.

At the upper reaches of the Sekong Basin the annual precipitation ranges between 2,700 and 2,900 mm whereas in the major part of the basin further down the valley it varies between 1,700 and 2,700 mm. (Meynell, 2014)[5].

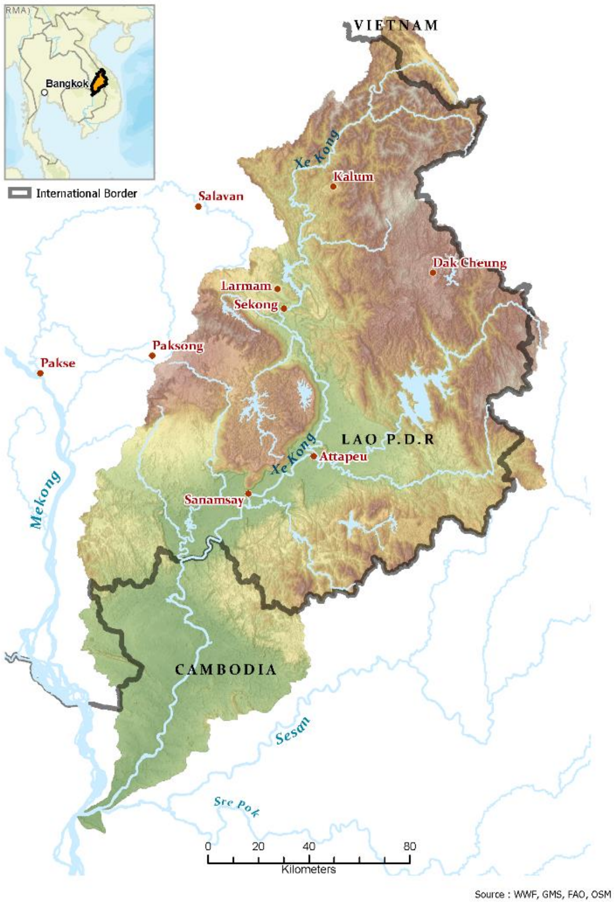


**Figure 1-3:** The *Sekong River Basin.*

The Sekong River Basin *(Figure 1-3)* is considered particularly important as one of the few remaining major Mekong tributaries with high biodiversity value and few hydropower projects in operation.

[2] *MRC (2018). Hydropower Mitigation Guidelines Mekong. The Manual. Volume 2. A Multiconsult and Deltares Report.*

[3] *National Heritage Institute (USA) and National University of Lao (2018). Sustainable Hydropower Master Plan in the Xe Kong Basin in Lao PDR. Government of Lao PDR.*

[4] *The 3S covers only around 10% of the total drainage area whereas it contributes up to 25% of the basin's total sediment load (25 megatons (Mt) yr–1 out of 100–160 Mt yr–1 for the whole of Mekong (Schmitt et al. 2018. Improved trade-offs of hydropower and sand connectivity by strategic dam planning in the Mekong. Nature Sustainability. Vol 1. February 2018. pp 96–104).*

[5] *Meynell P. J. 2014. The Sekong River in Viet Nam, Lao PDR and Cambodia - An Information Sourcebook for Dialogue on River Flow Management.*

The Sekong also supports a highly diverse fish fauna. Meynell (2014) reports 213 fish species of which 64 are migratory. The basin is furthermore important for the lower (fish) migratory system and thus the interaction between the 3S, Cambodian floodplains, Tonle Sap and the Delta, with the people relying on it as a source of income and food (MRC, 2018).

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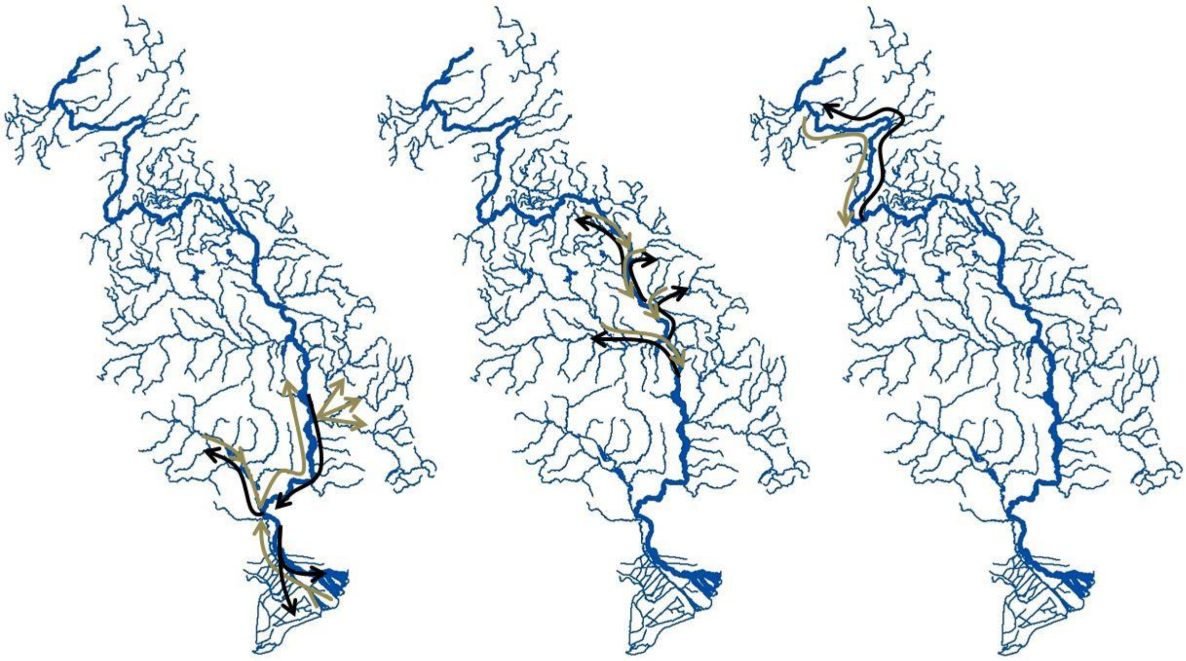


**Figure 1-4:** *Lower, middle and upper migration systems with major migration routes in the LMB; black arrows indicate migrations at the beginning of the wet season and brown arrows indicate migrations at the beginning of the dry season (from MRC, 2018 and Schmutz & Mielach 2015, based on Poulsen et al., 2002).*

Land resources and natural vegetation correlate closely with the area's topography. The mountains and foothills occupy about 25% of the basin and are suitable only for watershed protection or commercial forestry. The highly dissected plateaus occupy another 25% and have high potential for a wide range of agricultural production, particularly perennial crops that depend on good drainage. The lowland, which occupies the remaining 50% of the river basins, comprises hills with moderate agricultural potential and river valleys and floodplains with potential for irrigated agriculture and hydropower development (Watt, 2015).

The total population in the 3S Basins is about 3.5 million, of which about 3 million people inhabit Vietnamese territory while about 250,000 people inhabit each of the Lao and Cambodian parts. The 3S Basins in Cambodia and Lao PDR have some of the lowest population densities in the Lower Mekong Basin with 10 people or less per square kilometer ($km^2$). Many of Lao and Cambodian communities still live close to the river system and remain highly dependent on natural resources from, and ecosystem services of, the rivers. Poverty incidence is high and in Cambodia people are beginning to migrate into the sparsely populated lower parts of the river basins.

Development of additional hydro, wind and solar power resources, together with expanded industrial operations such as mining, logging and plantation forestry, indicate a significant risk of cumulative, including transboundary, impacts (ToR).

## 1.6 Objectives, Process and Expected Outcomes of the Study

### Vision

The Vision is embedded in sustainable planning for renewable energy[6] development in the Sekong River Basin and is founded on clear, multi-stakeholder commitment to assessing and managing cumulative impacts, collaborative monitoring and co-management.

### Objectives of the Assignment

To reach the above Vision the objectives of the assignment is threefold:

1. Plan and execute an integrated assessment of the cumulative impacts of renewable energy development in the Sekong River Basin, including power optimization and development scenarios.
2. Lead the participatory design of a framework for ongoing river basin co-management in the Sekong, including collaborative environmental and social impact monitoring and management.
3. Strengthen the capacity of Sekong River Basin stakeholders in CIA and co-management.

### Overall Process and Expected Outcomes of the Study

### Integrated Cumulative Impact and Power Optimization Assessment

To meet objective 1, an *integrated cumulative impact and power optimization assessment* (*'integrated CIA'*) will be conducted according to the *Draft CIA Guidelines for Hydropower Projects in Lao PDR (IFC/MONRE)* – with the intention of piloting their implementation. The Integrated Cumulative Impact and Power Optimization Assessment Process to be followed is illustrated in Figure 1-5.

[6] *Primary focus on medium and large-scale hydropower, with consideration of small hydro, wind and solar power projects.*

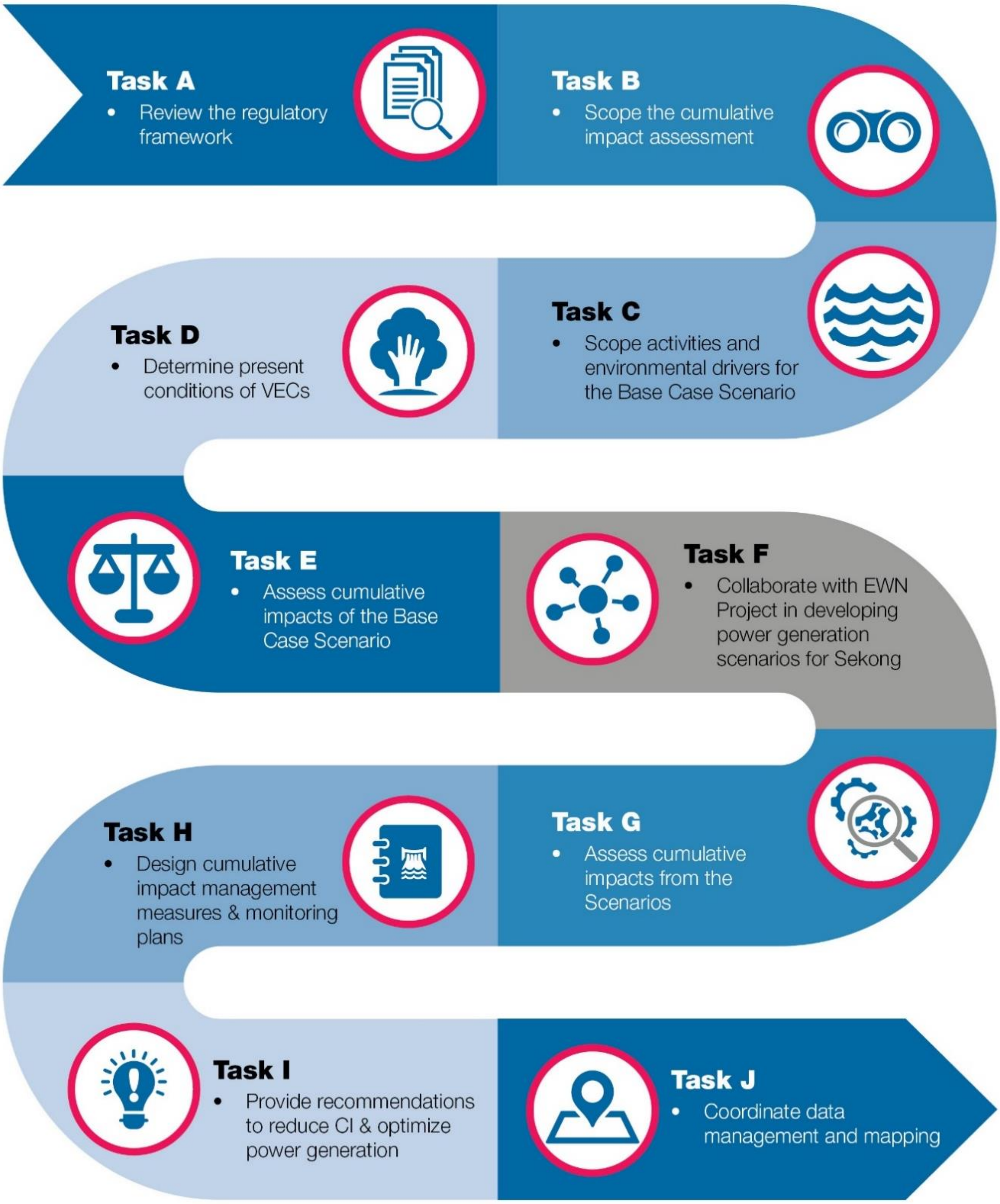



**Figure 1-5:** *Integrated Cumulative Impact and Power Optimization Assessment Process.*

### Sekong Basin Cumulative Impact Co-Management Platform

To meet objective 2, the Consultant will design a framework for involving the public and private sector in addressing identified cumulative impacts in the Sekong River Basin, including collaborative environmental and social impact monitoring and management. The Platform would ultimately aim to enhance collaboration and governance in the Sekong River Basin

### Capacity Building

To meet objective 3, the Consultant is to strengthen the capacity of Sekong River Basin renewable energy stakeholders in cumulative impacts assessment and co-management.

Detailed task description to cater for the above is given in Chapter 6.

# 2 Preliminary Review of the Regulatory, Institutional and Governance Framework

## 2.1 National Policy, Regulatory and Institutional Frameworks

As per the considerable hydropower and renewable development in Lao PDR over the past 20 years described in Section 1.2, with its associated challenges, the Government of Lao PDR has strengthened the policy and regulatory framework governing the renewable energy sector the last years. Key developments include the *Law on Environmental Protection (2012)*, *Ministerial Instruction on Environmental and Social Impact Assessment (2013),* the *Policy on Sustainable Hydropower Development in Lao PDR (2015),* a revised *Water Law (2017)* and recent revisions to the *Law on Electricity (Box 1).*[7]

Under these laws and regulations, all developments larger than 15 MW must conduct a comprehensive Environmental and Social Impact Assessment (ESIA), while smaller developments must complete a less rigorous Initial Environmental Examination (IEE).

The 2013 *Ministerial Instruction on Environmental and Social Impact Assessment* provides certain conditions in which a cumulative impact assessment (CIA) of interactions with other existing and planned developments in the area should be conducted by project proponents, in addition to the standard ESIA. However, in practice CIA implementation in Lao PDR has been weak. A key challenge is that to conduct a CIA, project developers require sufficient information about other existing or planned developments in the same or adjacent watersheds, which is usually not easily available from government agencies, private sector proponents or publicly-available records.

***Box 1: Electricity Law Amendments: Article 10 (New). Integrated Power Sector Plan***

1. An Integrated Power Sector Plan shall be developed at least once every five years by MEM in consultation with other sectors such as Planning and Investment, Finance, Natural Resources and Environment, Agriculture and Forestry and others. The Integrated Power Sector Plan shall, among other things, identify and prioritize projects based on criteria, which would include, but not be limited to, the following (…):

(i) Adherence to the principles of IWRM consistent with the laws and regulations governing water resources management in the country; (…)

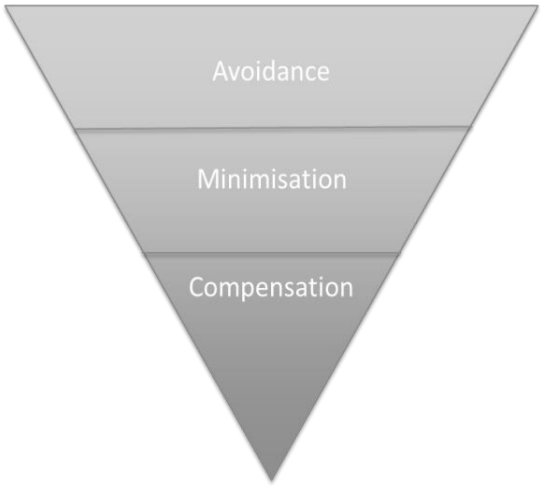
Most recently IFC has worked with the Government to develop the draft CIA Guidelines for Hydropower Projects in Lao PDR (2017), by which this CIA on Sekong is a pilot for. The Cumulative Impact Assessment Guidelines for Hydropower Projects in the Lao PDR (CIAG) have been developed based on the need to assess the cumulative impacts of hydropower projects in Lao PDR for the Department of Environment and Social Impact Assessment within the Ministry of Natural Resources and Environment. The CIAG has been developed under the International Finance Corporation's (IFC) Hydro Advisory Program which receives support from the Australian Department of Foreign Affairs and Trade (DFAT) and Japan Government. The CIAG have been developed consistent with the IFC's *Good Practice Handbook on CIA: Guidance for the Private Sector in Emerging Markets* (IFC Handbook) described in Section 1.4.

The general objectives of the CIAG are to improve and strengthen the cumulative impact assessment (CIA) process and implementation, to provide support for studies related to the Ministerial Directives and promote the sustainable development of natural resources while enhancing basin management planning. The CIAG are intended to define the scope of the studies required for the preparation of a CIA to allow for consideration and subsequent decision-making on the appropriateness of the construction, operation and decommissioning/rehabilitation of hydropower projects under the *Law on Environmental Protection 2012* and other relevant legislation.

[7] *Law on Electricity (1994, amended 2008, 2011, 2017).*

These CIAG are being developed in consultation with the Government of Lao PDR including significant consultation and workshopping with Ministry of Natural Resources and Environment (MONRE), businesses, development partners, hydropower project proponents and relevant stakeholders including regional and non-government organizations.

The Lao PDR Policy Guidelines for Implementation of Sustainable Hydropower Development in the country (MEM, 2015), described above, embarks primarily on sustainable planning principles from feasibility level and onwards in the project life cycle. However, embedded in the policy are some principles of Water Resource/Watershed Management and Conservation, including issues related to the *mitigation hierarchy of avoidance, minimization/mitigation and compensation* (MRC, 2018 - The Hydropower Mitigation Guidelines).




*"Natural conserved habitat area losses due to hydropower development projects shall be avoided and mitigated as much as possible. Where avoidance is not possible, it must be compensated and restored by the project developers as well as provide funding to help manage and effectively conserve the watershed area as well as nearby watersheds and other important conservation areas. Must also develop a sustainable biodiversity management plan, consider compensation or help mitigate the impact on the local natural resources base"*

As well as for those of revenue and benefit sharing, in accordance with international principles outlined in Section 2.3;

*"Project developer shall pay taxes, royalties and fees that is set-out in the regulations, laws and project specific agreements/contracts, as well as paying in cash or share benefits with the local communities through community funds for environmental protection and other funds for watershed protection and development of basic socio-economic infrastructure within the project areas".*

The planned hydropower schemes on the LMB mainstream and tributaries, including those on Sekong, are subject to national EIA procedures and decisions. All the LMB countries have developed regulations for EIAs at project level and partly also for SEAs and CIAs. For Laos these are described above but in Vietnam SEA is required by law (Keskinen & Kummu, 2010; Ke & Gao 2013). Additionally, Cambodia is drafting a new EIA law, the latest version of which also takes into account transboundary impacts (Ke & Gao 2013).

## 2.2 Transnational Guiding Governance Frameworks

### 2.2.1 The Mekong 1995 Agreement

The overarching transnational guiding framework, relevant also for Sekong, is the Mekong 1995 Agreement and during the last years the MRC has developed an applied its framework to address the issue of hydropower development in a holistic way.

The Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin signed by Cambodia, Lao PDR, Thailand and Viet Nam on 5 April 1995 defines a set of principles and processes for pursuing a coherent strategy of integrated water resources management (IWRM) on the regional scale.

The 1995 Mekong Agreement encourages cooperation amongst the LMB countries to optimise the multiple use and mutual benefits of all riparian's while protecting the environmental and ecological balance in the basin. The 1995 Agreement addresses different types of water use including proposed hydropower developments.

The Mekong River Commission (MRC) with its three bodies (Council, Joint Committee and Mekong River Commission Secretariat) serves as an international organization to ensure the implementation of the 1995 Mekong Agreement through its provisions and to adopt Procedures to facilitate and addressing such issues in a cooperative and amicable manner. The vision of the 1995 Mekong agreement is embedded within the following agreement between the member states; "..*to cooperate in a constructive and mutually beneficial manner for sustainable development, utilization, conservation and management of the Mekong River Basin water and related resources..*"

The five adopted Procedures for implementation within the MRC framework are the

(i) Procedures for Notification, Prior Consultation and Agreement (PNPCA; approved in 2003);

(ii) Procedures for Data and Information Exchange and Sharing (PDIES; approved in 2001);

(iii) Procedures for Water Use Monitoring (PWUM approved in 2003);

(iv) Procedures for Maintenance Flows on the Mainstream (PMFM approved in 2006);

(v) Procedures for Water Quality (PWQ approved in 2011).

According to the PNPCA, ***hydropower development on tributaries is subject to notification to the MRC Joint Committee*** and respective development on the mainstream requires prior consultation towards agreement between the countries. Thus for development on the Sekong, notification to the MRC Joint Committee is to be undertaken as part of the PNPCA process: Notification requires a country proposing a project to notify the details of the project to other member countries before it commences the proposed use.

The Mekong Agreement also requires the countries to "*make every effort to avoid, minimize and mitigate harmful effects*…", i.e. to adopt the mitigation hierarchy in the planning and implementation of hydropower and other infrastructure projects (see Section 2.1), also relevant when undertaking CIA for Sekong and the subsequent proposed mitigation measures (MRC, 2018).

### 2.2.2 Basin Development Strategy, MRC Strategic Plans and Transboundary EIA Framework

The adoption of the MRC Strategic Plan (2011-15) and the IWRM-Based Basin Development Strategy (BDS) for the Lower Mekong Basin endorsed by the MRC Member Countries in January 2011 are important steps towards regional-level cooperation for sustainable basin-wide development, as envisaged in the 1995 Agreement.

Both strategies address the key role the hydropower sector will have on the MRC's IWRM strategic direction. The documents identify the need for further studies and guidance by the MRC Initiative for Sustainable Hydropower (ISH) regarding the sustainable development of hydropower in the LMB. Given the importance of the 3S system, and Sekong in special, with regard to sustainable hydropower development, and because it is one of the major tributaries in the LMB (see for example Chapter 1.5) it is important that relevant aspects of these aspects are also reflected here, as HPP development on the Sekong also potentially can have transboundary impacts on flow, sediment transport and fish migration in the lower parts of LMB (see also Chapter 1.5).

The MRC Strategic Plan as well as the BDS has now been updated for the period 2016-2020 (MRC, 2016). Within the IWRM context the need to improve the sustainability of the basin's hydropower developments is a key Strategic Priority. With the significantly increasing scale and prevalence of this energy option, all MRC member countries are taking steps to understand and employ sustainable hydropower considerations, as the way forward. The new MRC Strategic Plan also includes a detailed roadmap for organisational reform of MRC and its functions currently under implementation.

For the next five years, the MRC will focus its work in delivering outcomes under four key result areas. These represent concrete and highly focused priority areas that MRC seeks to influence to advance its mission and role as a regional river basin organization in the Mekong region.

Under each key result area, the strategic outcomes and the approach to deliver these outcomes are presented, along with associated key deliverables (outputs), resources required and monitoring indicators. The outcomes grouped under each result area are of a similar nature but contribute to a specific result within the area.

**Table 2-1:** *Key Result Areas and their outcomes.*

| **I. Enhancement of national plans, projects and resources from basin-wide perspectives** |
|---|
| 1. Increased common understanding and application of evidence-based knowledge by policy makers and project planners<br>2. Environmental management and sustainable water resources development optimized for basin-wide benefits by national sector planning agencies<br>3. Guidance for the development and management of water and related projects and resources shared and applied by national planning and implementing agencies |
| **II. Strengthening of regional cooperation** |
| 4. Effective and coherent implementation of MRC Procedures by Member Countries<br>5. Effective dialogue and cooperation between Member Countries and strategic engagement of regional partners and stakeholders on transboundary water management |
| **III. Better monitoring and communication of the Basin conditions** |
| 6. Basin-wide monitoring, forecasting, impact assessment and dissemination of results strengthened for better decision-making by Member Countries |
| **IV. Leaner River Basin Organisation** |
| 7. MRC transitioned to a more efficient and effective organization in line with the decentralization Roadmap and related reform plans |

The BDS and SP (MRC, 2016) underline the rising sense of urgency among stakeholders for **the need to move basin development towards "optimal" and sustainable outcomes that can address long-term needs**, including environmental protection as well as ensuring water, food and energy security (MRC, 2018 – Hydropower Mitigation Guidelines).

A Framework for Transboundary Environmental Impact Assessment (TbEIA) has been developed by MRC to supplement existing cooperation as per the PNPCA described in Section 2.2.1. A specific focus of this activity is to better understand conflict resolution in transboundary environmental matters and environmental considerations for sustainable hydropower development. Taking into consideration potential transboundary impacts of some pilot sites, Member Countries are learning how to deal with the issues through dialogue, exchange of information, and capacity building. The experiences and procedures from the pilot projects are expected to improve the draft Framework for TbEIA for the Member States. As such it is also relevant for the transboundary issues arising when developing Sekong with regards to hydropower and other renewables.

### 2.2.3 The MRC Hydropower Mitigation Guidelines 2018 - Impact Mitigation across the Project Development Lifecycle

Between the years 2015 and 2018 MRC has developed its own Hydropower Mitigation Guidelines (MRC, 2018), that is supposed to be a technical guide for mitigation of risks and impacts of both mainstream and tributary development in the Mekong. Central principles are usage of the mitigation hierarchy throughout the project lifecycle as well as usage of ***basin scale mitigation techniques*** (contrary to project by projects) to cater for the risks, impacts and vulnerabilities with regard to hydropower development. The mitigation hierarchy, when overlayed into the different steps in the project development lifecycle, portrays various grades of importance (See also Figure 2.1). This approach will be important when evaluating the different scenarios for hydropower and renewable energy development for Sekong and subsequently suggest proper mitigation measures.

During basin (master) planning, siting and alternative design of hydropower projects it is important to consider ways to avoid the impacts in the first place.  This may include alternative locations for projects, alternative project design scales (e.g., lower dams) and/or alternative energy sources.  For this study on the Sekong this is typically reflected in the suggested Alternative Design and Operation Scenario and the Prioritization Scenario, compared to the Base Case Scenario, as discussed later in Chapter 3.1.2.

Once projects are approved to go to the feasibility stage, avoidance of impacts remains a priority and mitigation and minimisation options become more relevant. At the feasibility stage of projects it is also critical to optimise the design for maximum economic efficiency together with concurrent minimisation of environmental and social impacts.

The full and detailed environmental and social impact assessment (ESIA) may indicate that certain impacts are not able to be mitigated. In which case, during the project design and operations phase, compensation measures must be considered.

The operational phase of a project may last 50 years or more. It is therefore important that ongoing monitoring of the effectiveness of mitigation measures is put in place. If agreed performance targets are not being met, adaptive management and revised operating rules may be devised to further mitigate the impacts.

IFC's own mitigation hierarchy reflects the above, e.g." *To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize and, where residual impacts remain, compensate/ offset for risks and impacts to workers, affected communities, and the environment*." (IFC, 2012). See also Chapter 2.3 for a summary of IFC's Performance Standards.

## 2.3 International Sustainability Principles, Safeguards and Standards

There are multiple international sustainability principles that have been developed over the years with some that are still undergoing further development, including those of World Commission of Dams (2000), the IHA Hydropower Sustainability Protocol and the ADB and WB Safeguard Policies. For simplicity here and at this stage we concentrate on the Performance Standards and initiatives by IFC.

IFC has developed a Sustainability Framework aimed at promoting sound environmental and social practices as well as transparency and accountability. IFC's Environmental and Social Performance Standards, that constitute a vital part of the Sustainability Framework, were first launched in 2006 while the latest revision was carried out in 2012. Today the IFC Performance standards have been recognized across the world as the benchmark for environmental and social risk management in the private sector.

There are eight separate Performance Standards dealing with the main sustainability aspects of a project. The first Performance Standard, *Assessment and Management of Environmental and Social Risks and Impacts*, requires borrowers to carry out an integrated assessment to identify the environmental and social impacts as well as risks, and opportunities related to their projects. The establishment of an environmental management system to manage environmental and social performance throughout the life of the project is also demanded.

The other Performance Standards set out objectives and requirements *to avoid, minimize and compensate* (usage of the mitigation hierarchy) for impacts to workers, affected communities and the environment.

In the context of environmental impacts related to hydropower development Performance Standard 6, *Biodiversity Conservation and Sustainable Management of Living Natural Resources*, is one of the most important. Natural Habitats are here defined as intact geographical areas composed of plant and animal species of largely native origin. The main requirement is that a project shall not significantly convert or degrade natural habitats, unless no other viable alternatives exist or, where feasible, all impacts on the habitat will be mitigated so that no net loss of biodiversity occurs.

The Performance Standards are complemented by the separate Guidance Notes providing more details of the requirements under each Standard. Of high relevance for hydropower development on Sekong, is the IFC Good Practice Note: Environmental, Health, and Safety Approaches for Hydropower Projects (2018).

The IFC has also published a Good Practise Handbook for Cumulative Impact Assessment (IFC, 2013) amongst other with focus on required steps in the process and involvement of stakeholders. The handbook is described under Section 1.4.

# 3 Scoping of the Cumulative Impact Assessment

## 3.1 Definition of Boundary Conditions and VECs for CIA

As outlined in IFC Good Practise Handbook on Cumulative Impact Assessment (IFC, 2013), defining boundary conditions and VECs is a critical first step in a CIA (See also Section 1.4). Henceforth, boundaries for the analysis need to encompass the geographic and temporal extent of impacts (from other past, present, and predictable future developments) that influence VEC conditions throughout the time period during which project impacts will persist. This scope extends beyond a project's direct area of influence as typically defined in an ESIA (IFC, 2013).

### 3.1.1 Spatial Boundary Conditions

The natural definition of spatial boundary for the scope of the CIA is the basin boundaries of Sekong down to the confluence with the Srepok river. During the Inception and Scoping Workshop (23-24 August, 2018) it was discussed if this boundary may have to be extended if certain VECs, which are deemed important enough to become the subject of CIA analysis, also extend beyond the river basin boundary (for example navigation from the Mekong or the Virachey National Park in Cambodia). However, during the same workshop it was agreed that the Sekong river basin boundary should be the spatial extent of the CIA analysis.

**Extent of human activities to be considered**

Within the basin boundaries, all infrastructure associated with the hydropower and other renewable energy projects is to be considered within the scope of the CIA, along with roads and transmission lines for other major infrastructure projects (regional transport, mining, etc.). The various human activities to be considered in the CIA, within the spatial boundaries, can be summarized as follows:

- All large and medium sized hydropower projects, irrigation and water supply dams along the entire mainstream of the Sekong River and its tributaries, as well as the concession areas for large and medium scale wind and solar power generation in the basin.
- Associated infrastructure (e.g. transmission lines, roads) and ancillary activities (e.g. river navigation, transport of construction materials and equipment to the project site).
- Any other relevant development (industry, agriculture etc.) that will cumulatively impact on the VECs alongside the HPP development.

With the exception of one cascade of small hydro's, there is little data available on small projects in the basin. The consultant will however pursue possible further data availability.

### 3.1.2 Temporal Boundary Conditions and Alternative Pathways

The future temporal boundary was suggested to be up to 2030, for the main scenarios and alternative pathways (3 main pathways have been identified, see also Table 3.1), when all projects with existing data on size, location and associated infrastructure are expected to come on stream. The 2030 temporal boundary was agreed during the Inception and Scoping Workshop 23-24 August, 2018.

The Base Case Pathway (Current Plans/Practices) will be the expected situation in 2030, with all current and proposed projects, taking into consideration plans for mitigation per ESIA studies, but, without any CIA measures in place, e.g. business as usual. For our analysis there are 41 projects from the EWN study. Although all these will be part part of our analysis, 34 have been listed to have more info relevant projects (these are listed in Annex 2). Out of the 34, 4 are HPP's under 15 MW and one diversion dam with zero MW capacity.

Of the 29 medium and larger size HPP's, 9 are completed or advanced in construction, 10 are at the PDA stage, 9 have feasibility study complete or near complete and 1 is at pre-feasibility stage (Nam Krabai 1).

The CIA Mitigation Pathway includes the 2030 Base Case Pathway, but with proposed CIA mitigation measures and redesign approaches adopted if required. This pathway will follow the mitigation hierarchy and allows redesign of projects to avoid, minimize and compensate impacts. Typical measures will be joint operation of cascades and to consider regulating reservoirs with regard to hydropeaking in relation to such cascades.

The Sustainable Development Pathway takes as its starting point the CIA Mitigation Scenario above, and selects the most promising impact minimizing portfolio of HPPs, that also are sufficient to meet anticipated power generation needs. Impact minimization will take into account selected VECs (see Chapter 3.1.3). Power generation needs will take into account Lao PDR's domestic demand forecast and its commitments for export to neighboring countries (particularly Thailand and Vietnam). Floating solar additions will also be assessed here when comparing 2030 demand and supply balance. In this pathway we will also suggest realistic spatially configured/grouped HPP portfolios yielding the highest benefits weighted against least cumulative impacts. A recent research study, with focus on sediment transport (Schmitt et al, 2018), has actually already looked at HPP portfolios for the whole 3S system, suggesting improved trade-offs of hydropower production and sand connectivity by introducing alternative dam portfolios (different spatial configurations of dam groups).

All three pathways will be assessed for climate change with regard to 2030 and 2100 conditions, possibly also if feasible looking at difference in climate change resilience between the pathways.

**Table 3-1***: Proposed pathways for Sekong CIA.*

| Scenario | Temporal boundary | Description with regard to HPP development | Description with regard to ESIA an mitigation hierarchy |
|---|---|---|---|
| **Base Case** (Current Plans/Practises) | Planned Development 2030 | Operational, under construction and committed current planned HPP's up to 2030 | Current proposed mitigation practice in ESIA studies |
| **CIA Mitigation Pathway** | 2030 | Build on all planned HPP's up to 2030 | CIA mitigation measures adopted (avoid, minimize and compensate) and redesign of planned projects to reduce cumulative impacts (examples are re-regulation reservoirs, lower dams with gated barrages[1],etc.; will also include means for joint operation of cascades |
| **Sustainable Development Pathway** | 2030 | What is a realistic quantity of hydropower expansion to 2030, based on national PDP's | Adopt the recommended mitigation in the CIA Mitigation Scenario above, but in addition recommend select HPPs with the least impacts on selected VECs; could also suggest realistic spatially |

| Scenario | Temporal boundary | Description with regard to HPP development | Description with regard to ESIA an mitigation hierarchy |
|---|---|---|---|
| | | | configured HPP portfolios yielding the highest benefits weighted against least cumulative impacts |

[1] *As proposed in the MRC Mekong Hydropower Mitigation Guidelines, as a mean to cater for sediment flushing and fish migration in critical periods, since the gated barrages can temporally open the gates and shutdown of power production in ecologically critical periods of the year (critical sediment pulse and fish migration periods). See text below and illustration from the MRC Hydropower Mitigation Guidelines (2018).*

In the Mekong Hydropower Mitigation Guidelines Study (MRC, 2018) innovative overarching engineering design mitigation options were studied in detail, and included alternative schemes layouts with lower dams and gated barrages of proposed mainstream dams. The comparison between a typical full height mainstream project and the equivalent two half height schemes indicates that the combined construction cost of the two half height schemes will be approximately 15% greater. The results from this analysis is summarized in Table 3.2 (from MRC, 2018 – Volume 4, The Case Study).

**Table 3-2:** *Cost comparison – Alternative schemes for Mekong mainstream projects (from MRC, 2018).*

| Cost Comparison – Alternative Schemes | | | |
|---|---|---|---|
| Scheme Component | 30 m Gross Head Scheme | 15 m Gross Head Scheme | 2 No. 15 m Gross Head Schemes |
| **Powerhouse Structure** | 26.9% | 13.7% | 27.5% |
| **Spillway structure** | 7.7% | 4.3% | 8.6% |
| **Central Island** | 8.9% | 2.2% | 4.3% |
| **River Diversion** | 8.2% | 4.4% | 8.8% |
| **Navigation Lock** | 2.1% | 1.6% | 3.2% |
| **Fish Pass Structure** | 4.8% | 4.1% | 8.2% |
| **Switchyard(s)** | 0.2% | 0.3% | 0.6% |
| **Transmission line(s)** | 0.6% | 0.4% | 0.8% |
| **Access Roads** | 0.2% | 0.2% | 0.3% |
| **Preliminaries** | 10.2% | 8.5% | 17.0% |
| **Indirect Costs** | 30.2% | 17.2% | 34.4% |
| | | | |
| **Total** | **100%** | **56.9%** | **113.7%** |

Conversely, the project finance cost for the two half height schemes was analysed to be lower because energy and revenue is available approximately four years earlier. The overall implication is that the cost of energy from the half height schemes is approximately the same, and possibly lower, than the single full height scheme. Lower head schemes with gated barrages could be specifically relevant to assess for Sekong mainstream dams, ***on a case by case basis***, as gated barrages can also yield improved sediment transport and fish migration through ***temporally opening of the gates*** and shutdown of power production in ***ecologically critical periods of the year*** (critical sediment pulse and fish migration periods).

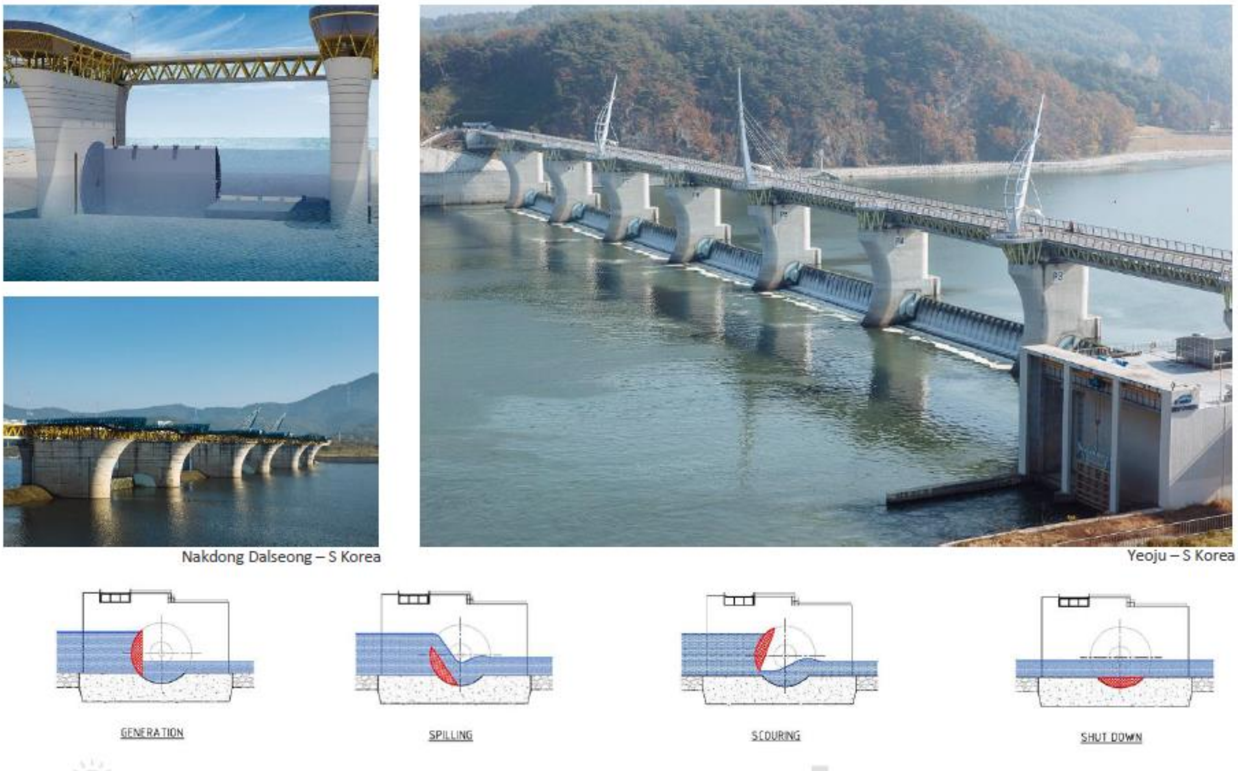



**Figure 3-1:** *Example of low head sector gate barrages.*

### 3.1.3 Selection and Prioritization of VEC's

A definition of VEC's has been given in Section 1.3. During this inception and scoping phase, a number of very broad VEC groups (see Table 3.3) was outlined for further discussion, selection and prioritization with the Client and stakeholders during the Inception and Scoping Workshop. It was decided during the workshop to keep the broad VEC groups for more detailed analysis in the following phase with regard to cumulative impacts for the different scenarios (see Table 3.3). For this CIA study, the VECs has been expanded to include also social, economic, and cultural components following the approaches of Shoemaker (1994) and Coffen-Smout and others (2001) and the IFC (2013).

The VEC's was thoroughly discussed in the Inception and Scoping Workshop and time was also spent on explaining the concept and potential impact pathways and their long-term ecological and social consequences on the VEC's. The workshop prepared also the ground to make informed decisions, on how to focus the further CIA/VEC analysis and reporting (See also Annex 3, minutes from the workshop).

From the 7 listed broad VECs in Table 3-3, the stakeholders listed Traditional Customs and Culture and Sekong River dependent livelihoods as the most important, followed by Sekong Basin Ecosystem Resilience, Valued Sekong Basin Habitats, Valued Fauna and Valued Flora. It was also suggested to merge to merge the two top listed VECs into one social and cultural VEC.

**Table 3-3:** *Broad VEC groups for further discussion, selection, prioritization and narrowing (Adapted from WB 2014, Marchand et al. 2014 and Multiconsult, Deltares et al. 2018).*

| VEC | Description/Function | Examples | Relevant Institutions |
|---|---|---|---|
| **Valued fauna** | Wild animals and fish, valued for economic reasons or conservation status (threatened species). | Super-endemic fish, e.g. species only found in Sekong (15)*<br>Endangered and critically endangered fish species<br>Important (economically and environmentally) migratory fish species | MONRE<br>MAF<br>LARREC |
| **Valued flora** | Forest and plant species and products (terrestrial, riverine, and wetlands) valued for economic, medical, food, important ecosystem function or high biodiversity reasons. | Plant and tree species for medical and traditional use | MONRE<br>MAF |
| **Sekong Basin ecosystem resilience** | Contingent functioning through physical/chemical/biological stress. | Biodiversity<br>Food-web dynamics<br>Filter capacity of wetlands<br>Sediment dynamics and transport | MONRE |
| **Sekong Basin ecosystem soil protection ability** | The ability to protect the soils in the basin/catchment from erosion. It is a function of forest and vegetation cover/quality as well as topography. | Land and vegetation cover in erosion prone terrain and soils | MONRE<br>MAF |
| **Valued Sekong Basin habitats** | Habitats important for human use. Habitats specifically important for biodiversity. | Protected Areas, Key Biodiversity Areas, Habitats/Areas with a variety of human use products. | MONRE |
| **Sekong River dependent livelihoods** | This is a social and economic VEC that is primarily a function of livelihood use of Sekong rivers natural resources. | Artisan fishermen, communities utilizing Sekong resources | Local communities |
| **Traditional culture and customs** | Gender roles, cultural diversity, traditional knowledge, social identity, tourism. | Women in the fisheries sector, cultural sites near the river and hydropower sites | Local communities, Ministry of Culture and Information Department of Heritage |

**Source: Meynell P.J. 2014. The Sekong River in Vietnam, Lao PDR and Cambodia. IUCN.*

## 3.2 Preliminary Baseline Analysis

The baseline analysis is primarily to be undertaken in the next Phase. Just a short preliminary review is given here in the Inception Report.

### 3.2.1 Hydrology and Water Resources

The most extensive information on the Sekong basin can be found in the monograph by Meynell (2014) and most information in this paragraph is based on this publication. A second important source is the "Atlas of the 3S Basins" by IUCN (2015).

According to the Atlas of the 3S Basins, the Sekong River is one of the largest tributaries of the Mekong River taking up a total area of 28,414[8] $km^2$, with 22,455 $km^2$ lying in Lao PDR, 5,417 $km^2$ in Cambodia and also 541 $km^2$ in Viet Nam. The total length of the Sekong mainstream from the headwaters, starting in Viet Nam, to the confluence in the Sesan and Srepok in Cambodia, is 516 km (Meynell, 2014). The average annual precipitation in the upper catchment is 1,400-2,900 millimetres (mm). The total irrigated area is about 21,537 ha, with the source of the water probably directly from the Sekong river or its tributaries.

According to the Atlas of the 3S Basins, there are a number of gauging stations in the Sekong basin, but most of them are in the lower parts, e.g. at Attapeu, and the quality of the data is not known. Some stations only measure gauge height and have no value for the present study. Meynell (2014) states that the records from Attapeu represent the most comprehensive data set of flows in the Sekong. There are also a number of meteorological stations, but most of the series are intermittent with many missing values.

Meynell (2014) reports that the mean annual rainfall of the Sekong Basin ranges between 1,400–2,900 mm. Nearly 60% of the basin falls into the range of 1,700–1,900 mm/yr, with 23% falling in the range of 2,300–2,700 mm/yr. The mean annual temperature of the Sekong basin lies in the range of 21–28 $^{o}$C. Most of the basin (56%) experiences the 21-22 $^{o}$C range, but there is about 33% of the area that experiences much higher temperatures. The distribution of both the mean annual rainfall and temperature by sub-basin is shown in Figure 3-.

[8] *Meynell (2014) gives a value of 28,815 $km^2$.*

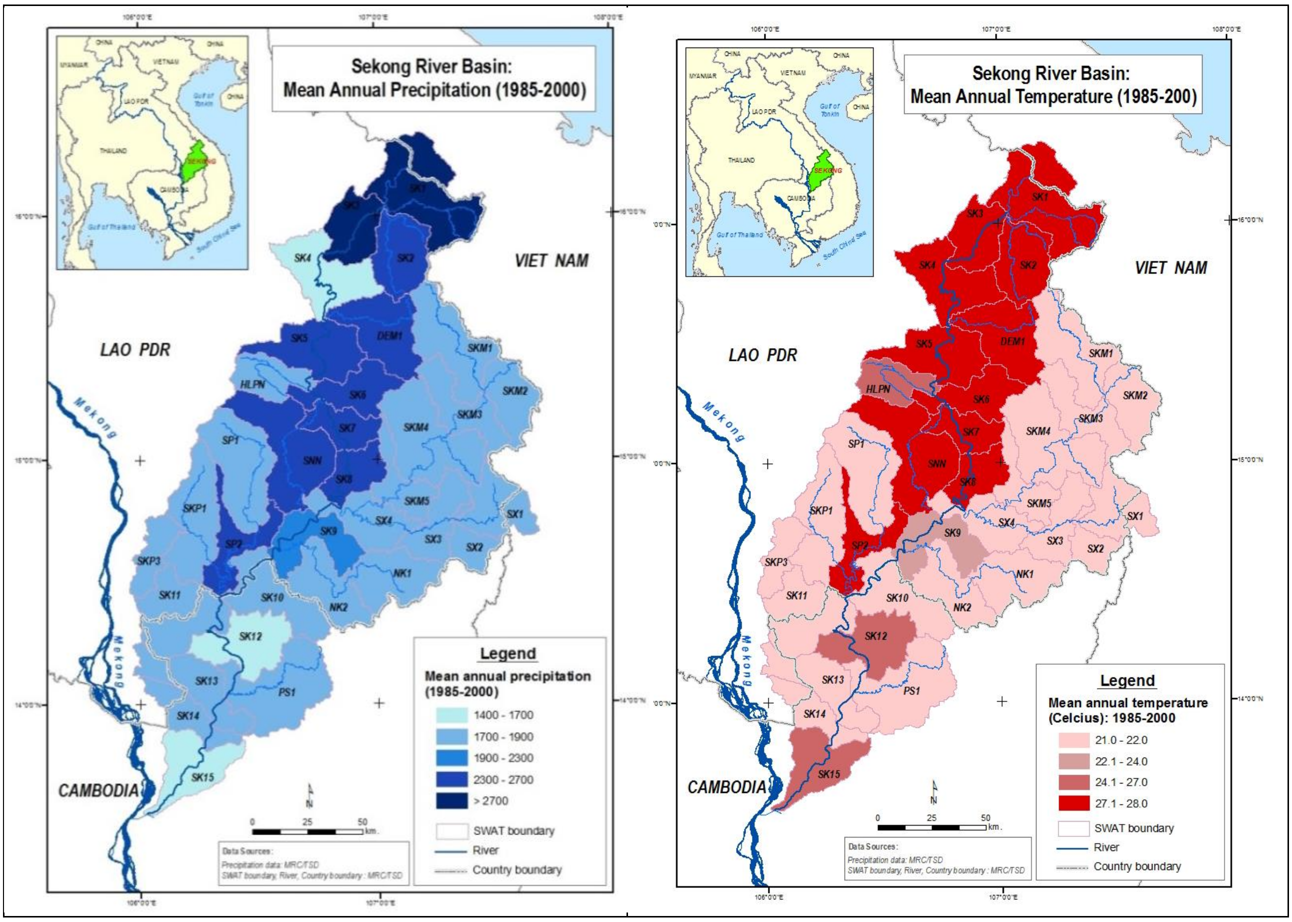



**Figure 3-2:** *Mean annual precipitation and temperature (Meynell, 2014).*

In Figure 3-3 the average monthly flows are shown for the Sekong river at Attapeu, showing on the left both the yearly fluctuation as well as the absolute values of the monthly average discharge. In the figure on the right, the expected impact of the regulation of the river is shown (Meynell, 2014, lists 22 large hydropower projects in his report).

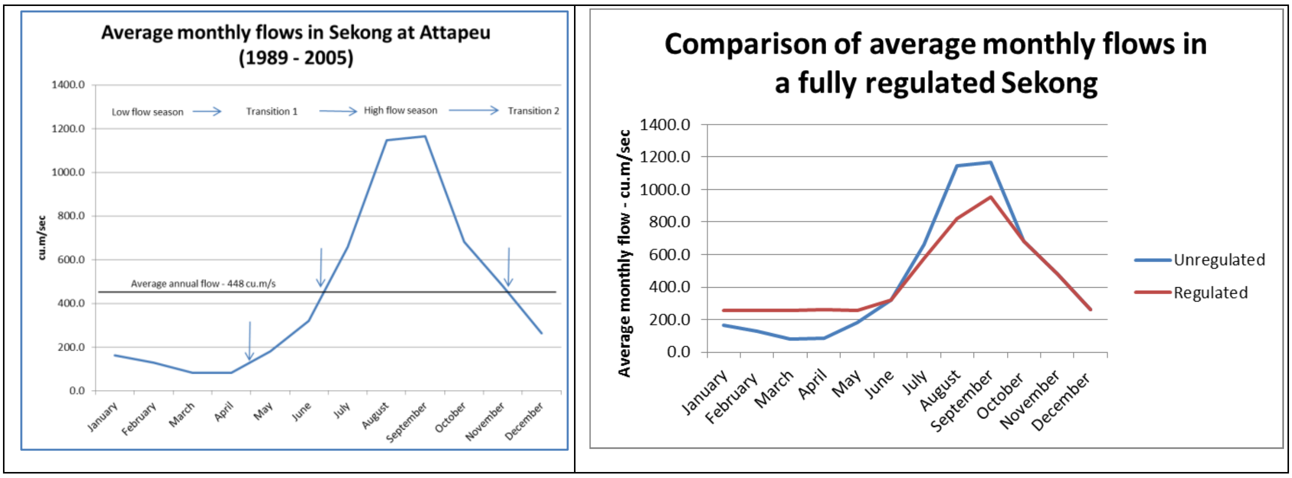



**Figure 3-3:** *Mean flow distribution over the year for the Sekong river at Attapeu (Meynell, 2014).*

The average values do not reflect well the actual range of the discharges in the Sekong river. In the low-flow seasons, discharges can go down to about 16-25 $m^3/s$ at Attapeu gauging station, while floods can reach values of nearly 4,000 $m^3/s$ (Meynell, 2014).

### 3.2.2 Flood Control and Water Supply Potential

At this stage it is not known where there might be potential for providing benefits from flood control (if any). However several reservoirs already built and in advanced stages of planning do seem to have some potential for flood control provided to downstream communities and irrigated agriculture. They are large enough, but so far we have not found concrete plans for multi-purpose reservoir use. Therefore the Consultant will further assess if there are potential flood control or water supply beneficiaries downstream of large dams, and some reports seem to indicate that this might be the case (e.g. town of Lamam). This will be important as it may be the case that win-win opportunities can be found for both dam owners and downstream communities affected by the dam, if appropriate action is taken early in the planning of the reservoir.

### 3.2.3 Climate Change

**A. First overview of existing assessments and reports**

*1. Website of the Mekong River Commission* – The website of the Mekong River Commission provides an overview of projected changes by 2030 for the whole of the Mekong including: temperature increases of 0.79 °C, annual precipitation increases of 200 mm, decrease in dry-season precipitation in the Southern catchments, a total runoff increase of 21%.

*2. Trang et al. (2017) Evaluating the impacts of climate and land-use change on the hydrology and nutrient yield in a transboundary river basin: A case study in the 3S River Basin* - Trang et al assess the influence of climate change on precipitation and discharge in the Sekong river basin using down-scaled climate model data. The results show that the climate in the three basins will become warmer and wetter. Annual average discharge is projected to increase, discharge during the wet season will also increase, but discharge of the dry season will decrease.

*3. Climate Change Analysis in the Lower Mekong Basin Review of Availability of Observed Meteorological Data MRC Working Paper No. 52 October 2014* – This working paper was part of the strategic planning cycle 2011-2015 of the MRC and focused on the collection of observed data and exploration of the possibilities for climate change assessment and trend analysis. It concludes that too little homogeneous time-series are available that include the recent past during which more extremes are experienced. This hampers reliable climate trend analysis and change assessments. This report is from 2014, but is part of the latest completed planning cycle. During their first mission in July 2018, the Consultant plans to visit the MRC and inquire on the latest climate change assessment and possibly updated reports.

*4. Visit to Dr. Cong – Climate change and adaptation specialist MRC*

During the mission of the climate change expert to MRC in July 2018, information on the present status of the climate change assessment at MRC was obtained[9]. This will be used as the principal input from local knowledge regarding the impact of climate change on the hydrology in the Sekong basin. The following projects were mentioned:

- The MRC is working on the MASA, the Mekong Adaptation Strategy Action Plan. This includes a climate impact analysis and covers the entire Mekong basin;
- MRC is starting CCAI's – small / local Mekong focused Adaptation Initiatives that are in line with the Adaptation Strategy Action Plan. The plan defines local / regional adaptation activities;
- Potential impacts on the basin and more specific the hydropower sector are also discussed in the BDP2 - the Basin development Plan.

In support of the MASA, an extensive climate impact analysis was made for the entire Mekong basin. At this stage only the draft summary for policy makers and draft technical report are available. For the development of the climate change scenarios, climate datasets from the IPCC 5th assessment report for RCP 4.5 and 8.5

[9] *Personal information Dr. Cong (MRC)*

were used. From all available scenarios three GCM's / scenarios were chosen representing the following change in conditions:

1. Wetter throughout the year;
2. Less rain in the dry season;
3. Drier throughout the year.

The SimClim software package was used to download and downscale the data to a 1 km resolution for a monthly time-step. The hydrological SWAT model was set-up and run with the climate data for the entire basin. The results showed large variations in projected flows, in the order of -20% to +20% in annual average discharge, and thus there was a large variation on the impact on the hydropower sector as well. The concerns are largest for the 3S basins. Compared to the Mekong the impacts are expected to be largest here, because of decreases in food security as the region is highly depended on local crops and fishery.

We suggest trying to align as much as possible with the outcomes of the MRC model simulations and apply these CC forecasts into the Sekong CIA scenario definitions. However, we will make our own model simulations as these will allow for a more precise assessment of the impact of climate change on the flow characteristics of the Sekong river.

### B. Technical approach

*Climate change assessment*

For the climate change assessment in this project we propose to use data from the 5th assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2014) – this is similar to the approach followed by Trang et al. (2017). The climate change projections of the IPCC report are based on representative concentration pathways (RCPs) that belong to pre-defined emission scenarios (Van Vuuren et al. 2010). We will focus on 2 RCPs, an approach that is also followed by the MRC:

- RCP 4.5 – representing moderate change with a global average temperature increase of 2 degrees by the end of this century: In this pathway the radiative forcing stabilizes before 2100 due to the introduction of technologies and strategies that reduce greenhouse gas emissions;
- RCP 8.5 – representing extreme change with a global average temperature increase of 4 degrees by the end of this century: In this pathway there is a continuously increasing radiative forcing.

Global Climate Model (GCM) simulations for these RCPs have been run as part of the international inter-sectoral impact model intercomparison project (ISI-MIP). The ISI-MIP project developed future climate change projections based on the bias-corrected output of these GCM simulations. The ISI-MIP data portal[10] contains open data for 4 GCMs (GFDL-esm2m, IPSL-cm5a, HadGEM2-es, NORESM1-m) for the period 2006 - 2100.

*Preparation of climate input data for the hydrological model*

Monthly delta changes in mean and extreme quantiles will be derived from the GCM datasets and applied to the historical precipitation time-series to generate future precipitation time-series. These will be input to the hydrological HEC-HMS model. With the HEC-HMS rainfall-runoff model we will assess future changes in river discharge.

[10] *https://esg.pik-potsdam.de/search/isimip-ft/*

The ToR mentions a temporal extent of 100-150 years. With the future climate data we cannot go further in time than 2100. Combined with the hydropower portfolio we will analyze the impacts of climate change over the period 2040-2100. By using this long a period we fully account for the natural climate variability.

### 3.2.4 Fish and Fisheries

Fish and other aquatic resources from the Sekong River are still important for the population’s livelihoods, only second to agriculture as a source of income.  According to IUCN’s Fact Sheet fish contribute to about 35-40% of annual household income through trade or sale of fish as well as providing 80% of the protein consumed in the Basin. In the Lao PDR part of the Basin, mean annual consumption of fish has been estimated at nearly 50 kg/person.

As the last major mainstream free flowing tributary to the Mekong river, the Sekong river provides unobstructed passage for migratory fish all the way to and from the headwaters to the South China Sea, including the Mekong mainstream, the Tonle Sap Great Lake and the Vietnam Delta. As such, the Sekong river contains a high level of fish diversity and endemism, with many species spawning only in its unique habitats. Estimates of fish species in the Sekong river vary between 175 and 265, with about 1/3 of these being migratory[11]. A Sekong river with high degree of connectivity would also be important for the Lower Mekong Fish Migratory system, also connecting the Sekong to Tonle Sap and the Vietnam Delta (MRC, 2018). See also Figure 1.3 in Section 1.5.

Meynell (2014) also reports fifteen super-endemic species, *e.g. species exclusively found in the Sekong*[12]. This is an unusual high number and highlights Sekong’s exceptional value in terms of biodiversity conservation.

Meynell (2014) also reports 14 endangered or critically endangered fish species in the 3S rivers (see Table 3.4). Their presence in Sekong will be further assessed during the Scoping period as they can be potentially important VECs.

**Table 3-4:** *Endangered and critically endangered fish species in the 3S rivers (from Meynell, 2014).*

| 3S species | Red List status |
|---|---|
| Aaptosyax grypus | Critically endangered |
| Catlocarpio siamensis | Critically endangered |
| Pangasianodon gigas | Critically endangered |
| Dasyatis laosensis | Endangered |
| Luciocyprinus striolatus | Endangered |
| Pangasianodon hypophthalmus | Endangered |
| Poropuntius bolovenensis | Endangered |
| Poropuntius deauratus | Endangered |
| Probarbus jullieni | Endangered |
| Probarbus labeamajor | Endangered |
| Schistura bairdi | Endangered |
| Schistura bolavenensis | Endangered |
| Sewellia patella | Endangered |
| Yasuhikotakia sidthimunki | Endangered |

[11] *Meynell (2014) reports 213 species on the Sekong, of which 64 is identified as migratory.*
[12] *Devario salmonata, Poropuntius lobocheiloides, Schistura bairdi, Schistura bolavenensis, Schistura clatrata, Schistura fusinotata, Schistura imitator, Schistura khamtanhi, Schistura nomi, Schistura rikiki, Schistura tizardi, Serpenticobitis octozona, Sewellia diardi, Sewellia elongata, Sewellia speciosa.*

### 3.2.5 Ecosystems and Natural Resources

Topographically the Sekong River Basin can roughly be divided into the low-lying areas in Cambodia, the large Bolaven Plateau in Laos and the steep upper slopes at the head of the catchment. However, the biogeography can be distinguished into 3 different types as the east and northeast, the west and the south of the Sekong Basin. The east and partly the north of the basin is the southern Annamite Mountain Range, from the Sekong watershed at Xe Xap National Protected Area and continues along the Sai Phou Luang, where the borders between Laos and Vietnam ARE, to Dong Ampham National Protected Area. This area is regionally defined as conservation corridor area. The west of the Sekong Basin is the Bolaven Plateau, which reaches up to 1,300 masl. This area allows for cultivation of more temperate crops such as coffee and many types of vegetables. The south of the Basin is mainly floodplain along the Sekong River. The Xe Pian National Protected Area (NPA) is found here, which ranks second in Lao PDR and 10 top in Asia with regard to biodiversity. The floodplain area also has a large portion of Dry Dipterocarp Forest (DDF) which is critical habitats especially for water birds.

The forest cover in the Sekong Basin is still presumed to be relatively high (natural deciduous and evergreen forests), but has declined over the last decade as agricultural land has been cleared for crop cultivation, especially in Lao PDR. There are also extensive economic land concessions on the right bank of the Sekong in Cambodia (Meynell, 2014).

The Sekong has amongst the highest proportion of Protected Areas and Key Biodiversity Areas (KBAs) of all the tributaries of the Mekong. Within the basin as a whole, about 39% lies within Protected Areas and 37% has been identified as lying within KBAs (Meynell, 2014) and Important Bird Areas (IBAs). These are unusually high numbers, and again important in terms of biodiversity conservation.

A number of globally threatened species has been reported and recorded in Sekong Basin. In the west of the basin a number of critically, endangered and vulnerable species are found; such as Buff-cheeked Gibbon (EN), Red-shanked Douc Langur (EN), Indochinese Silvered Leaf Monkey (EN), Banteng (EN), Gaur (VU) etc.

### 3.2.6 Livelihoods

Within the 3S Basin, the Sekong basin has the lowest population density and the smallest total population, which has been estimated at under 330,000 (around 40,000 people in Viet Nam, 240,000 in Lao PDR, and 44,000 in Cambodia). The population is concentrated in the towns of Attapeu and Sekong and in the large surrounding plains.

Various communities and households along the Sekong utilize the river for fishing and have been reported by Meynell (2014) for the Sekong and Attapeu provinces. Hence, fish and other aquatic resources from the Sekong River are central to families' livelihoods and food security. After agriculture, fishing and related activities provide the second largest source of income. Not only does fish catch contribute 35-40% of annual household income through trade or sale of fish, it also provides 80% of the protein consumed in the basin.[6,7] In the portion of the basin in Lao PDR, mean annual consumption of fish is nearly 50 kg/person (FAO, undated; LNMC, 2011; MRC, 2009).

### 3.2.7 Hydropower Development

A total of 4 hydropower projects have been constructed or are under operation on the tributaries of the Sekong River, while 5 are under construction. So far however, no hydropower dams have been constructed across the Sekong main stream and this makes it a unique sub-basin within the Mekong river basin as it is the last major relatively free flowing tributary in the entire Mekong River system. However, presently there are

26 hydropower projects in different stages of planning within the Sekong Basin and 8 of these are located on the Sekong mainstream.[13] In a recent study by Schmitt et al. (2018)[14], with focus on strategic hydropower portfolio planning in the 3S, they looked at trade-offs between hydropower production and sand flux for different spatial configuration of (planned) dams. They concluded that, to retain some connectivity between the 3S and the Mekong, one should preferentially develop dam sites upstream of existing dams. The portfolios they looked at would actually increase hydropower production with less additional impact on connectivity than building dams in still free-flowing parts of the 3S, including the Sekong mainstream.[15]

Below is a list of the various larger HPP's on the Sekong grouped in 3 separate portfolios (that could be relevant for the Sustainable Hydropower Development Pathway described in Chapter 3.1.2):

<u>10 projects already constructed, or in an advanced stage of construction</u>

1. Huay Ho and Huay Lamphan
2. Xe Kaman 1, 3 and Xekaman- Sanxai. All in cascade on the Xekaman river
3. Nam Kong 1, 2, 3 in cascade on the Nam Kong tributary
4. Xepian- Xenamnoy – large tributary project

<u>7 Projects upstream of the existing XeKaman reservoirs</u>

1. XeKaman 2A, 2B, 4
2. Nam Bi 1,2,3
3. Nam Ang Natabeng

<u>7 Projects along the mainstream Xe Kong</u>

1. XeKong Downstream A and B
2. Xekong 3A, 3B
3. XeKong 4A, 4B
4. Xekong 5

There are several other projects with unidentified locations and some uncertainty due to differing spellings and number systems, including Dak E Muen (or Mule including a downstream version), Nam E Muen (1,2,3 and 4?), Xe Xou, and Nam Krabai 1. An agreed name/ spelling, location and status at present should be clarified as part of the Inception workshop.

Smaller run-of-the-river projects is not listed in the portfolios above, but will be considered in the CIA final analysis, provided sufficient information has been obtained.

[13] *EWN study database.*
[14] *Schmitt et al. 2018. Improved trade-offs of hydropower and sand connectivity by strategic dam planning in the Mekong. Nature Sustainability. VOL 1. FEBRUARY 2018. pp 96–104*
[15] *This is generic for the whole 3S, and need to be more tailored too, and more practically investigated and potentially verified in the Sekong Basin CIA study.*


**Figure 3-4:** *Dams in the Sekong River Basin.*

### 3.2.8 Other Renewables

Wind energy has potential in the Sekong basin, and a proposed area for developing the first 600 MW potential was proposed in 2016 by IES (Impact Electrons Siam). The location does not affect any protected areas, but covers a large area of the Xe Kaman catchment. The Consultant will request further details and an update on this wind power project to see if this has realistic prospects for construction and if so to include it in the power sector studies and CIA analysis of certain terrestrial VECs.

Recent proposals have been made for large scale floating solar on a number of HPPs in the Sekong Basin, and similar potential exists in other reservoirs of the Sekong, both planned and existing. It is possible that the Consultant can, adhering to existing plans, expand this idea by deriving generic criteria for utilizing a certain fixed proportion of the proposed reservoir area for floating solar PV up to the capacity of the dams hydropower plant. This process is known as "hybridizing" the hydropower project to make use of the floating solar potential within certain practical limits (e.g., capacity of the substation/transmission line, availability of suitable reservoir area above the drawdown level, the limitations of floating solar for high variation in water level etc.). Only floating solar PV potential of more than 50 MW is worth considering at this level of early stage planning.

### 3.2.9 Grid Expansion and Other Infrastructure

Hydropower developments bring with them the need for new transmission lines in remote areas of Laos, and it is necessary to consider the cumulative impacts on VECs of transmission lines as well as wind farms, access roads and other infrastructure. Further baseline assessment will include possible routing of new transmission lines associated to hydropower and wind power projects.

### 3.2.10 Power Demand and Hydropower Operation and Dispatch

The power systems of Laos, Thailand and Vietnam are expected to benefit from the hydropower projects in the Sekong basin and the Consultant will further examine how these three systems intend to dispatch each of the larger projects. It is already known that EGAT dispatch existing hydropower projects in Laos as weekday peaking power plants, with operation at full or near full capacity during the hours of maximum load on the Thai power system. This causes hourly fluctuations in flows downstream of these power plants which have both local and downstream impacts. Since the hydropower portion of Vietnam's generation mix will fall to 25% by 2020, with import of only 2.5 % (Vietnam PDP 7 revised, 2016), it is possible that Vietnam will dispatch in a similar manner to Thailand, however yet to be confirmed.

The normal method of mitigating the downstream impact of rapid flow variations from power plants operating in peaking mode is to design a re-regulating reservoir immediately downstream of the power plant to be operated in peaking mode. If the power plant in the dam of the re-regulating reservoir operates on steady output, with no daily fluctuations for peaking operation, then the negative impacts of peaking mode are limited to the short stretch of river between the two reservoirs. This is often the principle to be followed in planning cascades where peaking operation is intended in the upper power plant. The reservoirs do not have to be large to facilitate this type of operation, and most of the schemes presented so far seem to have large enough reservoirs.

The EDL system in Laos is almost entirely hydropower supplied, but the role of each power plant in supplying EdL demand may differ. For instance, the Nam Ngum project may be supplying base load and/or hydro peaking depending on the EDL dispatch strategy and agreement with each of the other IPPs. This information will be important to update with regard to the planned Sekong hydropower projects, to clarify how the future EDL power system plans to operate, and whether any of the Sekong hydropower plants are intended to fulfill specific roles in the future system (e.g., hydropeaking, spinning reserve etc.).

# 4 Coordination with EWN Study

## 4.1 The EWN Study in Brief

The Energy-Water Nexus (EWN) study[16], presently being carried out by a consortium led by CNR Engineering, has as its core objective to increase MEM's understanding of the principles of and processes for integrating water resources management into hydropower management in order to maximize the value of Lao PDR's water endowment and provide security of water rights in the hydropower sector. For this purpose, the project is implemented in two pilot basins: the Nam Ou Cascade and the Sekong Basin. The project is expected to be finalized in September 2018 and therefore important synergy between the two projects is possible. For our project, an important aspect is the modelling approach, which makes use of existing models of the two basins implemented in the open-source software packages of HEC. The following models have been used:

- HEC-HMS (hydrological / rainfall-runoff model with soil moisture accounting method)
- HEC-ResSIM (reservoir simulation model)

These models were previously applied to the two studied catchments by IDOM in partnership with MEM.

It is important to note that these models are developed as demonstration tools, i.e. although effort is being made to include all relevant features of the two basins, particularly the many existing and planned reservoirs, the outcome of the model is less important for the EWN study than the capacity building aspect.

There is also a SWAT hydrological model available of the Sekong basin, coupled to the HEC-ResSIM model, but this model aims more at the sediment balance of the basin. Other models exist, like the distributed hydrological model VMod, but that was setup with a main focus on the Sesan River[17].

In the present study, we will make use of the two existing HEC models, although it is foreseen that improvements on the modelling calibration will be required given the demonstration purpose of the existing applications. Permission to use the models has been granted by MEM and the models were handed over and explained to the team members of the present project during a mission to Vientiane in the week of 9 July 2018. An in-depth discussion with Guillaume Lacombe of IWMI, who is presently working on an improved version of the HEC-ResSim model, made it clear that the hydrology of the HEC-HMS model, with just 5 years of data, has not yet been evaluated. In the present project, effort will be made to improve on the existing HEC-HMS model by extending the input data series and further calibration of the model. At the same time, a more elaborated version of the HEC-ResSim model will become available from IWMI at the end of August / beginning of September 2018. For this purpose, during the mission of the hydrologist of the project to MRC in July 2018, a request was made to the data base specialists to provide the team with longer time series, preferably in the order of 20-30 years of data, of both meteorological (principally rainfall) and discharge series. Although of limited use, water level series were also requested as they can give at least an impression of the flow regime, despite not giving any quantitative flow information. Once these data have been obtained, a validation of the series will be carried out and effort will be made to prepare a longer input time series as far as data gaps allow and there is sufficient overlap in time between the meteorological and hydrological time series.

## 4.2 Description of Modelling and Assessment Approach

As was mentioned in the proposal, the main purpose of hydrological assessment is to generate inflow series for the Sekong and its tributaries. We had already suggested to either use the HEC-HMS model for the hydrological modelling of the Sekong basin, or make use of measured discharge series from gauging stations,

[16] *Full title: "The Energy-Water Nexus in Lao PDR: Demonstrating Integrated Water Resources Management in the Hydropower Sector"*
[17] *Räsänen, T.A. (2013): Sesan-Srepok-Sekong VMod hydrological modelling report*

and transfer those to various locations in the (sub) basins by correction for the corresponding basin area and annual total precipitation. Now that HEC models are available of the Sekong basin, it is decided to start off from this development and improve them by further data collection and calibration for the purpose of the present project. The present schematization of the HEC-HMS model of the Sekong basin is shown in Figure 4-1. This schematization is still based on the original layout with a limited number of (existing) reservoirs.

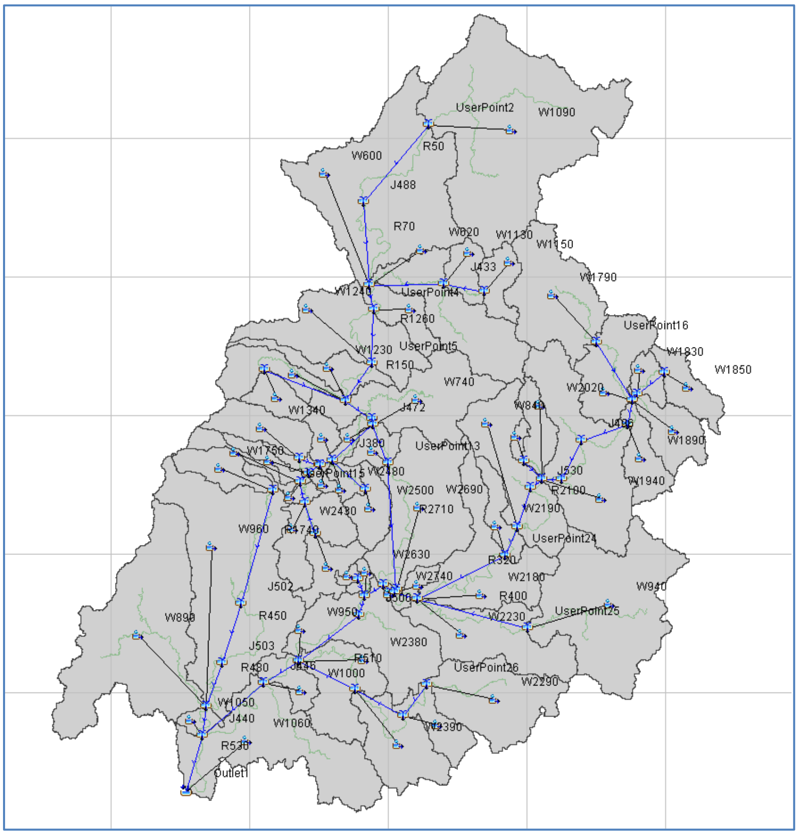


**Figure 4-1:** *HEC-HMS model of the Sekong basin (IDOM, 2014)*[18].

During the Inception phase, this preliminary version of the HEC-HMS model was obtained and the model was reactivated to run despite some initial computer memory problems. The main changes to the model that are foreseen for this project are:

- Extension of the input series from the present 5 years data to preferably 20 – 30 years of data
- Re-calibration of the model
- Redesign of the layout of the model based on the location of existing and planned reservoirs (see below)
- Run the model for both the present and future (climate change affected) situations (see chapter 3.2.3 B).

The output of the HEC-HMS model forms the input for the HEC-ResSim model, which furthermore makes use evidently of all hydropower dam information as well as other characteristics of the basin, particularly other water abstractions that might influence the water availability for hydropower production.

The present state of the HEC-ResSim model is shown in Figure 4-2, showing the various existing and planned reservoirs (in total 23) that are now incorporated in the model. For the present project, it is likely that some

[18] *IDOM (2014): Sub Basin Reservoir Simulation Modelling and Development of the Hydropower Decision Support Planning Tools (HDSPT) – Results and Conclusions Final Report.*

fine-tuning will be necessary for the various hydropower locations. Preparations will also be made to incorporate the impact of climate change on the model forcing data, i.e. the precipitation and the evaporation. The different hydro-meteorological forecasts that come out of this exercise, for the present and various future climate conditions will be combined with the alternative pathway development scenarios proposed under Section 3.1.2, Table 3.1.

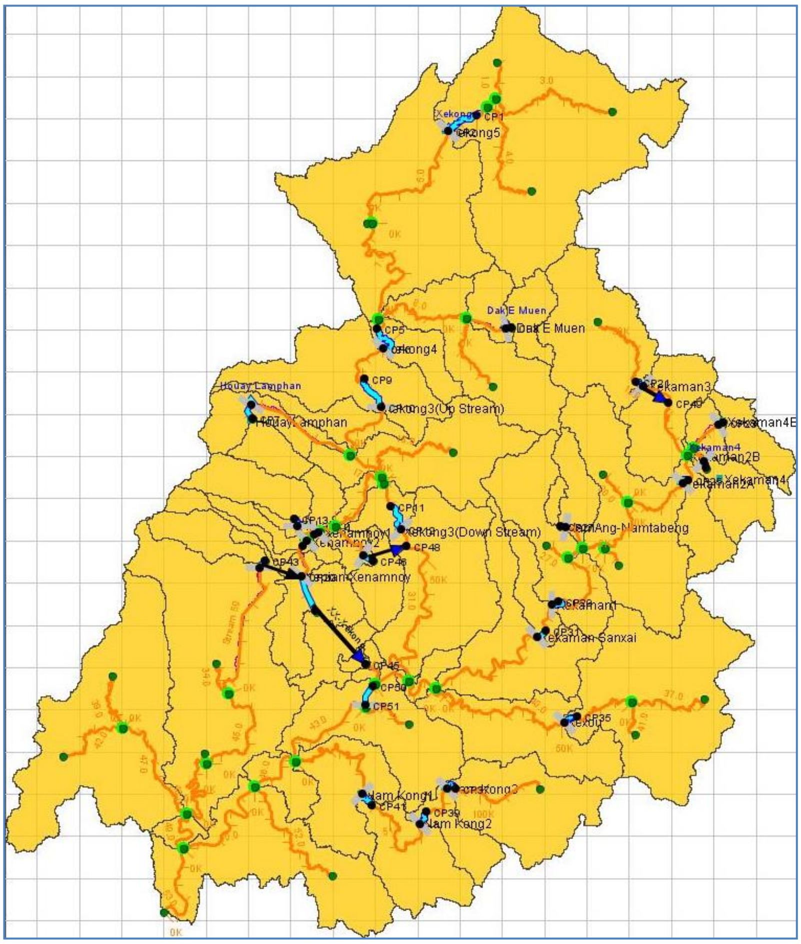


**Figure 4-2:** *HEC-ResSim model of the Sekong basin (version July 2018 - Source: EWN study and IWMI).*

According to the Inception Report of the EWN study, the following activities will be carried out for the HEC-ResSim model improvement:

1. *Model verification and validation: this step will consist in reviewing the parameters of the two watershed set-up collected at MEM DEPP:*
    - *HPPs main characteristics: number and location of dams, rating curves, operation rules (guide curve), power capacity and power functions;*
    - *River network main features: the reaches of the hydrographic network, their connectivity, and the flow routing functions;*
    - *Input data quality: river flow and evaporation time series used as input to the model. Parameterization will be updated wherever necessary and whenever possible.*
2. *Model improvements:*
    - *add new functionalities or properties to the reservoir system to account for different scenarios co-defined with the stakeholders (e.g. additional dams, sluice gates, fish passage);*
    - *set-up constraints (e.g. environmental flows, minimum or maximum river water level, or reservoir water level to be maintained at a given date or period of the year);*
    - *set-up goals (e.g. minimum power production over given time period);*

- *update simulated river flow time series used as input to the model (SWAT simulation provided by MONRE).*

*Subsequently, the objective is to run different configurations of the model to assess the effect of various options on power production and non-power interests*.

As the revised HEC-ResSim model will include all of the proposed reservoirs, a revised layout of the HEC-HMS model will be necessary, with sub-catchments that each represents the inflow to the particular reservoir. For this purpose, the GIS expert has already prepared a new GIS layer with all the existing and planned reservoirs as a basis for the delineation of corresponding sub-catchments (see Figure 4-3). This GIS layer will be used as a basis for the updating of the schematizations, and corresponding input data, of the two HEC models.

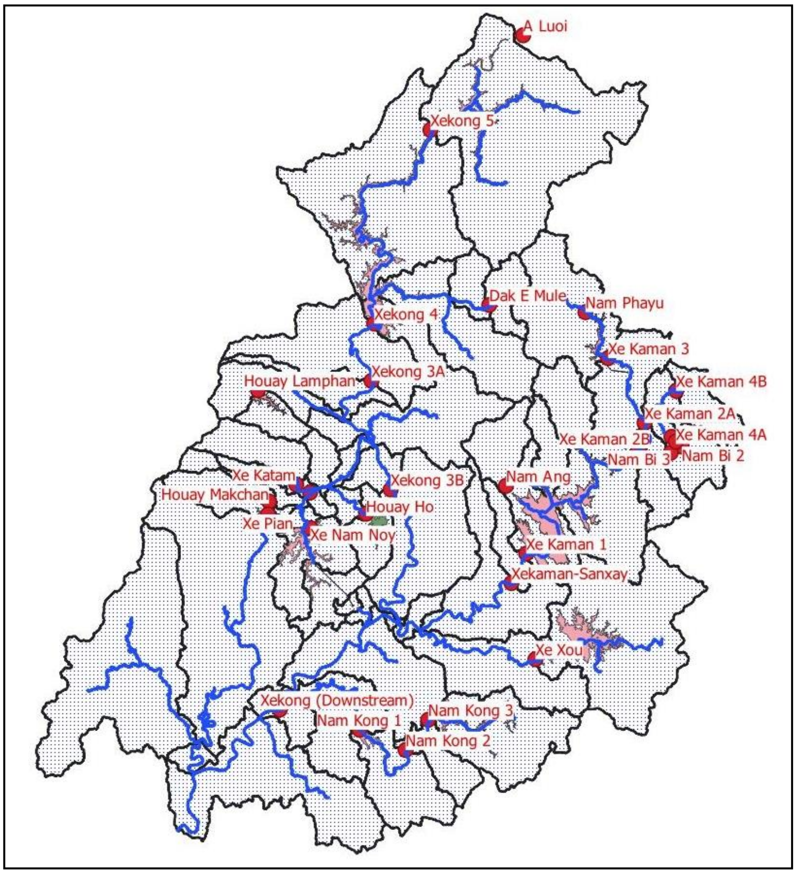



**Figure 4-3:** *Existing and planned reservoirs with corresponding contributing areas (Source: EWN study and IWMI).*

# 5 Stakeholder Participation, Consultation and Disclosure

## 5.1 Stakeholder Engagement Plan

The stakeholder engagement activities will take different forms such as formal meetings and informal group discussions with the different groups of identified stakeholders e.g. to elicit different perspectives vis-a-vis determination of VECs. Teleconferences (skype calls) and email correspondence will also be used to consult with stakeholders not present in the region.

With regard to determining the scoping the 2-day Inception and Scoping Workshop was organised on 23-24th August 2018. Together with stakeholders the final spatial and temporal boundaries and VECs was explored and determined.

In addition to the engagement through the Inception and Scoping Workshop, stakeholders will be consulted on the participatory design of the cumulative impacts basin co-management framework.

Finally, stakeholders will be engaged through regular meetings in the Sekong Basin Steering Committee.

Further stakeholder engagement was also discussed during the Inception and Scoping Workshop, 23-24th August, 2018 and it was agreed that provincial and local level stakeholder consultations should take place in the last week of September followed by an Interim Workshop first week of October, 2018.

As a starting point a review of the consultations already conducted during Inception (Section 5.3) with key stakeholder groups will be undertaken (see Annex 1 for details). In particular, the Consultant will review the outcomes of the stakeholder mapping and consultations hydropower and non-hydropower projects have conducted in connection with their ESIA Studies. Having compiled an overview of the stakeholder identification at project level, the Consultant will apply GIS based impacts zoning to further determine if there are additional communities and groups that potentially will be affected by the cumulative impacts of present and future hydropower development in the Basin. Having drawn up a long list of stakeholders, the Consultant will make a selection of the ones that will be included in the SEP for further consultation end engagement. The selection will be based on an assessment of the degree of impacts and influence as well as on practical consideration such as time and resource constraints.

In addition to setting out the engagement process with stakeholders within Lao PDR the SEP will also outline how stakeholders in Vietnam and Cambodia will be selected, contacted and consulted.

As indicated in the TOR there are three key project activities that in addition to the engagement though workshops and more formal meetings that will require stakeholder consultation: 1) Definition of the VECs and their temporal and spatial boundaries (undertaken in the Inception and Scoping Workshop); 2) Participatory design of the cumulative impacts basin co-management framework, and 3) Collaboration with other initiatives.

Concerning the third key project activity the Consultant has linked up with the EWN Project and will further also to gain an overview of their stakeholder engagement activities, both past and those planned for the future, to see whether it is possible to combine some of the two projects' the consultation events and activities. The Consultant has also liaised with MRC, WWF, IUCN etc., with regard to their past and ongoing activities on the Sekong.

## 5.2 Stakeholder Analysis and Mapping

The stakeholder identification was based on discussions with IFC and meetings with stakeholders during the inception visit that took place from 11th to 18th of June 2018. The main criteria in the stakeholder selection process were:

- Ministries and Departments that are involved in the planning, assessment and permitting process for renewable energy projects and other infrastructure process such as roads and mining projects;
- International NGOs and other international organisations involved in renewable energy projects and other projects such as biodiversity conservation projects;
- Private developers of renewable energy projects in the Sekong River Basin.

The table below lists the stakeholders that has been identified stakeholders so far.

**Table 5-1:** *Stakeholder identified during the Inception Period.*

| Institution | Roles and responsibilities |
|---|---|
| *Financial Institutions* | |
| IFC | Financing Institution / funding and overseeing the implementation of the CIA for the Sekong River basin. |
| The World Bank | Financial institution / funding and overseeing the implementation of the Energy-Water Nexus Project; the Lao-Vietnam Interconnector Project, Mekong- IWRM project. |
| Asian Development Bank | Financial Institution / funding and overseeing a number of energy sector and transportation sector projects in Lao PDR. |
| *Governments* | |
| Office of the Prime Minister | Overall coordination and follow up. |
| Ministry of Energy and Mines<br>• Department of Energy Business (DEB)<br>• Department of Policy and Planning (DEPP)<br>• Department of Energy Management (DEM)<br>• Institute for Renewable Energy Promotion (IREP)<br>• EDL/EDL-GEN<br>• Department of Mines (DOM) | MEM has the overall responsibility for the electricity and hydropower sector in Laos:<br>• DEB: IPP project development<br>• DEPP: Energy policy, power system planning<br>• DEM: Energy regulation and monitoring<br>• IREP: Renewable energy development<br>• EDL/EDL-GEN: Generation, transmission and distribution |
| Ministry of Natural Recourses and Environment (MONRE)<br>• Department of Water Resources (DWR)<br>• Department of Natural Resources and Environment Policy (DNREP)<br>• Natural Resource and Environment Inspection Office (NREI) | Responsible for water resources management, environmental impact assessment processes and issue of environmental permits. |

| Institution | Roles and responsibilities |
|---|---|
| Ministry of Planning and Investment<br>• Department of Planning and Cooperation | Responsible for screening and providing the final approval for foreign investment projects, including energy projects. Coordinates closely with MEM and MONRE. |
| Ministry of Agriculture and Forestry<br>• Department of Forestry<br>• Department of Irrigation<br>• Department of Fisheries<br>• Living Aquatic Resources Research Centre (LARReC) | Responsible for screening and assessing forestry and plantation projects, planning and overseeing irrigation projects and implementing the fisheries law. |
| Ministry of Public Works and Transport<br>• Department of Roads | Plans and implements major road projects. |
| National University of Laos | Involved in research on fish passage. |
| Ministry of Industry and Trade, Vietnam | Responsible for industrial development, including hydropower development. |
| Ministry of Natural Resources and Environment, Vietnam | Responsible for environmental protection, including Environmental Impact Assessment Studies and issuance of environmental permits. |
| Ministry of Industry and Handicraft, Cambodia | Responsible for industrial development, including hydropower development. |
| Ministry of Environment, Cambodia | Responsible for environmental protection, including Environmental Impact Assessment Studies and issuance of environmental permits. |
| *Other International Organisations* | |
| Mekong River Commission Secretariat<br>• Lao MRC Committee<br>• Vietnam MRC Committee<br>• Cambodian MRC Committee | Implements programmes and collects data on the Mekong River Basin. |
| GIZ | Provides support to MRC. |
| National Heritage Institute | Conducts studies on the Mekong River Basin and finalized a report on the Sekong River Basin. |
| IUCN | Works on policy level regarding water resource and biodiversity issues in the region. Conducts studies on the 3S Basins, including the Sekong basin. |
| WWF | Conducts studies and implements biodiversity programmes/projects in Laos and in the region. |
| *Consultants* | |
| CNR | Working for WB on Energy Water Nexus: Nam Ou and Sekong Basins Consultant implementing the EWN Project. |
| IWMI | Working for WB on Energy Water Nexus: Nam Ou and Sekong Basins. |
| ESL | Conducted EIA for Nam Kong 1 |
| Norconsult | EIA consultant for Sekong 5 |
| Lao Energy Engineering Corporation (LEEC) | EIA consultants for Nam Kong 2 and 3 |
| National Consulting Company (NCC) | EIA consultants for Nam Kong 2 and 3, also for Houay Lamphan Gnai |

| Institution | Roles and responsibilities |
|---|---|
| Lao Energy Engineering Sole (LEES) | EIA consultants for Sekong Downstream A |
| *Developers* | |
| Viet Lao Power JSC | Developer for Xekaman 3, Xekaman 1, Xekaman – Sanxai, Xekaman 4 |
| RATCH-Lao Services Co., Ltd. o | Developer for Xepien – Xenamnoy, Xekong 4A, Xekong 4B |
| Chaleun Sekong Energy Co | Developer for Nam Kong 2, Nam Kong 3 |
| China International Water and Electric Corp – CWE | Developer Nam Kong 1, Xekaman 2B |
| VASE Laos | Developer for Dakchaliou 1, Dakchaliou 2 |
| Construction and Investment International Co Ltd | Developer for Houay La Ngea |
| EDL-GEN Public Company | Developer for Nam Bi 1, Nam Bi 2, Nam Bi 3 |
| V & H Corporation | Developer for Sekong - downstream A |
| Asia Investment and Development | Developer for Sekong 3A, Sekong 3B |
| Kaleum Wind Farm | Developer for Xekong Province, Kaleum District |
| Xe-Pian Xe-Nam Noy Power Co., Ltd. (PNPC) | Xe-Pian – Xe-Nam Noy |
| Inter Rao Engineering | Developer for Sekong 5 |
| Impact Energy Asia Co Ltd | Developer for Monsoon Wind Farm |

## 5.3 Overview of Inception and Scoping Visit Consultation meetings

During the Inception Period two missions have been undertaken, with a focus on initial stakeholder consultations. These are summarized in the table below, with more details given in transcripts form the missions in Annex 1.

In the first mission, from the 11th to the 15th of June 2018, the Consultant Team (represented by Jens Johan Laugen and LCG) conducted a number of initial meetings with stakeholders in the Project. In the second mission, during the week of 8 – 15 July 2018, a visit was made to Vientiane and the Sekong Basin by Ron Passchier (hydrologist) and Frederiek Sperna Weiland (climate change expert).

**Table 5-2:** *Summary of stakeholder meetings and mission during the Inception and Scoping Period.*

| Date | Organisation | Remarks |
|---|---|---|
| **First Mission**, 11-15 June 2018 | | Conducted by Jens Johan Laugen and supported by LCG |
| 11 June | Mekong River Commission Secretariat (MRCS) and GIZ | Inform MRCS about the study and receive feedback |
| 12 June | Ministry of Energy and Mines (MEM) | Inform MEM about start up. Agree and consolidate on process and information needs |
| 13 June | Department of Livestock and Fisheries/Division of Fisheries | Inform about the study and receive feedback |
| 13 June | International Water Management Institute (IWMI) | Get information about the EWN study and its modelling efforts. Coordination with the Sekong Basin CIA study |
| 13 June | WWF - Laos | Inform WWF about the study and receive feedback. Gathering of information of relevant WWF activities in the basin |
| 13 June | Department of Water Resources, MONRE | Inform about the study and receive feedback |

| Date | Organisation | Remarks |
|---|---|---|
| 14 June | Department of Natural Resources and Environmental Policy (DNREP), MONRE | Inform about the study and receive feedback. Gathering of information about regulatory issues |
| 14 June | Department of Forestry, MAF | Inform about the study and receive feedback. Gathering of information about agriculture, forestry and other relevant issues |
| 14 June | Department of Planning and Cooperation, Ministry of Planning and Investment | Inform about the study and receive feedback |
| 14 June | Ratch-Lao Services | Inform about the study and receive feedback from a private developer |
| 15 June | IUCN – Laos | Inform IUCN about the study and receive feedback. Gathering of information of relevant IUCN activities in the basin |
| **Second Mission**, 8-15 July 2018 | | Conducted by Ron Passchier and Frederiek Sperna Weiland. Supported by LCG |
| 9 July | IWMI | Follow up of first mission. Coordination between the Sekong Basin CIA and EWN studies, with specific focus on the modelling |
| 10 July | MEM | Meeting with MEM about the HEC-HMS and HECResSim models for Sekong |
| 10 July | MRCS | Discussions about MRC modelling efforts in Sekong as well as availability of MRC data relevant for the study |
| 10 July | MRC Environmental Department | Liaison about MRC environmental initiatives in Sekong |
| 11 July | MRCS CC Initiative | Discussion about climate change (CC) work of MRC relevant for the study |
| 11 – 14 July | Field Trip to the Sekong Basin | Visiting the Sekong Basin and various relevant areas and sites (see Figure 5.1 for route) |
| **Third Mission**, 21-25 August, 2018 | Scoping mission | Conducted by Leif Lillehammer. Supported by LCG |
| 23-24 August | Inception and Scoping Workshop | Presenting and discussing the Inception And Scoping Report results and agreement with stakeholders on spatial/temporal boundaries and VECs |

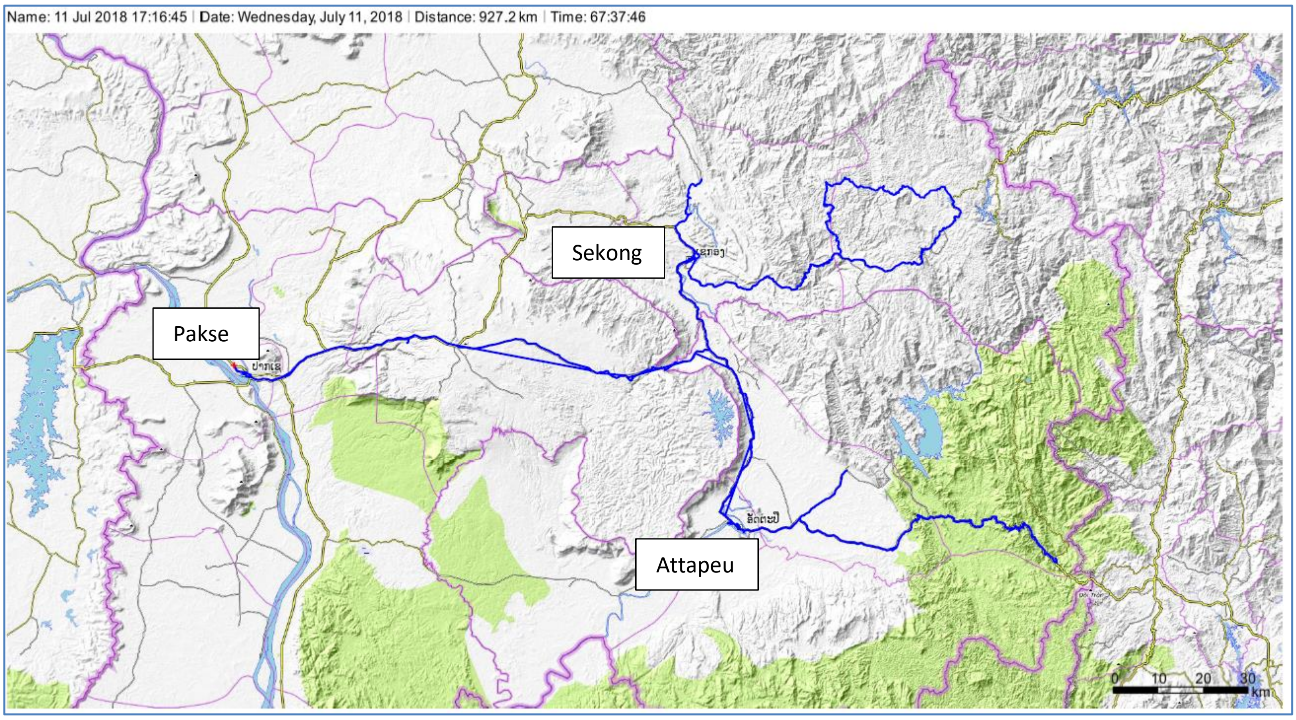



**Figure 5-1:** *Route of the fieldtrip during mission of 8 – 15 July 2018.*

# 6 Detailed Methodology – Scoping and Main Phase

## 6.1 Overall Project Process and Implementation

The Inception Phase was initiated on the 11th of June 2018 with meetings with the above ministries and international organisations, and followed due by the second mission in July. Based on discussions with IFC the work schedule has been revised. In the following an overview of important project milestones and deliverables in the revised work schedule is presented:

## Milestones:

**Objective 1: Integrated Cumulative Impact and Power Optimization Assessment**

| | |
|---|---|
| 1: Delivery of Draft Inception Report | 2 July |
| 2: Inception / Scoping Workshop | 23-24 August |
| 3: Final Inception and Scoping Report | 5 September |
| 3: Draft Interim Report | 25 September |
| 4: Draft Interim Report Workshop[19] (possibly in Sekong area) | Week of 1 October |
| 5: Final Interim Workshop Report | 15 October |
| 6: Draft Integrated CIA and Power Optimisation Report | 19 November |
| 7: Draft Integrated CIA and P. O. Report Workshop | 10 December |
| 8: Final Integrated CIA and P. O. Report and Works. Summary | First week of 2019 |

**Objective 2: Sekong Basin Cumulative Impact Co-Management Platform**

| | |
|---|---|
| 9: Draft Framework Report | 21-22 January 2019 |

**Objective 3: Capacity Building**

| | |
|---|---|
| 10: Workshop - Key CIA Issues | Week starting with 21 January 2019 |
| 11: Workshop - Proposed Sekong Basin Platform | Week starting with 18 February |
| 12: Workshop - Power Optimization Assessment | Week starting with 25 February |

**Final Reporting, Stakeholder meetings and Dissemination of Findings**

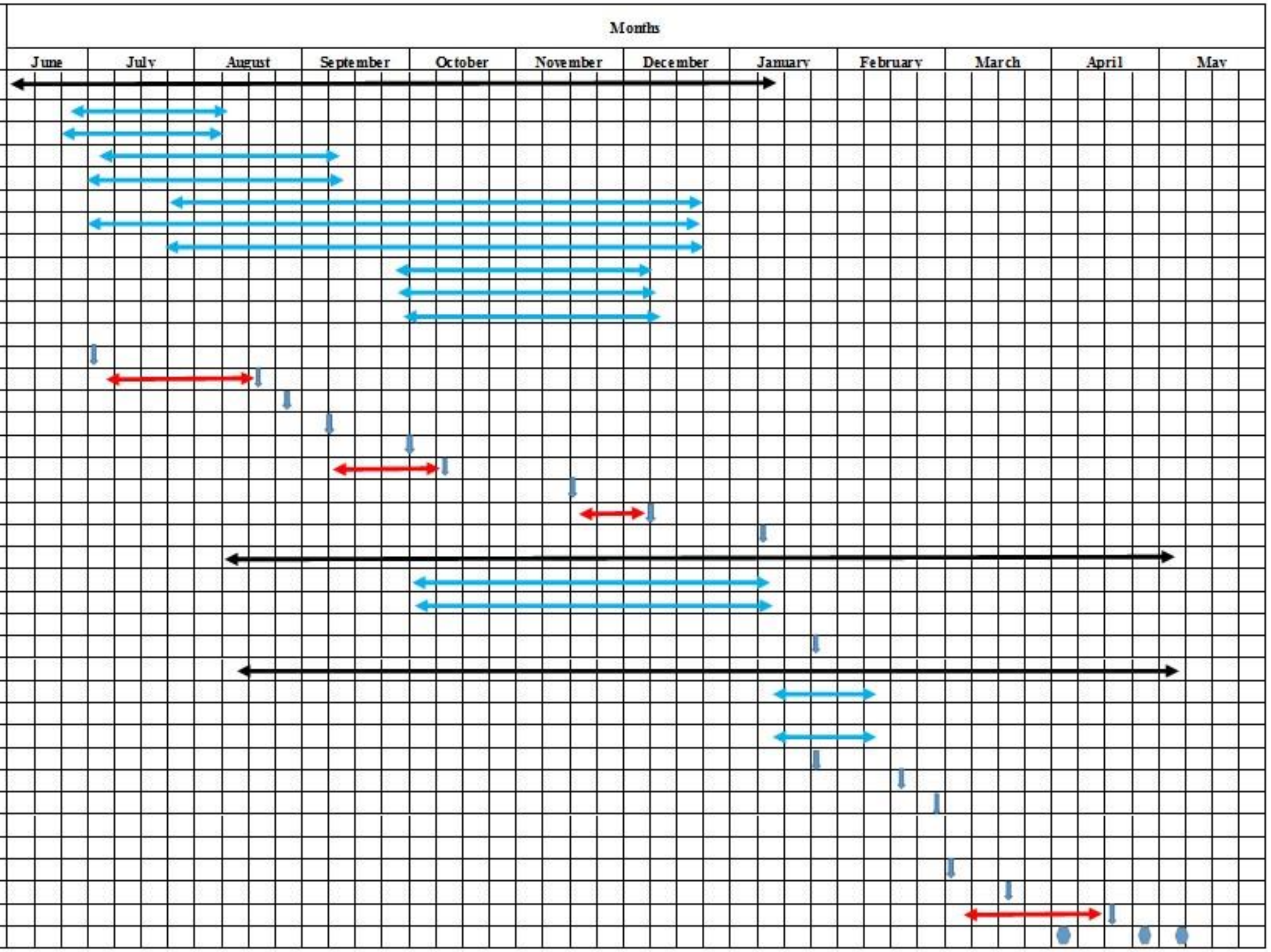
| | |
|---|---|
| 13: Draft Final Objective 1 and 2 Report | Week starting with 25 February 2019 |
| 14: Workshop - Presentation of Findings | Week starting with 18 March |
| 15: Final Stakeholder Meetings and Dissemination (x3) | Week starting with 1 April and following weeks (after Pi Mai?) |
| 16: Final Report | Week starting with 15 April |

The revised work schedule chart is presented overleaf.

[19] *Week of 24th September planned stakeholder consultation in Sekong Basin.*

**REVISED WORK SCHEDULE**

| | No. | Activity |
|---|---|---|
| Objective 1 | *Integrated Cumulative Impact and Power Optimization Assessment* | |
| | Task 1A | Review the Regulatory Framework |
| | Task 1B | Scope the Cumulative Impact Assessment |
| | Task 1C | Scope Activities and Environmental Drivers for the Base Case Scenario |
| | Task 1D | Determine Present Conditions of VECs |
| | Task 1E | Assess Cumulative Impacts of the Base Case Scenario |
| | Task 1F | Collaborate in Dev. Power Gen.Scenarios for the Sekong River Basin |
| | Task 1G | Assess Cumulative Impacts from the Scenarios |
| | Task 1H | Design Cumulative Impact Management Measures and Monitoring Plans |
| | Task 1I | Provide Rec. to Reduce Cumulative Impacts and Optimise Power Gen. |
| | Task 1J | Coordinate Data Management and Mapping |
| | *Deliverables* | |
| | D1 | *Draft Inception Report* |
| | D2 | *Inception and Scoping Workshop* |
| | D3 | *Final Inception Report* |
| | D4 | *Draft Interim/Objective 1 Report* |
| | D5 | *Interim Report Workshop* |
| | D6 | *Final Interim/Objective 1 Report* |
| | D7 | *Draft Intergrated CIA and Power Optimization Report* |
| | D8 | *Draft Intergrated CIA and Power Optimization Report Workshop* |
| | D9 | *Final Intergrated CIA and Power Optim. Report and Workshop Summary* |
| Objective 2 | *Sekong Basin Cumulative Impact Co-Management Platform* | |
| | Task 2A: | Design the Fr.work for a Sekong River Basin CIA Co-Managem. Platform |
| | Task 2B | Facilitate Harmon.of Data Managm, Mapping and Report Protocols |
| | *Deliverables* | |
| | D10 | *Draft Framework/Objective 2 Report* |
| Objective 3 | *Capacity Building* | |
| | Task 3A | Build the Capacity of Government and Private Developers in CIA |
| | Task 3B | Make Recomm. on Improvements to Lao PDR's Draft CIA Guidelines |
| | *Deliverables* | |
| | D11 | *Workshop - Key CIA Issues* |
| | D12 | *Workshop - Proposed Sekong Basin Plantform* |
| | D13 | *Workshop: Power Optimization Assessment* |
| Reporting and Disclosure | *Final Reporting, Stakeholder meetings and Disemination of Findings* | |
| | *Deliverables* | |
| | D7 | *Draft Final Objective 1 and 2 Report* |
| | D8 | *Workshop - Presentation of Findings* |
| | D9 | *Final Report* |
| | D10 | *Final Stakeholder Meetings and Disemination* |




## 6.2 Integrated Cumulative Impact and Power Optimization

**Task 1C - Scope Activities and Environmental Drivers for the Base Case Scenario**

According to the ToR, the following existing, proposed and likely future developments and other natural and social stressors will be included in the Base Case Scenario:

- Medium- and large-scale hydropower projects
- Small hydro, wind, solar and hybrid power projects
- Large-scale mining, forestry and agriculture
- Other natural / social stressors in the Sekong River Basin
- Known or likely transboundary issues from the Sekong River or adjacent river basins in Lao PDR, Cambodia and Vietnam.

These and possible other developments and stressors that may affect the VECs in the Sekong River basin will be discussed and agreed upon in collaboration with MEM. For each of these developments and projects the following information will be collected:

- Location and time period over which the construction / operation will take place;
- Nature of the project or development (e.g. vegetation clearing, construction methods, operational activities etc.), with a distinction between phases (construction, operation and maintenance, decommissioning, rehabilitation);
- Associated infrastructure, such as roads, power lines, pipe lines etc.;
- Proposed safeguards and mitigation measures;
- Description of the local and regional socioeconomic conditions with likely trends in order to define plausible future developments in agriculture, mining, forestry, energy etc. and future demands on natural resources (land, water etc.).

Maps and infographs will be used to illustrate the base case scenario in a suitable way to facilitate discussions with the stakeholders.

**Task 1D) Determine Present Conditions of VECs**

The objectives of this task will be to establish as precisely as possible the existing condition of VECs that have been selected for analysis. This will provide the basis for assessing trends and predicting the VEC's resilience in response to stress and change. Key issues in this connection will be to what degree relevant information is available and what kind of indicators should be used for the assessment of the present condition.

The Consultant will during the scoping work closely the Client, MONRE and MEM to establish the whole body of information available for the Sekong River Basin. In particular a review of all ESIAs conducted previously across the Sekong River Basin, including any cumulative impact assessments carried out as a part of these studies, will be conducted. In addition all other reports, studies and surveys carried out within the basin will be reviewed and used as a source for consolidating all available and relevant baseline data with regard to the identified VECs.

Having scoped and consolidated the available information on the VECs a gap analysis of the available information will be carried out to assess whether it is robust enough to proceed with the cumulative impact assessment on this basis. If the baseline information is considered to have too many gaps informed estimates will be generated to address the critical data deficiencies. Other possible ways to fill the gaps will be considered and proposed for the consideration of the Client. In case it is decided that further collection of baseline data information is necessary, it will be focused on the most important VECs and targeted to indicators that would allow determination of any changes in VEC conditions. If it is determined that the available information is sufficient to establish the natural range of variation of the VECs' the baseline conditions will be used to assess the cumulative impacts by comparing it to the estimated future state of the VECs.

In addition to establishing the present conditions of the VECs a quick analysis of the trend of changes will be undertaken to assess whether the VECs may be approaching a critical threshold level after which the response to additional impacts may change abruptly.

The output of this task will be clearly defined VECs defined in terms of their existing condition of VECs along with an assessment of their potential reaction to stress, resilience and recovery times.

**Task 1E) Assess Cumulative Impacts of the Base Case Scenario**

According to the ToR this task should assess cumulative impacts from the Base Case Scenario (see Chapter 3.1.2 and Table 3.1 for details of the Base Case Scenario) and evaluate their significance over VEC's future conditions. It includes:

- Consider past, present and future environmental and social impacts and the potential range of environmental variation that may influence VECs' conditions - not solely on expected average conditions (e.g. change in climate patterns and/or predictability).
- Identify and describe potential transboundary impacts.
- Assess significance of known and anticipated cumulative impacts, including the efficacy of existing mitigation, monitoring and management efforts.
- Determine anticipated residual cumulative impacts for the Base Case Scenario.

***Network Analysis method***

To assess the cumulative impacts of activities and developments described in the Base Case Scenario we will follow the network analysis method [World Bank, 2014]. An example of a network for hydropower cascades is depicted in Figure 6.2, from a study on small hydropower cascades on tributaries of Red River Vietnam. The main components of an impact pathway network analysis are explained as follows:

- ***Causes*** – Stressors or drivers that impact on the environment at large. These can be for instance a hydropower cascade; a wind or solar power park; related power transmission lines and roads; water demand for irrigation; forest extraction; resource extraction; and industrial/agricultural activities. See also stressors mentioned under task 1C, taken from the ToR.
- ***Primary Impacts*** – Direct impact of the development, often physical in nature.
- ***Secondary impacts*** – Effects of the primary impact. Secondary impacts in turn impose effects on the receptor/VECs.
- ***Receptors*** – These are the VEC's in its widest sense discussed in Sections 3.1.2 and 3.1.3.

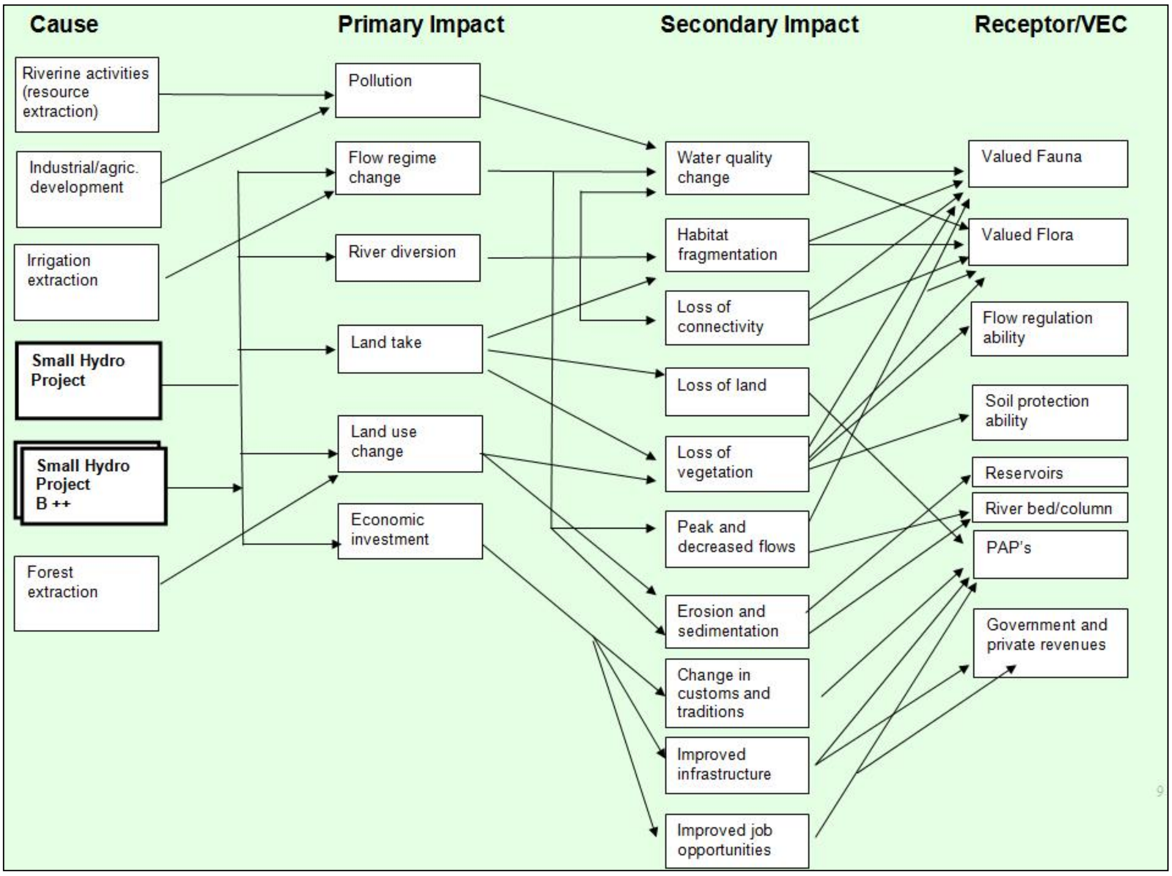



**Figure 6-1:** *Example of a cause-effect network for hydropower cascades (Source: World Bank, 2014, Marchand et al. 2014).*

From the example given in Figure 6.1, note that some pathways can lead to positive impacts (e.g. economic investment on government and private revenues), while others lead to negative impacts (e.g. land take can lead to habitat fragmentation negatively impacting valued flora and fauna). From this analysis it will also become clear that various impact pathways will have concerted or aggregated impacts on a single receptor. From the example given in Figure 6-1, we can for instance deduct that aquatic fauna (e.g. various fish species) are impacted by changes in water quality, habitat fragmentation, loss of connectivity as well as peak and decreased flows. The latter even have a feedback loop on water quality (not portrayed in the pathway framework), that can further exacerbate the negative impact on the ecosystem. This will also be analysed for the Sekong with its stressors, impact pathways and VEC's.

With respect to the physical impacts of the hydropower development we will perform a detailed hydrological assessment and an erosion, sediment transport and water quality assessment.

**Task 1F) Collaborate in Developing Power Generation Scenarios for the Sekong River Basin**

The Consultant has linked up with the Energy-Water Nexus (EWN) Project consultant team during the inception phase to establish a detailed understanding of the scope, tasks and objectives of the EWN Project and its objectives and review the reports so far. Our TOR lists the following elements that will be covered during the EWN study:

- Establish an understanding of the Government's overall vision, power planning and sustainable development objectives for the Sekong River Basin;
- Identification of key criteria and parameters for identifying and analysing power generation scenarios which minimize cumulative impacts whilst still meeting the vision/goals;
- Identification and characterisation of non-power interests in the Sekong River Basin and specification of planning objectives with respect to (cumulative) environmental, social and economic interests;

- Identification of integrated river basin development options using scenario analysis, with the focus on renewable energy;
- Conducting trade-off analysis among the possible scenarios, across technical, financial, economic, social and environmental objectives using multi-criteria decision tools;
- Identification of a shortlist of two or three scenarios, covering a range of options / combinations for development of the Sekong River Basin, including hydropower on the mainstream and/or tributaries of the Sekong River.

One aspect of the current development projects makes this a challenging task in terms of hydro diplomacy. It is understood that the projects will supply into the power systems of three different countries; Xe Kaman projects mainly to Vietnam, Upper Xe Kong (Sekong) projects to Thailand and the remainder to the EDL power system in Laos. There are therefore certain domestic and international interests involved, and the Consultant will take these into consideration when addressing cumulative impacts and proposing associated mitigation measures.

We know from experience (for example the Nam Theun projects) that the Thai system uses hydropower for hydropeaking, and it is possible that the Vietnam system will do the same. Even if there is a well-planned operation mode where outflow variations over the day for an upstream plant are rebalanced by a downstream reservoir, there might be considerable hour by hour flow variations in many river reaches below the hydropeaking plants.. The actual plants to be dispatched from the Thai and Vietnamese power system operators need to be identified, and the degree of intended hydropeaking established. It may be possible to discuss with the project developers the impact of certain environmental restrictions (e.g. on ramping rates) to evaluate in which degree this affects project economics.

The consultant will also identify and locate specific non-power interests in Sekong River Basin (e.g. NBCAs, plans for road construction and river crossings, irrigation abstractions, riverbank agriculture, mining etc.). A GIS database will assist in identifying and analysing conflicting interests and how to accommodate all of them in a compromise proposal through conducting trade-off analysis. An example of simple multi-criteria analysis of trade-offs is given in Table 6-1.

**Task 1G) Assess Cumulative Impacts from the Scenarios**

The objective of this task will be to identify the key potential impacts and risks caused by the selected scenarios (see Chapter 3.1.2 and Table 3.1 for the selected scenarios) that in aggregate may affect the long-term sustainability of the VECs.

The consultant will apply the VEC centred approach to cumulative impact assessment as described and illustrated in the figure overleaf, by usage also of the network analysis described in Task 1F. The right hand side of the figures with projects and indirect impacts represent the scenarios while the left hand side represents non-hydropower stressors and drivers that adds to and interacts with the effects of the hydropower development projects.

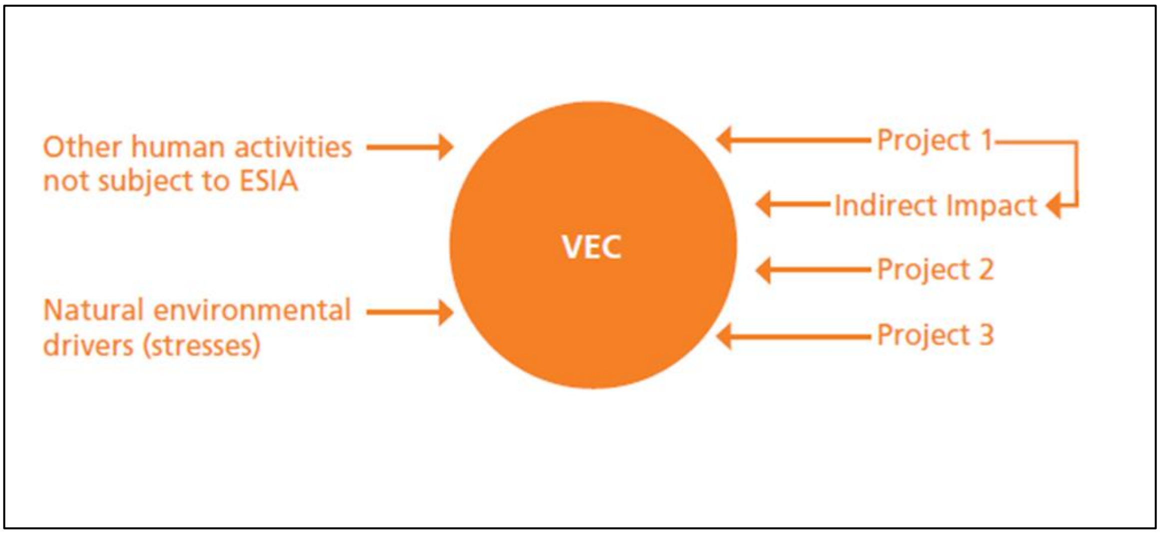



**Figure 6-2:** *The VEC Centred Approach for Cumulative Impact Assessment (Source: IFC, 2013).*

The Consultant will follow a systematic approach to the cumulative impact assessment by combining the baseline "value" of the selected VEC identified under Task 1B, assessing the predicted pathways (drivers, stressors, primary and secondary impacts) as well as relative "magnitude" of impacts to arrive at an overall impact rating (from large negative to large positive) of the VECs.

The cumulative impact assessment will start with taking the selected scenarios as a point of departure which incorporates the past, present and predictable future hydropower development projects in the region. For the assessment the most appropriate combination of evaluation tools and methodologies will be applied which will include but not be limited to:

- *Checklists* to systematically identify all stressors that are likely to result from the scenarios;
- *Spatial Analysis* and use of Geographical Information Systems (GIS) and overlay maps to identify where the cumulative impacts of may occur and areas where impacts will be most significant;
- *Network and Systems Analysis* in order to identify links and interaction pathways between individual VECs that are affected by the combined effects of the scenarios;
- *Carrying Capacity Analysis* to assess the cumulative impacts of the scenarios against identified or assumed carrying capacity or sustainability of the VECs

Finally, the cumulative impact assessment will take into consideration the full potential range of environmental variation, such as climatic that may influence the condition of the VECs and not only focus on the expected average environmental conditions.

**Task 1H) Design Cumulative Impact Management Measures and Monitoring Plans**

The Consultant will carefully analyse the outcomes of the assessment of cumulative impacts of the scenarios described in Task G. Having fully understood the impacts in the context of other non-hydropower projects and natural drivers that affect the VECs, the Consultant will embark on the formulation of designing cumulative impact management measures and monitoring plans.

The consultant will proceed in the following manner to identify realistic and practical mitigation measures, also by usage of the mitigation hierarchy (avoidance, minimization, compensation). Avoidance also cater for spatial configuration of hydropower portfolios as outlined in the prioritization scenario discussed in Chapter 3.1.2 as well as discussed by Schmitt et al. 2018r:

- Step 1: As an initial step review already existing project specific mitigation and monitoring plans that have been prepared in the ESIA Studies for the various projects in the Sekong River Basin, both hydropower and non-hydropower;
- Step 2: The next step will be to identify gaps in the existing mitigation plans and measures in relation to the cumulative impacts resulting from the selected hydropower development scenarios;
- Step 3: On the basis of the gap analysis additional and complementary mitigation measures will be identified and divided into two groups, those that can be implanted at individual project level and those that will require coordination and cooperation amongst first and foremost the hydropower project developers but also non-hydro project developers if relevant. Examples of Mitigation activities that can be implemented at single project level is preservation of downstream aquatic habitats by release of a sufficient amounts of environmental flow. Examples of mitigation measures that will require concerted action and cooperation by hydropower project developers is sediment flushing operations and hydropower plan operation modalities to dampen floods. In the MRC Hydropower Mitigation Guidelines (MRC, 2018), joint flow releases and joint flushing has also been discussed as a possible basin scale mitigation measure for the 3S system, to maintain some of the 3S, Tonle Sap, Mekong Delta pulse, both for sediment transport and fish migration that finally is important for livelihood.
- Step 4: Having identified possible mitigation measures they will be tentatively costed and a matrix indicating the timing of mitigating interventions along with assignment of implementation responsibility, whether individual or collective, will be prepared.

The identification of collective measures and implementation responsibilities will link up to the design of a framework for a Sekong River Basin cumulative impact co-management platform to be undertaken as Task 2A.

With the mitigation measures for the cumulative impacts in place the Consultant will move on to prepare a monitoring plan that mirrors the identified measures. The monitoring plan will identify and propose the following elements:

- Identification of the geographical scale of the monitoring, considering the trans-border nature of the Sekong River basin as well as the nature of the impacts and VECs that are being monitored;
- Identification of indicators against which the magnitude and significance of impacts can be gauged and traced over time;
- The frequency of monitoring activities and appropriate time-frame for the monitoring programme taking into consideration that some impacts may not be immediately apparent;
- Identification of the parties / stakeholders that will carry out the monitoring activity and whether the responsibility should be assigned to an individual party or it should be shared.

**Task 1I) Provide Recommendations to Reduce Cumulative Impacts and Optimise Power Generation**

### Conduct multi-criteria comparative analysis

The results of the integrated CIA report should be available before attempting this analysis. The objective of this sub task is to make a systematic, understandable and fair comparison between project portfolio proposals based on several criteria. At this early stage we envisage a two dimensional "tabular" approach as illustrated in Part 3 B of the World Banks Guide to Needs Assessment (see Table 6.1).

**Comparison of Regional Government-Sponsored Alternatives for Providing Temporary Shelters after a Natural Disaster**

Ratings: 1–2 = very low, 3–4 = low, 5–6 = medium, 7–8 = high, 9–10 = very high

| | **Criterion 1 rating** Speed in meeting needs | **Criterion 2 rating** Affordability (per unit) | **Criterion 3 rating** Quality of the shelter | **Criterion 4 rating** Durability (up to 12 months) | **Criterion 5 rating** Ease in coordination | ***Sum of weighted ratings*** |
|---|---|---|---|---|---|---|
| Weights | .30 | .20 | .15 | .15 | .20 | |
| **Alternative 1** Canvas tents (small, per family) | 9 × .30 = **2.70** | 7 × .20 = **1.40** | 3 × .15 = **0.45** | 2 × .15 = **0.30** | 9 × .20 = **1.80** | 6.65 |
| **Alternative 2** Canvas tents (large, 4–6 families) | 7 ×.30 = **2.10** | 9 × .20 = **1.80** | 3 × .15 = **0.45** | 2 × .15 = **0.30** | 9 × .20 = **1.80** | 6.45 |
| **Alternative 3** Construction of temporary wooden structures | 4 × .30 = **1.20** | 5 × .20 = **1.00** | 6 × .15 = **0.90** | 7 × .15 = **1.05** | 5 × .20 = **1.00** | 5.15 |
| **Alternative 4** Trailers, prefabricated | 4 × .30 = **1.20** | 1 × .20 = **0.20** | 9 × .15 = **1.35** | 10 × .15 = **1.50** | 2 × .20 = **0.40** | 4.65 |

**Table 6-1:** *Multi Criteria Analysis Table Example (Weighted Criteria).*

For this CIA study we envisage the columns for individual criteria to be represented by each VECs subject to a CIA analysis, while the rows of alternatives will be alternative scenarios / combinations of cascades of hydropower projects designed to provide a specific annual energy output (in GWh p.a.). Each box will be filled out with a score according to the degree of cumulative impact on each VEC in turn. Whether weighting is adopted or not, will depend on whether the increased complexity of weighting will be agreed with the Lao authorities and IFC.. Absence of weighting implies only that each VEC is considered equally important with no priority before other VECs.

In essence, this exercise will attempt to answer the question "What is the optimal scenario for obtaining a specified amount of hydropower energy from the basin with the least negative cumulative impact on the selected VECs. A lot of expert judgement is involved in assessing the CIA impact scores, and most of the consultant experts will participate in setting comparative scores. Figures for annual energy output from each individual project must be available to us.

### *Determining the economic efficiency of each project*

Approximate project costs and energy production values will be used in the multi-criteria analysis to determine which projects provide the lowest energy cost. In order to do this we rely primarily (but not exclusively) on cost estimates and energy estimates provided by the developer, but it is not expected that all will provide such costs. Multiconsult will attempt to bring any cost figures into a comparative cost level (for example 2016 prices) by adjusting for currency variations and inflation from the dates of the various estimates received.

A very approximate cost review will be done to see whether any cost estimates given to us do not conform to expected pricing in international competitive bidding situations. This will be based on information from the Nam Ngiep 2 project study which includes cost estimates with price level October 2011, and any other comparable cost estimates made available from recent projects in Laos.

The energy production figures from each project modelled in the HEC- ResSim model are expected to be most relevant and will be compared with whatever figures the developers provide. Once the probable energy production potential for each project has been ascertained at a comparable level for each project, simplified parameters will be used to determine the unit cost of energy delivered by each project. In the case of projects designed for peaking operation, this may not be the most interesting parameter to evaluate each project's value in the different power systems (Lao, Thai and Vietnamese). We may have to improvise in order to give a fair comparison of each project's fair value to each power system. For example we may have to include cost / MW peak capacity for projects providing peaking capacity, and develop a weighting technique between MW peak capacity, firm energy and random energy in order to provide fair comparisons of each project's "economic efficiency". Until the project cost and energy data has been received (ideally in terms of data given in terms of payment from each PPA - which we are unlikely to obtain) it is not possible to describe exactly how we intend to approach the project comparisons in terms of project economics.

We may have to accept that many projects will not have any reliable cost data released to us, and use of "energy value" or "economic efficiency" parameters in comparisons may be limited due to such lack of data.

The GIZ financed Vietnam Power Development Plan for 2011-2020 has been downloaded and reviewed. The projected figures for the expected energy demand and generation mix in 2030 are the most relevant time horizon for our study. Although it is expected that installed hydropower capacity in Vietnam will have reached 27 800 MW by 2030, it is implied that this figure comprises only projects in Vietnam and does not include any projects in the Sekong delivering power to Vietnam. Hydropower is nevertheless only 17% of the installed capacity in Vietnam expected in 2030 with the majority of supply coming from coal and gas-fired thermal. One planned nuclear reactor is also included. The plan also includes 12 000 MW of solar PV and 6000 MW of wind power in the same year. All of these figures point to the role of hydro in the Vietnamese system becoming similar to that of Thailand, i.e. providing peaking power for a few hours each evening during peak system load, or balancing short term variations in intermittent supply from solar PV and wind-farms. It is therefore assumed that the intended operation of the hydropower schemes designed for export to Vietnam will be based on expected peaking operation with short term (hourly) variations in output, and with resultant environmental consequences for the river below each hydropower station. This situation needs to be discussed with the Vietnamese developers, as is also the case for the Thai developers.

***Recommend optimal power generation with minimal cumulative impacts***

The recommendation will normally be based on the results of the above analysis.. The above approach is a tool for making systematic comparisons weighing economic benefits against cumulative impacts for each scenarios, eventually coming up with an agreed and recommended project portfolio.

### Task 1J) Coordinate Data Management and Mapping

For many of the different tasks in the Integrated Cumulative Impact and Power Optimization Assessment (Task 1I), assembled information on key features of the Sekong basin, as well as many assessment results will be stored and illustrated as maps. Depending on commonly used GIS software and database applications in Lao DPR, a database with spatial data on the basin features will be developed. It will be investigated which database and GIS application is selected to be used in the CMC project in order to ensure compatibility in easy data exchange, as well as harmonize data management, mapping and reporting protocols right away. The consortium has experience with working with the most popular GIS software (e.g. ArcGIS, QGIS or webGIS applications) and associated database applications (e.g. PostGIS / PostGreS), and will advise to optimize/balance the solution to the information needs identified. As such, we often advise to keep the geodatabase cost-effective and as simple as possible, suited for the tasks it should perform. As an example, in many circumstances file-based spatial databases (e.g. Shapefiles or GeoTiffs) are perfectly suited to get the job done in a very cost-effective and sustainable way. Further, these data formats are directly compatible with the main modelling software used in the assessment. Using OGC data formats ensures or improves long-term compatibility with other information systems in or outside Lao DPR.

## 6.3 Sekong Basin Cumulative Impact Co-Management Platform

**Task 2A) Design the Framework for a Sekong River Basin Cumulative Impact Co-Management Platform**

The Consultant will from the start of the assignment link up with the Hydropower Developers Working Group and the Sekong River Cumulative Impact Assessment Project Steering Committee[20]. Through constructive engagement and discussions with all relevant stakeholders the Consultant will lead in the participatory design of a framework for a Sekong River Basin Cumulative Impact Co-Management Platform. The key outputs of this activity will be:

- Defining the key features of the Platform, including a governance committee, institutional arrangements data collection/sharing protocols, privacy/confidentiality arrangements, standard operating procedures and plans for implementation;
- A proposal for institutional and financial mechanisms to support co-management of common environmental and social challenges, impacts and risks;
- A proposal for how to build an ongoing or periodic process of power optimization and CIA into the Platform's framework, in order to manage participatory planning for future basin development projects;

The design of the Platform will also involve investigating options for linking into past and present cross-border collaboration initiatives involving the Sekong and adjacent Sesan and Sre Pok River Basins. Piloting approaches and learning lessons to inform broader integrated management planning at basin level in Lao PDR will also be an important part of this activity.

The platform will be developed through iterative consultations with the MEM, IFC and other selected stakeholders agreed with MEM and IFC.

**Task 2B) Facilitate Harmonization of Data Management, Mapping and Reporting Protocols**

The consortium will develop protocols and guidelines on long-term data collection, storage and analysis on different (spatial) data sources available on the Sekong Basin. These protocols and guidelines will include on request specifications for ICT-hardware such as servers and networking, data collection and subsequent sharing protocols, including the importance of well-kept metadata, incl. attention for privacy and Confidentiality issues. Standardized mapping and reporting templates will be designed, in order to make high-quality professional maps and uniform reporting. The consortium is aware of the importance of intensive collaboration with the Mekong River Basin CMC, specifically for data management, mapping and reporting protocols and will take an active role in pursuing an effective working relation.

## 6.4 Capacity Building

**Task 3A) Build the Capacity of Government and Private Developers in CIA and Basin Co-management through Workshops, Seminars and on-the-job Training**

The Consultant will initially arrange and facilitate a 2-day Project Training Workshop for key stakeholders. Stakeholders that will be invited will include but not limited to:

[20] *This was actually undertaken during the first mission in June 2018.*

- Ministry of Energy and Mines (MEM) / Department of Energy Business;
- Ministry of Natural Recourses and Environment (MONRE) / Department of Environmental and Social Impact Assessment;
- Ministry of Agriculture and Forestry;
- Ministry of Planning and Investment;
- Ministry of Information, Culture and Tourism;
- Ministry of Labour and Social Welfare;
- Ministry of Public Health;
- Ministry of Industry and Commerce;
- Ministry of Public Works and Transport;
- Department of MEM at provincial level (Sekong and Attapeu provinces);
- Department of MONRE at provincial level( Sekong and Attapeu provinces);
- Representatives for hydropower project developers in the Sekong River Basin;
- IFC/World Bank Office in Vientiane;
- National University of Lao;
- Mekong River Commission;
- Sekong Basin CIA Coordination Committee.
- Sekong IPPs
- Reps from HDWG Lao PDR.

The first day of the workshop will present the project for the stakeholders, including project objectives work-plan and information requirements; etc. The second day will focus on the capacity building for the stakeholders and the needs for cumulative impact assessment based on the recommendations set out in the IFC's Good Practise Handbook and other applicable approaches.

The approach for delivering the messages and disseminate information will be presentations with subsequent ample time for discussions and questions. The capacity building seminar to be held the second day will mainly be conducted with relatively short introductions about cumulative impact methodology, impact analysis and understanding of the practical implications of the cumulative impact assessment outputs. A special emphasis will be given to identification of possible mitigation measures to reduce the impacts on VECs to keep effects within the limits of their carrying capacity. The short presentations will be followed by group work sessions to engage participants in constructive analysis and discussions around the presented main cumulative impact analysis topics.

Based on the workshop outcomes and stakeholder interviews during the scoping the Consultant will prepare a Capacity Building Plan focusing on the key stakeholders and the most important issues within a cumulative impact assessment perspective. The Plan will include provisions for simultaneous interpretation for all capacity building sessions and for translation of all final materials from English to Lao.

After completing the cumulative impact analysis part of the Project, the Consultant will develop and deliver a series of three 2-day capacity building sessions with key stakeholders. The sessions will relate directly to the issues identified in the cumulative impact assessment as a result of the hydropower development scenarios that have been analysed. The sessions will include but not necessarily be limited to:

- Key issues emerging from the CIA;
- Orientation to the Sekong River Basin Cumulative Impacts Co-Management Platform, and;
- Integration of power optimization into CIA for sustainable hydropower planning.

Whenever possible the workshop issues and messages will be formulated as realistic cases that workshop participants have to work on to gain an understanding of the practical consequences in terms of potential strategies for mitigation and co-management in the Sekong River Basin.

Suggested workshops and training, with dates, is outlined in Section 5.2.

**Task 3B) Make Recommendations on Improvements to Lao PDR's Draft CIA Guidelines Based on the Experience from the Sekong River Basin**

Throughout the project implementation the Consultant will evaluate and take note of the experiences that are made with respect to engagement of stakeholders, the determination the VECs and assessment of cumulative impacts. Towards the end of the project implementation the Consultant will revisit and review in detail the Draft Cumulative Impact Assessment Guidelines for Hydropower Project in the Lao PDR to evaluate the needs for revision of certain parts the Guidelines when it is held up against the experiences the Consultant has made. The conclusions and possible recommendations for improvements will be formulated and included in the Draft Final Project Summary Report to be delivered in week 35 of the assignment. The recommendations will be presented and discussed with the stakeholders scheduled in week 38. Finally, the recommendations will be adjusted according to the comments from the Client and presented in the Final Project Summary Report.

## References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## Annex 1 - Missions and stakeholder consultations

### First mission, 11-15 June, 2018:

**Mekong River Commission**

*Date:* 11 June 2018 *Venue:* Mekong River Commission Office, Vientiane

**Ministry of Energy and Mines**

*Date:* 12 June, 2018 *Venue:* Ministry of Energy and Mines, Vientiane

**Department of Livestock and Fisheries/Division of Fisheries**

*Date:* 12 June, 2018 *Venue:* Department of Livestock, Vientiane

**International Water Management Institute (IWMI)**

*Date:* 13 June 2018 *Venue:* Lao Consulting Group Office, Vientiane

**WWF-Laos**

*Date:* 13 June, 2018 *Venue:* WWF Office, Vientiane

**Department of Water Resources, MONRE**

*Date:* 13 June, 2018 *Venue:* Department of Water Resources, Vientiane

**Department of Natural Resources and Environment Policy (DNREP) - MONRE**

*Date:* 14 June, 2018 *Venue:* DNREP office, Vientiane

**Department of Forestry - MAF**

*Date:* 14 June, 2018 *Venue:* DOF office, Vientiane

**Department of Planning and Cooperation, Ministry of Planning and Investment**

*Date:* 14 June, 2018 *Venue:* Ministry of Planning and Investment Office, Vientiane

**Ratch-Lao Services**

*Date:* 14 June, 2018 *Venue:* Ratch-Lao Services Office; Vientiane

**IUCN - Laos**

*Date:* 15 June, 2018 *Venue:* IUCN Office, Vientiane

### Second Mission, 8-15 July, 2018:

**International Water Management Institute (IWMI)**

*Date:* 9 July, 2018 *Venue:* LCG Office, Vientiane

**IFC**

*Date:* 9 July, 2018 *Venue:* IFC Office, Vientiane

**Ministry of Energy and Mines**

*Date:* 9 July, 2018 *Venue:* Ministry of Energy and Mines, Vientiane

**Mekong River Commission**

*Date:* 10 July 2018 *Venue:* Mekong River Commission Office, Vientiane

**Mekong River Commission**

*Date:* 11 July 2018 *Venue:* Mekong River Commission Office, Vientiane

# Annex 2 – List of projects relevant for the CIA analysis

List of 41 projects on the Sekong from the EWN study.

| Project Dam / Criteria | Status | Stage | COD Year | COD Group | Level of Information | Installed capacity MW | Mean annual energy GH |
|---|---|---|---|---|---|---|---|
| Dak E Muen? | MOU | 1 MoU | tbc | tbc | low | 130 | 506 |
| H.Makchan | Pre F.S. | 2 PFS | tbc | tbc | very low | 3 | 0 |
| houay Lamphan | Completed | 6 Complete | 2015 | Current | medium | 88 | 480 |
| Houayho | Completed | 6 Complete | 1999 | Current | low | 152 | 450 |
| Nam BI 1 | PDA Stage | 4 PDA | 2021 | 2025 | very low | 50 | 210 |
| Nam BI 2 | PDA Stage | 4 PDA | 2021 | 2025 | very low | 68 | 288,5 |
| Nam BI 3 | PDA Stage | 4 PDA | 2022 | 2025 | very low | 12 | 51,2 |
| Nam E moun | PDA Stage | 4 PDA | 2024 | 2025 | very low | 129 | 427,4 |
| Nam E moun 2 | tbc | tbc | tbc | tbc | very low | 13 | tbc |
| Nam E moun 3 | tbc | tbc | tbc | tbc | very low | 38 | tbc |
| Nam E moun 4 | tbc | tbc | tbc | tbc | very low | 54 | tbc |
| Nam Ka Ouy | tbc | tbc | tbc | tbc | very low | 30 | tbc |
| Nam Kong 1 | Under construction | 5 Construction | 2020 | 2025 | high | 150 | 563 |
| Nam Kong 2 | Under construction | 5 Construction | 2017 | 2025 | high | 66 | 264,4 |
| Nam Kong 3 | Under construction | 5 Construction | 2021 | 2025 | high | 45 | 170,2 |
| Nam La Nge | F.S. completed | 3 FS | 2022 | 2025 | very low | 60 | 293,75 |
| Nam Krabai 1 | Pre F.S. | 2 PFS | n/a | n/a | very low | 40 | 164 |
| Nam Krabai 2a | Pre F.S. | 2 PFS | 2027 | 2030 | very low | 9 | 36,45 |
| Nam Krabai 2b | Pre F.S. | 2 PFS | 2027 | 2030 | very low | 8 | 32,8 |
| Nam Krabai 3 | Pre F.S. | 2 PFS | n/a | n/a | very low | 10 | 41,2 |
| Nam Payoun(Downstream) | Pre F.S. | 2 PFS | 2022 | 2025 | very low | 15 | 93,44 |
| NamAng-Natabeng1 | PDA Stage | 4 PDA | 2024 | 2025 | medium | 41 | 183,3 |
| Xe Kaman 1 | Completed | 6 Complete | 2017 | Current | high | 290 | 1039 |
| Xe Kaman 2A | F.S. ongoing | 3 FS | 2025 | 2025 | medium | 35 | 160 |
| Xe Kaman 2B | F.S. ongoing | 3 FS | 2023 | 2025 | medium | 100 | 380,5 |
| Xe Kaman 3 PH | Completed | 6 Complete | 2013 | Current | medium | 250 | 1000,3 |
| Xe Kaman 4 | PDA Stage | 4 PDA | 2023 | 2025 | medium | 80 | 287,4 |
| Xe Kaman Sanxal | Completed | 6 Complete | 2018 | Current | high | 32 | 121 |
| Xe Kong (Downstream A) | PDA Stage | 4 PDA | 2020 | 2025 | high | 76 | 388 |
| Xe Kong (Downstream B) | PDA Stage | 4 PDA | 2024 | 2025 | high | 50 | 206,3 |
| Xe Kong 3A | F.S. completed | 3 FS | 2024 | 2025 | high | 140 | 459 |
| Xe Kong 3B | F.S. completed | 3 FS | 2025 | 2025 | high | 146 | 418 |
| Xe Kong 4A | F.S. approved | 3 FS | 2022 | 2025 | high | 175 | 785,1 |
| Xe Kong 4B | F.S. approved | 3 FS | 2022 | 2025 | high | 165 | 800,9 |
| Xe Kong 5 | F.S. completed | 3 FS | 2022 | 2025 | high | 330 | 1502 |
| Xekatam | PDA Stage | 4 PDA | 2020 | 2025 | medium | 60,8 | 425 |
| xepian Xenamnoy | Under construction | 5 Construction | 2019 | 2025 | high | 410 | 2023 |
| Xepien_H.Chot | F.S. completed | 3 FS | 2023 | 2025 | very low | 21 | 100 |
| Xepien-Houysoy | PDA Stage | 4 PDA | 2023 | 2025 | very low | 45 | 171,3 |
| XEXOU | MOU | 1 MoU | MOU | n/a | medium | 30 | 143,3 |
| Lower Xenamnoy | tbc | tbc | tbc | tbc | medium | tbc | tbc |

List of projects specifically relevant for the detailed CIA analysis, with some preliminary information included.

| # | Project Dam | Status | COD | Installed capacity | Mean annual energy | Power Destination % | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Year | mW | GW | Lao | Tha | KHM | VNM |
| **1** | **Houayho** | Completed | 1999 | 152 | 450 | 5 | 95 | | |
| **2** | **houay Lamphan** | Completed | 2015 | 88 | 480 | 100 | | | |
| **3** | **Xe Kaman 3** | Completed | 2013 | 250 | 1000,3 | 10 | | | 90 |
| **4** | **Xe Kaman 1** | Completed | 2017 | 290 | 1096 | 20 | | | 80 |
| **5** | **Nam Kong 2** | Under construction | 2017 | 66 | 264,4 | 100 | | | |
| **6** | **Xe Kaman Sanxal** | Under construction | 2017 | 32 | 121 | 20 | | | 80 |
| **7** | **Nam Kong 3** | Under construction | 2021 | 45 | 170,2 | 100 | | | |
| **8** | **xepian Xenamnoy** | Under construction | 2019 | 410 | 2023 | 10 | 90 | | |
| **9** | **Nam Kong1** | Under construction | 2020 | 160 | 649 | 100 | | | |
| **10** | **Xe Kong (Downstream A)** | PDA Stage | 2020 | 76 | 388 | 100 | | | |
| **11** | **Nam BI 1** | PDA Stage | 2021 | 50 | 210 | 100 | | | |
| **12** | **Nam BI 2** | PDA Stage | 2021 | 68 | 288,5 | 100 | | | |
| **13** | **Nam BI 3** | PDA Stage | 2022 | 12 | 51,2 | 100 | | | |
| **14** | **Xekatam** | PDA Stage | 2020 | 81 | 299 | 100 | | | |
| **15** | **NamAng-Natabeng1** | PDA Stage | 2024 | 41 | 183,3 | 100 | | | |
| **16** | **Nam E moun** | PDA Stage | 2024 | 129 | 427,4 | 100 | | | |
| **17** | **Nam E moun Diversion Dam** | PDA Stage | | 0 | 0 | | | | |
| **18** | **Xe Kaman 4** | PDA Stage | 2023 | 70 | 287,4 | 10 | | | 90 |
| **19** | **Xe Kong (Downstream B)** | PDA Stage | 2024 | 50 | 206,3 | 100 | | | |
| **20** | **Xepien-Houysoy** | PDA Stage | 2023 | 45 | 171,3 | 100 | | | |
| **21** | **Xepien_H.Chot** | F.S. completed | 2023 | 21 | 100 | 100 | | | |
| **22** | **Xe Kong 3A** | F.S. completed | 2024 | 140 | 459 | 100 | | | |
| **23** | **Xe Kong 3B** | F.S. completed | 2025 | 146 | 418 | 100 | | | |
| **24** | **H.La Nge** | F.S. completed | 2022 | 60 | 293,75 | 100 | | | |
| **25** | **Xe Kong 5** | F.S. completed | 2022 | 330 | 1613,5 | | 100 | | |
| **26** | **Xe Kong 4A** | F.S. approved | 2022 | 175 | 785,1 | | 100 | | |
| **27** | **Xe Kong 4B** | F.S. approved | 2022 | 165 | 800,9 | | 100 | | |
| **28** | **Xe Kaman 2A** | F.S. ongoing | 2025 | 35 | 160 | 100 | | | |
| **29** | **Xe Kaman 2B** | F.S. ongoing | 2023 | 100 | 380,5 | 100 | | | |
| **30** | **Nam Payoun(Downstream)** | Pre F.S. | 2022 | 15 | 93,44 | 100 | | | |
| **31** | **H.Makchan** | Pre F.S. | MOU | 3 | 0 | 100 | | | |
| **32** | **Nam Krabai 1** | Pre F.S. | Planning | 40 | 164 | 100 | | | |
| **33** | **Nam Krabai 2a** | Pre F.S. | 2027 | 9 | 36,45 | 100 | | | |
| **34** | **Nam Krabai 2b** | Pre F.S. | 2027 | 8 | 32,8 | 100 | | | |

## Annex 3 – Inception and Scoping Workshop Agenda, Minutes of Meeting and Participants

23-24 August, Ministry of Energy and Mines, Vientiane

**Workshop Agenda**

**Day 1: 23 August**

| Time | Topic | Responsible |
|---|---|---|
| 08:30 – 09:00 | Registration | LCG |
| **Session 1** | **Introductory Remarks** | |
| 09:00 – 09:05 | Opening Address | Dr. Daovong Phonekeo, MEM |
| 09:05 – 09:10 | Welcome Remarks | Australian Embassy |
| O9:10 – 09:20 | Introduction of stakeholder participants | All |
| 09:20 – 09:35 | Introduction to the Project: Cumulative Impact Assessment of Renewable Energy in the Sekong Basin | Kate Lazarus, IFC |
| 09:35 – 09:50 | Sekong Basin CIA schedule and consultants team | Leif Lillehammer, Multiconsult |
| 09:50 – 10:00 | Comments and discussions | Chair |
| 10:00 – 10:20 | Coffee/Tea break | |
| **Session 2** | **Intro to CIA Methodology and Processes** | |
| 10:20 – 11:10 | IFC CIA Initiatives and Guidelines | Kate Lazarus |
| 11:10 – 11:40 | Definitions of CIA and VEC's | Leif Lillehammer, Multiconsult |
| 11:40 – 12:00 | Comments and Discussions | Chair |
| 12:00 – 13:00 | Lunch | |
| **Session 3** | **Approach and Scoping of the Sekong Basin CIA** | |
| 13:00 – 13:30 | Overall Approach and Workplan | Leif Lillehammer, Multiconsult |
| 13:30 – 13:50 | Comments and Discussions | Chair |
| 13:50 – 14:10 | Scoping the Cumulative Impact Assessment | Leif Lillehammer, Multiconsult |
| 14:10 - 14:40 | Comments and Discussions | Chair |
| 14:40 – 15:10 | Preliminary Baseline Analysis and Coordination with EWN | LCG |
| 15:10 – 15:20 | Comments and Discussions | Chair |
| 15:20 – 15:40 | Coffee/Tea Break | |
| 15:40 – 16:00 | Public Participation, Consultation and Disclosure | LCG |
| 16:00 – 16:20 | Comments and Discussions | Chair |
| 16:20 – 16:30 | Summing Up Day 1 | MEM |

**Day 2: 24 August**

| **Session 4** | **Defining and Prioritizing VEC's for Sekong Basin CIA** | |
|---|---|---|
| 08:30 – 09:00 | Day 2 registration | LCG |
| 09:00 – 09:05 | Welcome Day 2 | MEM |
| 09:00 – 09:30 | The VEC Approach Revisited and Sekong Basin CIA Relevant VEC's | Leif Lillehammer, Multiconsult |
| O9:30 – 09:50 | Comments and Discussions | Chair |
| 09:50 – 11:00 | Group Discussions on Prioritization and Harmonization of VEC's for Sekong Basin CIA | Facilitated by LCG |
| 11:00 – 11:20 | Coffee/Tea Break | |
| 11:20 – 11:50 | Reporting Back to Plenary on VEC's | Facilitated by LCG |
| **11:50 – 12:00** | **Summary and Closure of Workshop** | **MEM** |

## Minutes – Inception & Scoping Workshop 23-24 August, 2018

### Day 1

**Date:** 23-August 2018 Time: 8:30 – 16:30

The meeting was chaired by Dr. Daovong Phonekeo, Director General Cabinet of Ministry of Energy and Mines, and Ms. Kate Lazarus, Senior Operations Officer, IFC.

**Presentations:**
Following the introduction of all participants, Ms. Kate Lazarus, Senior Operation Officer of IFC, presented the purpose, scope of work, methodology and the timeframe of the Cumulative Impact Assessment of Renewable Energy Development in the Sekong River Basin.

Mr. Leif Lillehammer, team leader of the project, Multiconsult, presented the Sekong basin CIA schedule and consultant team, the overall approach and work plan, and the scoping of the cumulative impact assessment. The consultant emphasized that the CIA is the study of the environmental and social impacts existing and planned projects within given spatial and temporal boundaries, and that the cumulative impacts of several projects can lead to more significant impacts than the simple addition of individual project impacts. So CIA is different from EIA because it takes into consideration multiple projects, not only one. CIA is a way to have a global vision of the consequences on the environment of the overall project development to come in the Sekong Basin. The CIA allows for using the mitigation hierarchy to either avoid, minimize and compensate environmental impacts.

Examples were presented by IFC of several CIAs conducted in Nepal and Pakistan, and Multiconsult presented examples for the Lake Victoria in East Africa and Red River in Vietnam. CIAs may be required by regulators or by external parties (e.g. investors).

Ms. Vilayphone Vongpith presented the preliminary baseline analysis and coordination with EWN. Ms. Minavanh Pholsena presented the public participation, consultation and disclosure.

**Discussion:**

Session #1 - **Introductory Remarks**

| | |
|---|---|
| S1Q1 | Q. So CIA is a new concept. Does CIA replace EIA? Do approved projects need a CIA? |
| S1A1 | A. There are two types of CIA. The first type is a project level CIA , which is required by Lao PDR regulations as part of the ESIA. The second type more broadly considers a sector, strategy or geographical (such as a river basin). This CIA of the Sekong Basin is of the second type. GoL and IFC have jointly developed CIA Guidelines for hydropower. The Sekong Basin CIA is piloting these guidelines. |
| S1Q2 | Q. Is this CIA required by all international banks? |
| S1A2 | A. Many international investors require a CIA study. |
| S1Q3 | Q. Apart from hydropower, which other sectors will be considered by the CIA? |
| S1A3 | A. Other types of renewable energy will be included in the CIA study, i.e., solar energy and wind energy. |
| S1Q4 | Q. Must we undertake CIAs for our existing HPPs in different parts of the country? |
| S1A4 | A. There is no new requirement to conduct a project-level CIA for existing HPPs as this was done as part of the ESIA study. A basin-scale CIA is typically undertaken by government planners and information from individual HPPs is needed for a basin-scale CIA. Project level information also needs to be shared with new proposed developments so that they can complete a project-level CIA during the ESIA study. |
| S1Q5 | Q. CIA will add to the investment costs. Could the developers only do CIA but not EIA? |
| S1A5 | A. CIA is required as a component of the ESIA under Lao PDR regulations. |
| S1Q7 | Q. If CIA is a lender-requirement then developers may 'shop around'. It would be better if CIA is a government policy. What will happen if the results of the Sekong Basin CIA call for changes to hydropower projects currently being developed? |
| S1A7 | A. GoL will decide how to respond to the findings of the CIA. Any modifications to planned projects would need to be discussed between government and developers. |

**Session #2 - Intro to CIA Methodology and Processes**

| | |
|---|---|
| S2Q1 | Q. What are the main differences between the Sekong Basin CIA and the case studies presented for Nepal, Lake Victoria and Vietnam? |
| S2A1 | A. The Nepal CIA also focusses on hydropower but some of the conditions are quite different. For example, because the river is fed by glacial melt-water and is very cold fisheries are less significant for livelihoods in Nepal compared with Sekong. In Nepal the river has important cultural values (e.g. for funeral rites), which may not be so significant in Sekong. One similarity is that the rivers in Nepal and in Sekong Basin go through environmentally sensitive areas designated for conservation and protection. The Lake Victoria CIA is rather different as it deals with a lake not a river. Transportation on the lake was a key issue. There are various methods of CIA can be applied depending upon the context. |

| | |
|---|---|
| S2Q2 | Q. How do we select or reject projects based on the CIA result? For example, if the CIA identifies a big impact then does this mean certain projects should not go forward, or that projects should not be developed in certain areas? |
| S2A2 | A. The CIA will provide an assessment of different development pathways for the government to use in decision making about basin-wide planning. Planning also needs to consider power demand, i.e. how many projects are required to meet energy targets, how should development be sequenced to meet future demand, CIA can assist with this planning process. |
| S2Q3 | Q. As developers, we would like to know who is responsible for undertaking the CIA. The developer, the government or environmental consultants? Additionally, what if a CIA for my project identifies a risk or impact from another project? How can this be resolved? |
| S2A3 | A.<br>- For a project-level CIA, the project developer is responsible for hiring independent environmental specialists to conduct the assessment. For a basin-wide CIA, government planners would typically lead the process in consultation with developers active in the basin.<br>- In case a CIA identifies impacts, risks and other interactions between individual HPPs the government is responsible for seeking a solution. |

Session #3 - **Approach and Scoping of the Sekong Basin CIA**

| | |
|---|---|
| S3Q2 | Q. How does this CIA study link to existing studies and projects? Will the CIA use secondary data or undertake primary data collection? |
| S3A2 | A. We are using existing data and information, from various studies and from HPP projects in the basin. |
| S3Q3 | Q. How about other renewable energy projects? |
| S3A3 | A. Solar energy and wind energy will be considered in the study. Several solar and wind projects are proposed for the Sekong Basin including, for example, floating solar on reservoirs. |
| S3Q4 | Q. What will be the boundaries of the CIA? These need to be well-defined. For example, if impacts are identified on neighboring countries would developers be expected to mitigate those impacts? This could pose an unacceptable risk to the project. |
| S3A4 | A. The temporal boundary for the CIA is 2030, and longer for climate change effects. For the spatial boundary, the proposal is to take the Sekong Basin as the boundary. |
| S3Q5 | Q. Is Vietnam within the spatial boundaries? |
| S3A5 | A. Yes, the uppermost part of the Sekong basin is within Vietnam, and therefore included in the spatial boundary. |
| S3Q6 | Q/ If impact is found in within the Vietnam boundary, will this be taken into account? |
| S3A6 | A. Within the basin boundaries we include all impacts in Laos, Vietnam, and Cambodia in the study. |

| | |
|---|---|
| S3Q7 | Q. The national boundary between Laos and Vietnam is not firmly agreed. How will the consultant deal with this? |
| S3A7 | A. This is a (hydro) political question and beyond the scope of the study and what the consultant can engage in. |
| S3Q8 | Q. Given ESIA has already been undertaken as part of the project development, (i) Does developer have to implement a CIA again? (ii) How will this be implement since PPA's has already been issued? |
| S3A8 | A. Sekong CIA is at basin level and contains information for the whole of the Sekong Basin. By contrast CIAs for individual projects focuses more on project specific information. |
| S3Q9 | Q. It is recommended that IFC / MEM/ MONRE have clear final direction how to implement CIA study. |
| S3Q10 | Q. How many villages are included in the study? And what would be methodology for consultation of these in the study? |
| S3A10 | A. We have yet not identified numbers of villages, but will do so shortly after the scoping period, and before next mission. We will have informal discussion with the villagers. |
| S3Q11 | Q. What is the role of the private sector in this CIA study? |
| S3A11 | A. Private sector is crucial. Developers were consulted by IFC before issuing the formal TOR of this study and again during a workshop in June |
| S3Q12 | Q. Let's come back to investment. If the project is high risk, it will increase the cost of borrowing, the project may not be feasible and developer may decline from the project development. How can MEM support in term of policy? |
| S3A12 | A. Of course, developers favor lower E&S mitigation costs, but as regulator it is important to look into all dimensions. This CIA is expected to help MEM for sector planning and policy implementation. |
| S3Q13 | Q. We support this CIA study and as an opportunity to consider not only hydropower but also other activities that effect the environment such as sand and gravel extraction from rivers, road projects and coal mining. Currently different activities are permitted and monitored at different levels (central, provincial, district) so it will be useful if all impacts will be blended in the study. We suggest to have involvement of villagers as much as possible. |

## Day 2

**Date:** 24 August 2018 Time: 8:30 – 12:00

Day 2 of the meeting was chaired by Mr. Vithoun, DEPP Ministry of Energy and Mines, and Ms. Kate Lazarus, Senior Operations Officer, IFC.

**Presentations:**

As an introduction to group discussions, Mr. Leif Lillehammer reviewed the approach to defining and prioritizing VECs as outlined on Day 1. The presentation was followed by a Q&A in plenary, summarized below.

**Discussion:**

**Session #4 - Defining and Prioritizing VEC's for Sekong Basin CIA**

| | |
|---|---|
| S4Q1 | Q. Validity of data is key. Consultants are urged to utilize reliable and up to date field data (see for example, WWF, IUCN and MRC). |
| S4A1 | A. The consultants will take note of this. |
| S4Q2 | Q. Fish species are being focused on, but what about the trees and plants in the Sekong area? |
| S4A2 | A. The CIA is also focusing on trees and plants, including those for medical purposes. They are defined under "Valued Flora" in the broad list of VECs. |
| S4Q3 | Q. The table of threatened and endangered fauna in Sekong Basin needs review as some classifications are incorrect and some animals are no longer present, e.g. Tiger? |
| S4A3 | A. This has been noted, and will be followed up. |
| S4Q4 | Q. Are the consultants doing any primary field research for the CIA or are they relying only on secondary resources? |
| S4A4 | A. Given the time and resources for this CIA the consultants mostly relies on secondary data. We are however collecting primary data through the consultations with stakeholders. |
| S4Q5 | Q. Things have changed over the last 10 years; how do you know the data you are using is the updated ones? |
| S4A5 | A. The secondary resources will be assessed and the study will utilize the most recent and reliable secondary data available. |
| S4Q6 | Q. Some fish species listed do not use standard Lao names. What will you do to consolidate the different sources of data that contain different names for the same species? |
| S4A6 | A. We will double check the names, and adjust accordingly. |
| S4Q7 | Q. Sekong and Sesan rivers are connected, and some migrating species are between these. Have you identified these travelling species? |

| | |
|---|---|
| S4A7 | A. We will study migratory fishes; indeed there are multiple species that ascend these rivers that are part of the Lower Mekong Migratory (fish) System. |
| S4Q8 | Q. What is the status of the Lao CIA Guidelines for Hydropower, because for now CIA is not officially endorsed by the government? |
| S4A8 | A. At the moment the CIA Guideline is in draft form. This CIA study will help to review and finalize. |
| S4Q9 | Q. It was noticed that none of the private consulting companies involved in preparing ESIA for projects attended the workshop, and that we should invite them because they have experience and can provide feedback. |
| S4Q10 | Q. Please note there are a large number of fish conservation zones on the Sekong River and tributaries, which should be factored into the impact assessment. WWF can provide further information to the consultant team on this. |

**Session #5 – Group Activity: Defining and Prioritizing VEC**

Participants were divided into 2 groups with the following guidance:

1) Is there need to narrow the broadly identified VECs? If so, please discuss, identify and agree on more narrow VECs within each broad VEC category.
2) Please discuss and rank/prioritize the identified VECs with relation to importance.
3) Are there any other types of VECs not covered by the broad categories listed that should be included?
4) Are there any other relevant institutions with regard to the VECs that should be listed?

Ms. Vilayphone Vongpith explained the documents given to the participants to support the discussion.

<u>Summary of Group 1 Discussion:</u>

All 7 VECs are relevant for Sekong basin (see table overleaf). Highest priority VECS are:

1. 'Traditional Culture and Customs' because this relates to local livelihoods.
2. 'Sekong Basin Ecosystem Resilience' and 'Valued Sekong Basin Habitats'.

Other VECs should be considered joint-third priority.

The group suggested to add transport/navigation along the rivers in the basin as a VEC because during the wet season landslides frequently block roads and people from Attapeu therefore use the rivers.

Additional institutions to consider:

- Ministry of Culture and Information for VECS 'Traditional culture and customs '
- Mass organizations for VECs 'Traditional culture and customs
- National University: Faculty of Forestry, Faculty of Agriculture, Faculty of Water Resources, Faculty of Social Sciences.

Summary of Group 2 Discussion:

The VECs for Valued Fauna and Flora should also explicitly mention habitats (E.g. ‘Valued Fauna and supporting habitats’).

All 7 identified VECs are relevant to this CIA. The most important are:

1. Fauna and it’s habitat
2. Flora and it’s habitat
3. Livelihoods and culture

The other VECs are of secondary importance.
Additional institutions was not discussed in group 2.

**Table of VECs discussed in the group work.**

| VEC | Description/Function | Examples | Relevant Institutions |
|---|---|---|---|
| **Valued fauna** | Wild animals and fish, valued for economic reasons or conservation status (threatened species). | Super-endemic fish, e.g. species only found in Sekong (15)*<br>Endangered and critically endangered fish species<br>Important (economically and environmentally) migratory fish species | MONRE<br>MAF<br>LARREC |
| **Valued flora** | Forest and plant species and products (terrestrial, riverine, and wetlands) valued for economic, medical, food, important ecosystem function or high biodiversity reasons. | Plant and tree species for medical and traditional use | MONRE<br>MAF |
| **Sekong Basin ecosystem resilience** | Contingent functioning through physical/chemical/biological stress. | Biodiversity<br>Food-web dynamics<br>Filter capacity of wetlands<br>Sediment dynamics and transport | MONRE |
| **Sekong Basin ecosystem soil protection ability** | The ability to protect the soils in the basin/catchment from erosion. It is a function of forest and vegetation cover/quality as well as topography. | Land and vegetation cover in erosion prone terrain and soils | MONRE<br>MAF |
| **Valued Sekong Basin habitats** | Habitats important for human use. Habitats specifically important for biodiversity. | Protected Areas, Key Biodiversity Areas, Habitats/Areas with a variety of human use products. | MONRE |
| **Sekong River dependent livelihoods** | This is a social and economic VEC that is primarily a function of livelihood use of Sekong rivers natural resources. | Artisan fishermen, communities utilizing Sekong resources | Local communities |
| **Traditional culture and customs** | Gender roles, cultural diversity, traditional knowledge, social identity, tourism. | Women in the fisheries sector, cultural sites near the river and hydropower sites | Local communities, Department of Heritage |

## Workshop Participants 23/8

| No. | Name and Surename | Organizations | Position |
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| 13 | Phoutsakhone | IUCN | Head of Office |
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| 22 | Ms. Doung Hai Nhu | MRC | Stakholder Specialist |
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| 37 | Mr. Phouvong Phaophongsavath | MPI | Deputy of Division |
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| 39 | Mr. Tanavut Sudmivoraseth | Multiconsult | Key Account Manager |
| 40 | Ms. Vilayphone Vongphit | LCG | Consultant |

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| 13 | Mr. Jethro Alan Stern | IFC | Consultant |
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