MEKONG RIVER COMMISSION FOR SUSTAINABLE DEVELOPMENT

MRC

SUSTAINABLE HYDROPOWER DEVELOPMENT STRATEGY

A basin-wide strategy for a changing Mekong River Basin

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Sustainable Hydropower Development Strategy

A basin-wide strategy for a changing Mekong River Basin

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FOREWORD

So much has changed in the Mekong River Basin in the 20 years since the Mekong River Commission (MRC) adopted its first Hydropower Development Strategy in 2001.

Most notably, the rapid proliferation of hydropower projects along Southeast Asia's largest, most vital river, combined with the worsening repercussions of climate change, is becoming the key issue that the Mekong River Basin is facing today.

That is why this Sustainable Hydropower Development Strategy (SHDS) 2021 is an essential document, as it broadly addresses two key questions: on the one hand, how to optimize the positive benefits of hydropower – such as access to regular, cheaper electricity and renewable energy – while simultaneously minimizing any harmful impact for millions of fishing and farming families in the Basin.

On the other hand, there is the question of how to promote and coordinate "cascade" hydropower operations, in the four core MRC members – Cambodia, Lao PDR, Thailand and Viet Nam, as well as their upriver neighbors, China and Myanmar – to have a more harmonized system of coordination in place, for the interests of the entire region.

In this regard, promoting and coordinating "cascade" hydropower operations highlights the MRC role. With strategies like the SHDS, we are focusing on the most urgent transboundary issues, which affect all peoples living in the Basin. It is one thing to mitigate natural disasters, like climate change-driven floods and droughts; it is another to call for greater coordination among human made hydropower projects, managed by many different owners and countries.

These challenges are not unique to the Mekong River Basin. Basin societies around the world now face a similar dilemma of how to strike the right balance between competing forces.

Moreover, as we strive to achieve the UN's Sustainable Development Goals (SDGs), the emergence of hydropower actually touches on several SDGs: from access to clean drinking water (for which many Mekong denizens still rely on the river), to economic growth, sustainable livelihoods, affordable and renewable energy, and poverty reduction.

In our region, we must take responsibility for current and future generations, as we balance economic development with efficient uses of our precious natural resources. We already see the loss of wetlands, nourishing sediment and fisheries, while studies suggest that dams affect the ability of migratory fish to spawn upriver then mature downriver.

In response, this SHDS helps to provide a framework for how to "avoid, minimize and mitigate" the transboundary impact of hydropower projects, so they do not have significant adverse effects on food supply, people's livelihoods, the river's ecosystem or the surrounding environment.

For example, urban dwellers do indeed benefit from a more regular supply of more affordable electricity. However, rural riverine communities still experience irregular, relatively expensive electricity – while also bearing the brunt of a sudden, unexpected water release, or the withholding of water, which may affect their ability to fish, farm and feed their children.

That is why the words uttered in the 2018 Siem Reap Declaration ring true today – and with even greater necessity: *the increasing development in the mainstream and tributaries highlights the increasing need for the sustainability and coordinated operational management of tributary and mainstream water resources development projects.*

This helps explain why one of our top priorities for 2022, and beyond, is information sharing between the hydropower project owners and the MRC countries they impact, as well as among the owners themselves. Indeed, while advanced warning about water release or withholding enables riparian communities to better prepare, we also see information sharing as in the owner's self-interest. Having a mechanism to coordinate dam operations in place is what the SHDS will make a difference.

However, information sharing requires enormous trust and confidence. Therefore, it is a task best suited for the intergovernmental MRC, as a leading regional voice for "water diplomacy" and regional cooperation. What is true is that if there were no coordination or cooperation along the Mekong, it would have disastruous consequences.

That is why we need a coherent strategy for the Mekong River Basin. There is only one river – and one source of water. We must learn to share it, responsibly.

H.E. General Prawit Wongsuwon

Deputy Prime Minister of the Kingdom of Thailand
Chairperson of Thai National Mekong Committee
Member of the MRC Council for Thailand
Chairperson of the MRC Council for 2021

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ABBREVIATIONS AND ACRONYMS

ASEAN	Association of Southeast Asian Nations
BDP	Basin Development Plan
BDS	Basin Development Strategy
CGIAR	Consultative Group on International Agricultural Research
CIA	Cumulative Impact Assessment
DRIFT	An environmental flows decision support system
GHG	Greenhouse gas
GMS	Greater Mekong Subregion
ISH	Initiative for Sustainable Hydropower (of the MRC)
IWRM	Integrated water resources management
JAP	Joint Action Plan
JEM	Joint Environmental Monitoring
LMB	Lower Mekong Basin
LMC	Lancang Mekong Cooperation
M&E	Monitoring and evaluation
MRB-IF	Mekong River Basin Indicator Framework
MRC	Mekong River Commission
MRCS	Mekong River Commission Secretariat
MW	Megawatt
NGO	Non-governmental organization
NMC	National Mekong Committee
NMCS	National Mekong Committee Secretariat
PDG	Preliminary Design Guidance
PDP	Power Development Plan
PNPCA	Procedures for Notification, Prior Consultation and Agreement
RSAT	Rapid Basin-Wide Hydropower Sustainability Assessment Tool (of the MRC)
SBEM	Strategy for Basin-wide Environmental Management for Environmental Assets of Regional Importance in the Lower Mekong Basin
SDG	Sustainable Development Goal
SHDS	Sustainable Hydropower Development Strategy
TbEIA	Transboundary Environmental Impact Assessment
UMB	Upper Mekong Basin
WWF	World Wildlife Fund

SUMMARY

A hydropower strategy in a rapidly developing Mekong Basin

The rapid and large-scale development of hydropower in the Upper and Lower Mekong Basin is forecast to bring significant economic benefits to the region. However, this scale of development brings potential risks to the social and environmental condition in the Mekong Basin. The net economic benefits of these developments, once fully developed, is estimated to have a net present value (NPV) of $30 billion to 40 billion to the regional economies. However, hydropower and other basin developments (e.g. irrigation) may also impact the natural resources across the Basin, including fisheries. The resulting socio-economic impacts are not evenly shared across the Basin.

Therefore, how best to manage these major economic, environmental and social considerations is the focus of this Sustainable Hydropower Development Strategy.

MRC studies and regional and international research indicate that basin-wide cooperation, integrated planning, development and management are essential to achieve basin-scale sustainable development for the Mekong Basin. This is also highlighted in the Siem Reap Declaration adopted by Prime Ministers of the MRC Member Countries on 5 April 2018: *"…The increasing development in the mainstream and tributaries highlight the increasing need for the sustainability and coordinated operational management of tributary and mainstream water resources development projects.*"

A comprehensive process to update the Strategy

Building on prior technical works carried out by the MRC at the regional level, the Sustainable Hydropower Development Strategy 2021 (SHDS 2021) seeks to meet the following criteria:

- Enhance transboundary benefits. Enhancing benefits implies looking for opportunities to increase the range and value of services offered by hydropower and including multisector development options.
- Minimize adverse transboundary impacts. Minimizing adverse impacts implies adopting some form of mitigation measures. The MRC has previously established the guiding principles for impact mitigation to "avoid, minimize and mitigate harmful effects" (Mekong Agreement, Article 7) and to "*cease substantial damage*" (Mekong Agreement, Articles 7 and 8).

This update of the SHDS is part of an interactive planning cycle within the MRC's basin planning process. In addition, the need to update the MRC Hydropower Development Strategy 2001 is an agreed activity in the MRC Strategic Plan 2016–2020.

SHDS 2021 draws on a number of previous MRC initiatives, including the Basin Development Plan Programme Phase 2's Scenario Assessment (2011), the Strategic Environmental Assessment (SEA, 2010), MRC Hydropower Mitigation Guidelines (2016) and most recently, the Study on Sustainable Management and Development of the Mekong River including Impacts of Mainstream Hydropower Projects (MRC Council Study, 2017), and the additional assessment undertaken in preparation of the SHDS.[1]

A comprehensive consultation process with Member Countries and wider stakeholders has taken place in the development of the Strategy. The project methodology included joint interactive planning workshops to discuss the key trade-offs between the economic, environment and socio-economic dimensions.

The role of the MRC

In the 1995 Mekong Agreement, the MRC Member Countries agreed to:

> *cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin including… hydropower…in a manner to optimize the multiple-use and mutual benefits of all riparians and to minimize the harmful effects.*

1 While all Member Countries appreciate the knowledge and capacity gained from the results and findings of all MRC studies, some of them emerged from modelled assessments of future outcomes that would need to be further monitored and reviewed based on actual conditions. The MRC study on the Sustainable Management and Development of the Mekong River (i.e. Council study) was duly acknowledged by Prime Ministers of the four Member Countries during the 3rd MRC Summit at Siem Reap. Importantly, various tools and knowledge as developed and generated therein are considered useful for capacity building and to guide the implementation of the MRC BDS/SP as well as the SHD strategy.

While each country plans and implements hydropower projects nationally, the MRC has a mandate to assess and guide the planning and development of projects from a basin-wide perspective, in order to optimize transboundary benefits and minimize adverse transboundary impacts.

The development of the SHDS follows from this MRC mandate. In addition, the MRC has a role in disseminating international good industry practice relevant to sustainable hydropower planning and development in the transboundary context. The 1995 Mekong Agreement and MRC Procedures ensure consultation and evaluation, as well as monitoring of hydropower development projects submitted under the Procedures for Notification, Prior Consultation and Agreement (PNPCA). Moreover, the SHDS complements the national strategies and polices related to hydropower development and management of MRC Member Countries set out in Section 2.5.

It should be emphasized that decision-making on hydropower development and operations rests with the Member Country that hosts the project(s) through the PNPCA. The MRC has a role to play in supporting Member Countries in implementing basin-wide strategies and policies, coordinated and integrated impact assessments, and consistent and fair mitigation measures, especially those related to transboundary issues.

The MRC seeks to complement the work of national and other international institutions involved in hydropower development in the Basin and, more generally, in power development in the region. Cooperation with institutions involved in hydropower and water resources management in the region is emphasized in order to create a more coherent and effective coordination mechanism that ensures joint efforts to tackle the opportunities and challenges, while drawing on the experience of other River Basin Organisations.

Basin Development Strategy for the Mekong River Basin 2021–2030

The Basin Development Strategy for the Mekong River Basin 2021–2030 (BDS) was approved by the MRC Council in November 2020. The SHDS has been developed in parallel with the BDS and is therefore aligned and complementary to the BDS and the MRC Strategic Plan (2021–2025) that defines clear Outcomes, Outputs and Activities needed to achieve the BDS.

Five Strategic Priorities for Mekong River Basin development and management to 2030 are identified in the BDS to direct the Outcomes and Outputs towards improving the state of the Mekong Basin and contributing to the Sustainable Development Goals (SDGs). The BDS identifies five Strategic Priorities, one for each dimension of the Mekong River Basin Indicator Framework (MRB-IF), as follows:

1. **The environment:** Maintain the ecological function of the Mekong River Basin
2. **Social:** Enable inclusive utilization of the Basin's water and water-related resources
3. **Economic:** Enhance optimal and sustainable development of water and related sectors
4. **Climate change:** Strengthen resilience against climate risks, extreme floods, and droughts
5. **Cooperation:** Strengthen cooperation among all basin countries and stakeholders

The BDS Outcomes describe the resulting end state that basin countries would like to see by 2030. They are aligned with the strategic and assessment indicators of the State of Basin Report and MRB-IF, and their achievement will be evaluated using the MRB-IF indicators. In addition, the BDS outlines Outputs are the immediate results necessary for producing one of the Outcomes through an identified impact pathway.

The implementation of the SHDS is Output 3.2.2 under the **BDS Strategic Priority 3: Enhance optimal and sustainable development of water and related sectors.**

The goal of the SHDS

The goal of the SHDS is to support Member Countries in developing hydropower in a sustainable manner, consistent with the 1995 Mekong Agreement, and contributing to the Mekong River Basin vision of *"an economically prosperous, socially just, environmentally sound, and climate resilient Mekong River Basin".*

The goal of the Sustainable Hydropower Development Strategy for the Lower Mekong Basin

In support of the Mekong Basin vision, the Sustainable Hydropower Development Strategy

for the Lower Mekong Basin (SHDS) 2021 goal is to sustainably develop hydropower resources of the Mekong by applying Integrated Water Resources Management (IWRM) principles by taking into account:

- *opportunities to enhance national and regional benefits,*
- *the need to avoid, minimize and mitigate adverse transboundary impacts while ensuring water, energy, food, environmental, and livelihood security.*

A viable strategy: establishing basin-wide strategic priorities

Development of the strategic priorities included in the SHDS 2021 takes into account the goals, objectives and principles of the 1995 Mekong Agreement, and the core functions and mandate of the MRC. In addition, the Strategy is aimed at supporting Member Countries in addressing the significant sustainable development needs and challenges, and economic, social and environmental considerations in the Basin resulting from the rapid development of hydropower on the mainstream and tributaries.

These actions are defined under five basin-wide strategic priorities, which address longer-term risks and opportunities.

MRC Strategic Priorities and Outcomes for Sustainable Hydropower Development

Strategic Priority 1: ***Integrate sustainable hydropower considerations into project-level planning, preparation, design, implementation and operation activities.***

Outcome 1.1: Improved sustainability of individual hydropower projects in the Mekong Basin.

Outcome 1.2: Benefits optimized and potential adverse impacts of hydropower operations minimized through adaptive management of existing hydropower projects and updated designs for Mekong-specific impact mitigation.

Outcome 1.3: Improved effectiveness of the PNPCA's and related MRC Procedures' process and outcomes for hydropower projects.

Strategic Priority 2: ***Enhance cooperation on operational coordination and management of hydropower cascades*****.**

Outcome 2.1: Hydropower project information is shared with the MRC/Member Countries for all notified mainstream and tributary projects.

Outcome 2.2: Implementation of cooperation mechanisms for information sharing and coordinated LMB cascade operations support power production management, environmental management, flood and drought mitigation, and community safety.

Outcome 2.3: China and Myanmar exchange pertinent information on operational coordination and related scientific studies of hydropower to improve the sustainability of Upper Mekong/Lower Mekong Basin hydropower.

Strategic Priority 3: ***Enhance regional information sharing and cooperation on water/energy plans to capture economic and energy security benefits, and reduce transboundary social and environmental risks.***

Outcome 3.1: Net benefits of national hydropower and integrated renewable energy development plans, regional power system integration, and hydropower's role in climate change mitigation are maximized and balance basin-scale water, energy, food, environmental and livelihood security.

Outcome 3.2: Practical and tangible mechanisms/options further explored and developed for the equitable sharing of basin resources for hydropower and related development.

Strategic Priority 4: ***Enhance the livelihoods of hydropower project-affected river-based communities, particularly of women and ethnic minorities.***

Outcome 4.1: Improved and gender-equitable local development for riparian communities potentially adversely affected by hydropower projects in a transboundary context

Strategic Priority 5: ***Complete targeted studies to fill knowledge gaps and enhance analysis tools to support sustainable hydropower development and management*****.**

Outcome 5.1: Knowledge gaps will be filled through regional assessment and dialogue based on targeted studies carried out from Strategic Priorities 1 to 4

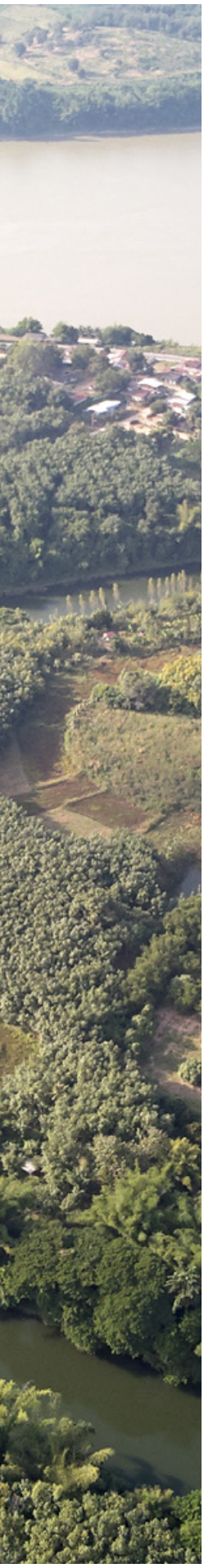
A basin-scale strategy involving a range of actors

The SHDS is a basin-scale strategy, aimed at guiding the priorities and actions, not only of the MRC, but also of agencies and actors that have an interest in sustainable hydropower development in the Mekong Basin and the region more generally. In particular, the SHDS draws attention to the close linkages between the energy and water sectors. Hydropower development should not come at the expense of the unique and abundant ecosystem services and biodiversity on which so many communities in the Basin depend.

Managing trade-offs and coordinating cross-sectoral links, which are evident from the study undertaken to develop this SHDS, will involve cooperation between a number of key MRC partners, agencies, and actors in the Mekong region. The Strategic Priorities set out in the SHDS may guide and support the actions and approach of these actors in close collaboration with the MRC.

Implementation of the SHDS: an action plan

An action plan was developed for the implementation of the SHDS, including a timeframe for each action and identification of the relevant stakeholders and their roles and responsibilities. The monitoring and evaluation (M&E) and reporting of the SHDS will be integrated into the M&E of the BDS and the MRC Strategic Plan. Given the rate of hydropower development in the Basin and uncertainties related to climate change impacts, it would be important to review the SHDS as needed and to update hydropower development strategy as part of the BDS update.



1. Introduction

1.1 The MRC Hydropower Development Strategy 2001 and MRC's Initiative for Sustainable Hydropower

Hydropower Development Strategy 2001 (HDS 2001) defined three strategic areas for the MRC to work on:

Strategic Area 1: Consideration of Integrated Water Use, Environmental and Socio-economic Factors

Strategic Area 2: Efficient Hydropower Generation and Distribution Mechanisms

Strategic Area 3: Information System and Capacity Building.

The outputs of this strategy emerged in the form of a variety of studies, guidelines and tools that were used to provide guidance for MRC involvement in hydropower activities in the Basin, including the provision of inputs for the Basin Development Plan. In addition, these principles guided the work of the former MRC core programmes, i.e. the Water Utilization Programme and the Environment Programme, as well as the relevant sector programmes such as the Fisheries Programme, the Agriculture and Irrigation Programme, the Navigation Programme, and particularly, the MRC's Initiative for Sustainable Hydropower (ISH).

MRC Basin Development Plans and Initiative for Sustainable Hydropower (2001–2021)

In 2008, the formulation and implementation of the ISH was a key strategic intervention by the MRC toward the fulfilment of the MRC's role in the hydropower sector. The ISH further advanced and implemented many of the strategies proposed in the Hydropower Development Strategy of 2001. A number of relevant guidelines and studies were completed and are available on the MRC website,[2] which are also listed in the Annex 1.

These MRC studies and the many others completed through research and investigations in a number of sectors have greatly improved the knowledge of the hydrological processes in the Mekong Basin and also the benefits and impacts of hydropower on the Basin's economic, environmental and socio-economic aspects.

The recommendations of the MRC studies and technical guidelines, which were developed from the implementation of the previous MRC Hydropower Development Strategy, are useful for the MRC Member Countries to consider for improving their national hydropower development process, including of the feasibility study reports, dam design and environmental impact assessment. These studies have highlighted the need for further cooperation between the MRC Member Countries to enhance national and regional benefits, and to avoid, minimize and mitigate adverse transboundary impacts while ensuring water, energy, food, environmental, and livelihood securities.

The need to update the Hydropower Development Strategy

The Hydropower Development Strategy adopted in 2001 must be updated to take into account major changes in the Basin occurring over the last 20 years since the construction of hydropower dams on the mainstream in the Lancang and Mekong Basin and tributaries.

In addition, with the development of many hydropower projects within the Basin, the need for operational coordination is now critical. This is also highlighted in the Siem Reap Declaration adopted by Prime Ministers of the MRC Member Countries on 5 April 2018: "*…The increasing development in the mainstream and tributaries highlight the increasing need for the sustainability and coordinated operational management of tributary and mainstream water resources development projects…*". Therefore, this aspect must be added to the Strategy to ensure community safety, minimization of impacts, and enhancement of national and regional benefits.

Knowledge on the hydropower potential benefits and the cumulative impact of hydropower have been advanced through MRC studies such as the Basin Development Strategy Scenarios Assessment (MRC, 2011) and the Council Study (MRC, 2017). These studies further support the need to update the hydropower development strategy. In addition, the MRC completed a major body of work covering the impact of climate change on the Mekong Basin, including work on the climate change impact on hydropower production and management.[3] The knowledge gathered in the studies have been carefully considered as part of this SHDS formulation.

2 See, for example, hydropower: www.mrcmekong.org/our-work/topics/hydropower

3 See the report by the MRC on basin-wide assessment of climate change impacts on hydropower production: https://bit.ly/3n9ICtQ

1.2 Purpose of the Sustainable Hydropower Development Strategy

The Sustainable Hydropower Development Strategy (SHDS or 'Strategy') reflects the commitment of the Lower Mekong Basin (LMB) countries (Cambodia, Lao PDR, Thailand and Viet Nam) to promote and support sustainable hydropower development, consistent with the 1995 Mekong Agreement and national development strategies and policies. It sets out the strategic priorities and actions at the basin level to address hydropower opportunities and risks, and strengthen basin-wide cooperation and sustainable development.

The SHDS will contribute to ensuring sustainable development of the Mekong River Basin, in line with the 1995 Mekong Agreement.

The SHDS focuses on areas that best serve the riparian countries with respect to developing and operating hydropower in a sustainable manner. It seeks to meet the diverse needs of the MRC Member Countries and the wider opportunities and challenges of sustainable basin development.

1.3 Aligned vision for sustainable Mekong hydropower development

The way in which hydropower is developed in the LMB will affect how MRC Member Countries are able to achieve their national development goals, global Sustainable Development Goals (SDGs), and the regional goals of the MRC.

The SHDS is formulated to achieve the Vision for the Mekong Basin towards *"an economically prosperous, socially just, environmentally sound, and climate resilient Mekong River Basin".*

The goal of the Sustainable Hydropower Development Strategy 2021

In support of the Mekong Basin vision, the goal of the Sustainable Hydropower Development Strategy (SHDS) 2021 is to sustainably develop hydropower resources of the Mekong by applying Integrated Water Resources Management (IWRM) principles by taking into account:

opportunities to enhance national and regional benefits,

the need to avoid, minimize and mitigate adverse transboundary impacts while ensuring water, energy, food, environmental, and livelihood security.

1.4 Approach to the development of a Sustainable Hydropower Development Strategy

The SHDS 2021 as an input to inform the Basin Planning Cycle 2021–2030

The Development of the SHDS 2021 is embedded in the MRC Strategic Planning Cycle and has been developed in alignment with the BDS 2021–2030. The Planning Cycle follows a process as shown in Figure 1.1.

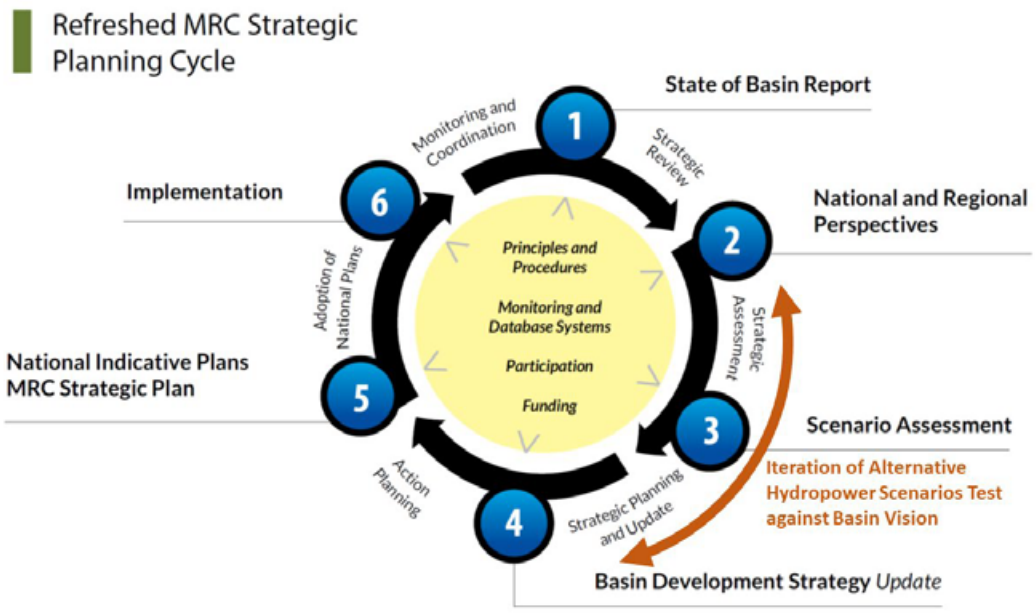


Figure 1.1. The Sustainable Hydropower Development Strategy embedded within the MRC Planning Cycle

The SHDS work is essentially positioned between Steps 2, 3 and 4 in the MRC Planning Cycle.

The Basin Development Strategy for the Mekong River Basin (2021–2030)

The Basin Development Strategy for the Mekong River Basin 2021–2030 (BDS) was approved by the MRC Council in November 2020. The SHDS has been developed in parallel with the BDS and therefore is aligned and complementary to the BDS 2021-2030 and the MRC Strategic Plan 2021–2025, which set out clear Outcomes, Outputs and Activities required to achieve the Mekong vision.

Five Strategic Priorities for Mekong River Basin development and management to 2030 are identified to direct the BDS Outcomes and Outputs towards improving the Mekong State of Basin and contributing to the SDGs. The five Strategic Priorities, one for each dimension of the Mekong River Basin Indicator Framework, are as follows:

1. **Environment:** Maintain the ecological function of the Mekong River Basin.
2. **Social:** Enable inclusive access and utilization of the Basin's water and water-related resources.
3. **Economic:** Enhance optimal and sustainable development of water and related sectors.
4. **Climate change:** Strengthen resilience against climate risks, extreme floods and droughts.
5. **Cooperation:** Strengthen cooperation among all basin countries and stakeholders.

The BDS Outcomes seek to describe the resulting end state that basin countries would like to see by 2030. They are aligned with the Strategic and Assessment Indicators of the State of Basin Report and

MRB-IF, and their achievement will be evaluated using the MRB-IF indicators.

> ***The preparation of the Sustainable Hydropower Development Strategy (2021) preceded the development of the Basin Development Strategy for the Mekong River Basin 2021–2030 (BDS 2021–2030) and the MRC Strategic Plan 2021–2025. The SHDS 2021 findings and Outcomes were incorporated into the BDS and MRC Strategic Plan. In this final version of the SHDS, the linkages to the BDS and Strategic Plan Outcomes and Outputs are noted in Sections 4 and 5 of this document.***

Link to the global Sustainable Development Goals

At the global scale, the SHDS also contributes to achievement of the SDGs, promoting science-based study and guidance, where project planners and implementers are able to make more informed decisions, striking a balance between hydropower development and environmental and social protection in the LMB to ensure integrated management of water resources while supplying sustainable energy for all.

Figure 1.2 indicates the linkages between the relevant 11 SDGs and the five MRC Indicator framework dimension themes for the BDS that are the focus of the SHDS Strategic Priorities.

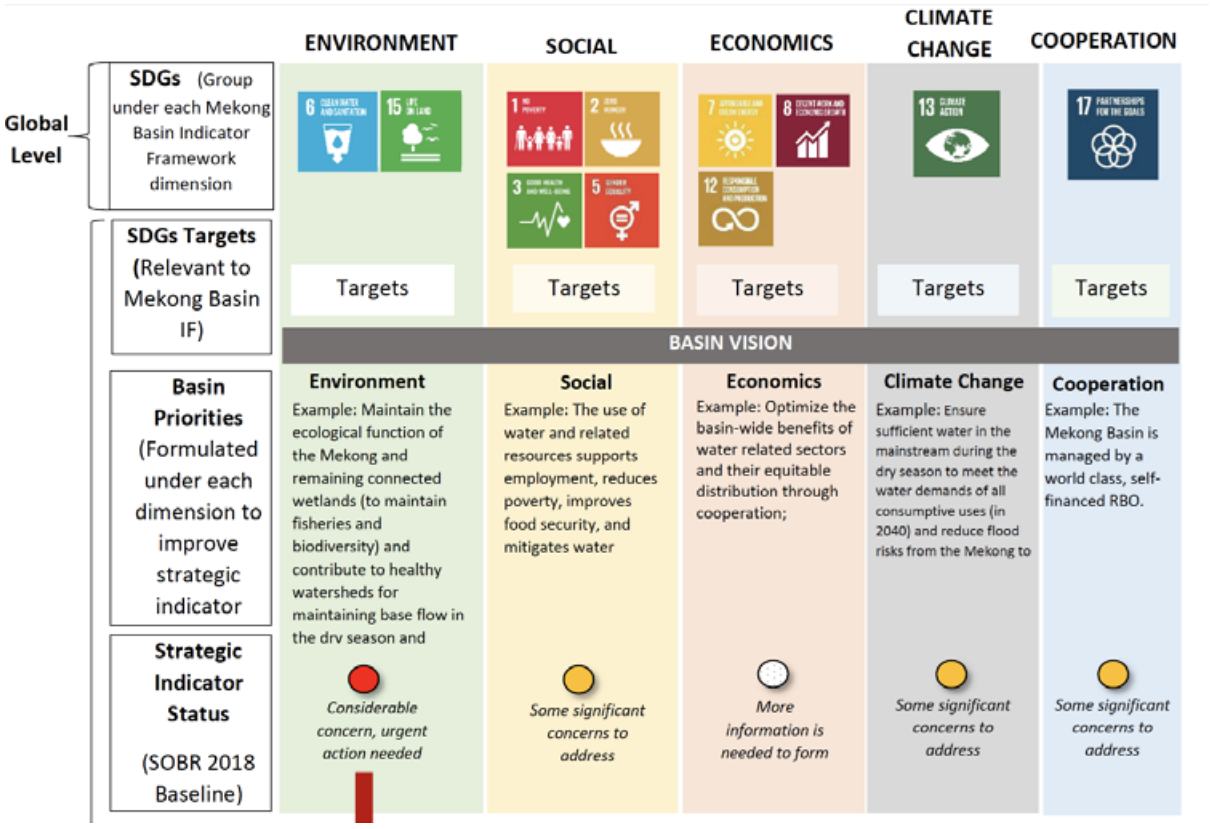


Figure 1.2. Linkages between the Sustainable Development Goals and the Basin Development Strategy

Relevant MRC studies

The recent State of the Basin Report 2018 (MRC, 2019) and the technical findings contained in other relevant and tested information sources provide the relevant baseline information for the SHDS.

This strategy document considers the main technical findings of these economic and scientific studies, and seeks to balance the findings of these studies with national priorities and perspectives through the set of Strategic Objectives (or Policy Recommendations) and an Action Plan needed to implement the strategy in a basin-wide perspective.

National and regional perspectives

National perspectives essentially come from the National Power Development Plans (PDPs) and the National Indicative Plans (NIPs) for other water resource developments, which have been gathered to reflect recent national priorities.

As set out in the overall goal above, the SHDS seeks to balance regional and basin needs with national priorities and perspectives. National plans seek to address energy, water, food, environmental and livelihood security from the national perspective. The SHDS, together with the other MRCS sector strategies being developed to inform the BDS, aims to complement the national plans. The sector strategies support the integration of these national plans into the BDS, according to integrated water resources management (IWRM) principles, towards increased regional benefits and reduced transboundary risks.

Therefore, the national PDPs, where available, and the sector plans collected for the Council Study and relevant MRC studies formed a primary input to the assessments undertaken to derive the SHDS.

The SHDS forms part of an interactive participatory planning stream and part of the BDS development process to engage with cross-sector, MRC-relevant, regional stakeholders and sectors (National Mekong Committees, government agencies, relevant non-governmental organizations (NGOs) and community groups) to achieve the goals of the SHDS 2021 and the BDS.

Scenario assessment

Before compiling SHDS 2021, an additional assessment was completed in 2018 to explore possible options to achieve the national priorities and perspectives, as well as the regional sustainable development goals set out in this SHDS. Different portfolios of hydropower project developments, which were characterized as 'scenarios', were defined to provide insights into how best these strategy goals could potentially be met.

The following **four 2040 alternative scenarios** were assessed:

- **The current plan scenario** – This scenario analyses the outcomes if all planned and proposed projects are built. It is equivalent to the Council Study M3 scenario and is the baseline against which the other scenarios are to be assessed.
- **The economic/power utility perspective scenario** – This scenario is focused on minimizing the costs of electricity supply and minimizing disruption to local communities.

- **The social (livelihoods) perspective scenario** – This scenario is focused on protecting fisheries and agriculture (for food, nutrition and income) and avoiding resettlement.
- **The environment (conservation) perspective scenario** – This scenario is focused on protecting biodiversity, preserving environmentally sensitive areas and reduction in greenhouse gases (GHGs).

For each of the scenarios above the other sector development in the Basin (e.g. irrigation) were kept constant for the time periods considered. Similarly, variations due to climate change were not considered. This was to allow a focus on the changes to the economic, social and environmental indicators under each of the scenarios resulting specifically from hydropower developments.

The scenarios are not 'plans', and there was no requirement that a specific scenario be identified and recommended for adoption by the Member Countries. The differently oriented scenarios instead have been analysed to provide a deeper understanding of hydropower development trade-offs that different scenarios involve. It should be emphasized that **decision-making with respect to hydropower development and operations rests with the Member Country hosting the project(s) under the Procedures for Notification, Prior Consultation and Agreement (PNPCA).**

A basin-scale strategy involving a range of sectors and actors

The SHDS is a basin-scale strategy aimed at guiding the priorities and actions of not only the MRC, but also agencies and actors that have an interest in the Mekong Basin and the region more generally. In particular, the SHDS draws attention to the close linkages between the energy and water sectors. The need for linked planning between these sectors is now more critical than ever before in the Mekong region. There are significant economic and GHG reduction benefits of hydropower development, as well as contributions to flood and drought management. At the same time the impacts on the unique and abundant ecosystem services and biodiversity of the Mekong, on which so many communities in the Basin depend, need to be considered.

Tackling these trade-offs and cross-sectoral links will involve the cooperation between a number of key MRC partners, agencies and actors in the Mekong region. The Strategic Priorities set out in the SHDS may guide and support the actions and approach of these actors in close collaboration with the MRC.

1.5 Limitations of scope and assessment

Decision-making on the major infrastructure development in the Mekong Basin must be based on the best available information and analysis. Although there have been significant advances in the understanding of basin processes and their benefits and risks, the rapid pace of these advances has outrun the necessary collection of data and research on their benefits and impacts. Therefore, decision makers must inevitably make decisions on imperfect data, taking into account the development needs and advantages of each country, as well as the probability of the risks.

The SHDS draws on a number of recent, detailed studies, as noted above, to understand the opportunities, trade-offs, and challenges. The indicators, models, and methods used in these studies are very wide ranging and attempt to cover many of the different aspects of benefits and impacts

of hydropower. However, these analyses will only represent part of the picture and rarely express absolute measurements or values. They may only reflect a small but measurable part of the whole, more complex issue. As such, they are indicative of trends, rather than the full/absolute cost or benefit.

The indicators, models, and methods used seek to highlight the different trade-offs between the key risks and benefits of a range of future development scenarios. The results provide a comparison of between the hydropower development options regarding benefits and risks in order to inform decision makers.

The indicators tend to be generalized across the whole basin, and particular indicators may have different values in the four countries and location. It should be stressed that these indicators are being used to compare the relative strengths and weaknesses of the scenarios, and specific impact assessment is required of individual dams, where the values may have to be adjusted.

1.6 Guide to content of the document

This document aims to cover the following logical flow:

- Clearly set out the mandate of the MRC within the hydropower sector.
- Understand the trade-offs opportunities and challenges facing the Mekong Member Countries in the hydropower sector over the next 10–20 years.
- Set out Strategic Priorities and related long-term outcomes to deal with these trade-offs and challenges to meet the goal of the SHDS.
- Formulate Outputs and Activities proposed to deliver these Outcomes.

Logic flow diagram and time frames

The Strategic Priorities and Outcomes are proposed as ten-year goals in line with the BDS 2021–2030. As noted above, they may guide MRC outputs and activities as well as those of other actors. The MRC-led Outputs and Activities are then to be included in the MRC Strategic Plan 2021–2025. The logic flow of the SHDS is shown in Figure 1.3.

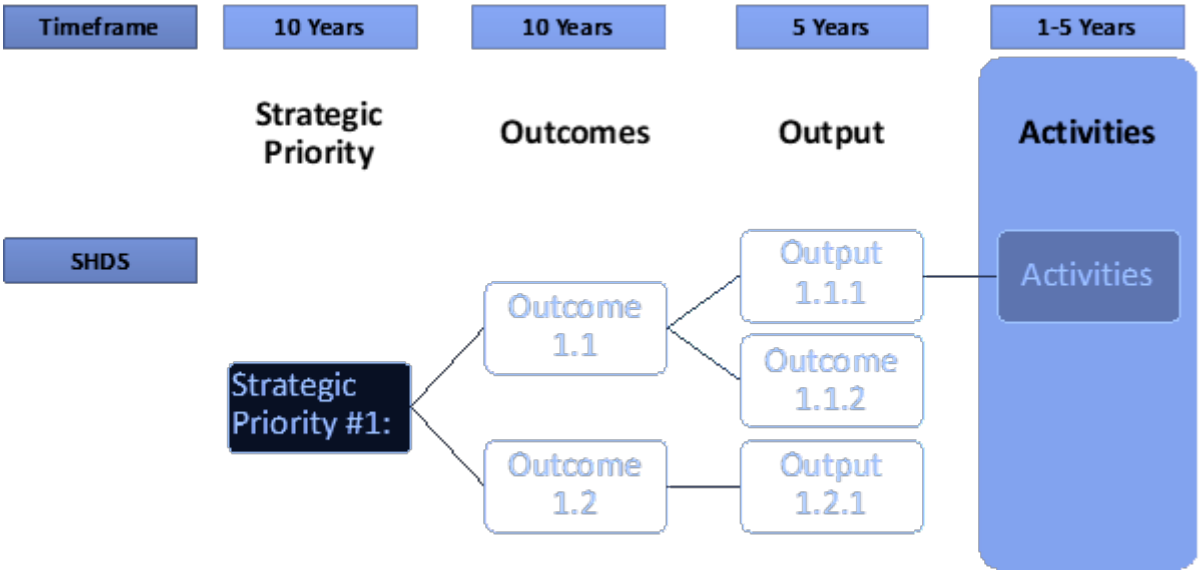


Figure 1.3. Logic flow and time frames of the Sustainable Hydropower Development Strategy (SHDS)

2. Framework conditions

2.1 The 1995 Mekong Agreement

The 1995 Mekong Agreement is a cooperative agreement among sovereign Member Countries and has rules and procedures to carry out its work in close cooperation and coordination with relevant agencies and peoples of the Member Countries. It identifies key mechanisms that support the sustainable development, equitable use, utilization, and protection of the Mekong's water and water- related resources for Member Countries.

The 1995 Mekong Agreement also provides the legal basis for the MRC cooperation on hydropower development and provides the mandate for implementing hydropower strategic priorities towards the MRC Vision.

Explicit and implicit references to hydropower in the 1995 Mekong Agreement are summarized in Table 2.1.

Table 2.1. Articles in the Mekong Agreement on cooperation on sustainable hydropower development

Section in the 1995 Agreement	Detail and relevance to hydropower considerations
Explicit references to hydropower	
Article 1	**Areas of cooperation** – To cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources … including, but not limited to irrigation, **hydropower**, navigation, flood mitigation and management, fisheries, timber floating, recreation and tourism, in a manner to optimize the multiple-use and mutual benefits of all riparian's and to minimize the harmful effects that might result from natural occurrences and man-made activities.
Article 2	**MRC's role in planning** – To promote, support, cooperate and coordinate in the development of the full potential of sustainable benefits to all riparian States and the prevention of wasteful use of Mekong River Basin waters, with emphasis and preference on joint and/or basin-wide development projects and basin programs through the formulation of a basin development plan, that would be used to identify, categorize and prioritize the projects and programs to seek assistance for and to implement at the basin level.
Article 5	**Reasonable and equitable utilization** – To utilize the waters of the Mekong River system in a reasonable and equitable manner in their respective territories, pursuant to all relevant factors and circumstances, the Rules for Water Utilization and Inter-basin Diversion provided for under Article 26 and the provisions of A and B, in which under A. concerning Notification of intra-basin use on tributaries (***e.g. proposed hydropower schemes***); and under B. concerning Prior Consultation on dry season intra-basin use on the mainstream, which aims at reaching an agreement by the Joint Committee (e.g. ***proposed mainstream hydropower schemes***).
Article 6	**Maintenance of flows on the mainstream** – To cooperate in the maintenance of the flows on the mainstream from diversions, storage releases (***e.g. from hydropower reservoirs***), or other actions of a permanent nature.
Implicit references to hydropower	
Article 3	**Protection of the Environment and Ecological Balance** – To protect the environment, natural resources, aquatic life and conditions, and ecological balance of the Mekong River Basin from pollution or other harmful effects resulting from any development plans and uses of water and related resources in the Basin.

Article 7	**Prevention of Harmful Effects** – To make every effort to *avoid, minimize and mitigate harmful effects* that might occur to the environment, especially the water quantity and quality, the aquatic (eco-system) conditions, and ecological balance of the river system, from the development and use of the Mekong River Basin water resource ….
Article 8	**State Responsibility for Damages** – Where harmful effects cause substantial damage to one or more riparians from the use of and/or discharge to waters of the Mekong River by any riparian State, the party(ies) concerned shall determine all relative factors, the cause, extent of damage and responsibility for damages caused by that State…
Article 9	**Freedom of navigation on the mainstream** – On the basis of equality of right, freedom of navigation shall be accorded throughout the mainstream of the Mekong River… navigational uses are not assured any priority over other uses, but will be incorporated into any mainstream project.
Article 10	**Emergency Situations** – Whenever a Party becomes aware of any special water quantity or quality problems constituting an emergency that requires immediate response, it shall notify and consult directly with the party(ies) concerned and the Joint Committee without delay in order to take appropriate remedial action. ***Author's note: Connected to safety of hydropower dams and emergency preparedness procedures linked also to coordinated reservoir flood management, and linked to water quality management in hydropower reservoirs).***
Article 26	**Rules for water utilization** – The Joint Committee shall prepare and propose for approval of the Council, *inter alia*, Rules for Water Utilization and Inter-Basin Diversions pursuant to Articles 5 and 6, including but not limited to: … (3) setting out criteria for determining surplus quantities of water during the dry season on the mainstream; 4) improving upon the mechanism to monitor intra-basin use;….

2.2 MRC's role in planning

The SHDS is aligned directly with the Article 2 of the 1995 Mekong Agreement under as stated in Table 2.1. Indeed, under Article 2, the MRC has the mandate for basin-wide planning, including for hydropower projects.

The SHDS seeks to promote sustainable development through a range of strategies, policy recommendations, and actions towards the strategy goal. The studies and analysis are aimed at

creating information on the trade-offs between alternative development scenarios at a basin scale to inform the *"identification, categorization and prioritization"* of hydropower projects.

According to 1995 Mekong Agreement, the Mekong River Commission supports a basin-wide planning process based on IWRM principles through Core River Basin Management Functions (CRBMF), which are considered the 'heart' of the MRC's work and are performed jointly at the regional and national levels.

The role of the MRC as an international, basin-wide knowledge hub and planning body reflects the limits of its authority. **Decision-making with respect to hydropower development and operations rests with the Member Country hosting the project(s) under the PNPCA.**

2.3 Reasonable and equitable use

Article 5 of the 1995 Mekong Agreement states that:

> *… to utilize the waters of the Mekong River system in a reasonable and equitable manner in their respective territories, pursuant to all relevant factors and circumstances, the Rules for Water Utilization and Inter-Basin Diversion, and [notification, prior consultation and agreement] …*

The reasonable and equitable use concept has mostly evolved around sharing water. In this context, any use of water by one riparian country may affect the other riparian countries or their river ecology.

In the current Mekong context, although the reasonable and equitable use concept has not yet been widely discussed and developed, it may be argued that each of the Member Countries is entitled to a reasonable and equitable share of the *development space,* or the degree of development that would enable sustainable water use, as well as *adequate* downstream sediment transport, fisheries, and key ecosystem functions, particularly where there is a high dependency on them.

According to the concept of reasonable and equitable use in the context of the SHDS, the Strategic Priorities will:

- weigh the national and regional economic and social benefits of hydropower development together with the other developments within the Basin, taking into account the cost of mitigation measures, and residual impacts after mitigation;
- consider different levels of economic and social development of Member Countries, as well as past benefits and costs that had already been derived by countries and sectors from water and its related resources;
- take into account the population that will be directly affected, their vulnerability, and the extent to which they would be affected by lost ecological functions;
- explore the role of hydropower in supporting the development of alternative energy sources that may be economically and sustainably developed in synergy with

hydropower.

- consider the climate change risks and opportunities (adaptation) associated with hydropower development that may have potential impacts on hydrology and hydropower production.

These principles are intended to underpin the Strategic Priorities and Outcomes of the SHDS and will be taken up in the BDS 2021–2030 as part of the "Proactive Regional Planning" exercise.

2.4 The link between the SHDS and the PNPCA

The SHDS sets out the strategic priorities and actions required at the basin level to address hydropower opportunities and risks, and strengthen basin-wide cooperation and sustainable development in line with the 1995 Mekong Agreement. It provides strategic direction for basin-wide sustainable hydropower development.

The concept behind basin planning, and hydropower planning, in particular, is to provide a process for considering the impacts of national plans, especially planned projects on the mainstream, at the regional basin scale **before these projects are discussed under the PNPCA**. The PNPCA then allows other riparian countries to review the proposed use once submitted by the notifying Member Country. **The principles and provisions underpinning the PNPCA process have been considered in the development of the SHDS.**

The preamble to the PNPCA includes the following:

> *Reconfirming the commitment to work together to address the protection of the environment and the ecological balance in the Mekong Basin, including the prevention of harmful effects and taking actions in emergency situations as covered by other Rules/ Procedures approved by the MRC Council.*

Since the PNPCA is neither a unilateral right to proceed, nor a veto right; its success relies heavily on good faith cooperation and on recognizing the rights of ***all*** the Parties. The PNPCA's Article 3 indicates that consultations shall be governed by the following principles:

a) Sovereign equality and territorial integrity
b) Reasonable and equitable utilization
c) Respect for rights and legitimate interests; and
d) Good faith and transparency.

2.5 National, regional and international policy initiatives

National sustainable hydropower policy

Each MRC Member Country has implemented activities to meet broader development needs and energy security needs through the development of PDPs, energy efficiency plans (EEP) and renewable

energy plans. These plans may include hydropower development as well as the full range of thermal and renewable energy options.

In the past decade, all LMB countries have incorporated sustainable development of the power sector in their body of energy laws and policies, expressed largely as policy aspirations. Therefore, addressing the gap between the new policy and actual practice is an acknowledged concern.

LMB countries have prepared laws an explicit policy for the promotion of sustainable hydropower, with associated guidance on implementation.

Cambodia

Cambodia is seeking to rapidly expand its power sector to keep up with increasing demand, having experienced double-digit annual growth in recent years. This sector is undergoing a major transformation, and high on the Government's agenda is increasing access, improving grid reliability, and reducing imports and costs for consumers. The objective of the current PDP is to satisfy future load growth with reliable and affordable electricity, enhance national energy security through the use of domestic energy sources, as well as the increase the percentage of clean energy sources such as variable renewable energy (VRE) and energy efficiency (EE) without compromising reliability and affordability to address national and environmental goals and global commitments (national determined contributions and United Nations Framework Convention on Climate Change). In the Cambodia context, hydropower has played an increasingly important role in the power supply system by responding to the rapidly growing demand in the countries. This is achieved by providing more reliable supply sources that are alternative to dependency on fossil fuel and that are imported from neighbouring countries, as well as generating more revenues from the sale of electricity. This contributes to the reduction of tariffs and the improvement of the rural electrification rate. Hydropower forms has a key component of Cambodia's strategy to meet future energy needs.

The legal framework for the development of sustainable hydropower is contained in several laws governed by the relevant ministries: the *Law on Environmental Protection and Natural Resource Management (1996),* the *Electricity Law (2001),* the *Law on Water Resources Management (1997)* and the *Protected Area Law (2008)*.

Lao PDR

The Lao PDR Policy on Sustainable Hydropower Development was signed by the Prime Minister in January 2015. The policy is aimed at providing policy guidance to the agencies responsible for overseeing the implementation of investment projects in the hydropower sector as well as to inform project developers/investors of the government policy on sustainable development in Lao PDR. The policy is applicable for projects of all scales and entire development stages, as necessary.

The policy emphasizes the need to ensure technical and economic sustainability as well as the minimization of environmental and social impacts, all of which aligns well with the SHDS. During the policy development, a number of laws and decrees have been updated, including: the *Electricity Law,* the *Water Law,* the *Environmental Protection Law,* the *Environment Impact Assessment Decree,* and the *Decree on Compensation and Resettlement of People Affected by Development Projects*.

In addition, the Lao PDR Ministry of Energy and Mines (MEM) has recognized the importance of coordination and monitoring of the hydropower cascades. With the support of the *Agence française de développement* (AFD), MEM completed an extensive feasibility study on the setting up of a Lao PDR Coordination and Monitoring Centre (CMC) in 2019.

The work undertaken is comprehensive, covering governance, information requirements, data management and staffing. The linkage between the CMC (proposed for implementation from 2021 and beyond) and MRC will be vital. It is proposed that the CMC will be implemented incrementally, commencing with projects in the upper reaches of the Mekong River below China/Lancang, which will be beneficial for the LMB. In addition, the CMC also proposes a Crisis Unit to manage emergencies such as Dam Safety.

Thailand

In recent years, Thailand has explicitly set energy security as the top policy objective, followed by economic affordability, and social and environmental sustainability in the Thailand Integrated Energy Blueprint (TIEB). This is underpinned by five individual but interrelated energy plans covering natural gas, oil, energy efficiency, the power sector, and alternative energy sources. This prioritization was in response to the continuous growth in energy demand with depleting domestic reserves of energy resources in Thailand.

Following the Thai Power Development Plan, Thailand has been a major customer of hydropower developed in Lao PDR with Thai developers also involved in specific project development. There are numerous laws and policies that cover sustainable hydropower topics including: the *National Energy Policy Council Act (1992)*, the *Energy Industry Act (2007),* and the *Rule of the Energy Regulatory Commission on Procurement of Electricity from the Hydroelectric Power Project in the Lao People's Democratic Republic (2020).*

Viet Nam

Hydropower also forms an important component of Viet Nam's electricity supply grid system. This system has been operating for several years, which has led to discussions in Viet Nam in recent decades on the adverse environmental and social consequences that hinder achieving the objectives of the Vietnamese Government on equitable and sustainable development.

In the Mekong context Viet Nam is an upstream hydropower operator (e.g. in the Se San and Sre Pok sub-basins of the Mekong), which affects the flows and water quality into the Cambodian reaches of those rivers and the Mekong mainstream. Viet Nam also is affected by all transboundary impacts arising from hydropower operations in the remainder of the Basin.

Viet Nam is therefore engaged with national and regional sustainability dialogue in relation to hydropower strategy and operations, and has used international standards to review individual hydropower projects. There have been several laws and decrees promulgated to address the changes that must be effected to make the hydropower sector sustainable, including the *Law on Environmental Protection (2020)* and *Decree No. 201/2013/ND-CP detailing the implementation of a number of articles of the Law on Water Resources (2013)*.

Regional initiatives in the Mekong and international practice

To effectively implement the SHDS, consideration of regional benefits and cost, regional guidance and initiatives developed within the MRC and other good international practice are required. Moreover, national development priorities must be taken into account, which requires Member Countries and stakeholders to existing dialogue and consultation platforms, especially when undergoing the PNPCA process.

A number of Mekong regional initiatives are relevant to the MRC's role in advancing sustainable hydropower considerations in the LMB. These initiatives are often part of larger regional development programmes of regional bodies such as the Association of Southeast Asian Nations (ASEAN), the Asia Development Bank-supported Greater Mekong Subregion (GMS) initiative, the Mekong Lancang Cooperation (MLC),[4] as well as regional programmes of international NGOs, such as the International Union for Conservation of Nature (IUCN), the World Wide Fund (WWF) and the Consultative Group for International Agricultural Research (CGIAR) Challenge Program on Water and Food (CPWF).

There are several international initiatives for sustainable hydropower development by organizations such as the International Hydropower Association (IHA), which is an industry-led organization that develops and promotes good industry practice for developers and hydropower operators. The IHA gathers good practice globally and provides guidelines and manuals pertaining to sustainable hydropower development. In addition, the International Commission on Large Dams (ICOLD), in which Thailand and Viet Nam are members and Lao PDR has recently become a member, will further contribute to the strengthening of dam management and safety standards.

Therefore, the MRC seeks to complement regional and other international institutions involved in hydropower development in the Basin and, more generally, in power development in the region. Cooperation with institutions involved in hydropower and water resources management in the region is emphasized, in order to create a more coherent and effective coordination mechanism that ensures joint efforts while drawing on the experience of other river basin organizations.

4 Also known as Lancang Mekong Cooperation (LMC).

3. Hydropower opportunities, trade-offs, and challenges in the Lower Mekong Basin

This Chapter addresses the hydropower opportunities, trade-offs, and challenges that emerged from the numerous regional and MRC studies[5] that have been completed in the last 10 years. The Strategic Priorities and actions required to address these challenges are found in Chapters 4 and 5.

3.1 Hydropower development trends in the Lower Mekong Basin countries

5 MRC studies (see Annex 1) include the Basin Development Plan Programme Phase 2's Scenario Assessment (2011), the Strategic Environmental Assessment (SEA, 2010), the MRC Hydropower Mitigation Guidelines ISH0306 (2016), and most recently, the Study on Sustainable Management and Development of the Mekong River including Impacts of Mainstream Hydropower Projects (MRC Council Study, 2017) and the additional assessment undertaken in preparation of the SHDS. While all Member Countries appreciate the knowledge and capacity gained from the results and findings of all MRC studies, some of them resulted from modelled assessments of future outcomes that would need to be further monitored and reviewed based on actual conditions. The MRC study on the Sustainable Management and Development of the Mekong River (i.e. the Council study), was duly acknowledged by Prime Ministers of the four Member Countries during the 3rd MRC Summit at Siem Reap. Importantly, various tools and knowledge as developed and generated therein are considered useful for capacity building and to guide the implementation of the MRC BDS/SP as well as the SHD strategy.

The pace of hydropower development in the LMB has accelerated in recent years with growing demand for low-cost electricity to support economic development. In 2001, there were approximately 17 hydropower projects in operation in the LMB with a capacity of less than 1,400 MW. From 2002 to 2015, 40 additional hydropower projects with a capacity of 6,442 MW were commissioned. As of 2021, there were 88 hydropower projects in operation in the LMB with around 12,600 MW total installed capacity. Around 15 dams with a total capacity of 1,600 MW are under construction. By 2040, it is estimated that hydropower in the LMB will generate more than 30,000 MW.

Six mainstream dam projects have been submitted to the MRC under the PNPCA Prior Consultation (PC) process. The 1,285 MW Xayaburi and the 260 MW Don Sahong Hydropower projects have been in commercial operation from late 2019. The 912 MW Pak Beng, 770 MW Pak Lay and 1,460 MW Luang Prabang projects completed their PNPCA PC reviews, in 2017, 2019, and 2020, respectively. Following from these last three PNPCA PC processes, a Joint Action Plan (JAP) was agreed on, which will be implemented to carry out measures to avoid, minimize, and mitigate negative impacts. The sixth proposed 684 MW Sanakham project is currently under the PC process.

Upstream of the LMB, China constructed 11 hydropower dams (two of which are large storage dams) along the mainstream in the Upper Mekong with another 11, each greater than 100 MW, either being constructed or planned. The installed hydropower capacity on the Upper Mekong is 21,310 MW with the planned total rising to 31,605 MW.[6] Only a small proportion of China's part of the Mekong River Basin is irrigated due to the narrow, steep sided gorges that dominate there.

In order to secure the power market and take advantage of the high potential of hydropower development, Lao PDR plans to further expand to meet domestic demand and commitments under memoranda of understanding with regional nations to supply power, as shown below:

- 9,000 MW to Thailand by 2025
- 5,000 MW to Viet Nam by 2030
- 695 MW to Cambodia by 2025.

Cambodia also has the potential to develop hydropower projects both on the mainstream Mekong floodplain and in tributaries.

The map in Figure 3.1 shows the location of commissioned, under construction and planned projects based on the MRC hydropower database as updated in 2020. A summary breakdown of LMB hydropower development status is shown in Figure 3.2.

6 Based on multiple sources (MRC recent studies and Consultative Group on International Agricultural Research (CGIAR) Research Program on Water, Land and Ecosystems (WLE) Greater Mekong, 2018, in MRC State of the Basin Report 2018, MRC hydropower database, and recently updated information of STIMSON Mekong Infrastructure Tracker).

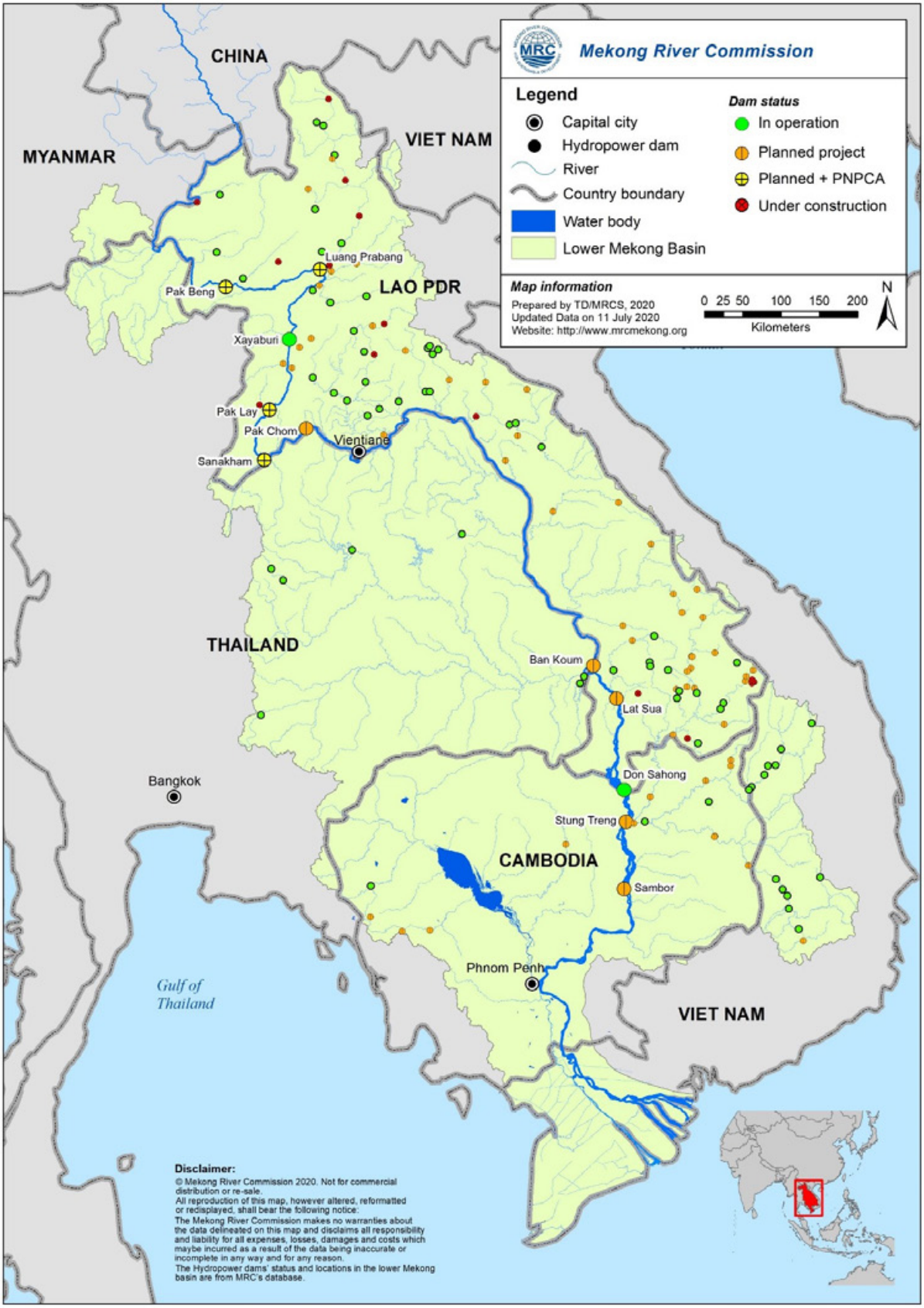


Figure 3.1. Map of commissioned, committed, and proposed hydropower

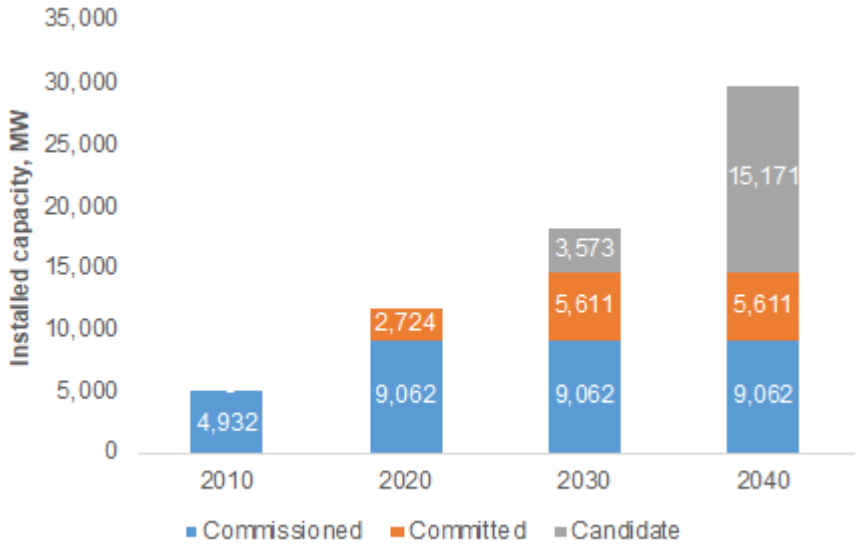


Figure 3.2. Commissioned, committed, and candidate LMB hydropower capacity

In Figure 3.2, 'Commissioned' projects are those already in operation at the time of the development of this strategy, while the 'Committed' projects are either under construction or have existing concession agreements and power purchase agreements.

Note that the "candidate" potential capacity represented in Figure 3.2 is indicative of the potential development opportunity. It is not currently representative of the power demand that is required to be met by hydropower over the next 20 years across the region.

3.2 Balancing the benefits and risks of hydropower development

Balancing the benefits and risks of hydropower development is widely recommended from the studies and initiatives referenced in chapters 1 and 2 above. The sections below summarize the key findings resulting from a review of the numerous regional studies noted in Section 1.4 above.

Energy security and economic benefits

Energy security and economic growth are strategic priorities for all MRC Member Countries. The SHDS seeks ways to support this priority by assessing low-cost and low-risk energy options that take into account the Mekong Basin water sector risks.

Multiple recent MRC studies find that hydropower development in LMB may deliver net economic benefits across the region. The savings are significant in electricity supply costs relative to alternatives, such as new coal and gas-fired generation. In addition, the studies recommend to explore how lower cost alternative renewable sources (solar and wind) may be developed in synergy with hydropower to provide energy security for Member Countries and in accordance with their own comparative advantages, capacity, and potential. These economic benefits are further supplemented by royalties, taxes, and profits accruing to governments, and the benefits from employment, flood and drought mitigation and management, irrigation, and local economic development.

To enhance the net benefits (i.e. benefits minus costs) arising from the range of energy development options available to Member Countries, detailed regional dialogue on water and energy plans is needed and should be explored further.

Major benefits and risks arise from commissioned and committed projects

As may be seen from Section 3.1 above, substantial mainstream and tributary hydropower has already been established (or is about to be commissioned) in the Upper and Lower Mekong River Basin. An important finding of the MRC studies is that many of the potential economic benefits as well as impacts of hydropower development will have been realized by 2020 due to this ongoing hydropower project construction.

In general, the most economic projects have been developed first, and the costs savings relative to other power development options are therefore the highest, and the economic benefits of these projects are greater.

Environmental risks

The economic benefits must clearly be considered in light of the substantive risk of potential negative impacts. These include the loss of livelihoods (notably through falling capture fisheries), declines in sediment flows, the loss of environmentally important wetlands and forests, which come also from other developments including irrigation expansion, navigation, flood control measures, roads, and urbanization.

The recent MRC Studies have pointed to the projected risks to the ecosystem services and the reductions in capture fisheries and sediment transport resulting from existing and planned hydropower as well as other developments. These changes are already being measured in the Basin (e.g. reduction in sediment transport).

There are also major but unquantifiable risks related to the disruption to ecosystems and the loss of the region's valuable and unique biodiversity as a result of all development within the Basin. However, putting an economic value on the biodiversity loss (or gain) is difficult.

The Joint Environmental Monitoring (JEM) programme on the Mekong mainstream is essential to understand the changes occurring within the Basin due to existing and under construction hydropower and other developments. Monitoring of projects on major tributaries is the role of national agencies. The sharing of the information from this monitoring will be important to allow coordinated operations and management on shared tributaries and on the mainstream. Adaptive management of the hydropower mitigation operations should then be undertaken to reduce measured impacts. This monitoring will also allow impact mitigation solutions to be adapted to the Mekong context.

Social risks

Hydropower development can bring about broad benefits to society, including better livelihoods for resettled peoples if properly managed. But there are also socio-economic risks, which not only come from hydropower development but also other developments. Thus, many of the risks and possible impacts cannot be measured with confidence. Information sharing and mitigation measures must be applied.

Well-designed resettlement, compensation and income restoration programmes can mitigate the adverse impacts and may even raise the economic status of affected communities to a higher level than the pre-project situation. Care in the design of these programmes is critical—there are also many examples of poorly designed and implemented programmes leaving people worse-off.

Even with effective resettlement and compensation programmes, such displacement is inevitably disruptive to existing cultural and social arrangements, and households will take time to adjust. These impacts may fall disproportionately on women, children, and ethnic minorities. Women will generally be responsible for managing households, and their livelihoods may be highly vulnerable to changes in river use (such as lost access to sources of firewood and the flooding of riverbank gardens).

Basin-scale disruption to food and livelihood security has been foreshadowed in the Council Study as a result of reduced fisheries' yield and impacts on ecosystem services.

The transboundary effects of these major infrastructure developments require that the MRC Member Countries cooperate on suitable impact assessment, mitigation and adaptive management approaches. Dialogue on the implementation of the recommended approach set out in the Preliminary Design Guidance and the Rapid Hydropower Sustainability Assessment Tool (RSAT), should be aimed at seeking practical solutions to mitigate these risks.

Climate change opportunities and risks

Many actors, including the Intergovernmental Panel on Climate Change (IPCC), consider hydropower together with other renewable energy sources as a key component of climate change mitigation. In the Mekong, this opportunity to reduce GHGs is substantial if these renewable energy resources are prioritized in the PDPs of the Member Countries. The assessment undertaken for this strategy has shown that, if these GHG reductions are able to be monetized in the future (e.g. through carbon pricing), they may provide a considerable additional economic benefit for the region.

Multi-purpose hydropower reservoirs may be utilized for a range of purposes including irrigation, and flood and drought mitigation and management. They therefore have the opportunity to play a role in climate change adaptation if these aspects are built into the design and operations of the reservoir.

However, uncertainties as to the impact of climate change on hydropower production variability as well as extremes of drought and flood must be considered. The MRC studies[7] have shown that there are risks associated with potential greater variability in wet and dry seasons, with resulting uncertain risks to both hydropower management and also riparian communities.

At a basin scale, these climate change opportunities and risks need to be built into dialogue on hydropower development within the context of basin planning.

7 See the report by the MRC on basin-wide assessment of climate change impacts on hydropower production: https://bit.ly/3n9ICtQ .

3.3 Basin-scale benefits and risks of alternative hydropower development scenarios

MRC Study findings highlight the need for Member Countries to strike an appropriate balance between regional and national equity and risk reduction according to the principles under Article 5 on the "Reasonable and Equitable" use of the Basin's resources. The economic benefits at the national level and regional levels must be carefully considered.

All Mekong countries may be exposed, to different degrees, to impacts from water resources developments in the Upper Mekong Basin (UMB, Lancang) and the LMB. And yet, not all countries have been able to realize the full potential benefit of their own hydropower development.

The study of 2040 alternative scenarios (Section 1.4) found that, at the national and regional levels, the benefits may be enhanced, and risks of further negative impacts may be reduced by cooperation and information sharing on plans for energy and water development and management.

A second important finding is that there is potential to improve the balance between benefits and risks by careful project selection, siting, and design during the feasibility study stage. Notably, a number of projects appear to have relatively high investment and social costs (therefore, offer much lower savings in electricity supply costs) and also have associated risks. Careful selection or improved design of projects to be developed may enhance national and regional outcomes as a whole, as illustrated in Table 3.1.

Table 3.1. Assessed benefits and risks of LMB hydropower development

Scenario	Current plans	Economic	Social	Environment
Scope	All identified projects	Prioritize lowest-cost projects	Prioritize least disruptive projects	Prioritize development in existing areas
BENEFITS				
Economic benefits (including electricity cost savings, royalties and taxes, etc.)	**Strongly positive**	**Strongly zzpositive**	**Strongly positive**	**Strongly positive**
Reservoir fisheries	**Positive**	**Positive**	**Positive**	**Positive**
Reduction in greenhouse gases	**Positive**	**Positive**	**Positive**	**Positive**

Flood mitigation and management, irrigation, local development	**Positive**	**Moderately positive**	**Moderately positive**	**Moderately positive**
RISKS				
Capture fisheries	**Strongly negative**	**Strongly negative**	**Strongly negative**	**Strongly negative**
Loss of wetlands and forest	**Negative**	**Negative**	**Moderately negative**	**Moderately negative**
Displaced and affected persons	**Negative**	**Negative**	**Slightly negative**	**Slightly negative**
Ecosystem disruption	**Strongly negative**	**Strongly negative**	**Negative**	**Negative**

Design, construction, and operation for sustainable hydropower enhancement

Recent studies on hydropower risk mitigation[8] have emphasized the importance of the implementation of regionally relevant approaches to the avoidance, minimization, and mitigation of hydropower risks. This work has emphasized the need for design, construction, and operations of individual projects in line with good industry practice, national laws and regional agreements. In addition, coordination of cascade design and operations is needed to enhance sustainable hydropower development and management, for example, the transmission of sediments and the safe passage of extreme floods. This has been brought to prominence by recent dam break events on a Mekong Basin tributary, which had potential transboundary consequences on community safety.

Implementation of global and regional sustainable hydropower practice guidance has been shown to substantially improve project risk mitigation, as required by Article 7 of the 1995 Mekong Agreement. However, the efficacy of currently deployed mitigation approaches is unknown in the Mekong context. Lessons learned from the JEM, as it is applied to two mainstream projects as pilot projects (Xayaburi and Don Sahong Hydropower Plants), should be applied in adaptively updating the mitigation approaches deployed in the Mekong.

At the project level, the MRC studies have identified various opportunities to enhance benefits and reduce risks of individual projects by:

- incorporating multi-sector development around each project to diversify and enhance benefits;

8 See a case study by the MRC "Development of Guidelines for Hydropower Environmental Impact Mitigation and Risk Management in the Lower Mekong Mainstream and Tributaries": https://bit.ly/3zYtdUD .

- utilizing good industry practice mitigation as the standard in project design, construction, and operation, including MRC and National Guidance within the Preliminary Design Guidance (PDG), MRC Mitigation Guidelines, Transboundary Environment Impact Assessment (TbEIA) Guidelines, and the JEM Programme;
- implementing opportunities to consider alternative project locations to reduce the risk of negative impacts and to avoid ecologically sensitive areas; and
- taking into consideration climate change impacts on production variability and flood and drought management.

Existing MRC tools and guidance on project design and operation are listed in Annex 1.

Hydropower cascade operation

Due to the intensity of hydropower development in the Mekong Basin mainstream and tributaries, enhanced information sharing and coordination of operation of cascades of projects, with potentially different owners, is now critical. Clearly, this is important to optimize production, but it is also essential for the coordination of flood and drought mitigation and management, sediment transmission during flushing operations, navigation, and riparian community safety.

National priorities for cascade operation may be linked to electricity market requirements; however, the consequences of this form of operation may have commercial as well as environmental and community safety implications. This is of particular concern in the transboundary context, where cross-border warnings of operational events (e.g. spillway gate operations) will be needed. These are issues that are already familiar to Member Countries based on past experience in the Basin. Flood warning protocols are already well established but need to be strengthened to include dam operations and related emergency response planning.

Cooperation mechanisms for Information sharing and clear roles and responsibilities of the participating projects and Member Countries will be required. Proposals for a coordination and monitoring centre have already been studied in Lao PDR. These concepts will need to be further expanded to ensure basin-scale management and transboundary communication.

Risks and uncertainties of hydropower developments

The main risks to consider in the Strategy are costs and time overruns of hydropower development, loss of competitiveness of hydropower in relation to other electricity technologies, and loss of export markets due to changing civil society attitudes to these forms of resource development.

Mitigating these risks is an important part of the SHDS 2021. These major risks may be mitigated through:

- regional coordinated power planning to secure markets and enhance benefits through economic least-cost planning and operation;
- appropriate project locations and sequencing to reduce social and environmental impacts;
- prioritizing smaller, lower-cost projects and those with lower social and environmental impacts to reduce project implementation risks.

A typology of risks and estimates of the magnitude of impacts is provided in Table 3.2.

Table 3.2. Risks associated with hydropower development in the Mekong Basin

Risk			Likelihood of impacts	Size of impacts
Lower benefits than expected	Higher costs and lower revenues	Cost and time overruns	High	Large
		Lower output due to climate change	High	Small
	Loss of competitiveness	Lower gas and coal prices	High	Large
		Falling costs of wind, solar, storage	Medium	Large
Loss of markets	Civil society opposition to hydropower		Medium	Large
	China and Myanmar hydro exports		Low	Small positive (China)
Adverse macro-economic impacts	Excessive external debt		Low	Medium
	'Dutch disease'		Low	Medium

3.4 Regional cooperation and information sharing

MRC Studies also highlight the further large potential benefits of hydropower development that may be realized in future through regional cooperation and information sharing on energy and water plans. Electricity demand in the region will continue to grow, and hydropower in synergy with other renewables may offer a lower risk and more sustainable solution in meeting this demand when compared to expansion of fossil fuel generation. Member Countries have recognised these links and considered these options in their power planning processes.

Low-cost renewable energy options, operating in combination with hydropower, may therefore further reduce GHGs and the cost of energy generation.

As **regional power integration** continues to develop, countries with supply deficit may benefit from increased reliance on regional energy generation resources by countries with supply surplus, with resulting cost savings relative to using domestic resources alone.

Climate change is emerging as a major challenge globally and in the Mekong Basin. Renewable energy resources are now cost competitive with fossil fuel energy options. If it becomes possible to monetise the value of **GHG emissions reductions** from hydropower and other renewable resources, this may provide a valuable source of income—initial estimates on the value of **GHG emissions reductions** only from hydropower are that this could double existing hydropower benefits.

3.5 Lessons learned from the PNPCA process

The recent working paper on lessons learned from the PNPCA process of the four mainstream dams [9]emphasizes several important aspects that are important context for the SHDS:

- The Basin Development Planning process (and the related work arising from this Sustainable Hydropower Development Strategy) should allow for sharing of information on hydropower development plans prior to the PNPCA process.
- This information sharing and assessment (e.g. the Basin Development Plan Scenario Assessment, Council Study) allows for dialogue on basin-scale development plans and associated transboundary impacts, which can then inform the PNPCA.
- The PNPCA is a project specific dialogue process, while the Basin Development Plan and SHDS are basin-scale and project portfolio dialogue processes; and
- There is a need for more thorough analysis of the TbEIA for projects submitted for PNPCA and also Cumulative Impacts Assessment (CIA).

Based on lessons learned from the PNPCA to date, MRC is putting in place improvements to the requirements for project development prior to and after construction of hydropower projects to avoid, minimize and mitigate impacts. For the Pak Beng, Pak Lay and Luang Prabang projects, Member Countries have agreed on a JAP. The JAP is to be implemented by the notifying country and the developer prior to and during construction and operation. This will inform the notified Member Countries of actions implemented in design or operations of the projects to address their concerns raised during the PNPCA process.

In addition, MCs have agreed to implement JEM of certain Mekong mainstream hydropower developments post-construction with the intention to expand this program basin-wide. This will allow assessment of changes to the environment post-project implementation and support adaptive management of the project's mitigation measures to address residual impacts measured upstream and downstream of the projects.

3.6 Summary of Issues, needs, opportunities, and challenges

Taking the preceding extracts from the relevant MRC studies and regional assessments, the key points are summarized below. The SHDS Strategic Priorities must then be set to address these issues, needs, opportunities and challenges (see Section 4).

9 For details, see the MRC's Working Paper on Lessons Learnt from Implementation of the Procedures for Notification, Prior Consultation, and Agreement (PNPCA).

Energy security and economic benefits

- To enhance the regional net benefits (i.e. benefits minus costs) arising from the range of energy development options available to Member Countries, detailed study and regional dialogue on energy plan alternatives and associated water system risks are needed.
- Energy security and economic benefits may be enhanced if the role of regionally sourced hydropower and other renewable generation options is integrated into national PDPs, both for capacity (MW) and generation (GWh).
- There are thus substantial benefits, including GHG reduction, to be gained through regional cooperation on power system integration.
- Regional dialogue on these water and energy planning options and transboundary benefit- sharing mechanisms may be appropriate to address the issues regarding the "reasonable and equitable use" of the basin resources.

Climate change opportunities and risks

- Multi-purpose hydropower reservoirs in the Upper and Lower Mekong mainstream and tributaries may be utilized for a range of purposes including irrigation, and flood and drought mitigation and management. They therefore have the opportunity to also play a role in climate change adaptation if these aspects are built into the design and operations of the reservoir.
- At a basin scale, these climate change opportunities and risks need to be built into dialogue on hydropower development within the context of basin planning.

Avoid, minimize, and mitigate adverse transboundary impacts The environment

- Basin-scale monitoring, as foreshadowed in the JEM programme, is essential to understand the changes occurring within the Basin due to existing and under construction hydropower and other developments. Adaptive management of the hydropower mitigation operations should then be undertaken to reduce measured impacts.
- Implementation of international good industry practice for sustainable hydropower development, in terms of project selection, siting, design, and management, is essential to avoid, minimize and mitigate risks for individual and cascades of dams.
- This practice should be adapted for Mekong conditions, however, based on lessons learned from jointly monitoring existing mainstream projects (i.e. JEM).

Management of hydropower cascade operation

- Detailed hydropower design and operational information and emergency action plans should be made available to ensure community safety for the relevant, notified hydropower projects in the LMB.

- With intense hydropower development in the Basin, the management and operating mechanisms for cascades of dams is essential for power production management, environmental considerations, drought mitigation, and safe passage of large floods.
- Information sharing, coordination of operating mechanisms and clarity on roles and responsibilities of the participating projects and Member Countries will be important. Proposals for a coordination and monitoring centre have already been studied in Lao PDR. These concepts will need to be further expanded to ensure basin-scale management and transboundary communication.

Socio-economic

- The transboundary effects of these major infrastructure developments require that MRC Member Countries cooperate on suitable impact assessment, mitigation and adaptive management approaches. Dialogue on the implementation of the recommended approach set out in the Preliminary Design Guidance (including any approved updates) and the Rapid Hydropower Sustainability Assessment Tool (RSAT) should seek practical solutions to mitigate these risks.

PNPCA enhancement

- Timely and adequate TbEIA (once approved) and CIA information prior to PNPCA initiation for mainstream hydropower projects is needed to improve PNPCA assessment.
- Post-PNPCA cooperation and sustainable hydropower practice may be enhanced through agreement and implementation of the JAP and JEM.

Information gaps (see Section 1.5)

- Recent studies have shown that information gaps remain in the assessment of the benefits and risks associated with hydropower development in the Mekong Basin. Key areas of uncertainty include: hydropower project economics relative to other renewable sources, impacts on fisheries and the efficacy of fish passage; efficacy of sediment flushing; and impacts on biodiversity and their impacts on livelihoods.

4. Priorities for Sustainable Hydropower Development

4.1 Strategic Priorities to address hydropower opportunities and risks

Vision for the Mekong River Basin

"An economically prosperous, socially just, environmentally sound, and climate resilient Mekong River Basin."

Goal of the Sustainable Hydropower Development Strategy

In support of the Mekong Basin vision, the Sustainable Hydropower Development Strategy for the Lower Mekong Basin (SHDS) 2021 goal is to sustainably develop hydropower resources of the Mekong by applying Integrated Water Resources Management (IWRM) principles by taking into account opportunities to enhance national and regional benefits, the need to avoid, minimize, and mitigate adverse transboundary impacts while ensuring water, energy, food, environmental and livelihood security.

Issues, needs, opportunities, and challenges (reference Section 3.6)	MRC Strategic Priorities and Outcomes for sustainable hydropower development[10]
Avoid, minimize and mitigate adverse transboundary impacts: ***Environment:*** • Basin scale monitoring, as foreshadowed in the Joint Environmental Monitoring (JEM) programme, is essential to understand the changes occurring within the Basin due to existing and under construction hydropower and other developments. This includes assessment of the efficiency of mitigation designs. Adaptive management of the hydropower mitigation design and operations may then be undertaken to reduce measured impacts. • Implementation of good industry practice for sustainable hydropower development, in terms of project selection, siting, design and management, is essential to avoid, minimize, and mitigate risks for individual and cascades of dams. • International good industry practice should be adapted for Mekong conditions, based on lessons learned from monitoring existing mainstream projects (i.e. JEM).	**Strategic Priority 1:** ***Integrate sustainable hydropower considerations into project-level planning, preparation, design, implementation, and operation activities.*** **Outcome 1.1:** Improved sustainability of individual hydropower projects in the Mekong Basin. **Outcome 1.2** Benefits optimized and potential adverse impacts of hydropower operations minimized through adaptive management of existing hydropower projects and updated designs for Mekong-specific impact mitigation.
Enhance the PNPCA implementation for hydropower • Timely and adequate Transboundary Environment Impact Assessment (TbEIA) and CIA information prior to PNPCA initiation for mainstream hydropower projects are needed to improve PNPCA assessment. • Sustainable hydropower practice will be enhanced through implementation of the JAP and JEM.	***Outcome 1.3:*** • Improved effectiveness of the PNPCA and related MRC Procedures process and outcomes for hydropower projects.

10 This strategy will implement existing and approved guidelines.

Issues, needs, opportunities, and challenges (reference Section 3.6)	MRC Strategic Priorities and Outcomes for sustainable hydropower development[10]
Management of hydropower cascade operation • Hydropower plant design and operational information and emergency action plans must be available to ensure community safety for the relevant, notified hydropower in the Lower Mekong Basin (LMB). • With intense hydropower development in the Basin, Cooperation mechanisms for information sharing and operational coordination of LMB dam cascades is essential for power production management, environmental management, drought impact mitigation, and safe passage of large floods. • Cooperation mechanisms for information sharing and operational coordination of LMB dam cascades with clear roles and responsibilities of the participating projects and Member Countries will be important. Proposals for a coordination and monitoring centre" have already been drafted in Lao PDR. These concepts will need to be further expanded to ensure basin-scale management and transboundary communication.	**Strategic Priority 2:** ***Enhance cooperation on processes for operational coordination and management of hydropower cascades*** ***Outcome 2.1:*** Hydropower project information is shared with MRC for all notified mainstream and tributary projects. ***Outcome 2.2:*** Implementation of cooperation mechanisms for information sharing and coordination of LMB cascade operations support power production management, environmental management, flood and drought mitigation, and community safety. ***Outcome 2.3*** China and Myanmar exchange pertinent information on operational coordination and related scientific studies on hydropower to improve the sustainability of Upper Mekong Basin (UMB) and Lower Mekong Basin (LMB) hydropower.

Issues, needs, opportunities, and challenges (reference Section 3.6)	MRC Strategic Priorities and Outcomes for sustainable hydropower development[10]
Energy security and economic benefits • To enhance the regional net benefits (i.e. benefits minus costs) arising from the range of energy development options available to Member Countries, detailed study and regional dialogue on energy plan and associated water system are needed. • There are substantial energy security and economic benefits, including GHG reduction, to be gained through regional cooperation on power system integration. • Regional dialogue on water and energy planning options and transboundary benefit-sharing mechanisms may be appropriate to address issues on the "reasonable and equitable use" of basin resources. *Climate change opportunities and risks* • Multi-purpose hydropower reservoirs may be utilized for a range of purposes including irrigation, flood and drought mitigation, and management. They therefore have the opportunity to play a role in climate change adaptation if these aspects are built into the design and operations of the reservoir.	**Strategic Priority 3:** ***Enhance regional information sharing and cooperation on water and energy plans to capture economic and energy security benefits and reduce transboundary social and environmental risks.*** ***Outcome 3.1:*** Net benefits of national hydropower and integrated renewable energy development plans, regional power system integration and hydropower's role in climate change mitigation are maximized and balance basin-scale water, energy, food, environmental, and livelihood security. ***Outcome 3.2:*** Practical and tangible mechanisms/ options further developed for equitable sharing of basin resources for hydropower and related developments based on past MRC studies/reports.
Social impact • The transboundary effects of major hydropower infrastructure and other developments require that MRC Member Countries cooperate on a suitable transboundary, socio-economic impact assessment, mitigation and adaptive management approaches. • Dialogue on the implementation of the recommended approach set out in the Preliminary Design Guidance (including any approved updates) should be aimed at seeking practical solutions to mitigate these risks.	**Strategic Priority 4:** ***Enhance the livelihoods of hydropower project-affected river-based communities, particularly of women, children and ethnic minorities.*** ***Outcome 4.1:*** Improved and gender-equitable local development for riparian communities adversely affected by hydropower projects in a transboundary context. ***[Also discussed under SP 1]***

Issues, needs, opportunities, and challenges (reference Section 3.6)	MRC Strategic Priorities and Outcomes for sustainable hydropower development[10]
Information gaps (see Section 1.5) • Recent studies have shown that information gaps remain in the assessment of the benefits and risks associated with hydropower development in the Mekong Basin. Key areas of uncertainty include: hydropower project economics relative to other renewable sources, impacts on fisheries and the efficacy of fish passage; efficacy of sediment flushing; and impacts on biodiversity and the related impacts of these on livelihoods.	**Strategic Priority 5:** ***Complete targeted studies to fill knowledge gaps or enhance analysis tools in order to support sustainable hydropower development and management*** ***Outcome 5.1:*** Targeted studies fill knowledge gaps and facilitate regional assessment and dialogue on SP 1 to 4 above.

5. Action Plan for Sustainable Hydropower Development

5.1 Roles and responsibilities for implementation

There are a large number of stakeholders engaged in the issues pertaining to sustainable hydropower in the Mekong Basin, as summarized in Table 5.1.

Most of the stakeholders in Table 5.1 are from the government and public sector; however, NGOs and civic society have very significant roles to play.

Table 5.1. Stakeholder with roles and responsibilities in the implementation of the Sustainable Hydropower Development Strategy

Stakeholder/actors	Roles and responsibilities
The Mekong River Commission Council	It provides strategic guidance to the implementation and promotion of the Sustainable Hydropower Development Strategy (SHDS) at a high level to all relevant national and regional development initiatives.
The Mekong River Commission Joint Committee	It provides direct implementation guidance to implement and promote the SHDS at the senior level to all relevant national and regional development initiatives.
The Mekong River Commission Secretariat (MRCS)	It facilitates, supports and monitors the implementation of SHDS and regularly report to the Joint Committee and the Council. Hydropower is a cross-cutting sector and requires collaboration across the Divisions of the MRCS.
The National Mekong Committee Secretariat	It acts as a liaison between the MRC and the respective national power and water planning committees and promotes integration/implementation of the SHDS at the country level.
National line agencies	They share information and cooperate on dialogue on power and water plans, taking into account the strategic priorities and actions of the SHDS that will contribute to enhancing transboundary benefits and minimizing transboundary risks.
Dialogue partners	Building on existing dialogue frameworks (e.g. Mekong Lancang Cooperation), they share information and cooperate on power and water plans, taking into account relevant strategic priorities and actions of the SHDS in order to optimize benefits to downstream countries and minimize costs. They continuously exchanging technical expertise and research on future coordinated operation and management of hydropower cascades.

Stakeholder/actors	Roles and responsibilities
Development partners involved in hydropower (World Bank, Asia Development Bank, Australia, Norway, Republic of Korea, etc.)	They continuously provide financial and technical support (at the regional and at national, bilateral levels) to assist in the implementation of the SHDS and the promotion of regional power sector integration and embedding sustainable hydropower practice in regional projects.
The Greater Mekong Subregion (GMS) and other regional initiatives/ institutions	They identify synergies between the SHDS Strategic Priorities and other regional initiatives. Support co-implementation of actions in order to effectively ensures coherent joint effort to tackle opportunities and challenges.
The private sector, hydropower developers and operators	They cooperate with the MRC and Member Countries in implementing the policies and in following the Guidelines specified in the SHDS.
Research institutes and universities	The contribute to the generation and dissemination of information and knowledge on sustainable hydropower development in the Mekong Basin. They work with the MRC on action-oriented research, including preparation of guidelines and policy papers, specified in the SHDS.
Non-governmental and civil society organizations	They assist in promoting SHDS, contributing to information generation and supporting the MRC's stakeholder outreach, contributing to the formulation of guidelines and policy papers as well as providing comments on hydropower development projects under the PNPCA.

5.2 SHDS 2021 Strategic Priorities and Action Plan

The SHDS 2021 provides a recommended set of Strategic Priorities to meet its goal The associated Outputs and Actions are proposed to achieve the Outcomes under each Strategic Priority. These are based on principles that have been derived both from MRC documents from previous MRC studies on hydropower in the LMB basin and from the findings of the scenario analysis. Strategic Priorities and related actions are shown in Table 5.2.

Table 5.2. Strategic Priorities, Outcomes, Outputs, and Activities

Strategic Priority 1: Integrate sustainable hydropower considerations into project-level planning, preparation, design, implementation and operation activities.

Outcome 1.1: Improved sustainability of individual hydropower projects in the Mekong Basin.

Outputs and activities	Indicators/timeframe
Output 1.1.1: The Preliminary Design Guidance (PDG) is disseminated, together with related MRC tools and guidance, to key stakeholders, particularly developers. • Disseminate the PDG and build capacity inside national agencies and with private developers. • Implement the PDG as well as MRC tools, guidance and international good industry sustainable hydropower practice. • Conduct a post-implementation review of the PDG after use in the PNPCA process.	• PDG disseminated and implemented along with related MRC and good industry sustainable hydropower practice (2021–2022). • MRC and stakeholder post-implementation review of the PDG (2022–2024).

Outcome 1.2: Benefits optimized and potential adverse impacts of hydropower operations minimized through adaptive management of existing hydropower projects and updated designs for Mekong-specific impact mitigation.

Outputs/activities	Indicators/timeframe
Output 1.2.1: Documented scientific analysis of JEM [11] results on efficacy of sediment and fish passage mitigation. Design and operation with recommendations for adaptive management and future design modifications. • Complete Joint Environmental Monitoring (JEM) of two pilot hydropower projects. • Analyse results and make recommendations for adaptive management/design. • Apply lessons learned for basin-scale monitoring linked to project monitoring.	• Scientific review report on mitigation efficacy and adaptive management recommendations documented and disseminated to developers and stakeholders (2023–2024). • Lessons learned from the MRC's JEM Programme applied to basin-scale monitoring (2022–2024).

11 JEM pilots underway in 2019–2021, managed as a cross-sector activity.

Outcome 1.3: Improved effectiveness of the PNPCA and related MRC Procedures process and outcomes for hydropower projects

Outputs/activities

Output 1.3.1: Transboundary and cumulative Impacts and basin-scale mitigation options documented and consulted to support the documentation submitted to the PNPCA process for hydropower projects.

- Disseminate to hydropower developers and agree on an approach for implementation once the TbEIA Guidelines are finalized and agreed on,
- Facilitate dialogue on implementation options for basin-scale avoidance, mitigation and adaptation to transboundary impacts, using knowledge from MRC and other studies (once finalized and agreed by Member Countries),
- Disseminate findings to inform the PNPCA process.

Output 1.3.2: Formalization of post-PNPCA preparation and implementation of the Joint Committee Statement and the Joint Action Plan (JAP)

- Formalize post-PNPCA preparation and implementation of the MRC Mekong River Commission Joint Committee Statement and the JAP in the PNPCA Technical Guidelines, Commentary or related MRC documents.
- Document agreed approach for endorsement of the Joint Committee.

Indicators/timeframe

- Lessons learned from the Guidelines for Transboundary Environmental Impact Assessment (TbEIA) trial application (2021–2022).
- Concrete strategies to address projected residual transboundary and cumulative impacts from hydropower development are proposed, documented and discussed prior to the PNPCA (2021–2023).
- Statement and JAPs agreed on and implemented after all hydropower PNPCA (2021 and beyond)
- **Lead:** BDS Output 1.1.2, MRC SP Activity 1.1.2.2: Support implementation of the JAPs for all mainstream hydropower projects.

Strategic Priority 2: Enhance Cooperation on processes for operational coordination and management of hydropower cascades

Outcome 2.1: Hydropower project information is shared with MRC for all notified mainstream and tributary projects

Outputs/activities

Output 2.1.1: A detailed description of required hydropower project information is defined, documented, agreed on, and implemented.

- Define, consult and agree on required project information for all notified mainstream and tributary hydropower projects.
- Develop a framework and data storage/access method for comprehensive and timely information access in line with broader MRC data and information management, including for emergency action planning.

Indicators/timeframe

- Framework and data management in place (2023–2024) in line with broader MRC data management systems, particularly on the reinvigoration of the MRC's data and information system initiative.

Outcome 2.2: Implementation of cooperation mechanisms for information sharing and coordination of LMB cascade operations support production management, environmental management, flood and drought mitigation, and community safety.

Outputs/activities

Output 2.2.1: Cooperation mechanism for Information sharing and coordination of cascade operating mechanisms are in place covering power production, sediment management, navigation, dam safety, transboundary emergency action planning and other related matters, including implementation processes and governance mechanisms.

- Define required transboundary operational coordination mechanisms in the context of MRC Procedures and in cooperation with existing Member Country initiatives.
- Document coordination mechanisms for priority cascades/projects including for notification of downstream flooding, approaches for safe passage of extreme floods
- Explore a process for transboundary emergency response planning for mainstream and tributary hydropower projects (with potential transboundary effects) notified under the PNPCA.

Indicators/timeframe

- Process and mechanisms developed and agreed for hydropower cascade operations (2025)
- Cascade operating mechanisms in place based on case study mainstream projects (2025)
- Emergency response planning framework in place (2025)

Outcome 2.3: China and Myanmar exchange pertinent information with MRC on operational coordination and related scientific studies of hydropower to improve sustainability of UMB/LMB hydropower.

Outputs/Activities	Indicators/timeframe
Output 2.3.1: Mechanisms for information exchange on operational coordination of hydropower developed and implemented. • Explore existing mechanisms for information exchange on operational coordination of hydropower (maintenance outages, flood management, drought management, etc.) between UMB and LMB hydropower projects, and communication to appropriate stakeholders • Scope and implement joint studies on UMB/LMB operational interactions (including seasonal flow patterns and sediment transmission).	• Mechanisms and information exchange in place (2021–2025) • Two key studies implemented (2021–2025)

Strategic Priority 3: Enhance regional information sharing and cooperation on water and energy plans to capture economic and energy security benefits and reduce transboundary social and environmental risks

Outcome 3.1: Net benefits of national hydropower and integrated renewable energy development plans, regional power system integration and hydropower's role in climate change mitigation, are maximized and balance basin-scale water, energy, food, environment and livelihood security.

Outputs/Activities	Indicators/timeframe
Output 3.1.1: National options paper on energy development evaluated for basin-scale and regional benefits and risks. • Conduct capacity building in related economic/options analysis. • Assess national hydropower plans in the basin context based on request and agreement from countries.	• Capacity building supported, and the national agency's power plans reviewed internally (national process) (2023–2024).

Output 3.1.2: Documented options on sustainable integration of LMB hydropower and other regional renewable energy generation options into national/ regional power systems and Mekong Basin water development plans.

- Conduct forums to facilitate cooperation and information sharing on energy supply and demand, and on the benefits for and risks to the Mekong Basin of the integration of water and energy planning and regional power system integration.
- Document the assessment of high-level options and consult with the relevant agencies, including on role of hydropower in climate change adaptation/ mitigation.
- Integrate selected high-level options into proposed *proactive regional planning scenarios*.

- Three Forums in MRC SP 2021–2025 completed, and findings documented (2021–2025).
- Exploratory paper on regional water and energy security, and options for sustainable and economic energy/water developments to 2050 (2024).
- Proactive regional planning and BDS Scenario Analysis informs the hydropower development strategy and operation (2025).

Outcome 3.2: Practical and tangible mechanisms/options are further developed for equitable sharing of basin resources for hydropower and related developments

Outputs/Activities

Output 3.2.1: Documentation on specific options for equitable sharing of LMB resources, including options for sharing of costs and benefits of hydropower and other developments.

- Facilitate dialogue on equitable sharing of basin resources (1995 Mekong Agreement Articles 2 and 5), considering the Basin Development Strategy (BDS) and knowledge gained through MRC studies, benefit- sharing reports, and lessons learned from the PNPCA process.
- Explore further potential approaches to a funding mechanism considering all sources of funding and targeting all development sectors.
- Scope and complete practical and implementable pilot case studies within the Mekong Basin.

Indicators/timeframe

- Improved understanding of the implementation of relevant 1995 Mekong Agreement Articles (2 and 5) and integrated implementation of Member Country Procedures (2022) and various benefit-sharing options of hydropower and other developments.
- Exploratory paper on options for costs and benefit sharing among MRC Member Countries is disseminated, and concrete proposals are recommended to the Joint Committee and Council (2022–2024)

Strategic Priority 4: Enhance the livelihoods of hydropower project-affected river-based communities, particularly of women, children and ethnic minorities

Outcome 4.1: Gender-equitable local development is improved for riparian communities adversely affected by hydropower projects in a transboundary context

Outputs/Activities	Indicators/timeframe
Output 4.1.1: Explore opportunities to improve gender-equitable, local development and adaptation for riparian communities affected by hydropower projects and other water utilization projects in the transboundary context. • Options paper on opportunities to enhance local socio-economic development and adaptation in a transboundary context.	• Proposals drafted and consulted (2021–2024)

Strategic Priority 5: Complete targeted studies to fill knowledge gaps and enhance analysis tools, to support sustainable hydropower development and management

Outcome 5.1: Knowledg gaps will be filled through regional assessment and dialogue based on targeted studies carried out from Strategic Priorities 1 to 4

Outputs/activities	Indicators/timeframe
Output 5.1.1: MRCS tools for the economic assessment of hydropower project portfolios (see Annex 1) enhanced and customized for national assessments to support hydropower strategic priorities above (See Output 3.1.1).	• Hydropower project portfolio economic assessment tools are enhanced and customized, and their capacity is built (2023–2024)

Output 5.1.2: The Mekong Basin toolbox (the Decision Support Framework) for hydropower reservoir operations enhanced to allow assessment of cascade operational mechanisms, effects of integration of other renewables (e.g. reservoir floating solar) and multi-purpose operations, including climate change adaptation options.	• mproved basin modelling of hydropower operations available and skills built (2023–2024) • **Lead:** BDS Output 4.1.3: Compatible Decision Support Systems inline with reinvigorated data, modelling, forecasting, and communication capabilities [MRC SP Activity 4.1.3.2] • **Linked:** BDS Output 3.1.1: the basin development plan and associated national plans for water resources development are informed by the findings of a more proactive regional planning approach

5.3 Implementation of the SHDS

Implementation of the SHDS[12] is the responsibility of the MRC (i.e. Council, Joint Committee and MRCS), the National Mekong Committee Secretariat (NMCS), and the responsible national agencies as well as concerned stakeholders.

While the MRCS is responsible for managing the process, procuring resources and seeking financial and technical supports from the development partners and regional cooperation initiatives for implementation of the Strategy, the MRCS and NMCS are mutually accountable for achieving the outcomes.

National Mekong Committees are also primarily responsible for ensuring communication of the SHDS at the respective national levels as well as for mainstreaming it into national plans and facilitating the participation of relevant government agencies and stakeholders in the nominated activities.

Given the cross-sectoral nature of the SHDS activities, the engagement of national agencies will be critical to success. This is particularly the case with national power and water agencies who will need close involvement in all the relevant dialogue and forums.

12 SHDS will be implemented according to the principles contained in the BDS 2021–2030, Chapter 6. Actions will be consulted and agreed on with Member Countries based on sound, agreed information.

Multilateral agencies, active in this field, should also be engaged to facilitate coordinated activities and avoid duplication.

All of the above is achieved with the support of the MRC.

5.4 Monitoring, evaluation, and reporting

The evaluation of the SHDS implementation is needed to determine its efficiency and effectiveness, its outcomes and lessons learned from implementation, considering its strategic objectives. The monitoring, evaluation, and Reporting of the SHDS will be integrated into the monitoring and evaluation (M&E) of the BDS and MRC Strategic Plan.

The following steps will need to be undertaken for M&E of the SHDS:

- Operationalize SHDS M&E indicators.
- Integrate the SHDS M&E indicators and their defined operation into the M&E system of the MRC SP.

5.5 Updating of the SHDS

Due to the rapid deployment of hydropower in the Mekong Basin, the Outputs and Actions of the SHDS will need to be reviewed in the context of MRC priorities. Strategic Priorities and Outcomes will be updated as needed as part of the BDS and Strategic Plan update cycle.

The updating of the SHDS should include, but not be limited to, the following tasks:

- monitoring the hydropower development status in the Mekong Basin and the uptake of sustainable hydropower practices;
- updating the MRC's hydropower database as an ongoing activity;
- reporting on the results of implementation of JEM and other basin-scale hydrological, sediment, fisheries and socio-economic monitoring;
- extracting lessons learned for PNPCA implementation as well as monitoring of JAP process for mainstream dams;
- monitoring the implementation and relevance of the SHDS proposed strategic priorities and actions and revising if necessary.

ANNEX 1. MRC STUDIES, TOOLS AND GUIDANCE TO ASSIST THE SUSTAINABLE HYDROPOWER DEVELOPMENT OF PROJECTS AND PORTFOLIOS

The following MRC documents related to sustainable hydropower are all available publicly on the MRC website unless otherwise noted.

Project-specific studies and guidance

- **The Study on the Sustainable Management and Development of the Mekong River Basin including Impacts of Mainstream Hydropower Projects (Council Study, 2018).** This Study, known as the 'Council Study', assesses current and potential future development plans of the Mekong countries in six water-related sectors – hydropower, land use, irrigation, navigation, flood protection, and industry – and predicts both positive and negative impacts across economic, social, and environment spheres.
- **Preliminary Design Guidance 2009** (PDG, currently being updated) for proposed mainstream dams in the Lower Mekong Basin: This Guidance provides initial design guidance in the form of performance targets, design, and operating principles for mitigation measures, as well as compliance monitoring and adaptive management for reducing the environmental and social risks posed by hydropower schemes.
- **Guidelines for hydropower environmental impact mitigation and risk management in the lower Mekong mainstream and tributaries (2018):** These Guidelines provide considerations on planning, feasibility, and design stages of hydropower projects and their mitigation and adaptation, as well as coordination options against risks.
- **Guidelines for Transboundary Environmental Impact Assessment in the Lower Mekong Basin:** This working document is a supporting tool applicable to the different national Environmental Impact Assessment legislation systems in Member Countries. In recognition of already agreed MRC mechanisms, the TbEIA Guidelines build on and supplement the MRC Procedure for Notification, Prior Consultation and Agreement (PNPCA), and use and take into account other MRC Procedures in addressing potential transboundary environmental impacts of development projects.
- **Joint Environment Monitoring of Mekong Mainstream Hydropower Projects (2019):** This aims to provide a framework to standardize monitoring in the Mekong to support assessment of hydropower development and also to determine the status and trends in resources.
- **Guidelines for the evaluation of hydropower and multipurpose project portfolios (2015):** These Guidelines aim to provide a fuller picture of the wider social, economic and environmental implications of hydropower project portfolio planning with a view to maximizing overall net benefits. It also looks at the integration of all risks and

benefits into the national strategic planning approach.

- **Guidance on national-to-local benefit and cost sharing options for hydropower on Mekong tributaries (2013):** This Guidance examines different benefit-sharing mechanisms to plan and implement hydropower projects so that project-affected communities may benefit from the hydropower development both nationally and within transboundary context.
- **The rapid basin-wide hydropower sustainability assessment tool (RSAT):** The RSAT is a multi-stakeholder dialogue and assessment tool designed to consider hydropower sustainability issues in a river basin context, such as major tributary basins of the Mekong (e.g. Se Kong). It has the potential to help identify development strategies, institutional responses and management measures that can be deployed to realize the benefits of hydropower development and reduce risks.

Other relevant technical reference papers include:

- **Scoping of Regional Benefit Sharing in the Mekong Basin** (2015): The Basin Development Plan's extensive review of international and Mekong experiences on transboundary benefit sharing through joint projects.
- **Review of international practices on fish passage:** The review examines available research on fish passage through large dams and its applicability to Mekong mainstream dams.
- **Review of fish compatible turbine design:** review of available knowledge on the effectiveness and economics of fish compatible turbines.
- **Identification of ecologically sensitive sub-basins for sustainable development of hydropower on tributaries:** While enabling sustainable hydropower development, the guidance also ensures the identification and risk assessment for identified ecologically sensitive areas.

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