



## Technology Collaboration Program on Hydropower

Executive Committee

Annexes

**ANNEX IX**  
Valuing  
Hydropower  
Services

**ANNEX XIII**  
Hydropower  
and Fish

**ANNEX XVI**  
Hidden Hydro Opportunities

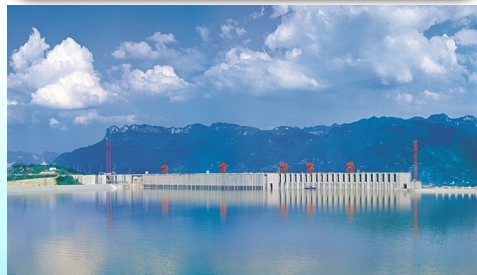
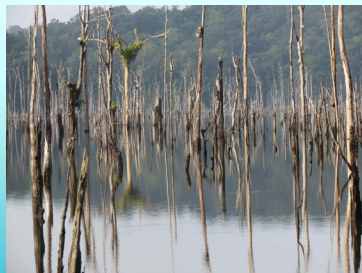


**ANNEX XVIII**  
Decision support for  
comprehensive Utilization  
of Basin Water Resources

**ANNEX XV**  
Maintenance Works and  
Decision-Making for  
Hydroplant Renewals

**ANNEX XVII**  
Measures to enhance Climate  
Resilience

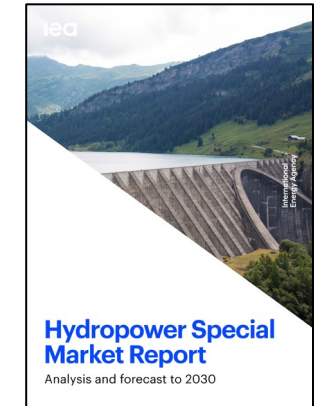
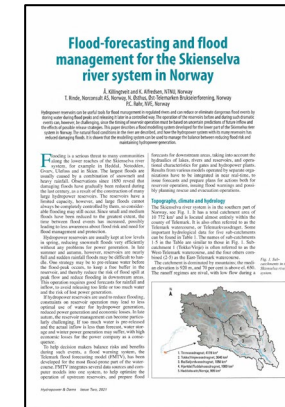
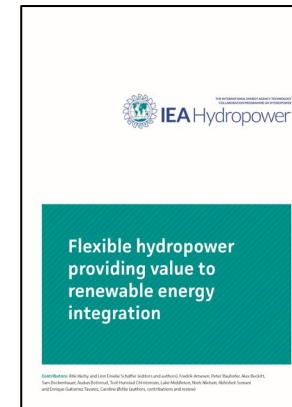
**ANNEX XII**  
GHG Emissions  
from  
Freshwater  
Reservoirs



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# ANNEX IX -Valuing Hydropower Services

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- 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



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



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





- 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	
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)