



Technology Collaboration Program on Hydropower

Executive Committee

Annexes

ANNEX IX
Valuing
Hydropower
Services



ANNEX XIII
Hydropower
and Fish



ANNEX XVIII
Decision support for
comprehensive Utilization
of Basin Water Resources



ANNEX XV
Maintenance Works and
Decision-Making for
Hydroplant Renewals



ANNEX XVI
Hidden Hydro Opportunities



ANNEX XVII
Measures to enhance Climate
Resilience



ANNEX XII
GHG Emissions
from
Freshwater
Reservoirs



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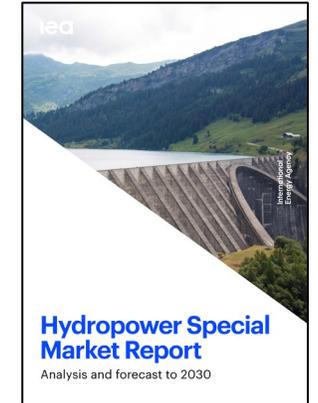
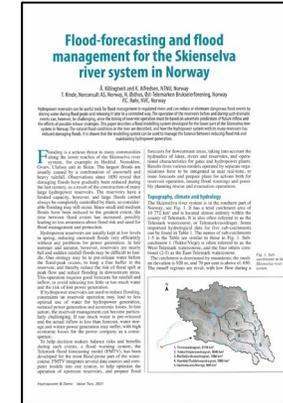
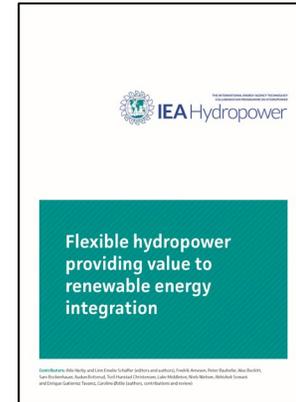
ANNEX IX -Valuing Hydropower Services

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Task 1. Energy, Grid Services and Flexibility. Integration of variable renewable energy

Task 2. Climate Change Services Adaptation: Flood control and drought management



- Written two White Papers
- Several reports and two articles
- IEA Hydropower Special Market Report
- Workshops open to external participants

Further plans:

- White Paper on Flood Control & Drought Management
- White Paper on Electricity market solutions for VRE integration - long-duration flexibility and energy storage
- Collaboration with other TCP's
- Hybrid solutions with hydropower



- Hydropower + floating solar PV on the reservoir
- Hydropower + wind power
- More than two technologies?
- Power-to-gas; hydrogen; batteries; thermal systems

Flexibility type	Short-term		Medium term	Long-term		
	Sub-seconds to seconds	Seconds to minutes	Minutes to hours	Hours to days	Days to months	Months to years
Time scale	Sub-seconds to seconds	Seconds to minutes	Minutes to hours	Hours to days	Days to months	Months to years
Issue	Ensure system stability	Short term frequency control	More fluctuations in the supply / demand balance	Determining operation schedule in hour- and day-ahead	Longer periods of VRE surplus or deficit	Seasonal and inter-annual availability of VRE
Relevance for system operation and planning	Dynamic stability: inertia response, voltage and frequency	Primary and secondary frequency response	Balancing real time market (power)	Day ahead and intraday balancing of supply and demand (energy)	Scheduling adequacy (energy over longer durations)	Hydro-thermal coordination, adequacy, power system planning (energy over very long durations)