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# Council Study

## Work Plan: Formulation of Development Scenarios for the Hydropower Thematic Area



5<sup>th</sup> RTWG Meeting  
Siem Reap, Cambodia  
13-14 August 2015

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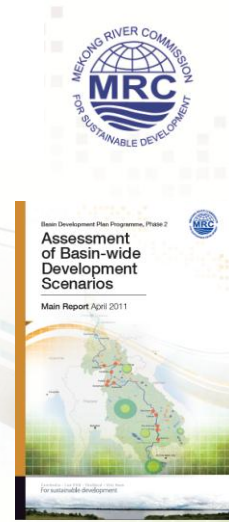
Content

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## Sub Scenario for hydropower thematic area

- The concept proposed for Sub Scenario of hydropower thematic area was conceived and proposed for the 1st time for consideration
- The concept take stock of the content of the “Assessment of basin-wide Development Scenarios – Apr 2011” and the application of the Preliminary Design Guidance
- Figures and numbers are indicative. They can be refined after the concept for HP Sub-Scenarios has been accepted

Overview and References



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## Three main development scenarios approved during 3<sup>rd</sup> RTWG Meeting



| Scenarios # | Name                              | Level of Development* |      |      |      |      |      |
|-------------|-----------------------------------|-----------------------|------|------|------|------|------|
|             |                                   | ALU                   | DIW  | FPF  | HPP  | IRR  | NAV  |
| 1           | Early Development Scenario 2007   | 2007                  | 2007 | 2007 | 2007 | 2007 | 2007 |
| 2           | Definite Future Scenario 2020     | 2020                  | 2020 | 2020 | 2020 | 2020 | 2020 |
| 3           | Planned Development Scenario 2040 | 2040                  | 2040 | 2040 | 2040 | 2040 | 2040 |

Note:

\*Levels of developments for the various thematic areas: ALU = Agric/Landuse Change; DIW = Domestic and Industrial Water Use; FPF = flood protection/floodplain infrastructure; HPP = hydropower; IRR = irrigation; and NAV = Navigation

Overview and References

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## HPP Thematic Sub-scenarios



- **Subset of Planned mainstream HPs implemented (HPS1): No Joint Operation** (limited coordination) where each hydropower dam will be operated to maximize their individual energy production. The “subset” will be determined with MC on the basis of realistic constraints to full development.
- **Reservoir Operation Alternative 1 (HPS2): Level of Development as for HPS1 With Joint Operation and good coordination among all MS Dams** and by taking account operation for navigation lock, fish passages, sediment flushing as well as measure to maintain acceptable water quality during and after sediment flushing.
- **Reservoir Operation Alternative 2 (HPS3): With some basin wide Joint Operation and good coordination among all MS Dams and most tributary dams** to strengthen flood management and flood protection measures throughout the Lower Mekong Basin as well as to maximize navigation potential .

HPP Sub Scenarios

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## Subset of Planned mainstream HPs implemented **No Joint Operation (HPS1)** :



### Operation :

- **No Joint operation:** All dams operate on “an independent basis”
- Each hydropower dam will look to maximize their individual energy production

### Level of Development

1. Assuming that only Sesan 2 HPP built in Cambodia
2. Some 6 - 8 Mainstream Dams which mainly are in the Lao PDR,
3. About some 80% of Tributary hydropower dams built in Lao PDR and Cambodia;
4. All the 6 UMB Chinese dams should be included in this scenario.

HPP Sub Scenarios

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## HPS2 (JO): Reservoir Operation Alternative 1



### Operation:

- **With Joint Operation** and good coordination among **all MS Dams** only
- To include in the simulation wherever possible: details flow operation for navigation lock, fish passages, sediment flushing
- as well as measures to maintain acceptable water quality during and after sediment flushing. (mitigation measures)

HP Sub Scenarios

### Level of Development:

1. As for HPS1

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## HPS3 (JO): Reservoir Operation Alternative 2:



### Operation:

- **With Joint Operation** and good coordination among **all MS Dams** and most **Tributary dams**.
- May include:
  - strengthening **flood management** and **flood protection** measures throughout the Lower Mekong Basin
  - Impact mitigation
  - as well as to maximize navigability in the Mekong Mainstream

HP Sub Scenarios

### Level of Development:

1. As for HPS1

**NOTE:**  
To be analysed after results of HPS1 &2 are available. The key issues and constraints and impacts may then feed in to alternative basin coordination approach.

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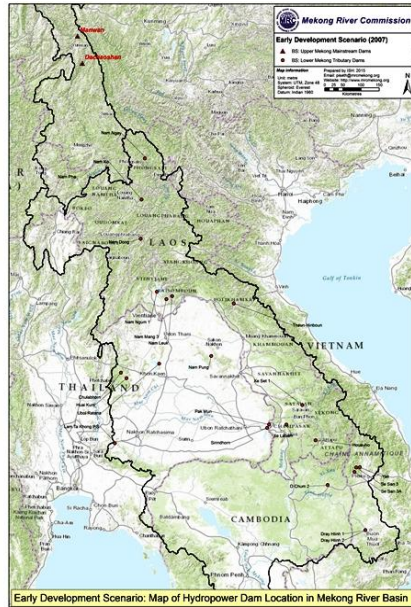
### Early Development Scenario 2007

| No.             | CODE | Project Name    | COD @ 2013 | Status @ 2013 | Installed Capacity | Annual Energy    | Live Storage    | Gross Storage    |
|-----------------|------|-----------------|------------|---------------|--------------------|------------------|-----------------|------------------|
| <b>Lao PDR</b>  |      |                 |            |               |                    |                  |                 |                  |
| 1               | L002 | Nam Dong        | 1970       | E             | 1                  | 4.8              | 0.015           | 0                |
| 2               | L003 | Xekabam         | 1970       | E             | 5                  | 25               | 0.8             | 0.6              |
| 3               | L001 | Nam Ngum 1      | 1971       | E             | 155                | 1025             | 4700            | 7003.99          |
| 4               | L004 | Xeset 1         | 1980       | E             | 45                 | 180              | 0.3             | 2.33             |
| 5               | L009 | Nam Ko          | 1986       | E             | 1.5                | 5                | 0.0045          | 0                |
| 6               | L005 | Theun-Hinboun   | 1988       | E             | 210                | 1356             | 15              | 28.94            |
| 7               | L006 | Houayho         | 1989       | E             | 152.1              | 450              | 527             | 674.1            |
| 8               | L007 | Nam Leuk        | 2000       | E             | 60                 | 215              | 228.2           | 345.36           |
| 9               | L010 | Nam Ngay        | 2002       | E             | 1.2                | 3                | 0.674           | 0.7              |
| 10              | L008 | Nam Mang 3      | 2004       | E             | 40                 | 138              | 45              | 140.73           |
| <b>Cambodia</b> |      |                 |            |               |                    |                  |                 |                  |
| 11              | C001 | Chum 2          | 1992       | E             | 1                  | 3                | 0.12            |                  |
| <b>Viet Nam</b> |      |                 |            |               |                    |                  |                 |                  |
| <b>Viet Nam</b> |      |                 |            |               |                    |                  |                 |                  |
| 12              | V014 | Dray Hirnh 1    | 1980       | E             | 12                 | 100              | 1.5             | 2.9              |
| 13              | V003 | Yat             | 1986       | E             | 720                | 3868.392         | 779.02          | 1037.1           |
| 14              | V004 | Se San 3        | 2006       | E             | 260                | 1325.354         | 3.8             | 82               |
| 15              | V005 | Se San 3A       | 2007       | E             | 96                 | 479.3            | 4               | 80.6             |
| 16              | V011 | Dray Hirnh 2    | 2007       | E             | 16                 | 94               | 1.5             | 2.9              |
| <b>Thailand</b> |      |                 |            |               |                    |                  |                 |                  |
| 17              | T003 | Nam Pung        | 1965       | E             | 6.3                | 17               | 156.8           | 170              |
| 18              | T006 | Ubol Ratana     | 1968       | E             | 25.2               | 56               | 1695            | 2290             |
| 19              | T005 | Srinohom        | 1971       | E             | 36                 | 90               | 1135            | 1970             |
| 20              | T001 | Chulabhom       | 1972       | E             | 40                 | 59               | 144.5           | 190              |
| 21              | T002 | Hua Kum         | 1982       | E             | 1.18               | 2                | 20              | 20               |
| 22              | T004 | Paik Mun        | 1984       | E             | 136                | 260              | 125             | 225              |
| 23              | T007 | Lam Ta Khong PS | 2001       | E             | 500                | 400              | 289.6           | 319.9            |
|                 |      | <b>Total</b>    |            |               | <b>2,520.48</b>    | <b>10,175.85</b> | <b>9,862.83</b> | <b>14,546.35</b> |

Data & assumption

Dams in China to include in the EDS scenario:

1. Manwan Dam
2. Dachaoshan Dam



Early Development Scenario: Map of Hydropower Dam Location in Mekong River Basin

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| Cambodia       | Lao PDR                  | Thailand | Viet Nam      |
|----------------|--------------------------|----------|---------------|
| Lower Se San 2 | Xeset 2                  |          | Plei Krong    |
|                | Nam Theun 2              |          | Buon Tua Srah |
|                | Nam Lik 1-2              |          | Buon Kuop     |
|                | Nam Ngum 2               |          | Se San 4      |
|                | Nam Nhone                |          | Sre Pok 3     |
|                | Nam Ngum 5               |          | Sre Pok 4     |
|                | Xekaman 3                |          | Se San 4A     |
|                | Theun-Hinboun expansion  |          | Sre Pok 4A    |
|                | Theun-Hinboun exp. (NG8) |          | Upper Kontum  |
|                | Nam Long                 |          |               |
|                | Xenamnoy 1               |          |               |
|                | Tad Salen                |          |               |
|                | Nam Song                 |          |               |
|                | Nam Sana                 |          |               |
|                | Xekaman 1                |          |               |
|                | Xekaman-Sarxay           |          |               |
|                | Nam Lik 1                |          |               |
|                | Nam Khan 2               |          |               |
|                | Houay Lamphan Gnai       |          |               |
|                | Nam Ngiep 2              |          |               |
|                | Nam Hinboun              |          |               |
|                | Xekatam                  |          |               |
|                | Nam San 3                |          |               |
|                | Nam Beng                 |          |               |
|                | Nam Mang 1               |          |               |
|                | Nam Ou 2                 |          |               |
|                | Nam Ou 5                 |          |               |
|                | Nam Ou 6                 |          |               |
|                | Nam Suang 1              |          |               |
|                | Nam Suang 2              |          |               |
|                | Nam Kong 2               |          |               |
|                | Nam Ngum 3               |          |               |
|                | Nam Theun1               |          |               |
|                | Nam Ngiep 1              |          |               |
|                | Nam Ngiep-regulating dam |          |               |
|                | Xepian-Xenamnoy          |          |               |
|                | Xayaburi (L)             |          |               |

Data & assumption

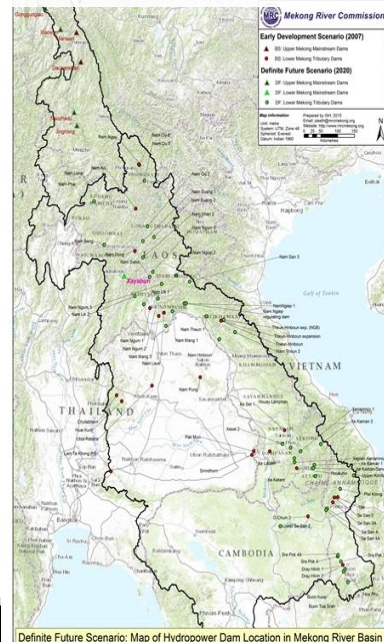
#### M/S Dam:

1. Xayaburi Dam

#### Chinese Dams:

1. Manwan Dam
2. Dachaoshan Dam
3. Jinghong Dam
4. Xiaowan Dam
5. Nuozhadu Dam
6. Gonggouqiao Dam

### Definite Future Scenario 2020

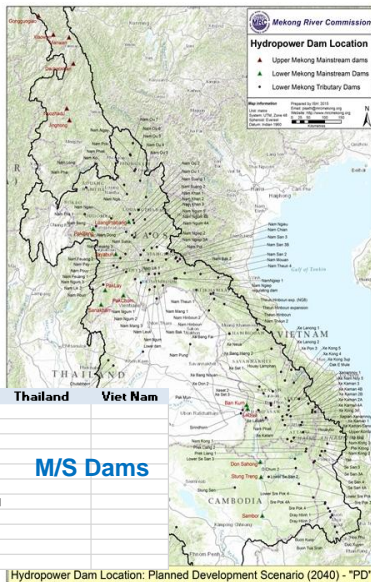


Definite Future Scenario: Map of Hydropower Dam Location in Mekong River Basin

| Cambodia            | Lao PDR                    | Thailand | Viet Nam  |
|---------------------|----------------------------|----------|-----------|
| Battambang 1        | Xe Nam Noy 5               |          | Duc Xuyen |
| Battambang 2        | Nam Chan                   |          |           |
| Stung Pursat 1      | Nam Por                    |          |           |
| Pursat 2            | Nam Phak                   |          |           |
| Lower Se San 3      | Nam Hinboun 1              |          |           |
| Prek Liang 1        | Nam Hinboun 2              |          |           |
| Prek Liang 2        | Xe Pon 3                   |          |           |
| Lower Se Pok 3A     | Xedon 2                    |          |           |
| Lower Se Pok 4      | Nam Tha 1                  |          |           |
| Stung Sen           | Xekong 4                   |          |           |
| Se Kong             | Nam Kong 1                 |          |           |
| Lower Se San 1      | Xe Kong Sup                |          |           |
| Lower Se Pok 3B     | Xe Kong 3d                 |          |           |
| Lower Prek CHHlaung | Xe Kong 5                  |          |           |
| Upper Prek CHHlaung | Nam Ou 1                   |          |           |
| Prek Por            | Nam Ou 3                   |          |           |
| Prek Ter            | Nam Ou 4                   |          |           |
|                     | Nam Ou 7                   |          |           |
|                     | Nam Ngao                   |          |           |
|                     | Nam Feuang 1               |          |           |
|                     | Nam Feuang 2               |          |           |
|                     | Nam Feuang 3               |          |           |
|                     | Xe Kaman 2A                |          |           |
|                     | Xe Kaman 2B                |          |           |
|                     | Xe Kaman 4A                |          |           |
|                     | Xe Kaman 4B                |          |           |
|                     | Dak E Mule                 |          |           |
|                     | Nam Khan 1                 |          |           |
|                     | Nam Khan 3                 |          |           |
|                     | Nam Ngum 4A                |          |           |
|                     | Nam Ngum 4B                |          |           |
|                     | Nam Ngum, (down) Lower dam |          |           |
|                     | Nam Poy                    |          |           |
|                     | Nam Poun                   |          |           |
|                     | Nam Ngao                   |          |           |
|                     | Nam Ngieu                  |          |           |
|                     | Nam San 3B                 |          |           |
|                     | Nam San 2                  |          |           |
|                     | Nam Pok                    |          |           |
|                     | Xe Bang Fai                |          |           |
|                     | Xe Neua                    |          |           |
|                     | Nam Heuan 4                |          |           |
|                     | Nam Mouan                  |          |           |
|                     | Xe Bang Hieng 2            |          |           |
|                     | Xe Set 3                   |          |           |
|                     | Xe Bang Nouan              |          |           |
|                     | Xe Lanong 1                |          |           |
|                     | Xe Lanong 2                |          |           |
|                     | Nam Phak (Houykatam)       |          |           |
|                     | Xesu                       |          |           |
|                     | Houay Champi               |          |           |
|                     | Nam Bak 1                  |          |           |
|                     | Nam Bak 2                  |          |           |
|                     | Nam Ham                    |          |           |
|                     | Nam Leng                   |          |           |
|                     | Nam Ngiep (Mouang Mai)     |          |           |
|                     | Nam Phouan                 |          |           |
|                     | Sakong Downstream          |          |           |
|                     | Xebanghieng 1              |          |           |
|                     | Nam Ang Tha Beng           |          |           |
|                     | Xepian-Houaysoy            |          |           |
|                     | Nam Kong 5                 |          |           |
|                     | Nam Pha                    |          |           |

- Chinese dams
1. Manwan
  2. Dachaoshan
  3. Jinghong
  4. Xiaowan
  5. Nuozhadu
  6. Gongguojiao

Planned Development Scenario 2040



| Cambodia          | Lao PDR                 | Thailand | Viet Nam |
|-------------------|-------------------------|----------|----------|
| Sambor (Cam)      | Don Sahong (L)          |          |          |
| Stung Treng (Cam) | Pakbeng (L)             |          |          |
|                   | Luangprabang (L)        |          |          |
|                   | Paklay (L)              |          |          |
|                   | Sanakham (L-T)          |          |          |
|                   | Sangthong-Pakchom (L-T) |          |          |
|                   | Ban Kum (L)             |          |          |
|                   | Latsua (Phou Ngoy) (L)  |          |          |
|                   | Thakho (L)              |          |          |
|                   |                         |          | 8302     |

M/S Dams

Hydropower Dam Location: Planned Development Scenario (2040) - 'PD'

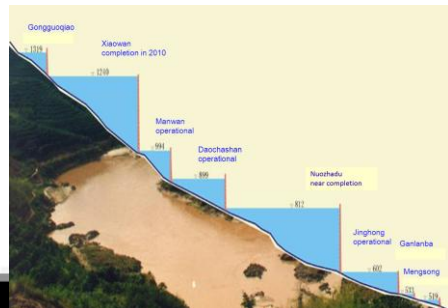
Data & assumption

Planned Chinese dams in the lower reaches of Lancang river



| No | Name        | Installed Capacity (MW) | Annual Energy (GWh) | Total Storage (Million m3) | Active Storage (Million m3) | Dam Height (m) | Status Year 2012              | Start construction | Commission |
|----|-------------|-------------------------|---------------------|----------------------------|-----------------------------|----------------|-------------------------------|--------------------|------------|
| 1  | Gongguojiao | 750                     | 3,940               | 510                        | 120                         | 130            | Operation                     | 2,008              | 2011       |
| 2  | Xiaowan     | 4,200                   | 18,890              | 15,043                     | 10,382                      | 292            | Operation                     | 2002               | 2010       |
| 3  | Manwan      | 1,500                   | 7,600               | 920                        | 257                         | 132            | Operation                     | 1986               | 1996       |
| 4  | Dachaoshan  | 1,350                   | 6,710               | 940                        | 467                         | 111            | Operation                     | 1996               | 2003       |
| 5  | Nuazhadu    | 5,850                   | 23,900              | 23,703                     | 21,749                      | 261.5          | Impounding Under-Construction |                    | 2016       |
| 6  | Jinghong    | 1,750                   | 7,620               | 1,233                      | 249                         | 108            | Operation                     | 2003               | 2010       |
| 7  | Ganlanba    | 150                     | 780                 | N/A                        | N/A                         | N/A            | Planned                       | Planned            |            |
| 8  | Mengsong    | 600                     | 2,890               | N/A                        | N/A                         | N/A            | Cancelled                     |                    | Cancelled  |

Data & assumption





## Data and assumption

- Most data used in the Model for “Assessment of basin-wide Development Scenarios – Apr 2011”
- Any additional data from the MCs are welcome, particularly the operation rule curves
- Any missed data or information will be assumed using the experts opinion and experiences

Data & assumption

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## Schedule

| Task  | Dates                                |
|---|--------------------------------------|
| Draft Work Plan for the Formulation of Development Scenarios                                    | Completed                            |
| Progress Update – 5 <sup>th</sup> RTWG Meeting  | 13-14 August 2015                    |
| Technical Work Sessions – Development of Operational Rule Curves and Data Review                | TBD                                  |
| National Consultations (combined with all other Thematic Teams)                                 | September – October 2015 (Tentative) |
| Draft Final Data for the Development Scenarios and Report (Data and Map Specification Document) | October – November 2015 (Tentative)  |
| Approval of Scenarios and Data<br>6 <sup>th</sup> RTWG Meeting                                  | October – November 2015 (Tentative)  |

Schedule

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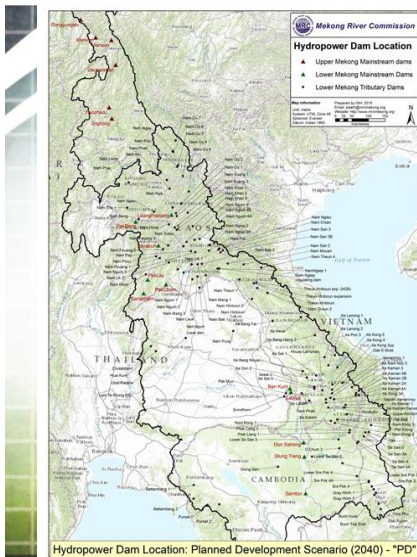


## The RTWG is specifically requested to:

- Take note of the progress
- Provide feedback and agree if possible with the proposed development scenarios
- Provide feedback and guidance on the approach for determining the level of development and management for each of the proposed thematic sub-scenarios

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Hydropower Dam Location: Planned Development Scenario (2040) - "PD"

Thank you



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