The Development of Guidelines for Hydropower Environmental Impact Mitigation and Risk Management in the Lower Mekong Mainstream and Tributaries (ISH0306)

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Introduction - Study objective

Providing measures, GUIDELINES and good industrial practice and state of the art insight into the sustainable development of hydropower in the Lower Mekong Basin. By linking it to the Mekong 1995 Vision

“an economically prosperous, socially just and environmentally sound Mekong River Basin”

Assessment in LMB, UMB, GMS and Internationally
Process for Risk and Impact Mitigation Assessment

Article 7 – Mekong Agreement (1995) «To make every effort to avoid, minimize and mitigate harmful effects......»

Mitigation Hierarchy

Avoidance = Identifying alternative sites or technology to eliminate Impacts (Master plans, Pre-feasibility, Feasibility)

Minimization = most often used prescribing actions during design, construction and operation stage to minimize or eliminate impacts

Compensation = used to restore or offset residual impacts identified at different stages
Process for Risk and Impact Mitigation Assessment

MRC Generic Practical Process for Risk and Impact Mitigation - Project Life Cycle

Master Plan

Feasibility Study

Understand the characteristics of the impact

Research mitigation options

Project Design

Design and Operation measures, rules and procedures

Project Construct. and Operation

SEA, CIA, EIA
Avoid Impacts

Avoidance

Minimization

Compensation
Study Scoping and Planning

Geographic Scope

Twofold:
1) A general assessment at the basin level for the Lower Mekong, including its tributaries
Study Scoping and Planning

Geographic Scope

Twofold:
2) A more detailed assessment of the 6 mainstream cascade dams planned to be constructed in Lao PDR:
   • Pakbeng
   • Luangprabang
   • Xayaburi
   • Paklay
   • Sanakham
   • (Pakchom)
Main Activities with outputs

General Output
Build knowledge base, capacity building, training and communication and dissemination material

Output 1
Study scoping and planning

Output 2
Review of information

Output 3
Study key physical processes

Output 4
General mitigation options

Output 5
Cascade Case Study

Output 6
Alternative HPP layouts

Output 7
Further research requirements

Output 8
Final Reporting and Compilation

Inception Report
1st Interim Report
2nd Interim Report
Final Report

1st version Guidelines
2nd version Guidelines
Final Guidelines
Overall Guiding Principles
(Mekong 1995 Agreement supported by Strategic Planning Guides and PDG)

- International Policies and Safeguards
- Cooperation on International River Basins
- Robust Governance Base line data informs decisions
- Multidisciplinary approach
- Engage stakeholders – protect rights and entitlements
- Equitable share benefits and costs
- Address Poverty and Food Security
- Maintain Basin wide ecosystem integrity

Guidelines and recommendations for planning, design and construction of new hydropower

Guidelines and recommendations for operation of existing and new hydropower

General Mitigation Options (including impacts, risks and vulnerabilities)
- Theme
- Project life cycle
Mitigation Guidelines and Recommendations

Focus Themes (First Version of Guidelines):
1. Hydrology and downstream flows
2. Geomorphology, sediments and water quality
3. Aquatic ecology and fisheries; and
4. Biodiversity, natural resources and ecosystem services

Related to:

Key Risks, Impacts & Vulnerabilities

| 1. Annual / inter-annual changes to flow |
| 2. Daily / short-time scale changes to flow and water level |
| 3. Loss of river connectivity |
| 4. Impoundments |
| 5. Diversion scheme / inter basin transfers |
## Mitigation Guidelines and Recommendations

<table>
<thead>
<tr>
<th>Key Changes Related to Hydropower Development</th>
<th>Key Risks, Impacts and Vulnerabilities by Thematic Area</th>
<th>Potential Mitigation Approach/Strategy</th>
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</thead>
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<tr>
<td>1. Annual / Inter Annual changes to flow</td>
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<td>Planning / design / construction</td>
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<td>2. Daily / short-time scale changes to flow and water level</td>
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<td>Operation</td>
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<td>3. Loss of river connectivity</td>
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<td>4. Impoundments</td>
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<td>5. Diversion scheme / inter basin transfers</td>
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</table>
Basic architecture for final output

Hydropower Risks and Impact Mitigation Guidelines, Manual and supporting Knowledge Base (KB)

1. Hydropower Risks and Impact Mitigation Guidelines and Recommendations (previous slides)
   • Will also include description of suitable stakeholder involvement during the different phases of the HPP project cycle.

2. Manual (Planning Kit) to support implementation of Guidelines
   • Manual overview
   • Approach on how to choose the most tailored and right mitigation options for and linkage to KB
   • Examples and experiences of good industrial practice Description of what kind of broad type of models is needed
   • Needs for capacity building and training.

3. Knowledge Base

Example Guidelines
Transboundary river basin
Example Mitigation Guidelines and Recommendations

Details from Supporting Manual – Risks, Impacts and Mitigation

Overall flow regime (left) and main contributions to annual flow (right)
Example Mitigation Guidelines and Recommendations

Details from Supporting Manual – Risks, Impacts and Mitigation

1. Flow Changes – The Big Picture
Most likely vulnerabilities for flow changes

• 1. Tonle Sap
• 2. Cambodian floodplains (levels and velocities)
• 3. Mekong Delta (salinity intrusion, sediment, ...)
• Flow vulnerabilities themselves are not the prime interest → *always connected to impact on fisheries, ecology and sediment*
Expected changes - UBM and tributary storage

Peak flows decreased and lower annual flood volumes
Overall annual hydrograph “smoother”
Early flood season flows lower and later flood season flows higher
Mean annual discharge unchanged
Later start and end of flood season conditions
Increased dry season flows
Mitigation guideline artificial floods

• Bring back some of the natural flow dynamics by releasing flood pulses
• Based on hydrological indicators, environmental indicators
• Requires large-scale planning when applied for the Mekong River: joint operation of tributary storage dams in Laos and Cambodia. Incorporate in Master Plans.

Reference: artificial floods to preserve sand bars in the Grand Canyon (USA)
Example Mitigation Guidelines and Recommendations

Details from Supporting Manual – Risks, Impacts and Mitigation

Loss of Connectivity – Fisheries and Aquatic Ecology

Lower, middle and upper migration systems of LMB
Schmutz and Mielach, 2015

Grill et al., 2014
Connectivity restoration

Upstream
Nature-like
Bypass channels &
Large scale bypass systems

Technical
Vertical slot

Downstream
Fish protection
Fish passage

Fish protection
t Screens
Fish-friendly turbines
Spill flow

Bypasses

Nature-like
Example of Guidelines (PDG) used in the assessment of Xayaburi – Mainstream Project

Design revised to respond to MRC Prior Consultation Process

Status in June 2015

(photo courtesy of Poyry Energy Ltd)
Case study details

Geographical overview of case study

Catchment & basin models (hydrology, sediment yield) & river-basin models

Detailed reservoir models (cascade), hydropower models

Downstream impacts (sediment, fish, water quality, Tonle Sap, delta)
Case study details

Test and support proposed hydropower mitigation guidelines and associated research recommendations
Thanks for your attention