



# HydroCen

NORWEGIAN RESEARCH CENTRE FOR HYDROPOWER TECHNOLOGY

## HYDROPOWER SUMMIT

Breakout Session 2 - Technological Challenges

Trondheim, 5<sup>th</sup> and 6<sup>th</sup> February 2020



# Agenda - Breakout Session 2 - Technological Challenges

Innovations in Hydropower Technology		
Time	Title	Speaker
12:30	Purpose and Topic Introduction	Leif Lia and Ole G. Dahlhaug
12.35	R&D-overview from US – Standard Modular Hydropower	Mark H. Christian
12.50	R&D-overview from Norway – Hydropower structures	Leif Lia
13:00	Tunnel systems	Bjørn Nilsen
13:15	Dams and dam safety	Fjola G. Sigtryggisdottir
13:30	Sediment handling	Nils Rüter
13:45	Discussion: What are the opportunities, challenges and paths forward in new technology	
14:15	Coffee break	

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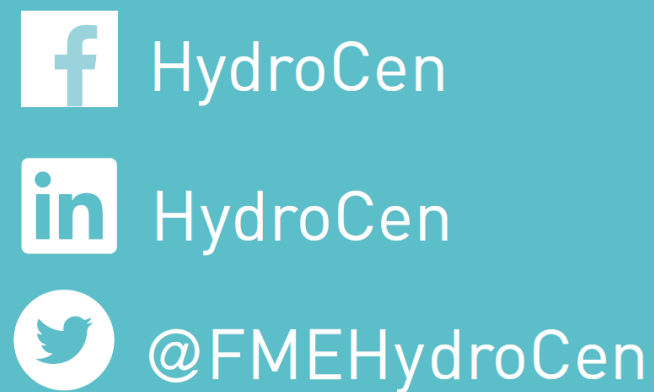
Turbines and Pumped Storage Advancements		
Time	Title	Speaker
14.45	Purpose and Topic Introduction	
14.50	R&D-overview from Norway – Turbines and generators	Arne Nysveen Ole G. Dahlhaug
15.05	Pump-storage – Nordic and European perspective	Leif Lia
15:20	Pump-storage – US perspective	Mark H. Christian
15.35	Variable speed operation/design	Arne Nysveen
15:50	Pump-turbines in existing powerplants	Pål-Tore Storli
16:00	Discussion: What is the role and opportunity for advancements in Turbines and PSP ?	
16:50	Wrap-up and summary of the day	
17.00	End of workshop day 1	

# Agenda - Breakout Session 2 - Technological Challenges

Asset Management and Digitalization		
Time	Title	Speaker
09.00	Purpose and Topic Introduction	
09.10	Flexible operation – fatigue, remaining lifetime, condition assessment, fault detection	Arne Nysveen
09.30	High head Francis turbines	Bjørn W. Solemslie
09:55	Coffee break	
10:15	Digitalization and digital twins	Hans Ivar Skjelbred
10.40	Hydropower Fleet Intelligence and Digital Twins	Mark H. Christian
11.00	Discussion:	
12.00	Lunch and closing of workshop (Room: C201) Plenary session with lunch and takeaways from each session	
13:00	Closing of workshop	

# Breakout Session 2 - Technological Challenges

- **Innovations in Hydropower Technology**
  - Production capability/technology
  - Verification of numerical tools
  - Variable speed turbines - high ramping rates
- **Turbines and Pumped Storage Advancements**
  - No new pump storage in US the last 20 years
  - European experience
- **Asset Management and Digitalization**
  - Life cycle analysis
  - Digital twins
  - Condition monitoring - data analysis
  - Cost of dispatch variability
  - Condition based repair
  - Access to data from power plants
  - Sheet signature - fingerprints when you put it in to service



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