Sustainable Hydropower – Design & Operation

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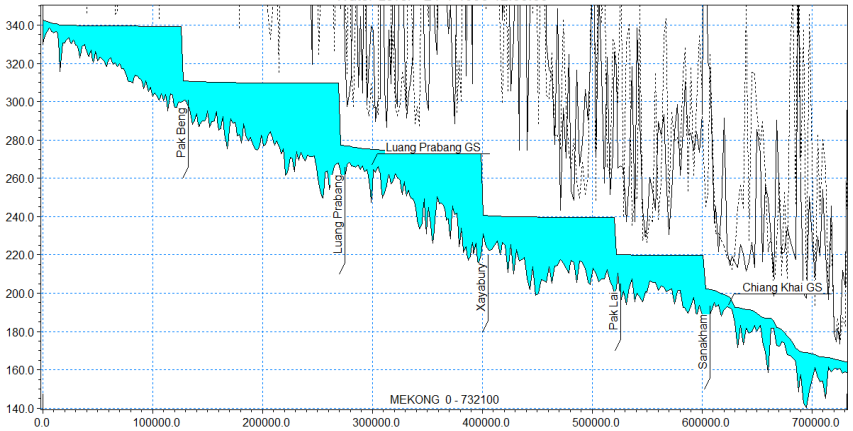
Oslo

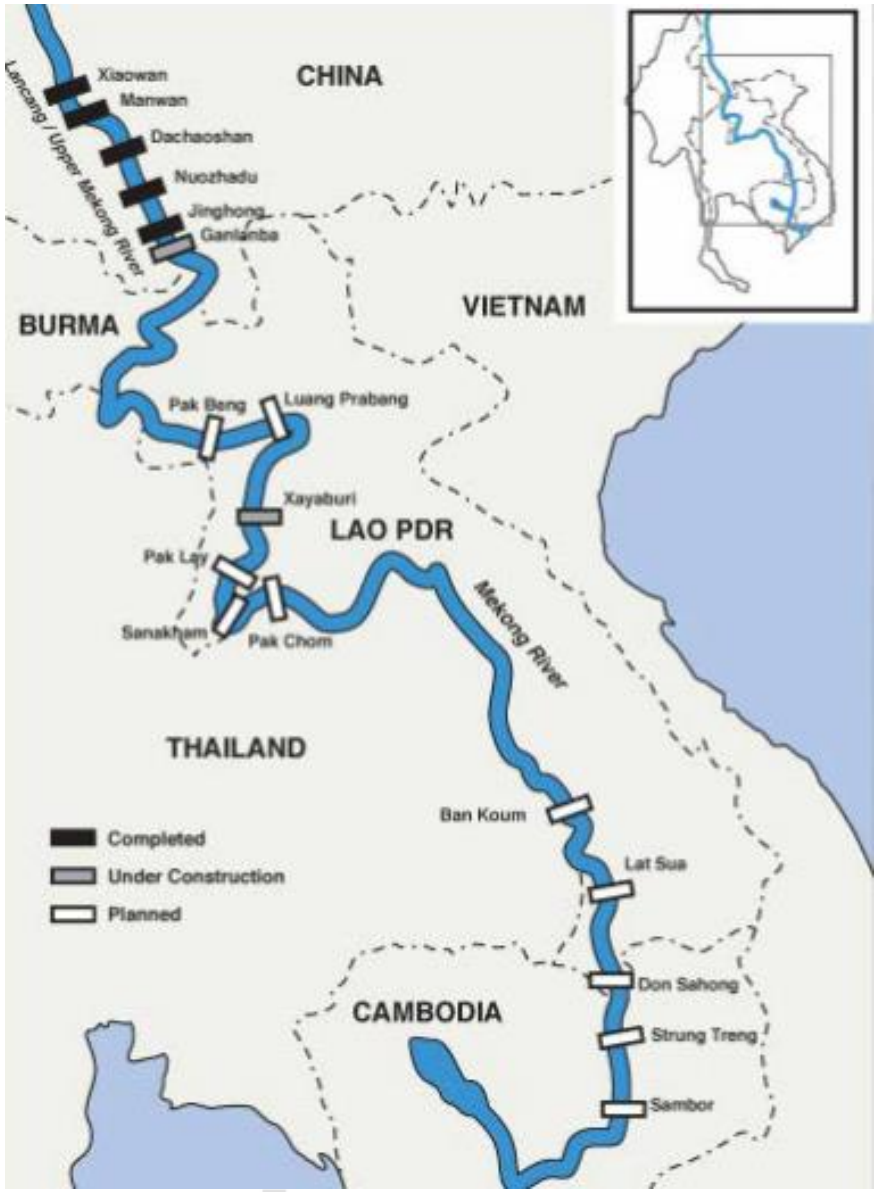
4th September 2017

Mekong mainstream – planned projects



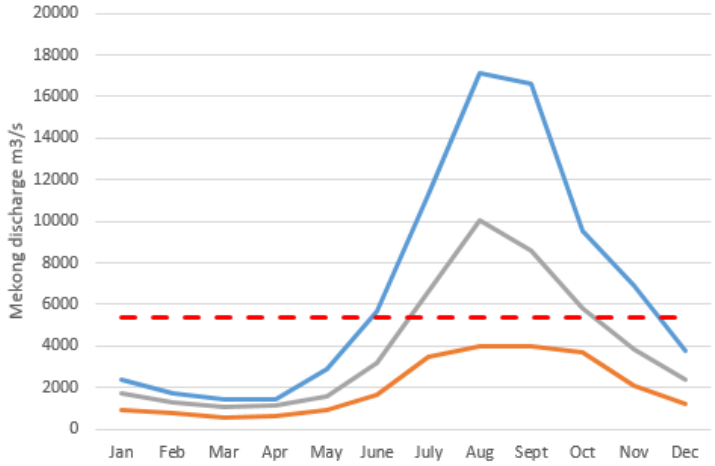
Planned upper cascade comprises:

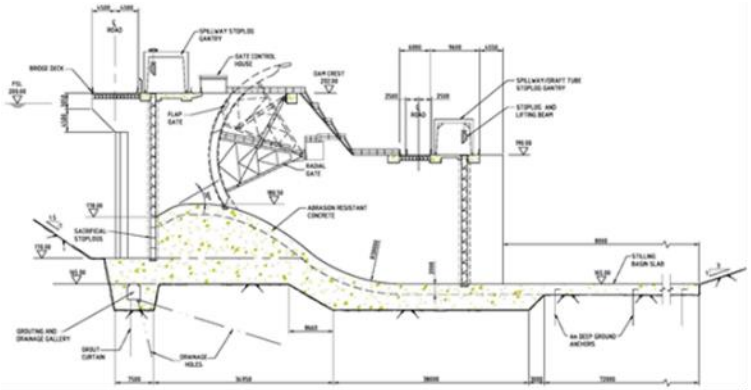
- 5 projects commanding the available reach;
- Gross heads in the range 20 to 30 m;
- Creating reservoirs, largely within bank up to 100 km long



Mekong mainstream – key vulnerabilities

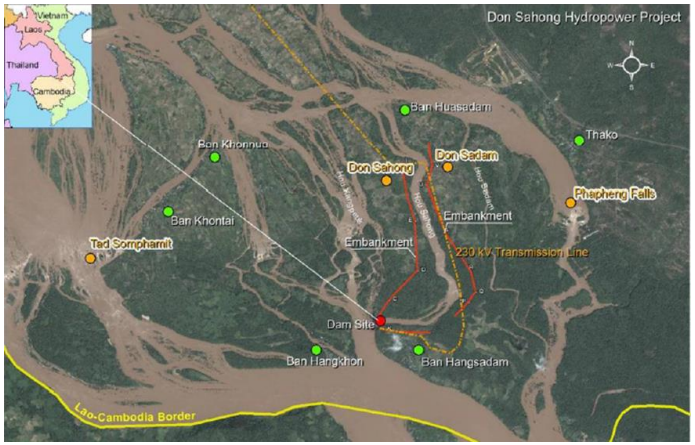
- Fish:
  - zero flow velocity prevents the downstream drift of eggs and larvae - breaking the migration cycle.
  - downstream fish mortality in turbines and undershot spillway gates
- Sediment:
  - reservoirs trap coarse sands and gravels
  - sand can be mobilised by flushing but this severely impacts ecology
- Water quality:
  - increased temperature
  - discharge of algae
  - decreased oxygen in early years

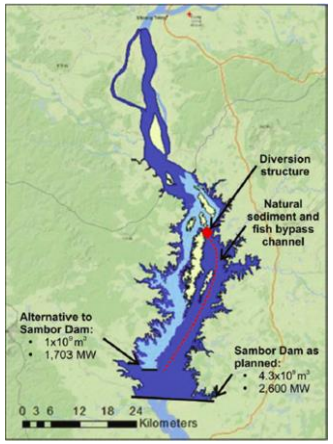


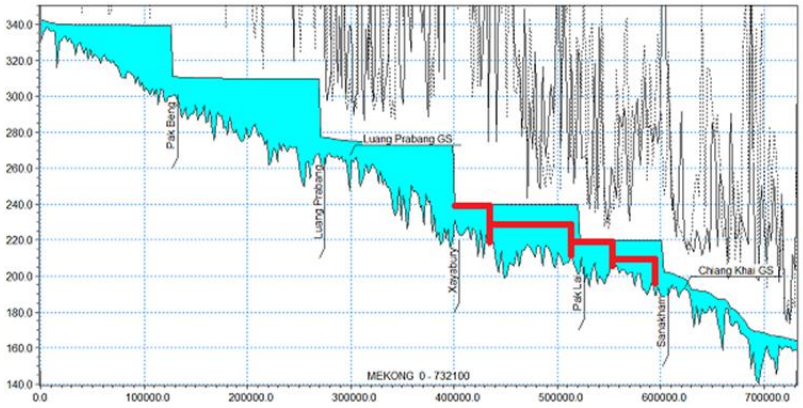


Mekong mainstream – alternative concepts

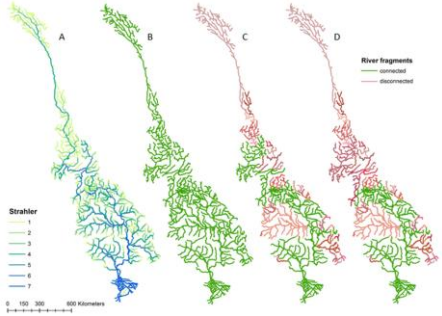
- Natural bypass:
  - Don Sahong commands one channel at Kone Falls
  - A lower Sambor alternative with preserve a left bank by pass channel







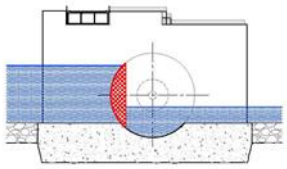
- Sub divided projects:
  - Lower heads
  - Smaller reservoirs
  - Ability to restore natural river conditions and 100% connectivity



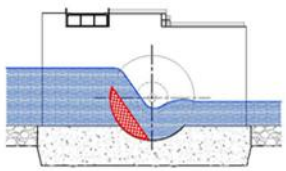
Mekong Mainstream – sector gate barrage

Nakdong Dalseong – S Korea

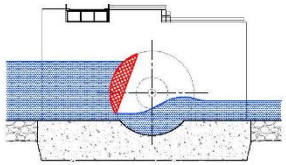
Yeoju – S Korea



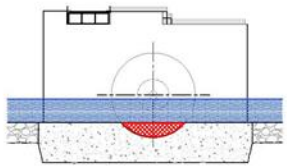
GENERATION



SPILLING



SCOURING

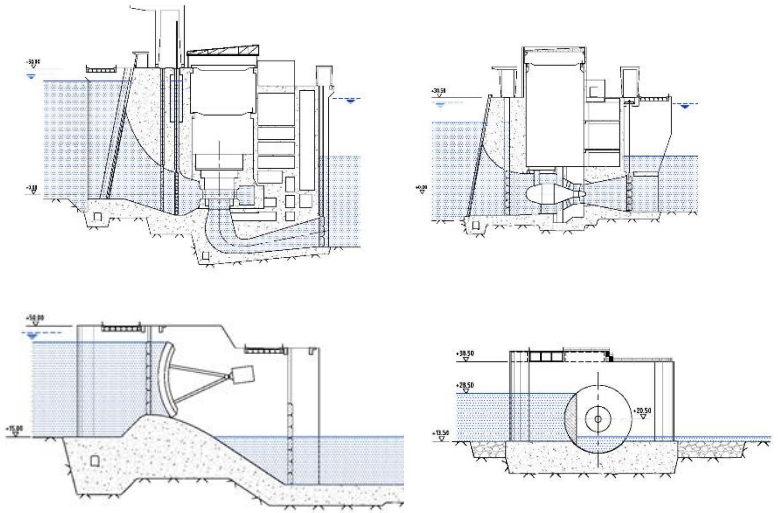


SHUT DOWN

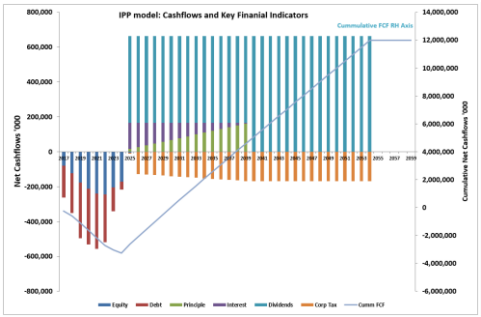
Mekong Mainstream – sector gate barrage

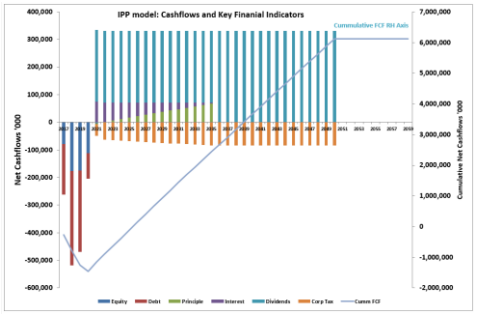
Comparison with a single scheme

- Construction cost:
  - Design comparison currently in progress, but early indications suggest <+45%



- Finance cost:
  - Preliminary modelling suggests -30% if projects are constructed concurrently

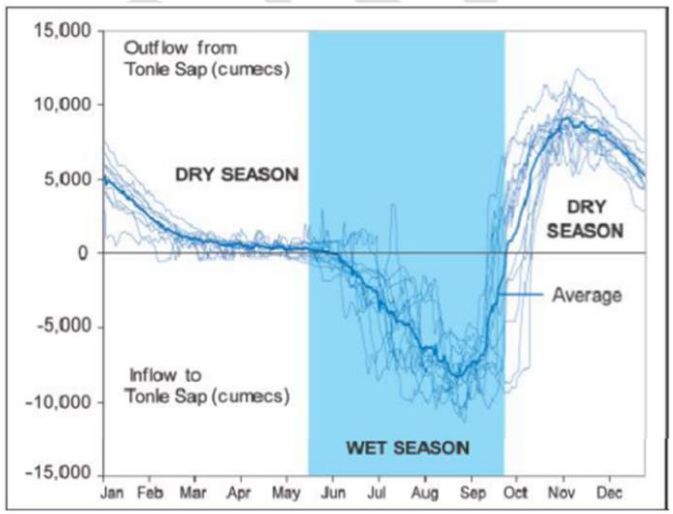


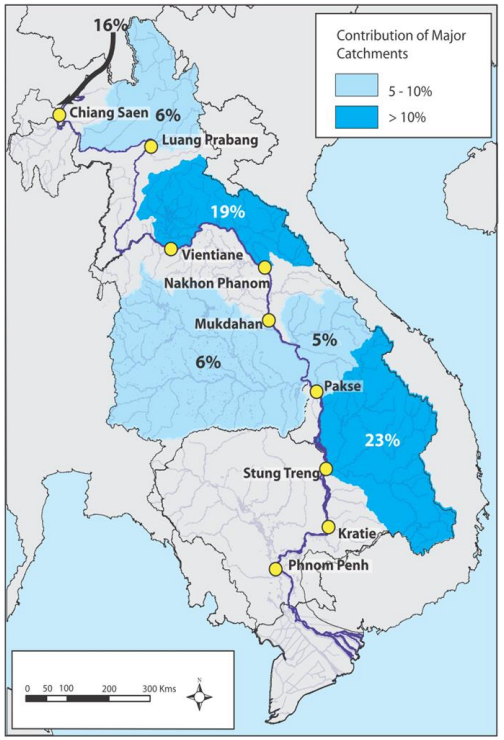


- Energy impact
  - Tailwater impact -7%
  - 3 month shut down -30%

Mekong tributaries – seasonal storage

- Storage projects on the tributaries introduce loss of seasonality and floods in downstream discharges

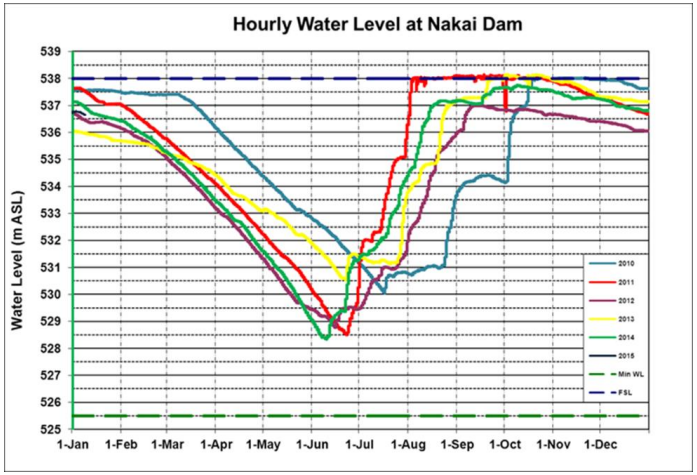




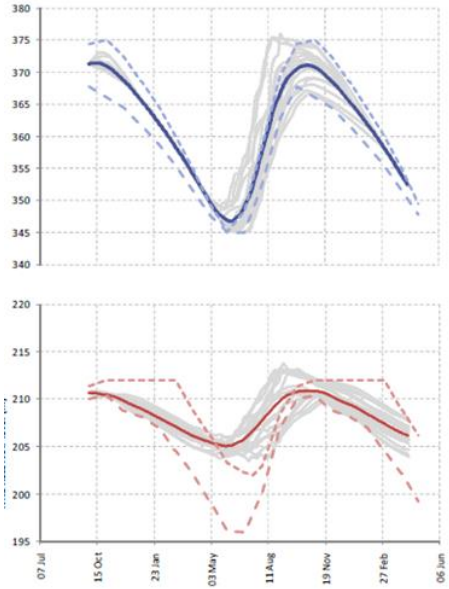
- Tonle Sap – one of the worlds most productive eco systems

Mekong tributaries – storage projects

- Single storage:
  - operated to deliver dry season energy and capture wet season floods
  - partial seasonality in discharge could be restored by taking less dry season energy



- Cascade storage:
  - the downstream project in a cascade does not need its seasonal storage
  - keeping the reservoir full provides a higher average head and restores seasonal floods



PPA Implications

- If owners are paid for energy it creates an incentive to resist environmental objectives:
  - seasonal regulation
  - minimise compensation & fish by-pass flows
  - project (not river basin) optimisation
  - all environmental constraints must be defined before the project proceeds

- If owners were paid for available power, a central river basin authority could direct operations:
  - integrated river basin optimisation
  - plant can be despatched to suit system requirements
  - improved cascade management
  - multi criteria (non financial) decision making
  - adaptive environmental management for fish, water quality and sediment

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