CNR: OVER 80 YEARS OF MULTIPURPOSE PROJECT
CASCADAS DESIGN, OPTIMIZATION AND OPERATION

MRC Sustainable Hydropower Practice Forum #4
Vientiane, August 10th, 2017
INTRODUCTION TO CNR
RUN-OF-RIVER CASCADES MANAGEMENT
CNR EXPERIENCE IN LAOS
CONCLUSIONS
INTEGRATED MISSIONS ON THE RHONE RIVER (SINCE 1934)

Producing **hydroelectricity**

Developing inland **navigation**

Facilitating **irrigation** for agriculture

Unique “CNR model”

↔

Financial equalization between 3 missions
CNR: an integrated vision of large river management & hydropower from design, construction to O&M including...

- Run-of-River Hydropower
- Navigation, Locks, Ports
- Hydromet Energy Forecasting
- Environment
- Assistance to O&M / Capacity Building
LEADER IN RENEWABLE ENERGY SOURCES

Installed capacity - 3 553 MW (Dec 2016)

- Hydropower: 3 020 MW, av. 15 000 GWh/y
- Wind farms: 457 MW (12/2016)
- Solar PV: 61 MW (12/2016)
- Small Hydro: 20 MW (12/2016)
- Other: Hydrokinetics, ocean energy, storage (H2..)

1st French electricity producer in 100% REN
25% of French Hydropower generation
A TYPICAL RUN OF RIVER HPP ON THE RHONE RIVER

- No Storage
- All water use
- Sustainability
MULTIPURPOSE ASSETS

Assets:

- 19 hydropower plants & dams
- 14 wide-gauge navigation locks
- 400 km of maintained dikes
- 330 km of large navigable waterway
- 32 pumping stations
- Wind mills
- Solar PV plants
- 21 Small HPP
- 29 Industrial & port sites
- 4 Leisure locks

BOLLENE multipurpose scheme 2 030 GWh/y

GENISSIAT 1 730 GWh/y

PIERRE-BENITE

LOGIS-NEUF
Pursuing the development considering environmental issues

- Learning from experience
- Participation to the energy transition
- Development with territories crossed by the River Rochemaure

Seyssel – upper Rhone
Sediment management / restoration of oxbows

Rochemaure – 10/2015
Fish migration / ecological flows
7 MW SHPP + 2 fish pass systems

Bleak fish (fr. ablette)
Oct 2015
SUSTAINABLE DEVELOPMENT

- Pursuing the development considering every water use

Energy & sustainable mobility
30 fast charging stations

River transport
AIS system for skippers
New locks for leisure

Economic/Tourism development of 815 km long bicycle path

Water resources/biodiversity
Fish pass
Restoration of oxbows

Energy transition model
Development and dialogue with all involved partners

Pursuing the development considering every water use
To face the randomness nature of hydropower generation and considering that there is no storage for run-of-river HPPs, CNR is specialized in managing hydropower production in order to optimize power production, based on hydromet monitoring and energy forecasting, while ensuring safety and other water use (irrigation, navigation...).
Hydrometeorological Monitoring and Energy Forecasting System

Operational soft package developed by CNR

Discharge observation
Real-time database on watershed
- HYDROMET®

Rainfalls observation
Numerical forecast (M.France, GFS)
Analogs method OPALE® till J+4

Discharge forecasting
Rainfall/discharge on tributaries:
- PHARE®

HPP generation forecasting & remote control
- GAIPAR® and OSCAR®
- GIC®

Electrical Transport Network
From 24 to 36 h
\( \Delta t \approx 1 \text{h} \)

Outages and limitations management
1 day to 1 week
(even more) \( \Delta t \approx 24 \text{h} \)

Marketing
Spot Market or PPA
From 6 h to 1 week
\( \Delta t \approx 1 \text{h to 1 day} \)
Mekong River Commission (MRC)
• 1993-1994: Mekong river Hydropower Potential
• Hydromet Network – Mekong HYCOS
• Recommendations in Navigation and Sediments

Technical assistance to Ministry of Energy and Mines (MEM) as GoL Engineer on the Mekong mainstream
• Mekong mainstream hydropower projects – Optimization study
• Peer Review of XAYABURI HPP on navigation, hydrology and sediment
• Sediment transport study and surveys on 1000 km of Mekong River
• Feasibility Study reviews of 4 Mekong mainstream HPP
• GoL CE on Don Sahong HPP
• Coordination and Monitoring Center (CMC)

XAYABURI Hydropower Plant – 1285 MW (XPCL)
• Capacity review of IPP contracts: Concession Agreement and PPA with EGAT
• Assistance to O&M – defining O&M team structures and procedures for Locks, HPP..
• Development of XPCL Hydrology Monitoring and Forecasting System

Methodology based on CNR experience of the Rhône River
Recommendations for impact assessment studies

Projects under construction: Xayaburi (SA) and Don Sahong (DS)
PNPCA: Pak Beng (PB)

To-date the reference study for development of the Mekong River
Updating the 1993/94 study and performing additional studies: hydrology, hydraulics modeling, flood mapping, power generation, operating guidelines, ESIA screening…

Implementing environmental, social, technical and economical criteria in order to optimize and propose a manageable operation regime for all 5 projects upstream Vientiane:

⇒ cascade optimization


Operation of the cascade depending of the flow

Optimization in the interest of GoL

To-date the reference study for development of Lao upper stretch of the Mekong River
Project Feasibility Study Review

Key principles: Xayaburi HPP as the benchmark and consistency of the cascade
Review of 4 HPPs from 2014 to 2017: Pak Beng, Pak Lay, Sanakham, Phou Ngoy
Issues addressed by CNR: Hydrology, Dam safety, Navigation, Sediment transportation
Hydrometeorological Monitoring and Forecasting System for Xayaburi HPP

- Installed capacity: 1285 MW
- Design discharge: 5000 cum/s
Coordination and Monitoring Center (CMC)

- Development and Implementation of a GoL state agency dedicated to the coordination and monitoring of the management of all the multipurpose HPPs implemented in Lao PDR
- Mekong River upstream Vientiane as a first step
- Core functions to address:
  - Integrated water resource management, incl. institutional issues, power and non-power water uses,
  - Safety: dam safety, coordination of flood management, early warning system, water quality, etc.
  - Continuity: sediment management, fish migration follow-up, inland navigation development, etc.
Coordination and Monitoring Center (CMC)

- Development and Implementation of a GoL state agency dedicated to the coordination and monitoring of the management of all the multipurpose HPPs implemented in Lao PDR
- Mekong River upstream Vientiane as a first step
- **Key issues to deal with at FS stage:**
  - Data sharing from upstream to downstream, including the main tributaries,
  - Coordination with operation in Lancang (all year long, every day, including daily flows and, if possible, flow programs...),
  - Coordination of O&M in the frame of existing Cascade from upstream to downstream,
  - …
CONCLUDING REMARKS
MULTIPURPOSE BENEFITS OF RUN-OF-RIVER MANAGEMENT

- Integrated vision of a whole river is of paramount importance to implement best practices
- Run-of-river production as a catalyst for development of large rivers (no storage and no regulation capacity)
- River Cascade: need for consistency in the design from upstream to downstream and coordination of operation
ขอบใจร่วมวัฒนธรรมใกล้รูปแบบ
ขอบคุณสำหรับความสนใจของคุณ

Cám ơn vì sự quan tâm của bạn
Thank you for your attention
Merci pour votre attention