Concept note

# Adapting to multiple and uncertain changes in the Mekong Region: Strategies for today and a +4C world

## Rationale and framing issues

### The regional development context

The Mekong Region is rich in natural resources, and in particular has enjoyed a relative abundance of water resources, although seasonal and periodic droughts affect some sub-regions  Historically, the countries and sub-regions of the Mekong have been only loosely integrated due in part to weakly developed regional transportation, energy, and hydraulic infrastructure and relatively low levels of trans-boundary natural resources and investment flows (Smajgl & Ward 2013). Dramatic changes are now occurring within the region. These include:

- extensive large-scale infrastructure development, including dams for hydropower production (including several on the lower Mekong mainstream), large-scale diversions of water (much of this for irrigation); and rail- and road networks that increasingly cross borders and enable large-scale movements of population;

- economic integration via increased cross-border trade and investment flows enabled by tariff and trade agreements and driven by rapid economic expansion within the region; and,

- increasing competition for the region's natural resources, inclusive of land, water, minerals, and biological resources.

The Mekong Region's climate and hydrology are also changing reflecting global climate changes driven by increasing concentrations of greenhouse gasses (GHG) in the atmosphere. These changes will potentially have profound impacts on the economic development of the region and on the livelihoods of its inhabitants, although the specific nature of these impacts, like the future behavior of climate itself, is subject to deep uncertainty. Proactive planning is clearly required to guide the region's sustainable development, although resource management policies and investment strategies must be made in the context of multiple sources of uncertainty. There is a clear potential for policy conflicts, failures and other unintended consequences.  The waters of the Mekong, (along with the region's other important basins including Ayeyarwady and Chao Phraya) are among the key resources that will guide, enable, and in some instances constrain the region's development.

### Uncertain and potentially dangerous climate change

The IPCC has recently released its Fifth Assessment Report (2013). On the basis of model ensemble projections, the IPCC projects increases in global mean temperature in the range 0.3°C and 4.8°C by 2081-2100 relative to 1986–2005. Higher temperature projections are associated with GHG emissions scenarios (RCP) 6.0 and 8.5, which are in turn consistent with contemporary emissions trends and "business as usual". Temperature changes over land are in addition projected to exceed changes over the ocean by a substantial ratio (1.4 to 1.7). Many scientists now view global increases exceeding 2.0°C, long considered the threshold of "dangerous" climate change, to be inevitable, most likely by mid- century, and changes near the upper end of the IPCC's projections (4°C) to be likely in the absence of rapid and dramatic changes in global energy policy. The implication is that the Mekong Region's inhabitants, - including many alive today - and much public infrastructure currently existing or planned, will be directly exposed to dangerous levels of climate change.

The World Bank (2013) commissioned a study by the Potsdam Institute for Climate (PIK) to examine the consequences of a 4°C increase in global temperature for several climate-sensitive regions including Southeast Asia. Among the most important impacts anticipated for this region are increases in hot days, increasing frequency and intensity of tropical storms, changes in rainfall patterns, and sea level rise. The region's three major river deltas - Mekong, Ayeyarwady and Chao Phraya, each with significant land areas at less than 2 m above sea-level - were identified as facing particular risk from combined sea level rise, intensified tropical storms and land subsidence exacerbated by the damming of river main channels and reduction of sediment deliveries to the deltas.

A review (Rodgers 2013) of recent global and regional climate modeling and recent studies of climate change impacts on the hydrology of the Lower Mekong Basin indicate that the region may become up to 20C warmer by mid-century; and will most likely experience moderate increases in precipitation. Impacts

on basin runoff are more uncertain, with many recent studies projecting changes in discharge of between -15% and +15% of current annual discharge. A major concern regarding future regional climate and hydrology is the high degree of uncertainty: the mean of projections suggests little change relative to contemporary climate, but the difference across models, and the variability (both within- and between-year) and extremes can be quite large.

The Mekong ARCC study (ICEM 2013) focused on the period to 2050, and found that the region is expected to be generally wetter, with the southern Lower Mekong Basin experiencing greater variability. The study also found significant expected changes in the Mekong "hydrobiological seasons", which captures changes both to the flow and to biological communities. In particular, the flood season is expected to lengthen, while the others shrink. Over the next 20-30 years, dams are likely to have a larger impact on river flow in the Mekong than will climate change, particularly during the dry season (Lauri et al. 2012). However, climate change compounds and complicates an understanding of the impact of dams, especially toward the middle and end of the century. Also, dams affect the delivery of sediment to the delta, which combines with sea level rise and more intense storm surges due to climate change to significantly impact, and potentially erode the delta. Understanding the combined impacts of expanding hydraulic infrastructure and climate change will be critical, as the Mekong contains the world's largest freshwater fishery (ICEM 2013), and the Mekong countries, in particular Thailand and Vietnam, are the world's largest suppliers of rice (a water-intensive crop) to international markets. The Mekong Delta alone provides almost 25% of internationally traded rice (Fullbrook, in Smajgl & Ward 2013).

## Increasing variability and potential scarcity of water resources

Although water resources in the Mekong Basin have been relatively abundant historically, recurring seasonal and periodic drought has always been a concern in many sub-regions including parts of Northeast Thailand and areas within the Delta. While Mekong flooding delivers many benefits in addition to occasionally severe damages, droughts in the Mekong Region produce few (if any) benefits and result in loss of income and food insecurity. While the impacts of drought on agricultural production are well known, drought in the Mekong has other implications that are not as widely understood. Reduced wet season flows on the Mekong mainstream reduce inflows to the Tonle Sap Lake in Cambodia, negatively affecting fisheries and in turn reducing outflows during the dry season. Reduced dry season outflows exacerbate seasonal drought in the delta, leading to more extensive saline intrusion. Drought also negatively impacts energy production and navigability of waterways (Adamson and Bird 2010). These impacts take on greater importance in the future as more hydropower capacity is installed along the Mekong and riparian nations increasingly come to depend on it.

Drought in the Mekong can reflect not only absolute reductions in precipitation and flow, but changes in timing as well, in particular the Southwest monsoon. The duration of the dry period following the end of monsoon rains is critical, as there is relatively little groundwater storage in the lower Mekong system to buffer extended dry periods. It is widely anticipated that climate change will result in increased inter-seasonal and interannual variability in Mekong climate and hydrology, with wet periods becoming wetter and dry periods longer and drier. Even in the absence of changes in mean annual rainfall accumulation, increased warming and alterations in the timing of the monsoon will tend to reduce soil moisture during the dry season, making the region more vulnerable to drought.

Strategies, policies and actions at subnational basin, national and the international regional level are needed to deal with the recurrent challenges of adapting to water shortages. For example, while the MRC operates the Regional Flood Management and Mitigation Center, which issues daily regional flood forecasts, no comparable capacity for providing regional drought early warning and management currently exists (Adamson and Bird 2010). Maintaining viable livelihoods for vulnerable groups in the dry season and in very dry years, in particular, is a critical challenge. Given increasing water demands by different sectors, river basin modification, inter-annual climate variability and the prospects of further large changes in global climate with uncertain impacts it is important for the sustainability of development that any response strategies adopted to deal with water shortages are robust.

## Implications of economic integration

Although the Mekong has historically been only weakly integrated, rapidly expanding investments in transportation, energy, and hydraulic infrastructure are greatly accelerating regional economic integration. A range of international and bilateral initiatives have promoted increased economic integration among countries in mainland Southeast Asia, and in the Mekong Region in particular, as well as more broadly. These initiatives have acted to lower trade tariffs, harmonize border procedures, and expand opportunities for foreign direct investment among other impacts. In some cases there are

relatively direct links between specific investments and how water and land are used, as in the case of land concessions or construction of hydropower dams, but in many others, and on aggregate, the implications for social development and environment are not clear.

In particular, the basin-scale integration of economic activities involving water (hydropower, irrigation, municipal water supply, aquaculture, etc.) invariably introduce asymmetries of power and potential for conflict, as e.g., upstream developments have impacts downstream but seldom vice versa, and developments favored by central governments, often benefitting national capitals, can take precedence over those benefitting peripheral regions and inhabitants (Lebel et al. 2005). Concerns are often raised due (among others) to the multiplicity of actors and agendas and the corresponding potential for conflicts and unintended consequences. Nor is it clear how these changing economic relationships among countries might influence vulnerabilities and adaptive capacities related to living in a changing climate.

## SUMERNET's contribution

The development of the Mekong Region, and in particular its water and land resources, will occur in the context of multiple, profound and uncertain changes. Some of these changes (including improved public infrastructure) are potentially beneficial in supporting the region's sustainable development. Others, including regional climate change, are at best uncertain and at worst present fundamental challenges to sustainable development. The presence of multiple drivers of change, and uncertainty over if and how they will interact, provides motivation for the design of regional development policies that are robust to a range of possible futures. It is likely that the needed changes will be "transformational" (Kates et al. 2012) rather than incremental. If that is true, then there will be an unprecedented need for close collaboration between Mekong riparian states on levels of policy, investment, and security (including food security).

SUMERNET is well positioned to interpret the multiple potential changes in the context of sustainable development of the Mekong, and to provide an integrated assessment that identifies the most critical and policy-relevant scenarios likely to affect the region. SUMERNET can contribute by communicating the implications of these critical scenarios for policymakers and planners within the Mekong Region, and assist them in developing robust policies and investment strategies.

## Guiding policy questions

1) What strategic water allocation and watershed management policy options exist at subnational basin, national and international levels in the Mekong Region to deal with water shortages arising from seasonal drought, inter-annual climate variability and climate change?

2) What combination of investment and resource management strategies would be robust against large uncertainties of climate impacts if global mean temperature rise reaches or exceeds 4°C and would support long-term regional sustainability? Is adaptation to the impacts of 4°C even possible?

3) Will the changes occurring (climate, water scarcity, investment) lead to greater cohesion and cooperation among Mekong riparian partners, or will they lead to increasing potential for conflict?

4) Will the economic development trends with the region lead to increasing or decreasing dependence on the region's water resources?

## Design

The proposed assessment would utilize the robust decision making (RDM) framework (Groves & Lempert 2007). RDM was developed to support decision-making in the context of multiple objectives and multiple sources of uncertainty. When planning must contend with many evolving trends and uncertain outcomes, RDM seeks to identify those scenarios (clusters of outcomes) that present particular challenges to proposed policies and strategies, thus enabling policy-makers to design and select policies that are robust to uncertain outcomes. The assessment would begin by convening an expert group to provide scientific advice and a policy group involved with regional planning processes. These bodies would help to define the scope of the assessment.

The subsequent assessment would have four main parts:

1. A set of 4-5 subnational basin case studies

2. An analysis of international region-level options

3. Using RDM approaches, identification of highly relevant and challenging scenarios that allow for a regional level exploration of what increasing water scarcity and increasing regional economic integration imply in a world up to +4°C warmer, with focus on the water resources in the Mekong Region

4. A test of strategic policy options proposed in 4-5 subnational basin studies (1) and regional study (2) in +4°C world using the critical alternative scenarios identified in (3)

Parts 1, 2 and 3 could be largely done in parallel. Part 1 studies would be led by SUMERNET partners. Parts 2 and 3 would be led by the SUMERNET Secretariat. Part 4 could be led by SUMERNET Steering Committee (SC).

The individual assessment case studies in Part 1 and 4 would be carried out in locations with significant prior work upon which to base document reviews, stakeholder consultations, as well as modest additional modeling work if appropriate.

The entire process is designed to take 18-24 months.

## Products

Key assessment documents from initial plans to final reports would be prepared in all the Mekong languages. Only technical appendices might remain in English (for regional work) or in local languages (for subnational assessments).

Assessment partners and users involved in planning. The expected users of the assessment findings fall into the following categories:

· Boundary partners of SUMERNET projects working at national level responsible for disaster preparedness, water resources, and climate adaptation

· Regional and national policy-advising bodies responsible for longer-term strategic planning

· Experts in climate modeling and climate impact modeling

Regional processes that can be informed by this work include:

· Mekong River Commission post-2015 Strategic Plan (the current plan runs from 2011 to 2015)

· MRC Climate Change and Adaptation Initiative (CCAI)

· MRC - IKMP / Drought Management Project & Mekong IWRM Project

· Climate Investment Funds (CIF) Pilot Program for Climate Resilience administered by ADB in Cambodia

· ASEAN Socio-Cultural Community (ASCC) Blueprint, which guides ASEAN action on climate; the current blueprint ends next year (having run from 2009-2015)

## Invitation for collaboration

We welcome feedback from individuals or organizations who are interested in this effort and wish to offer advice for the concept note and collaborate in our work. Kindly contact the SUMERNET Secretariat through the contact details given below.

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