



MEKONG RIVER COMMISSION

THE COUNCIL STUDY

**Key Findings from the Study on Sustainable
Management and Development of the Mekong
River Basin, including Impacts of Mainstream
Hydropower Projects**

Version 0.3 for Stakeholder Forum

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Disclaimer:

These Council Study reports are considered final drafts prepared by the technical experts and specialists of the Mekong River Commission, through a process of consultation with representatives of member countries. The contents or findings of the reports are not necessarily the views of the MRC member countries but will serve as knowledge base and reference in the work of the MRC and its member countries in their ongoing technical and policy dialogues in ensuring the sustainable development of the Mekong river basin.

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During the Third Mekong-Japan Summit in Bali in November 2011, Prime Ministers of the four MRC Member Countries resolved to conduct a Study on Sustainable Management and Development of the Mekong River including Impacts of Mainstream Hydropower Projects. The MRC Council commissioned the Council Study at its 18th meeting in Siem Reap in December 2011 with a primary aim of providing objective scientific assessments of the environmental, social and economic costs and benefits of existing and planned water resource developments in the Lower Mekong Basin (LMB) to inform decision makers.

The Council Study used a sequence of qualitative and quantitative models to examine the consequences of a set of water resource development scenarios. The modelling outputs were integrated as a systematic framework to describe outcomes for selected environmental, social and economic indicators and to carry out assessments. These, in turn, informed the social and economic analysis of six thematic sectors. The framework provides a coherent, scientific foundation for the systematic assessment of the consequences of water resource developments, complemented by accessible, practical methodologies and modelling tools developed as part of the Council Study.

The Council Study examined three main water resource development scenarios: (i) Scenario M1: **The early development scenario** characterizing baseline water resource developments in 2007; (ii) Scenario M2: **The medium-term definite future scenario** characterizing existing, under-construction, and firmly-committed water related developments in 2020¹; and (iii) Scenario M3: **The long-term planned development scenario**, characterizing the planned water developments in 2040 in addition to those assigned for 2020 for implementation over the following two decades. The main scenarios aggregate combinations of water resource developments enabling the cumulative assessment of environmental, social and economic effects in the Member Countries.

Assessing the cumulative effects of a combination of investments tends to mask the consequences associated with individual developments and/or thematic areas. Twelve sub-scenarios were evaluated to isolate sector-specific contributions, comprised of reductions or increases in agricultural land use, flood protection infrastructure, hydropower and irrigation investments relative to those in Scenario M3. A set of three sub-scenarios was also devoted to isolate the impacts of Climate Change.

The study was designed to be flexible, transparent and repeatable to accommodate improved data management and continued refinements of the assessment tools. The importance of the study assessment framework is not that it is definitive and without information gaps, but that it provides a coherent scientific foundation combined with an accessible, practical methodology and knowledge base to support further studies, deliberations and decision processes.

Existing Water Resources: Trends and Challenges in the Lower Mekong Basin

Future development of water resources in the LMB will need to address a wider portfolio of environmental, social and economic resolutions, and account for the current and future challenges specific to the region:

- Existing water resource developments in the LMB create substantial trade-offs between water, food and energy, and between countries.
- The effects of poverty remain despite substantial advances in the Member Countries, manifest when flood or drought simultaneously reduce rice and fish production. The coincidence of reduced fish and rice production introduces an increased potential of household undernourishment.
- Compared to current levels, flood damages and risks will increase by a factor of 5 to 10 as countries develop urban infrastructure and more assets are exposed to extreme floods. Although it is expected that flood protection will reduce the risk for recurrent floods, it is not sufficient for extreme floods.
- Climate change is correlated with impacts associated with water resources development. The interdependent effects are extremely challenging, demanding broader multidisciplinary analyses. Focal issues include the increased rate of sea level rise, the propensity for flooding and saltwater intrusion in the Vietnam Delta and the increased vulnerability of some riparian communities.

¹ Scenario M2 includes the Xayaburi and Don Sahong mainstream hydropower projects.

- Rapid industrialization and urbanization will generate increased levels of pollution of river systems and soils with large quantities of untreated wastewater.
- Safety guidelines, preparedness and impact assessments of projects are becoming more objective and the findings increasingly subject to independent scrutiny and stakeholder verification.
- Quantifying the relative advantages and disadvantages of water resource developments is challenged by the conflicting demands of diverse stakeholders, a lack of accepted, standardized methodologies, data of varying reliability and accessibility, and processing capabilities. Combined, the challenges create an environment conducive to multiple and diverse Council Study interpretations aligned with specific advocacies, interests and biases.
- Targeted data collection is still required and the integrated tools developed during the Council Study are being further refined in consultation with the Member Countries. The Council Study results are not definitive but introduced as a coherent, scientific foundation to support ongoing studies, deliberations and decision processes.

Water Resource Development Plans: Challenges and Opportunities

Overall key messages of the planned development scenario outcomes. The Council Study identified a number of challenges and opportunities associated with the planned development scenario (2040) in comparison to the (2007) baseline situation:

- Hydropower growth equals the combined economic effect in agriculture, navigation and fisheries under Scenario M3. Estimates of hydropower contributions have not traditionally accounted for economic and ecological trade-offs.
- Hydropower projects in the Mekong Basin **reduce wet season flows and increase dry season flows under normal operation (with the exception of extreme climatic conditions)**, reducing flood damage but introducing negative effects on riparian ecosystems, sustainability and food security associated with fish production.
- **Reduced sediment and nutrient transport downstream** caused by hydropower projects in the Mekong Basin including China is expected to reduce soil fertility, rice production and fish yields. The most vulnerable areas are the Cambodia floodplains and the Tonle Sap system and the Mekong Delta in Viet Nam.
- **Bank and bed erosion is expected to increase substantially due to sediment reduction and water level fluctuations** in the lower basin, especially in the Mekong Delta in Viet Nam and some areas along the Mekong River from Vientiane to Stung Treng.
- **Wide-ranging negative ecosystem impacts** are predicted **from the reservoirs associated with mainstream hydropower projects**, the construction of flood-protection infrastructure and barriers to fish migration. Reservoirs are expected to convert much of the Mekong River from Chiang Saen in Thailand to Kratie in Cambodia into deeper lake-like habitats – with the exception of a large area from Vientiane to Pakse in Lao PDR that will not be impounded. Such habitats are not suitable for many species that inhabit the Mekong but are suitable for others such as bivalves, frogs and snails.
- Water resources development of Scenario M3 is predicted to **reduce food security and potentially increase poverty levels**. At current levels of agricultural productivity, aggregate household incomes are predicted to decline. Poverty levels are expected to rise in most zones. The total dollar value of fish catch in the Mekong corridor is expected to decline by \$1.57 billion. Fish prices are expected to increase, which would affect poor households. The dollar value of the predicted increase in corridor rice production is \$0.95 billion.
- The **benefits and trade-offs are not evenly distributed** throughout the LMB and are not necessarily confined to the source country.
- The initiatives included in the development plans potentially **over-invest in agriculture and hydropower** to the detriment of existing food security. The proposed investments are likely to negatively affect GDP growth in the LMB countries. Planned agricultural expansion especially in medium-long term scenarios would increase labour demand and raise the possibility of underutilised or abandoned agricultural infrastructure.

- **Climate change** will likely amplify negative impacts. Climate change poses a significant risk to both food security and GDP growth, particularly if predicted drier conditions materialise. Drier climatic conditions reduce hydropower benefits by up to \$2.2 billion in net present value and increase fish losses by approximately 15%. The combined effects of over-investment in agriculture and hydropower and more severe climate change could compromise the prospects of lower Mekong basin countries achieving or sustaining lower or middle income status.
- The future growth potential of all Member Countries depends on the availability of **natural capital, particularly soils, forests and fish. Predicted declines in natural capital of the medium-term development plans amount to nearly 40% the entire GDP of the lower Mekong basin in 2017.** Substantial reforestation included in long-term development plans would reverse this trend and increase natural capital by \$30 billion, which equals about 13% of 2017 GDP.

Specific Sector Outcomes:

- **Agriculture Land Use:** Hydropower development under regulated operation could enhance farm productivity by reducing the risks of recurrent flood and drought. In Vietnam, however, reduced Mekong flows and rising sea levels will increase saltwater intrusion and lower rice production. Expanding farmlands and increasing irrigation capacity would make agricultural production more reliable but comes at the cost of accelerating soil erosion, increased use of agro-chemicals and land degradation.
- **Irrigation:** increases agricultural production and reduces food security risks. But irrigation efficiency in the lower basin needs to be improved. Sustainable irrigation requires reducing water delivery losses, enlarging storage capacity, rehabilitating old irrigation facilities and strengthening the capacity of farmers to manage the facilities.
- **Domestic and Industrial water use:** Concentrations of nutrients (nitrogen, phosphorus) in the river systems tend to exceed MRC thresholds levels. Nutrient loads are amplified during the dry season, increasing risks to human health and degrading aquatic ecosystems.
- **Floods:** Reductions in sediment load due to upper basin, lower basin and tributary dams will necessitate significant expenditure on bank protection in Cambodia and Vietnam's Mekong delta. Transboundary erosion will increase rapidly with the completion of dams in the lower Mekong basin. At risk river bank protection will require investments of up to \$6 billion. Flood risk and potential damage will increase 5 to 10 times as the value of assets increase with developing economies, especially in urban areas with higher exposure.
- **Hydropower:** Hydropower contributes nearly half of the combined sector growth under 2040 plans. Hydropower is linked to negative trade-offs: about 26% of the hydropower gains would be lost in Scenario M2 and 15% under Scenario M3. Implemented Hydropower related mitigation measures could reduce Scenario M3 fish losses by an estimated 11%.
- **Navigation:** Upstream hydropower dams in Scenario M3 would create river sections with sufficient water depth over the whole year for larger vessels to sail, which substantially reduces dredging works. Contingent on realizing the necessary investments and production, the forecast growth of the navigation sector in the lower Mekong basin can be achieved.

Recommendations

Sustainable water resources development in the LMB, the central tenet of the MRC 1995 agreement, will not be achieved by a singular reliance on unilateral investment decisions of the Member Countries. **The transboundary connectivity**, mutual dependencies, shared resources, opportunities of scale and cooperation necessities require a set of supra-national development and planning policies to advance sustainable and beneficial projects. An objective science based approach is one of the essential ingredients to guarantee mutually shared benefits and costs, including those available to the private sector. This requires more synergetic management.

The management of trade-offs between hydropower and fisheries is more efficiently achieved by cross-sector benefit sharing than by the compensation of losses between countries. A possible solution to reallocate benefits acquired by energy companies at the expense of fishing households faced

with lower catches in all four countries, for example, could be a levy of around 9 percent of annual profits for tributary dams and 19 percent of annual profits for mainstream dams.

The Council Study highlights the research contribution of the **MRC** to LMB transboundary deliberations and the design and testing of mechanisms to coordinate multiple sectoral objectives. The MRC, in close collaboration with the National Mekong Committees, can further support national and regional planning, including the management of trade-offs.

Member Country consideration of **emerging energy technologies** that are competitive with hydropower is a main recommendation emerging from the Council Study. Assessing emerging new technologies would provide major insights for managing the water, energy, and food security nexus in the lower Mekong basin.

Several other components of this Study would benefit from further improvement, in particular the socio-economic modelling by considering price, labour, and migration dynamics, the improved analysis of sediment, and the advancement of the sustainability index aligned with the UN Sustainability Goals.