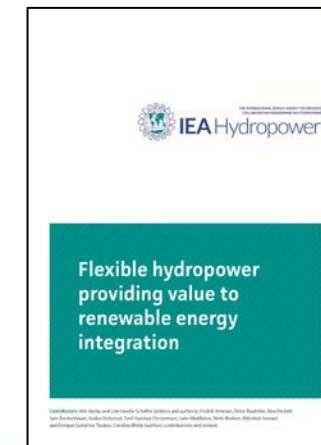
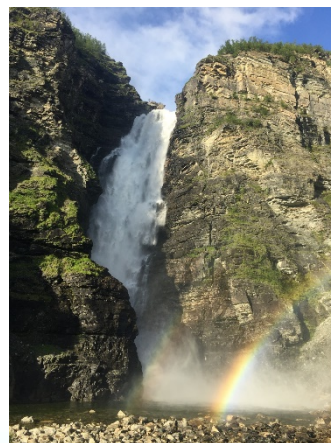




ANNEX IX -Valuing Hydropower Services

Welcome to all participants. Workshop will start 14.00 CET



Please mute yourself when not speaking. Let's try to keep webcams on!
Please use the chat to give comments and ask questions.

PS: You can undock all webcams by right-clicking when holding the mouse above the camera icon



Time	Wednesday 3 rd June 2020	Presented by
14:00	Opening and welcome	Atle Harby, SINTEF
14:10	Brief overview of the idea of White Paper II "Valuing Hydropower Flexibility in Evolving Electricity Markets"	Audun Botterud, Argonne
14:20	Grid and Flexibility Services: An Overview of the Swiss scenario	Elena Vagnoni, EPFL
14:30	Flexibility Services: An overview of the Australian NEM	Donald Vaughan, ENTURA
14:40	Flexibility Services in the Power Grid: Indian case	SS Barpanda, POSOCO
14:50	Potential for flexibility revenues on different time horizons in the spot market	Fredrik Arnesen, NVE
15:00	Q&A and discussions	
15:15	Break	
15:25	Flexibility Services in the Power Grid: Brazil case	Albert de Melo, CEPEL
15:35	Flexibility Services in the Power Grid: Quebec case	Guillaume Tarel, Hydro Quebec
15:45	Flexibility Services in the Power Grid: California case	Abishek Somani, PNNL
15:55	Q&A and discussions	
16:15	Content and contributions to White Paper II	Audun Botterud, Argonne
16:25	Any other business	
16:30	End of meeting	



ANNEX IX -Valuing Hydropower Services

Task 1. Energy, Grid Services and Flexibility:

The future role and value of hydropower in energy markets and electricity systems. The final outcome of this task is a Hydropower Balancing and Flexibility Roadmap



Task 2. Climate Change Services Adaptation:

The role and value of hydropower in minimising or mitigating risks associated with a changing climate





Hydropower providing flood control and drought management



- Workshop December 2019
- Online workshop May 2020
- Collecting examples from case studies
- Writing White Paper
- Integration with flexibility

- Reservoir operations
- Value of avoiding floods
- Value of reducing floods
- Value of providing water when needed

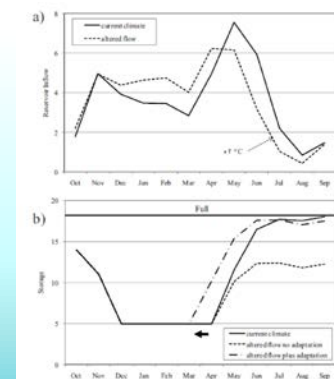
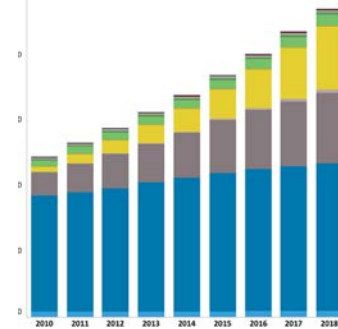


Fig. 1. Schematic illustration of the influence of warming on reservoir refill due to streamflow timing shifts for a hypothetical reservoir on the west slope of the Cascade Mountains: (a) hydrograph for 20th century climate and a warming scenario; (b) simulated reservoir refill



White Paper: Flexible hydropower providing value to renewable integration

- What kinds of flexibility are needed?
- Capability (power – ramp rate – energy)
- Phases of VRE integration [IEA 2017]
- Timescales of power system flexibility






Timescales of power system flexibility

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)



Timescales of power system flexibility

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
				Determining operation schedule in hour- and day-ahead	Longer periods of VRE surplus or deficit	Seasonal and inter-annual availability of VRE
				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)



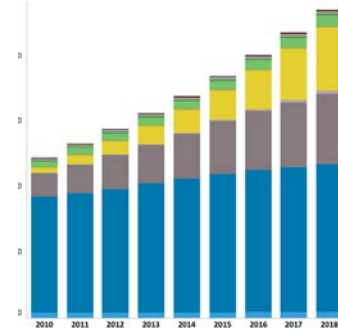
White Paper: Flexible hydropower providing value to renewable integration

- What kinds of flexibility are needed?
- Capability (power – ramp rate – energy)
- Phases of VRE integration [IEA 2017]
- Timescales of power system flexibility
- How can hydropower contribute?
- What is the value of flexibility?
- Conclusions
- Recommendations

Other activities:

Descriptions of ongoing research

Meetings, workshops and collaboration with IEA
Factsheets, vocabulary list, policy brief planned



IEA Renewables Market Report 2020

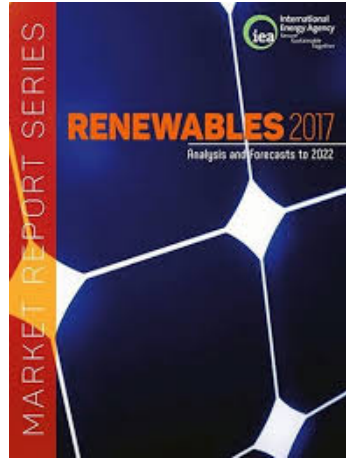
Our discussions will inform our next renewables market report this year, which will focus on hydropower – the largest source of renewable electricity generation.

Fatih Birol
[@IEABirol](#)



Last year, I said the [@IEA](#) would be the "voice of hydropower", an essential renewable technology that sometimes doesn't get the attention it deserves. This week we gathered more than 90 top stakeholders at the [@IEA](#) to discuss opportunities and challenges of hydropower.

Workshop 10th February
IEA main office, Paris



IEA Renewables Market Report 2020

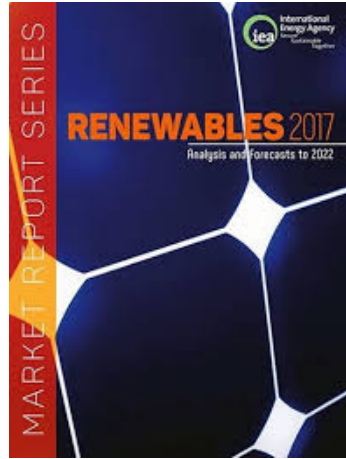
Our discussions will inform our next renewables market report this year, which will focus on hydropower – the largest source of renewable electricity generation.

Fatih Birol
@IEABirol



....an essential renewable technology that sometimes doesn't get the attention it deserves

Workshop 10th February
IEA main office, Paris





Further work

- White Paper: "Valuing Hydropower Flexibility in Evolving Electricity Markets". First step is to collect information on current markets and remuneration in different countries/regions – and today's workshop
- Showcasing examples of how hydropower provides value to the society in providing flood control and drought management. Next step is to analyse these services in a changing climate – potential White Paper or journal paper
- Workshops and meetings – also open to join from "non-members"
- Working with IEA on Renewable Energy Market Report
- IEA Hydropower Roadmap
- Dissemination of results



10 min break
We resume
15.32 CET

