Sustainable Hydropower – Design & Operation

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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
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 world’s 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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