



Economic, Environment and Socical Impact Assessment of Basin-wide Development Scenarios

Overall initial findings from assessments

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Structure of presentation

- 1) Purpose, scope and progress of scenario assessment
- 2) Some initial main findings
- 3) Overarching considerations
- 4) Issues for discussion

Purpose, scope and progress of scenario assessment

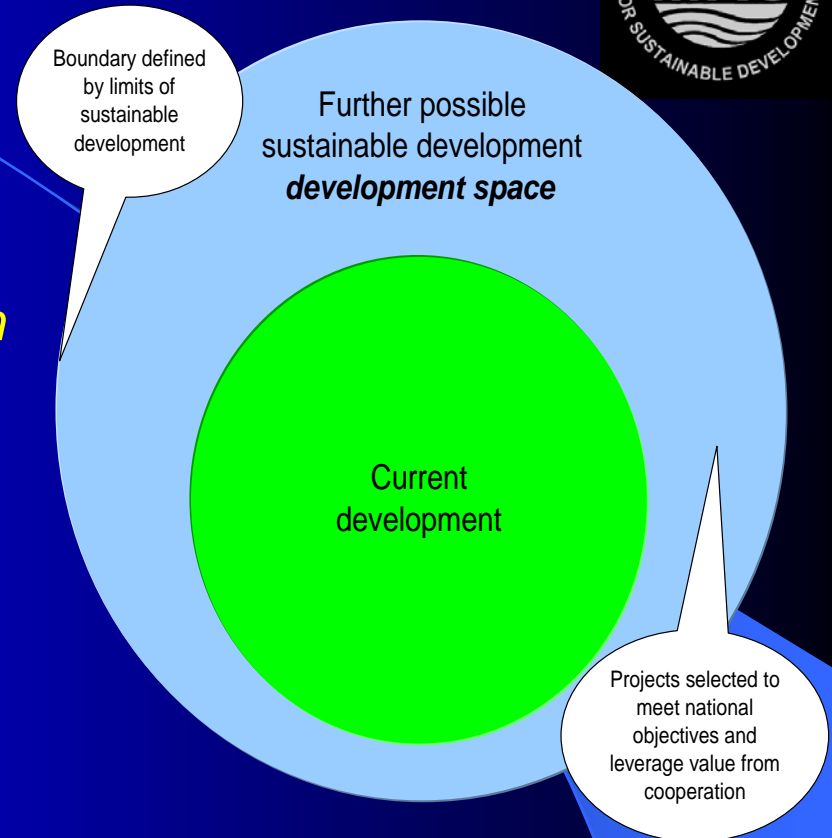
Purpose of scenario assessment



- To support the definition of the 'Development Space', which is:

- *NOT just a volume of water that can be used*
- *BUT a space for development and management of water and related resources, shaped by sustainable boundaries , e.g. **acceptable transboundary impacts derived from the scenario activities***

- Countries can work and plan within the 'Development Space', supported by Strategic Guidance, and a package of IWRM guidelines
- MRC monitors, facilitates and periodically evaluates



Benefits for Riparian States and the Basin itself

- *Builds confidence* that water can be allocated and used without significant unforeseen impacts
- Help *attract funding* for projects with increased confidence of developers in water resources management processes
- Enables a more strategic implementation of agreed procedures and technical guidelines *to facilitate national sustainable development*, such as the PNPCA
- *Enhances the sharing of benefits, risks and impacts among MRC member countries*

Scope of scenario assessment

- Each basin-wide scenario represents different combinations of sectoral water resources development, recognizing the synergies and trade-offs between sectors
- The assessment approach is based on the concept of IWRM that holds the promise of reconciling goals of economic efficiency, social equity, and environmental sustainability
- Each scenario has a unique 'trade-off' between these goals, which is being assessed
- Scenarios that are beneficial to all LMB countries and sustainable from a basin perspective, would be the preferred scenarios

Considered basin-wide development scenarios



Baseline situation	Definite future situation	Foreseeable future situation (20 years)	Longer-term future (50 years)
1. Baseline line scenario in year 2000	2. Upper Mekong Dam Scenario 3. Definite Future Scenario	4. LMB 20-Year Plan Scenario (National perspectives) <u>Alternative perspectives</u> 5. LMB 20-Year Plan Scenario without Mainstream Dams 6. LMB 20-Year Plan Scenario with different configuration of Mainstream Dams in the LMB 7. Mekong Delta Flood Management Scenario	8. LMB Long-term Development Scenario 9. LMB Very High Development Scenario

Foreseeable Future and Longer Term Future Scenarios will be assessed with and without *climate change*



Goal	Primary Objectives	Assessment Criteria				High relevance to Work Package					
		Specific development	Issue	Indicator <i>Description</i>	Unit	B2	B3	B4	B5	B6	
Sustainable development	Optimal development (triple bottom line)	1 Economic development	1.1 Increase irrigated agricultural production	Irrigable area, production tonnage and value	Incremental area Incremental crop production Net incremental economic value	'000 ha '000 ton NPV US\$m	✓		✓	✓	✓
			1.2 Increase hydropower production	Hydropower capacity, power generated and value	Incremental installed capacity Incremental power generated Net incremental economic value	MW GWh/year NPV US\$m	✓			✓	✓
			1.3 Improve navigation	River transport	Incremental navigable days by class Net incremental economic value	'000 boat-days NPV US\$m					✓
			1.4 Decrease damages by floods	Extent and duration of annual flooding by class	Average area flooded annually to max 0.5-0.9m depth Average area flooded annually > max 0.9m depth Incremental net economic value of flood damage	'000 ha '000 ha NPV US\$m		✓	✓	✓	✓
			1.5 Maintain productivity of fishery sector	Capture fisheries and aquaculture production	Incremental annual average capture fish availability Incremental annual average aquaculture production Net incremental economic value	'000 ton '000 ton NPV US\$m	✓		✓	✓	✓
		Impact of flow and sediment transport changes on deep pools		Sediment loads at specified locations on mainstream Water levels at specified locations on mainstream Net incremental economic values	Trend m Trend		✓		✓	✓	
		2 Environmental protection	2.1 Maintain water quality and acceptable flow conditions	Water quality	Water quality incl. sediment in transport in mainstream	Trend			✓	✓	✓
				Flow characteristics	Key flow characteristics (to be defined)	Trend				✓	✓
			2.2 Maintain wetland productivity and ecosystem services	Protection of forests around Tonle Sap	Forest flooded for specified depth duration at Tonle Sap Net incremental economic values	'000 ha NPV US\$m			✓	✓	✓
				Productivity of wetland ecosystems	Incremental wetlands with required depth-duration Net incremental economic value	'000 ha NPV US\$m			✓	✓	✓
				2.3 Manage salinity intrusion in the Mekong delta	Impact of salinity intrusion on land use potential	Area within delta within thresholds of salinity levels Net incremental economic value	'000 ha NPV US\$m			✓	✓
		2.4 Minimize channel effects on bank erosion	River bank erosion	Incremental area at risk to erosion Vulnerability to bank erosion Net incremental economic values	'000 ha Trend Trend		✓		✓	✓	
		2.5 Conservation of biodiversity	Impacts of flow management changes on endangered species	Incremental area of suitable habitats Estimated number of species affected Incremental net economic value of habitat areas	'000 ha no. NPV US\$m			✓	✓	✓	
3 Social development	3.1 Maintain livelihoods of vulnerable resource-users	Health, food and income security	No. of people affected Severity of impact on health, food and income security	'000 h/h Trend	✓		✓	✓	✓		
	3.4 Increased employment generation in water related sectors	Incremental sustainable employment from water resource interventions	Incremental number of people engaged in: Agriculture Fisheries Water-related service industries Tourism	'000 '000 '000 '000	✓		✓	✓	✓		
4 Equitable development	4.1 Ensure that all four LMB countries benefit from the development of water and related resources	Aggregate benefits by country	Summation of incremental net economic benefits Summary of non-quantifiable impacts	NPV US\$m Trends	✓		✓	✓	✓		

The assessment criteria include 12 specific development objectives within economic, environmental and social spheres

A total of 37 indicators have been identified within the framework

In addition, equity is evaluated

Overview of assessment approach



The key aspects of the assessment approach are:

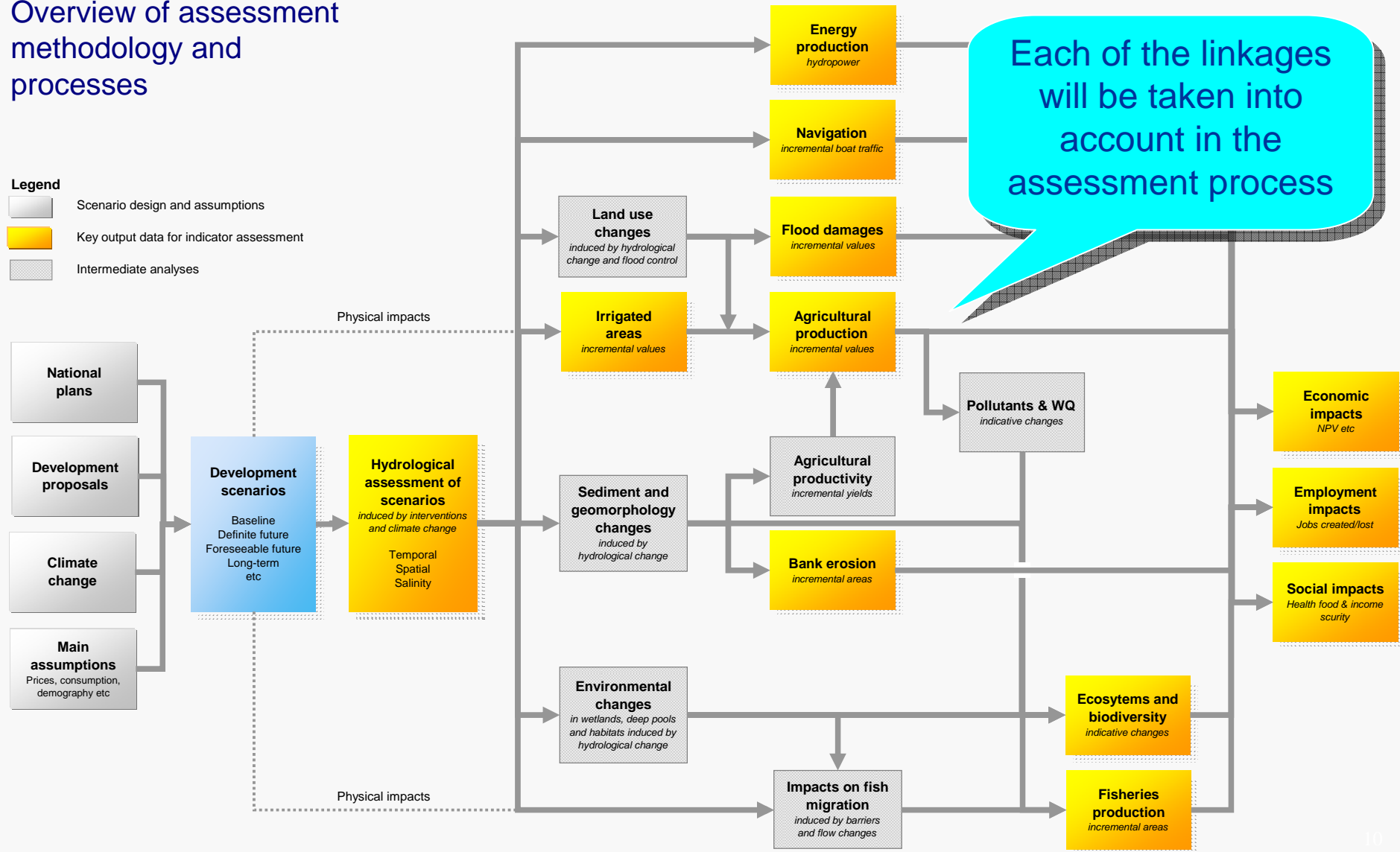
- ❑ Founded on the principles of **integrated water resources management**, recognizing the inter-dependence of the different sectors
- ❑ Building on the rich body of acquired knowledge of the natural resource system and a **structured approach** that uses **transparent data sets**
- ❑ **Dealing with uncertainties** in an open and transparent manner and understanding their development implications
- ❑ **Participation** by public and non-public stakeholders at the basin, national and sub-basin levels

Hydrological changes and physical impacts caused by interventions are assessed for their environmental and economic impacts and thence their social impacts. The process mirrors the approach adopted under IBFM

Overview of assessment methodology and processes

Legend

- Scenario design and assumptions
- Key output data for indicator assessment
- Intermediate analyses



Each of the linkages will be taken into account in the assessment process

Status of assessment

- ❑ **Scenario assessment is in full swing now**
- ❑ **The assessment is following the methodologies presented last October in Chiang Rai**
- ❑ **Preliminary findings are now available for the baseline, definite future and foreseeable future scenarios**
- ❑ **Comments and suggestions are welcomed on these findings and ways to improve the scenario assessment in the light of these findings**



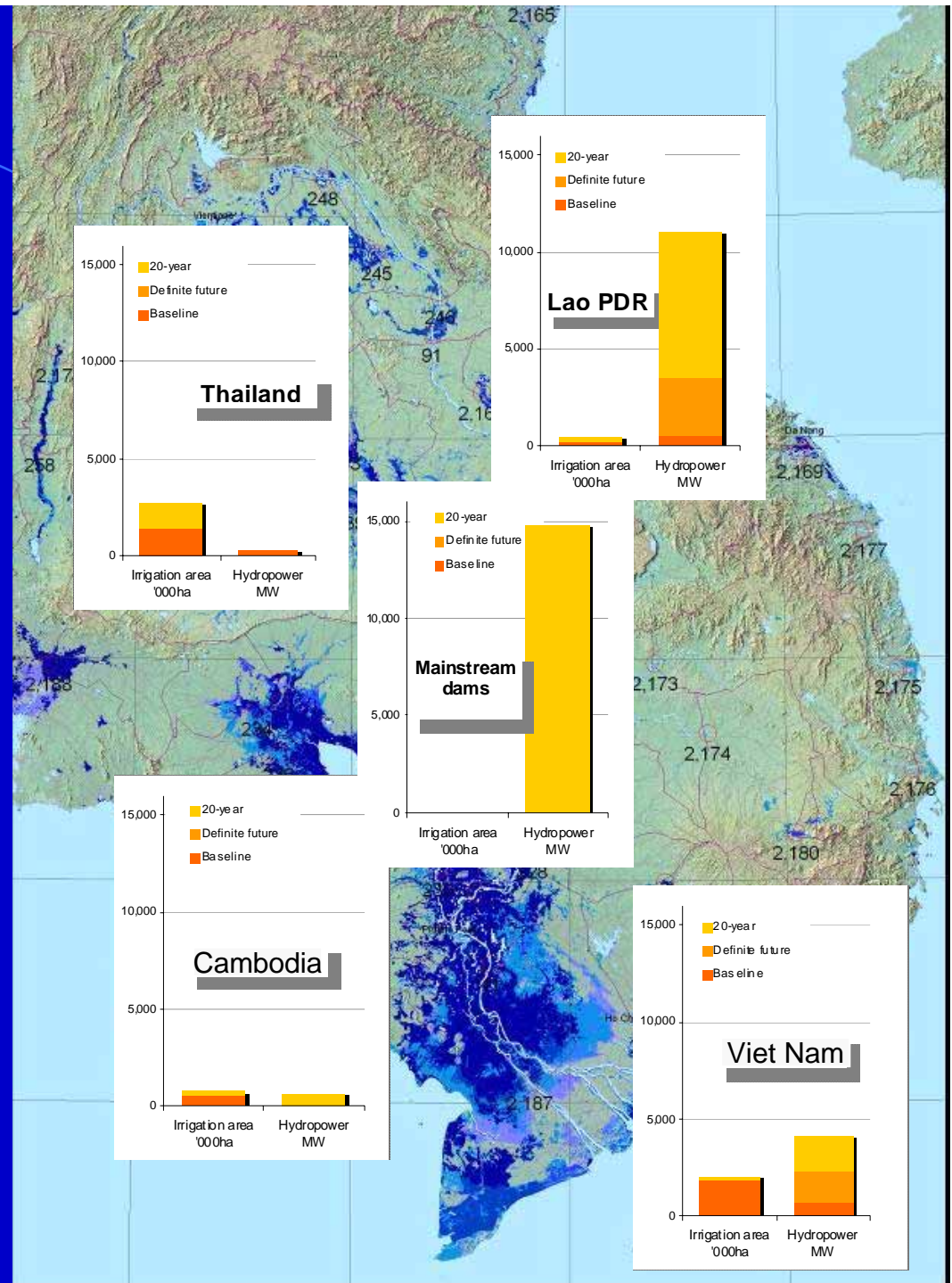
In progress

Nine main scenarios have been defined in response to each country's suggestions

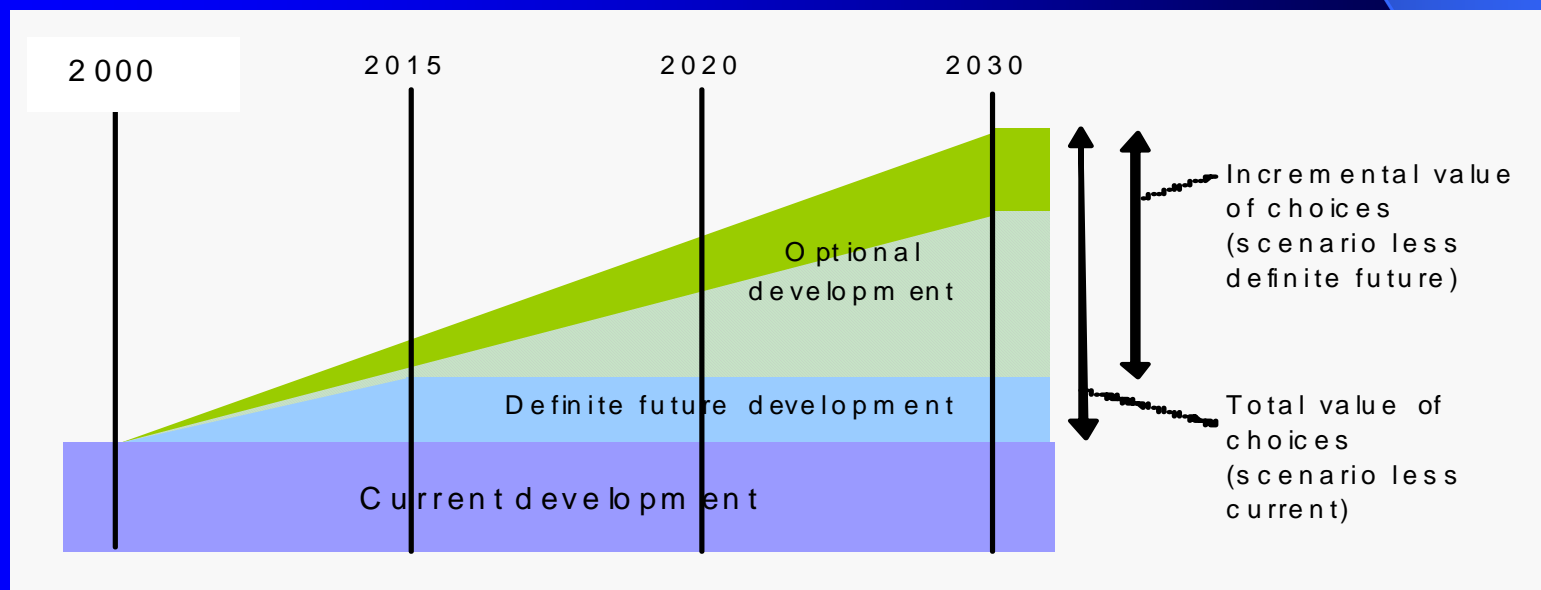
Effects of climate change and long term scenarios will be investigated later

	Title	Time horizon
1	Baseline scenario	Baseline (1985-'00)
2	Upper Mekong Dam scenario (UMDS)	Definite future over next 5-10 years
3	Definite future scenario (DFS)	
	Foreseeable future situation (FSS)	
4	LMB 20-year plan scenario	Foreseeable future over next 20 years
5	LMB 20-year plan without mainstream dams	
6	LMB 20-year plan with 6 m/s dams in upper LMB LMB 20-year plan with 9 m/s dams	
7	Mekong delta flood management scenario	Baseline (1985-'00)
	Long term future	
8	LMB long-term development scenarios	Long term future over next 50 years
9	LMB very high development scenarios	
10	Further scenarios	

- Scenarios are defined by the amounts of irrigation and hydropower in place
- Three time periods:
 - Baseline - present
 - Definite future 2015
 - Foreseeable future 2030
- The Foreseeable Future is considered with and without mainstream dams



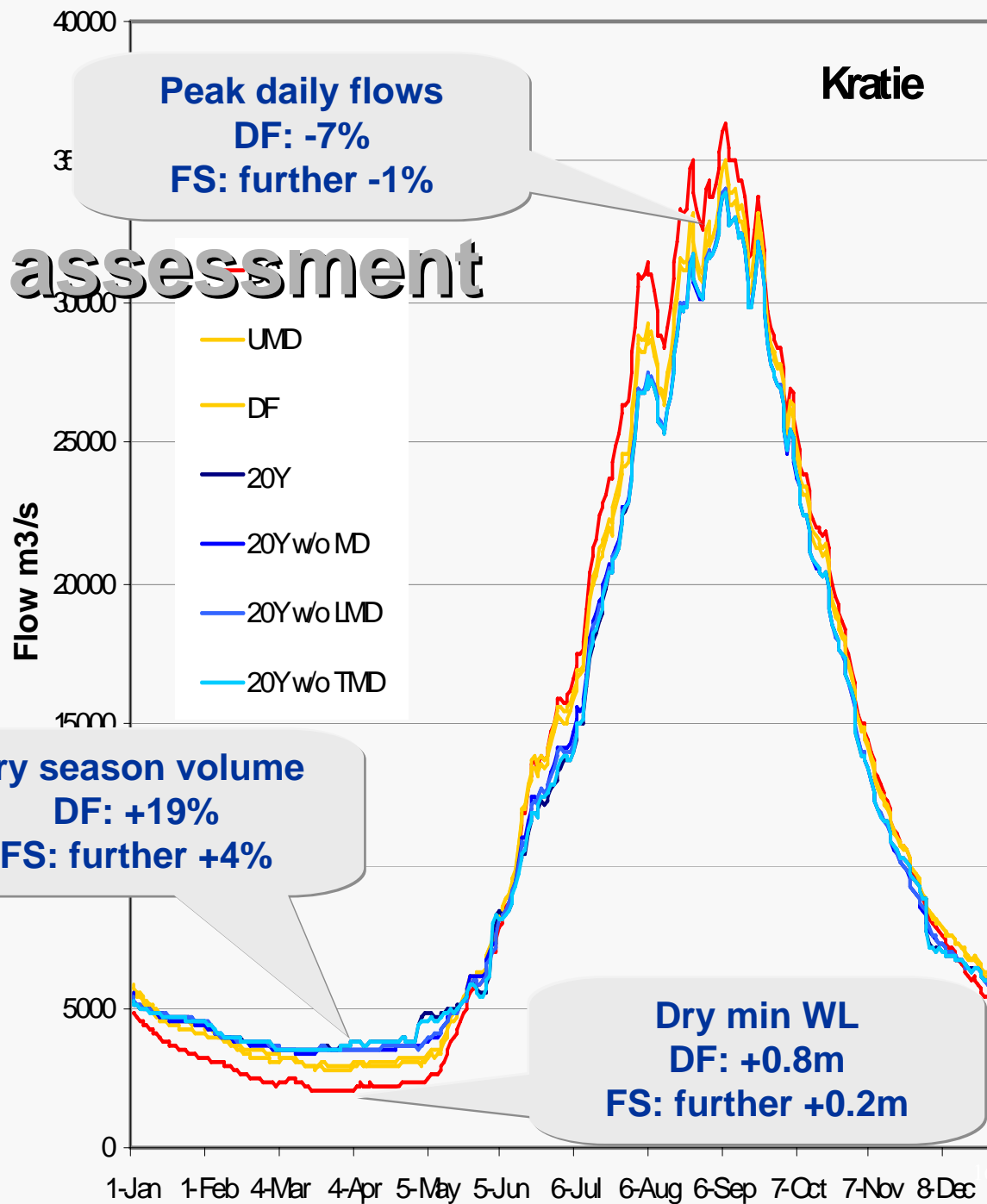
- ❑ **The Definite Future is about understanding the impact of what is expected to definitely happen, based on past decisions**
- ❑ **The Foreseeable Future investigates the choices that can be made this year and beyond about what else may be taken up in addition to the Definite Future**



Some initial main findings

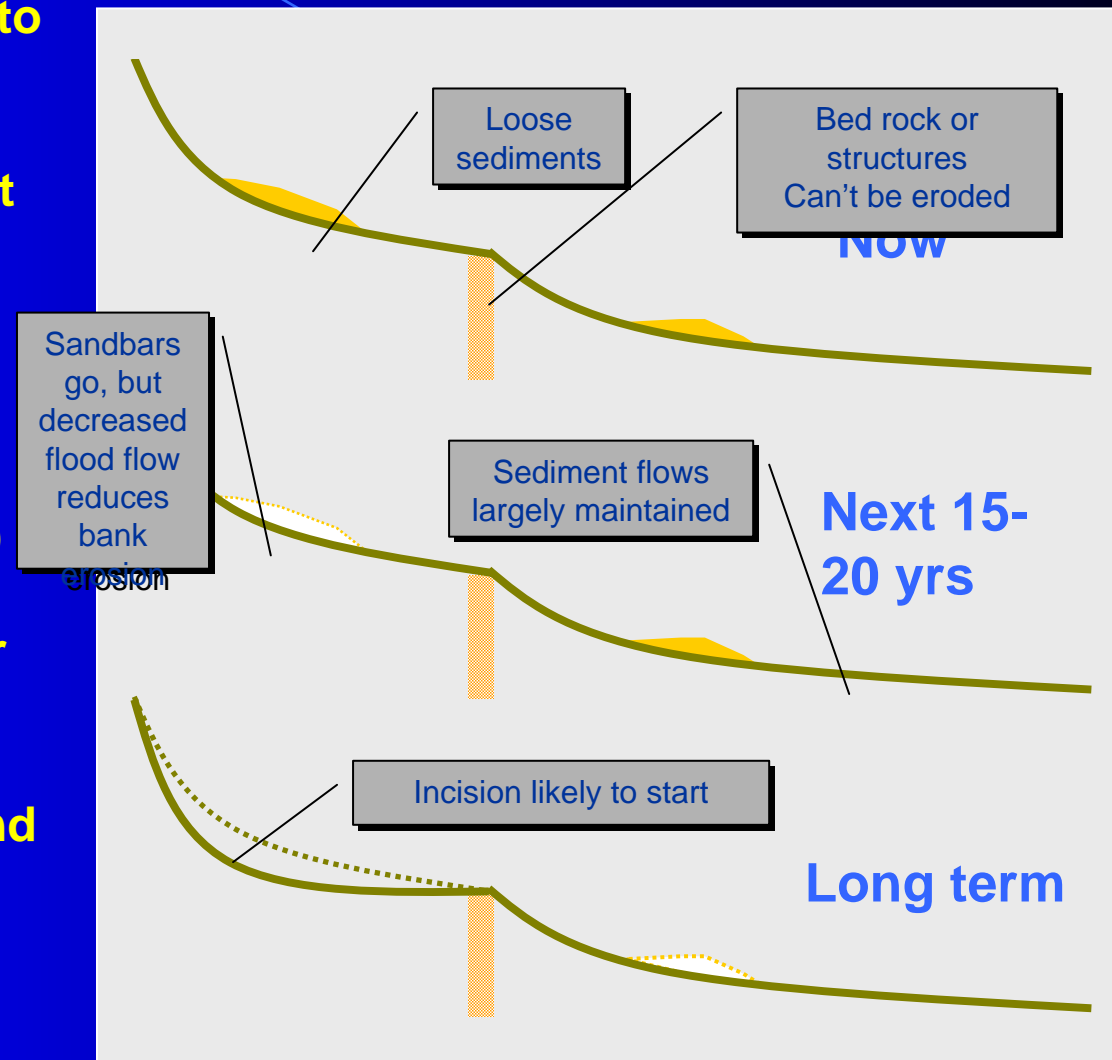
Hydrological assessment

- Large storages in UMB plus 27 tributary dams under implementation will bring about a permanent change to the natural flow regime
- By contrast, all scenarios in the Foreseeable Future add only small further amounts to this change



Geomorphology assessment

- Potential major changes to the morphology of the Mekong mainstream will be induced by the current developments in the Definite Future Scenario
- The adverse impacts will become visible in the longer-term (15-20 years)
- In the long-term, the river bed will start to incise, constrained by the presence of rock beds and any future dams



Environmental assessment



- ❑ By 2030, the changes in flow regime result in considerable wetland loss in Lao PDR and Thailand (20%)
- ❑ Wetland loss in Cambodia is moderate (7%), in Vietnam low (1%)
- ❑ Combination of decrease in reverse flow volume to the Tonle Sap Lake and increase discharge of BOD and nutrients into the lake from tributaries in Cambodia, could induce large changes in the ecology of the lake, with basin-wide consequences
- ❑ Saline intrusion reduced with productivity rise of 0.5 Mton
- ❑ Most of the above changes already result from current developments in the Definite Future Scenario

Flagship species

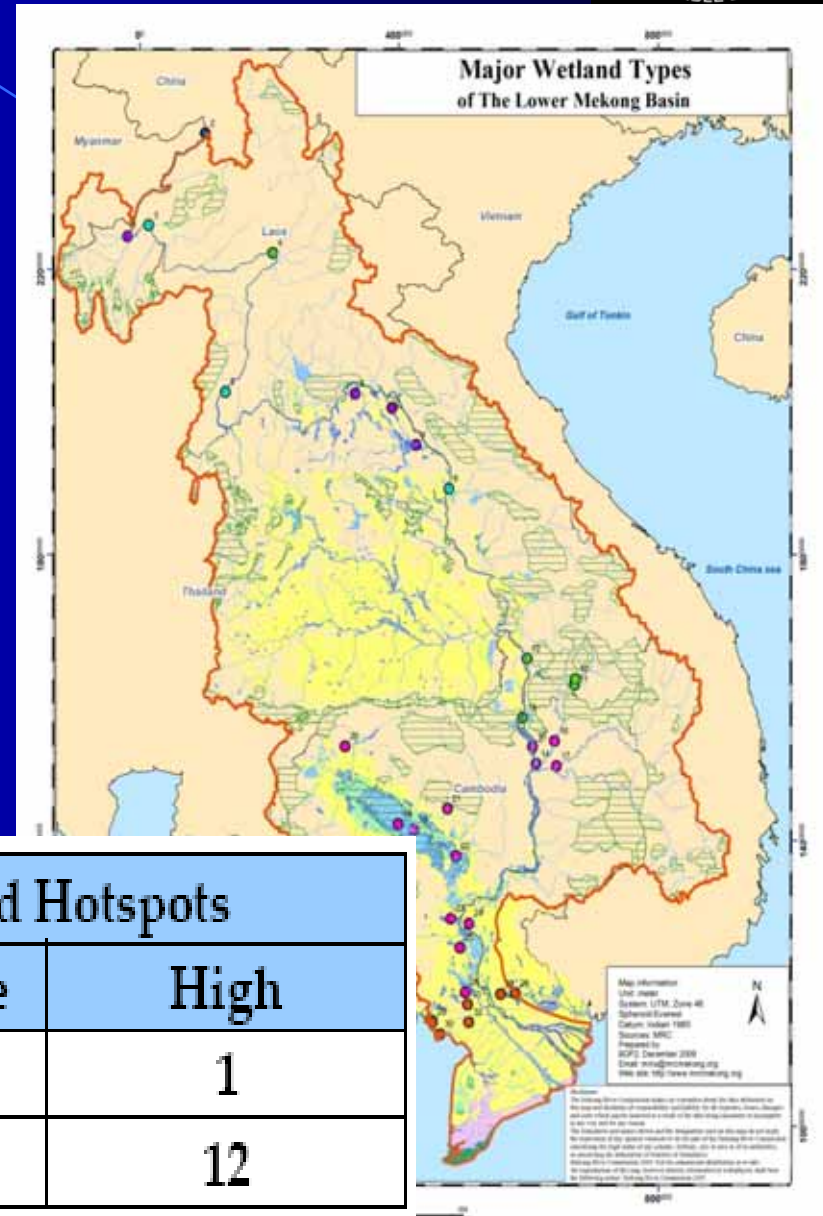
Flagship species	Baseline	Definite Future	20-year Plan
Mekong River Dolphin, Irrawaddy Dolphin <i>Orcaella brevirostris</i> (CR)	High	High	Extinct
Mekong Giant Catfish <i>Pangasianodon gigas</i> (CR)	High	High	Extinct
Siamese Crocodile <i>Crocodylus siamensis</i> (CR)	Moderate	Moderate	Moderate
Eastern Sarus Crane <i>Grus antigone sharpie</i> (VU)	Low	Low	Moderate



Environmental Hotspots



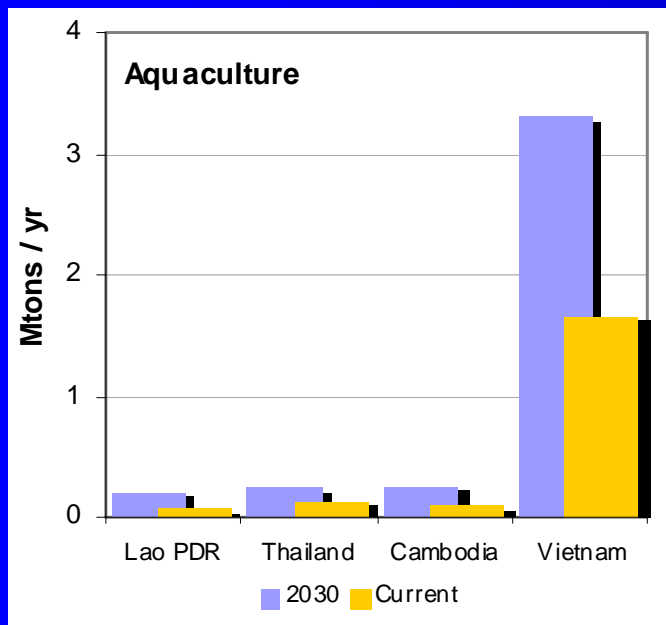
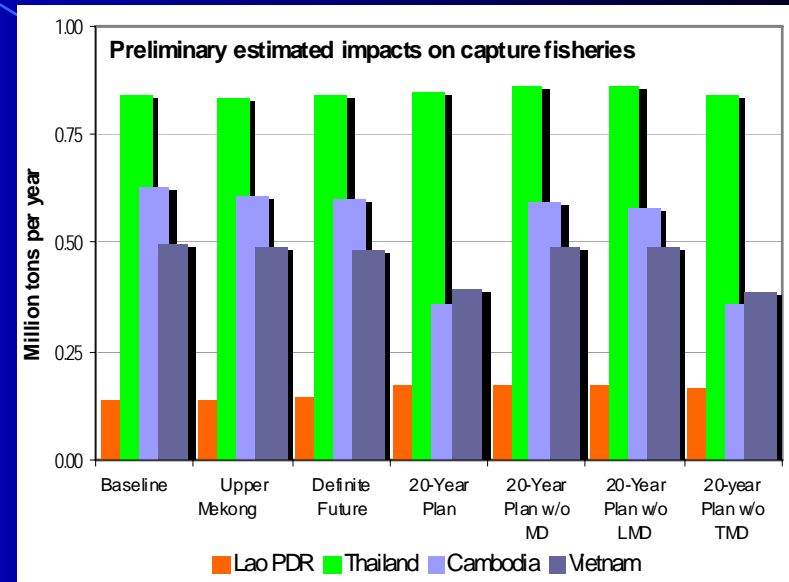
32 environmental hotspots identified: Ramsar sites, Biosphere reserves, Protected areas, Important Bird Areas (IBA's)



	No of impacted Hotspots		
	Minor	Moderate	High
Definite Future scenario	22	9	1
20 Year Plan scenario	11	9	12

Fisheries assessment

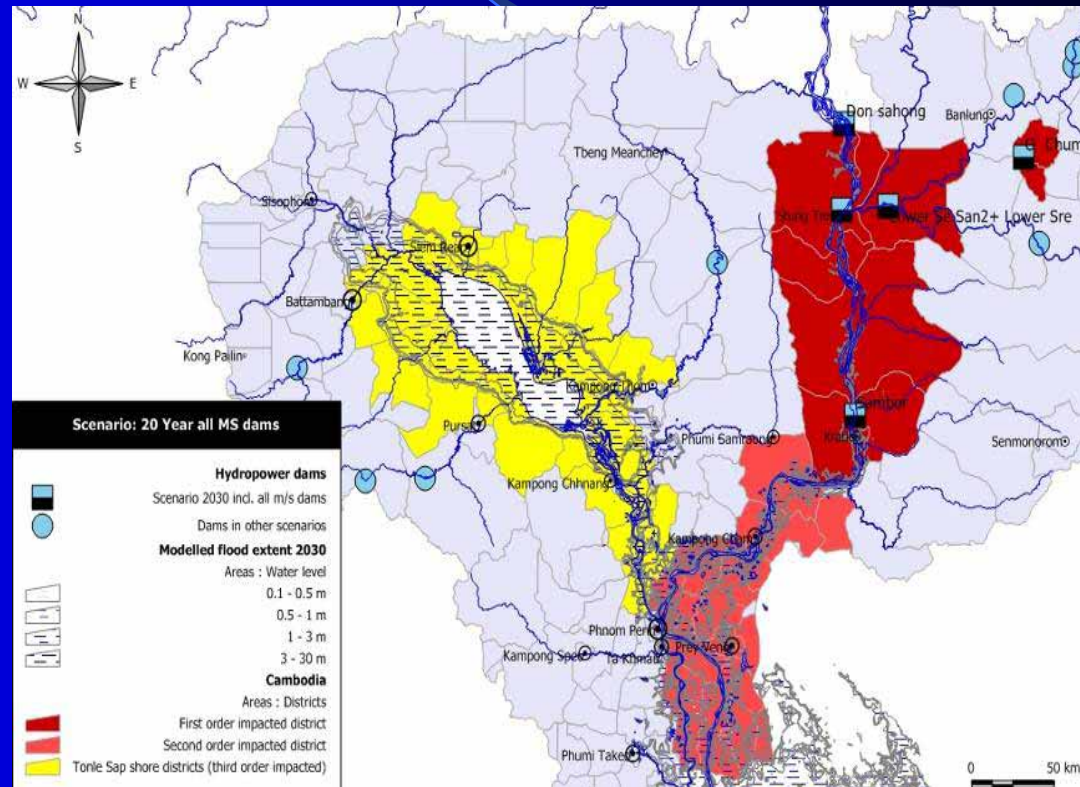
- Preliminary assessment forecasts 21% decline in capture fisheries yield with m/stream dams
- Cambodia (-43%) and Viet Nam (-23%) will suffer most



- Aquaculture set to double over next 20 years, but mostly in Viet Nam
- Aquaculture offsets productivity losses but does not address lost wild fish-related livelihoods

Social assessment

- Main threats from reduction in capture fisheries reduction from dam construction
- Cambodia likely to be most vulnerable with >1 million livelihoods at risk
- Other assessments in process





Economic assessment

- **Economic benefits of hydropower order of magnitude greater than all other sectors combined**
- **Fisheries losses largely offset economically by aquaculture and irrigation, but all fishery losses borne by vulnerable rural poor**

Comparison of total economic NPV by development scenario, sector and country

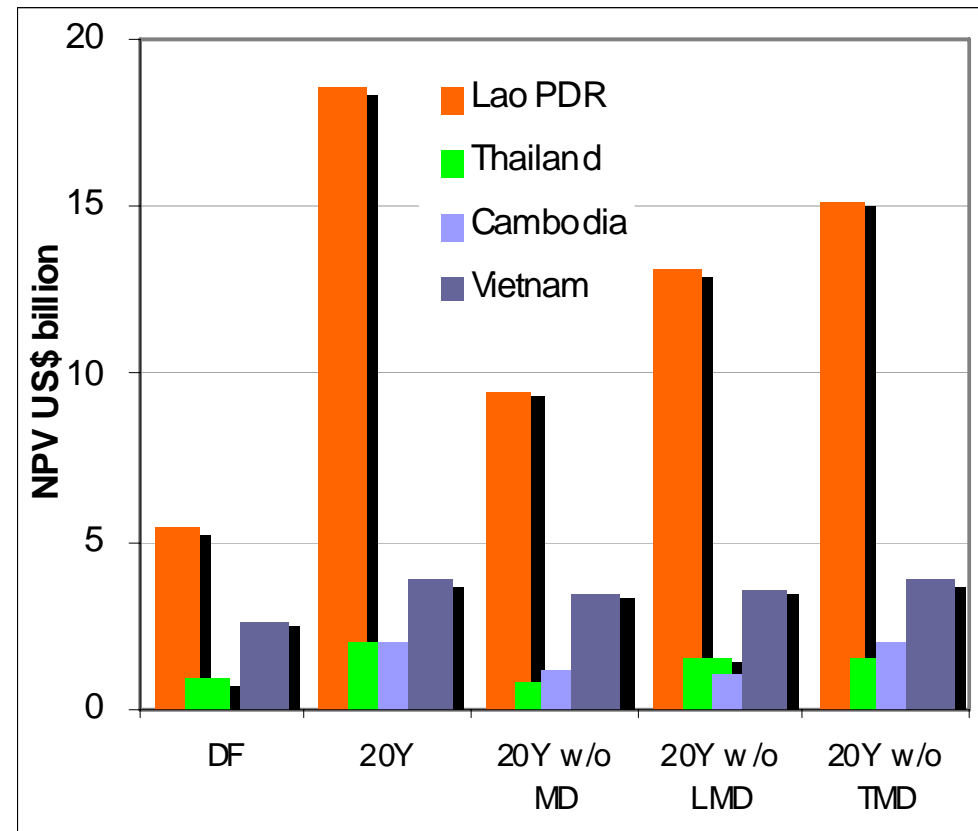
US\$ million

	3000	4000	5000	6000	6100	7000
	DF	20Y	20Y w/o MD	20Y w/o LMD	20Y w/o TMD	Flood management
Hydropower	8,200	26,335	14,037	18,596	22,821	
Irrigated Agriculture	0	86	86	86	86	
Flood Management	0	0	0	0	0	224
Reservoir Fisheries	429	456	428	451	445	0
Aquaculture	0	679	679	679	679	0
Capture Fisheries						
NPV fish catch losses	-392	-1,480	-239	-350	-1,480	0
NPV wetland area lost	-21	-17	0	0	0	0
Flood Mitigation	777	367	0	0	0	0
Saline Intrusion	77	n	n	n	n	0
Riverbank erosion	0	n	n	n	n	0
Navigation	64	n	n	n	n	0
Total LMB	9,133	26,427	14,991	19,462	22,551	224
Lao PDR	5,450	18,549	9,497	13,102	15,178	
Thailand	989	1,946	865	1,581	1,550	
Cambodia	-21	2,012	1,197	1,158	1,974	254
Vietnam	2,715	3,920	3,432	3,621	3,849	-30
Total LMB	9,133	26,427	14,991	19,462	22,551	224

Economic assessment



- Economically, Lao gains most due to hydropower generation
- Others gain from hydropower use
- Negative NPV Stung Treng reduces benefits Cambodia in 20-Year Plan Scenario
- Negative NPV for irrigation expansion reduces benefits Thailand



Overarching view

Definite Future Scenario

- ❑ **Creates a major change in flow regime by 2015, caused mainly by developments in the Upper Mekong Basin**
- ❑ **This opens an opportunity for irrigation expansion, primarily in Thailand, Lao PDR and Cambodia.**
- ❑ **The irreversible Definite Future changes will cause a range of positive and negative environmental and social impacts in the foreseeable future**
- ❑ **Without mainstream dams, the LMB 20-Year Scenarios add only small incremental positive and negative impacts, except for the Tonle Sap Lake**

LMB 20-Year Plan Scenario without mainstream dams



- ❑ **Substantial net economic benefits (NPV US\$ 6.3 billion), with only a small change in losses to capture fisheries (NPV US\$ 0.03) compared to Definite Future Scenario**
- ❑ **Ambitious irrigation proposals (1.9 million hectares) can be sourced with redistributed water from the hydropower developments**
- ❑ **“Natural” dry season flow can be protected**

LMB 20-Year Plan Scenario



- ❑ Will cause a range of very significant adverse transboundary impacts
- ❑ Mainstream dams severely affect capture fisheries in Cambodia and Viet Nam, increasingly from the upstream dam locations to the downstream ones
- ❑ The large reduction of capture fisheries production in the LMB 20-Year Plan Scenario would be offset by the increases in aquaculture in Vietnam and largely mitigated by increases in irrigation and aquaculture in Cambodia
- ❑ However, the increases in aquaculture might not benefit the up to one million poor people in Cambodia who lose their wild fishing and have no access to land, water and capital

LMB 20-Year Plan Scenario (2)



- ❑ **Economically, the hydropower benefits are considerably larger than the benefits and costs of all other assessed impacts**
- ❑ **The LMB mainstream dams have a large economic value (NPV US\$ 12.3 billion)**
- ❑ **As a result, in economic terms, all LMB countries would benefit from the LMB 20-Year Plan Scenario**

LMB 20-Year Plan Scenario (3)



- ❑ **Reconsideration of the plans for mainstream dams in Cambodia and the southern part of Lao PDR would reduce the negative impact considerably**
- ❑ **The LMB 20-Year Plan Scenario without the two Cambodian mainstream dams would have less severe impacts than the scenario with all 11 LMB mainstream dams**
- ❑ **Migration up the 3Ss-Basin would still be possible and the ecologically very valuable stretch between Kratie and the Cambodia-Lao border would maintain its natural character**

Benefit sharing



- ❑ **Foreseeable Future Scenarios require very large investments (US\$ 30-65 billion across all countries)**
- ❑ **And produce very substantial net economic benefits (US\$ 15-30 billion across all countries)**
- ❑ **Although the scenarios would benefit all countries, the benefits are spread unevenly across the four countries, depending on the scenario**
- ❑ **Therefore, it would become important to also study how the adverse impacts of the various scenarios are distributed between and within countries**

Benefit sharing (2)

- ❑ **Many of the existing transboundary benefit sharing in international river basins agreements relate more to specific development projects**
- ❑ **In the BDP process we are taking a much wider view of benefits and impacts that are more suited to the scenario assessment approach (as opposed to a single project approach)**
- ❑ **A concept paper is being prepared on benefit and impact sharing to assist the countries in the discussions on the scenario assessment results**

Issues for discussion

Issues for discussion (1)

- **The assessment findings are preliminary. The assessment is ongoing, including the evaluation of risks and uncertainties. Long-term and climate change scenarios have yet to be modeled.**

- **Nevertheless, the preliminary assessment findings offer a first opportunity to ‘rise above’ the mere impact figures and take an ‘overarching view’ of the results so far. This RTWG meeting is encouraged to discuss:**
 - **the critical differences between scenarios**

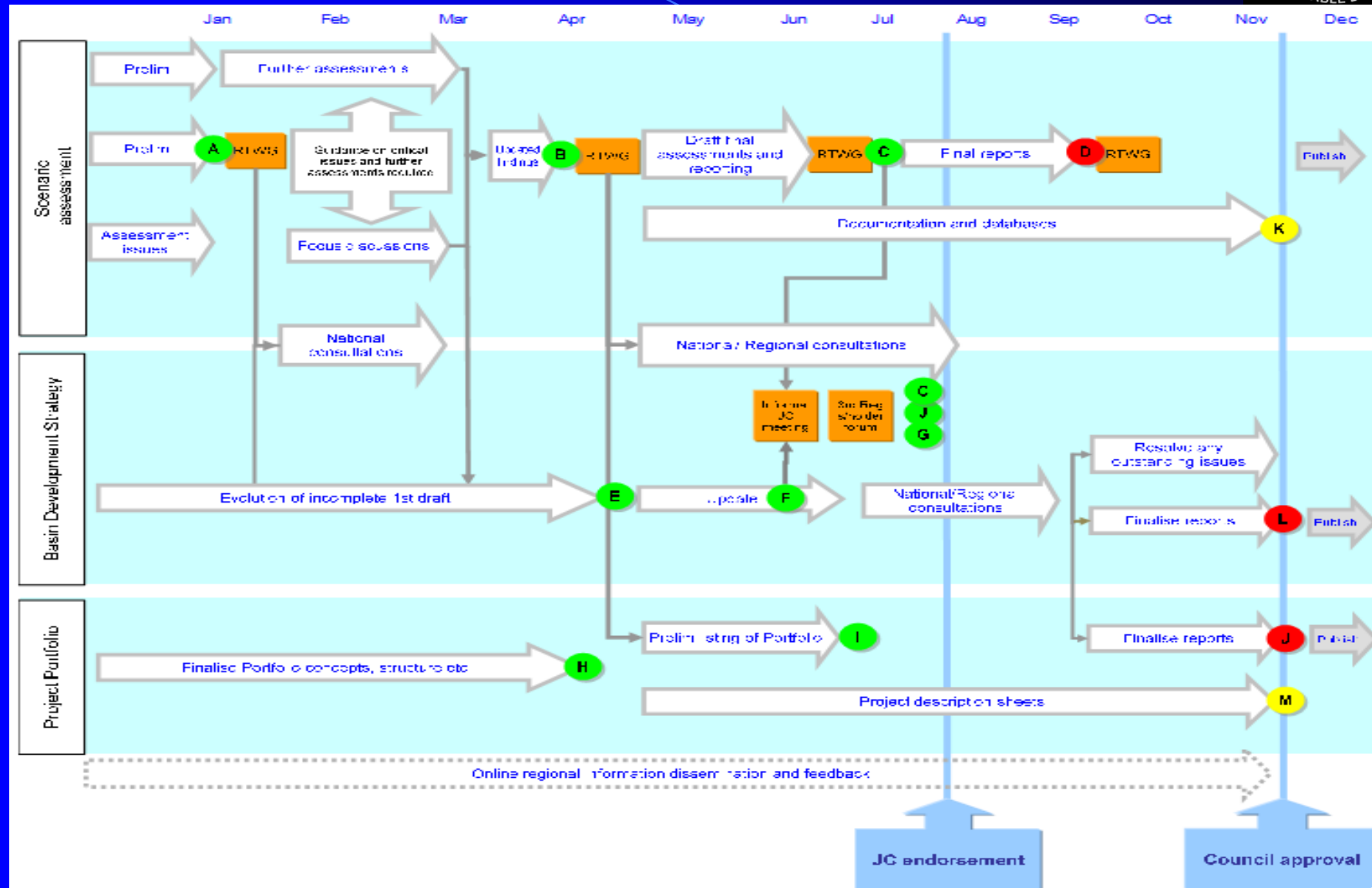
 - **emerging synergies, trade-offs, and options for benefit sharing**

Issues for discussion (2)



- **Refinements to the assessment process, for example:**
 - **How to assess the criterion 'equitable development' (since the benefits are not necessarily evenly distributed between countries)?**
 - **How to address autonomous and/or exogenous conditions?**

Road Map in Summary



Thank you!

