

2023

# INTERNATIONAL HYBRID POWER PLANTS & SYSTEMS WORKSHOP

ORGANIZED BY ENERGNAUTICS



23 - 24  
MAY 2023

Faroe Islands



## AGENDA AS OF 22 MAY 2023

Important: This preliminary agenda is subject to changes. It is strongly recommended to check back regularly.

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# TIMETABLE 7<sup>TH</sup> INTERNATIONAL HYBRID POWER PLANTS & SYSTEMS WORKSHOP

TUESDAY, 23 MAY 2023		WEDNESDAY, 24 MAY 2023	
Hybrid Power Plants & Systems Workshop Day 1		Hybrid Power Plants & Systems Workshop Day 2	
08:00 – 09:00	FOYER		
	REGISTRATION		
09:00 – 09:10	HOYDALAR 1–3		
	OPENING: WELCOME AND INTRODUCTION		
09:10 – 10:50	HOYDALAR 1–3	HOYDALAR 1+2	HOYDALAR 3
	SESSION 1: KEYNOTE SESSION	SESSION 5A: HYBRID POWER SYSTEM EXPERIENCE FROM HAWAII	SESSION 5B: STORAGE
COFFEE BREAK (30 MIN) + GROUP PHOTO		COFFEE BREAK (30 MIN)	
11:20 – 13:00	HOYDALAR 1+2	HOYDALAR 1+2	HOYDALAR 3
	SESSION 2A: PROJECT EXPERIENCE HYBRID POWER SYSTEMS	SESSION 6A: DESIGN ASPECTS	SESSION 6B: DEMAND SIDE AND MARKET ASPECTS
LUNCH (1 H)		LUNCH (1 H)	
14:00 – 15:40	HOYDALAR 1+2	HOYDALAR 1+2	HOYDALAR 3
	SESSION 3A: FREQUENCY STABILITY ASPECTS	SESSION 7A: HYBRID POWER SYSTEMS – CASE STUDIES	SESSION 7B: DAILY AND SEASONAL ASPECTS OF HYBRID SYSTEMS
COFFEE BREAK (20 MIN)		COFFEE BREAK (20 MIN)	
16:00 – 17:45	HOYDALAR 1+2	HOYDALAR 1–3	
	SESSION 4A: MODELLING HYBRID POWER SYSTEMS	SESSION 8: CLOSING SESSION	
19:00	WORKSHOP DINNER		

## TUESDAY, 23 MAY 2023

### 08:00 – 09:00 REGISTRATION

All times in the session tables show the on-site time in Tórshavn/Faroe Islands (Western European Summer Time/WEST = BST = UTC+1), the highlighted stripes show the starting times of the respective sessions in additional time zones.

#### 09:00 – 09:10 WELCOME

04:00 New York | 05:00 Rio de Janeiro | 09:00 London | 10:00 Berlin | 13:30 New Delhi | 15:00 Jakarta | 17:00 Tokyo | 18:00 Sydney

#### 09:10 – 10:50 SESSION 1 – KEYNOTE SESSION

04:10 New York | 05:10 Rio de Janeiro | 09:10 London | 10:10 Berlin | 13:40 New Delhi | 15:10 Jakarta | 17:10 Tokyo | 18:10 Sydney

> Session Chair **Thomas Ackermann (Energynautics, Germany)**

#### 09:10 – 10:30 Presentations (20 min. each)

- **Welcome Address**  
Ingilín D. Strøm (Minister of Environment, Faroe Islands)
- **Suðuroy Hybrid Power System – a 100% IBR Power System**  
**B. Joensen** (Magn [formerly SEV], Faroe Islands) ([Submission-ID HYB23\\_056](#))
- **Faroe Energy Policy with Focus on Increased Renewable Electricity Production, Electrification, Smartgrid and PtX.**  
**K. M. Mortensen** (Head of Department, US-Orka / Energy Directorate, Umhvørvisstovan /Environment Agency, Faroe Islands) ([Submission-ID HYB23\\_055](#))
- **Roadmap toward 100% Renewable Energy in the Faroe Islands**  
**H. M. Tróndheim** (SEV, Faroe Islands) ([Submission-ID HYB23\\_053](#))

#### 10:30 – 10:50 Discussions

### 10:50 – 11:20 COFFEE BREAK + GROUP PHOTO

#### 11:20 – 13:00 SESSION 2A – PROJECT EXPERIENCE WITH HYBRID POWER SYSTEMS

06:20 New York | 07:20 Rio de Janeiro | 11:20 London | 12:20 Berlin | 15:50 New Delhi | 17:20 Jakarta | 19:20 Tokyo | 20:20 Sydney

> Session Chair **Terji Nielsen (SEV, Faroe Islands)**

#### 11:20 – 12:40 Presentations (20 min. each)

- **Optimization-Based Operation of Island Hybrid Power Systems: A Case Study In Suðuroy, Faroe Islands**  
**M. Alferink** (University of Bremen, Germany), L. Reus, F. Goudarzi, L. Hofmann (Leibniz University Hannover, Germany), K. Michels (University of Bremen, Germany) ([Submission-ID HYB23\\_006](#))
- **Toward High Levels of Renewables in the French Insular Systems**  
**G. Prime** (EDF R&D, France), **J. Witkowski** (EDF SEI, France) ([Submission-ID HYB23\\_029](#))
- **De-Dieselization: Updates on Hybrid Systems in Indonesia**  
**P.-P. Schierhorn** (Energynautics, Germany) ([Submission-ID HYB23\\_057](#))
- **How to Quickly Transition from 0% to 100% Renewable Energy on an Island in the Northwest Corner of Europe?**  
**D. G. Quirk** (DTU Offshore, Denmark), J. D. Boucher (Energy & Sustainability Centre Isle of Man, Isle of Man), P. A. Østergaard, H. Lund, F. Camara, F. F. da Silva (Aalborg University, Denmark), R. Peake (Energy & Sustainability Centre Isle of Man, Isle of Man) ([Submission-ID HYB23\\_030](#))

#### 12:40 – 13:00 Discussions

<b>11:20 – 13:00</b>	<b>SESSION 2B – HYBRID POWER PLANTS I</b>
06:20 New York   07:20 Rio de Janeiro   11:20 London   12:20 Berlin   15:50 New Delhi   17:20 Jakarta   19:20 Tokyo   20:20 Sydney	
> Session Chair	Michael Nortøft Frydensbjerg (Vattenfall, Denmark)
<b>11:20 – 12:40</b>	<b>Presentations (20 min. each)</b>
<ul style="list-style-type: none"> <li>• <b>Revealing the Potential of Hybrid Power Plants: Highlights of NREL Research and Project Experiences</b> V. Gevorgian (National Renewable Energy Laboratory – NREL, USA) (Submission-ID HYB23_038)</li> <li>• <b>Implementations of Utility Scale Hybrid Power Plants in the Australian NEM</b> J. Dyson (Greenview Strategic Consulting, Australia) (Submission-ID HYB23_041)</li> <li>• <b>How to Teach a Machine Kitesurfing – and Why</b> B. E. Westre (Minesto, Sweden) (Submission-ID HYB23_069)</li> <li>• <b>Airborne Wind Energy - a New Pillar of the Renewable Energy Supply</b> N. Taphorn (SkySails Power, Germany) (Submission-ID HYB23_015)</li> </ul>	
<b>12:40 – 13:00</b>	<b>Discussions</b>

**13:00 – 14:00 LUNCH BREAK**

<b>14:00 – 15:40</b>	<b>SESSION 3A – FREQUENCY STABILITY ASPECTS</b>
09:00 New York   10:00 Rio de Janeiro   14:00 London   15:00 Berlin   18:30 New Delhi   20:00 Jakarta   22:00 Tokyo   23:00 Sydney	
> Session Chair	Adolfo Anta (AIT Austrian Institute of Technology, Austria)
<b>14:00 – 15:20</b>	<b>Presentations (20 min. each)</b>
<ul style="list-style-type: none"> <li>• <b>Fixed-Frequency Operation of an Island Grid with Multiple Grid-Forming Inverters and GPS-Based Synchronization</b> R. Strunk, L. Reus, L. Hofmann, A. Mertens (Leibniz University Hannover, Germany) (Submission-ID HYB23_021)</li> <li>• <b>Grid Forming Wind for Island Power Systems</b> V. Gevorgian (National Renewable Energy Laboratory – NREL, USA) (Submission-ID HYB23_039)</li> <li>• <b>Power Grids Regain Missing Inertia with Synchronous Condensers</b> C. Payerl (ABB, Sweden) (Submission-ID HYB23_047)</li> <li>• <b>Transient Stability Study for a Developing Island Power System with Increasing Shares of VRE</b> A. Jotwani, N. Martensen (Energynautics, Germany) (Submission-ID HYB23_050)</li> </ul>	
<b>15:20 – 15:40</b>	<b>Discussions</b>

<b>14:00 – 15:40</b>	<b>SESSION 3B – HYDROGEN ASPECTS</b>
09:00 New York   10:00 Rio de Janeiro   14:00 London   15:00 Berlin   18:30 New Delhi   20:00 Jakarta   22:00 Tokyo   23:00 Sydney	
> Session Chair	Peter-Philipp Schierhorn (Energynautics, Germany)
<b>14:00 – 15:20</b>	<b>Presentations (20 min. each)</b>
<ul style="list-style-type: none"> <li>• <b>Coordinated Control of Hydrogen Production Based on Wind Power Generation</b>  <b>B. Alahmad</b>, O. Sahin (Vattenfall R&amp;D, Sweden), N. Cassamo (Vattenfall Offshore Wind, Netherlands), N. Espinoza (Vattenfall R&amp;D, Sweden), D. V. Pombo (Vattenfall R&amp;D, Denmark), S. Kanev (Vattenfall Offshore Wind, Netherlands), G. A. Raducu (Vattenfall Offshore Wind, Denmark) (Submission-ID HYB23_017)</li> <li>• <b>Developing the Geo-Techno-Economic Analysis of Hydrogen Ecosystems</b>  <b>F. Weise</b> (Fraunhofer ISE   University of Freiburg, Germany), B. Koch (University of Freiburg, Germany), C. Voglstätter, T. Smolinka, C. Hebling (Fraunhofer ISE, Germany) (Submission-ID HYB23_062)</li> <li>• <b>How Efficient Can Hydrogen Be? Hydrogen Technologies and their Limits of Optimizability</b>  <b>N. Eggers</b> (Fraunhofer IFF   University of Applied Sciences Hamburg   Technical University of Dresden, Germany), <b>T. Birth</b> (Fraunhofer IFF   University of Applied Sciences Hamburg, Germany), M. Scheffler, S. Jentsch (Fraunhofer IFF, Germany), A. Hurtado (Technical University of Dresden, Germany) (Submission-ID HYB23_020)</li> <li>• <b>Techno-Economic Modelling of Stationary Energy Storage Systems with a Focus on Temperature's Influence on Aging</b>  <b>C. T. Schwarz</b> (Technical University of Vienna, Austria), J. Kapeller, Y. Wimmer (Austrian Institute of Technology – AIT, Austria) (Submission-ID HYB23_018)</li> </ul>	
<b>15:20 – 15:40</b>	<b>Discussions</b>

## 15:40 – 16:00 COFFEE BREAK

<b>16:00 – 17:45</b>	<b>SESSION 4A – MODELLING HYBRID POWER SYSTEMS</b>
11:00 New York   12:00 Rio de Janeiro   16:00 London   17:00 Berlin   20:30 New Delhi   22:00 Jakarta   00:00 Tokyo   01:00 Sydney	
> Session Chair	Daniel Vázquez Pombo (Vattenfall, Denmark)
<b>16:00 – 17:25</b>	<b>Presentations (20 min. each, except 1<sup>st</sup> presentation)</b>
<ul style="list-style-type: none"> <li>• <b>Transforming Small Island Power Systems</b>  <b>G. Nair</b> (IRENA, Germany) (Submission ID 066) (45 minutes)</li> <li>• <b>The Evolution of Hybrid Systems: Insights from 30 years of Modeling</b>  <b>P. Lilienthal</b> (UL Solutions, USA) (Submission-ID HYB23_007)</li> <li>• <b>Assessment of the German Innovation Tender for the Promotion of Hybrid Energy Systems</b>  <b>F. Mandler</b> (BayWa r.e., Germany) (Submission-ID HYB23_064)</li> </ul>	
<b>17:25 – 17:45</b>	<b>Discussions</b>

16:00 – 17:40 SESSION 4B – HYBRID POWER PLANTS II

11:00 New York | 12:00 Rio de Janeiro | 16:00 London | 17:00 Berlin | 20:30 New Delhi | 22:00 Jakarta | 00:00 Tokyo | 01:00 Sydney

> Session Chair Bernhard Schropp (SMA, Germany)

16:00 – 17:20 Presentations (20 min. each)

- **Wind Turbines in Hybrid Power Plants: Let's Talk!**  
D. McMullin (Enercon, Ireland), E. Quitmann (Enercon, Germany)
- **Utility Scale PV Plant OPEX Optimization with BESS**  
D. Jaber (BayWa r.e., Germany) (Submission-ID HYB23\_065)
- **Optimal Operation of Hybrid Power Plants: A Case Study of an Operation Park in Sweden**  
O. Lindberg (Uppsala University, Sweden), R. Zhu, K. Das (Technical University of Denmark – DTU, Denmark), D. Lingfors (Uppsala University, Sweden), P. E. Sørensen (Technical University of Denmark – DTU, Denmark) (Submission-ID HYB23\_019)
- **Techno-Economic Viability of Pumped Hydropower Plants in Germany, with Focus on Battery Hybridization**  
Ø. S. Klyve (Institute for Energy Technology – IFE | University of Oslo, Norway), V. J. Olkkonen (Institute for Energy Technology – IFE, Norway), A. Hensel (Fraunhofer ISE, Germany) (Submission-ID HYB23\_044)

17:20 – 17:40 Discussions

19:00 Dinner (to be booked separately)

## WEDNESDAY, 24 MAY 2023

<b>09:00 – 10:40</b>	<b>SESSION 5A – HYBRID POWER SYSTEM EXPERIENCE FROM HAWAII</b>
04:00 New York   05:00 Rio de Janeiro   09:00 London   10:00 Berlin   13:30 New Delhi   15:00 Jakarta   17:00 Tokyo   18:00 Sydney	
> Session Chair	Thomas Ackermann (Energynautics, Germany)
<b>09:00 – 10:15</b>	<b>Presentations (25 min. each)</b>
<ul style="list-style-type: none"><li>• <b>Introduction to the Situation in Hawaii</b> T. Ackermann (Energynautics, Germany) (Submission-ID HYB23_058)</li><li>• <b>Experience from High Share PV on Kauai</b> B. Rockwell (Kauai Island Utility Cooperative – KIUC, USA) (Submission-ID HYB23_068)</li><li>• <b>Hawaiian Electric’s Plans to Reach 100% RE</b> K. Aramaki (Hawaiian Electric, USA) (Submission-ID HYB23_070)</li></ul>	
<b>10:15 – 10:40</b>	<b>Discussions</b>

<b>09:00 – 10:40</b>	<b>SESSION 5B – STORAGE</b>
04:00 New York   05:00 Rio de Janeiro   09:00 London   10:00 Berlin   13:30 New Delhi   15:00 Jakarta   17:00 Tokyo   18:00 Sydney	
> Session Chair	Julian Gerstner (BayWa r.e., Germany)
<b>09:00 – 10:20</b>	<b>Presentations (20 min. each)</b>
<ul style="list-style-type: none"><li>• <b>SEV’s Planned Pumped Hydro Project</b> D. R. Hansen (SEV, Faroe Islands)</li><li>• <b>On the Usage of Hybrid Storage Systems for the Provision of Services for Local Grids</b> D. Cifelli, A. Anta (AIT Austrian Institute of Technology, Austria) (Submission-ID HYB23_011)</li><li>• <b>Advanced Battery Energy Storage Systems for Hybrid Power and Energy Management</b> F. Baccino, M. Santarelli (Hitachi Energy, Italy) (Submission-ID HYB23_016)</li><li>• <b>Design of Wind-Solar Hybrid Power Plant by Minimizing Need for Energy Storage</b> E. Jonasson, O. Lindberg, D. Lingfors, I. Temiz (Uppsala University, Sweden) (Submission-ID HYB23_008)</li></ul>	
<b>10:20 – 10:40</b>	<b>Discussions</b>

### 10:40 – 11:10 COFFEE BREAK

<b>11:10 – 12:30</b>	<b>SESSION 6A – DESIGN ASPECTS</b>
06:10 New York   07:10 Rio de Janeiro   11:10 London   12:10 Berlin   15:40 New Delhi   17:10 Jakarta   19:10 Tokyo   20:10 Sydney	
> Session Chair	Peter-Philipp Schierhorn (Energynautics, Germany)
<b>11:10 – 12:10</b>	<b>Presentations (20 min. each)</b>
<ul style="list-style-type: none"><li>• <b>Development of a Software in the Loop Environment to Control a Microgrid</b> M. Mütherig, G. Puleo, M. Zdrallek (University of Wuppertal, Germany), A. Schönbauer (RheinEnergie, Germany) (Submission-ID HYB23_023)</li><li>• <b>Procedure for Parameter Identification and Validation of Governor and Automatic Voltage Regulator Dynamic Models</b> H. M. Tróndheim (SEV, Faroe Islands   Aalborg University, Denmark   University of the Faroe Islands, Faroe Islands), F. F. da Silva, C. L. Bak (Aalborg University, Denmark), T. Nielsen (SEV, Faroe Islands), A. Niclasen (University of the Faroe Islands, Faroe Islands), R. S. Nielsen, N. Weikop (AFRY, Denmark) (Submission-ID HYB23_051)</li><li>• <b>Developing Standardized Plant Controls and Sizing Methodologies - In the face of an Industry in Flux</b> B. J. Braun, B. Lang (Fluence Energy, Germany) (Submission-ID HYB23_035)</li></ul>	
<b>12:10 – 12:30</b>	<b>Discussions</b>

<b>11:10 – 12:30</b>	<b>SESSION 6B – DEMAND SIDE AND MARKET ASPECTS</b>
06:10 New York   07:10 Rio de Janeiro   11:10 London   12:10 Berlin   15:40 New Delhi   17:10 Jakarta   19:10 Tokyo   20:10 Sydney	
> Session Chair	John Zack (MESO, USA)

<b>11:10 – 12:10</b>	<b>Presentations (20 min. each)</b>
<ul style="list-style-type: none"> <li>• <b>Load Shifting to Increase the Match of Consumption and Renewable Generation through Added Thermal Storage, Analysed for the Case of Domestic Heating on the Faroe Islands</b> T. Balle, H.-G. Beyer (University of the Faroe Islands, Faroe Islands) (Submission-ID HYB23_049)</li> <li>• <b>Techno-Economic Effects of Electricity Market Conditions in the Optimal Operation of Hybrid Power Plants</b> J. Martinez Rico (Tekniker – Basque Research and Technology Alliance   University of the Basque Country, Spain), I. Ruiz de Argandoña (Tekniker – Basque Research and Technology Alliance, Spain), E. Zulueta (University of the Basque Country, Spain), M. Armendia (Tekniker – Basque Research and Technology Alliance, Spain), U. Fernandez-Gamiz (University of the Basque Country, Spain) (Submission-ID HYB23_013)</li> <li>• <b>Ærø Island Community project: Load Shifting to Increase the Match of Consumption and Renewable Generation by Means of Electrification of District Heating and Bi-Directional Charging of Electric Ferries and Vehicles</b> T. Estrup (Blue Innovators, Denmark)</li> </ul>	
<b>12:10 – 12:30</b>	<b>Discussions</b>

## 12:30 – 13:30 LUNCH BREAK

<b>13:30 – 15:10</b>	<b>SESSION 7A – HYBRID POWER SYSTEMS – CASE STUDIES</b>
08:30 New York   09:30 Rio de Janeiro   13:30 London   14:30 Berlin   18:00 New Delhi   19:30 Jakarta   21:30 Tokyo   22:30 Sydney	
> Session Chair	Jonas Kehr (Hitachi Energy, Denmark)

<b>13:30 – 14:50</b>	<b>Presentations (20 min. each, except 1<sup>st</sup> presentation)</b>
<ul style="list-style-type: none"> <li>• <b>IRENA Grid Assessment and modelling- Case studies</b> G. Nair (IRENA, Germany) (Submission-ID HYB23_067) (presentation 40 minutes)</li> <li>• <b>Optimal Dispatch for the US Virgin Islands to Increase Renewable Rates in Saint Croix</b> D. Vazquez Pombo (National Renewable Energy Laboratory – NREL, USA   DTU, Denmark   Vattenfall, Sweden), V. Gevorgian, D. Olis (National Renewable Energy Laboratory – NREL, USA), H. W. Bindner (DTU, Denmark) (Submission-ID HYB23_010)</li> <li>• <b>Coupling Wind Power and Heating with a Thermal Grid: Simulation Case Study Isle of Barra</b> M. Auer (University of Strathclyde, Glasgow, United Kingdom   Lucerne University of Applied Sciences and Arts, Switzerland) (Submission-ID HYB23_063)</li> </ul>	
<b>14:50 – 15:10</b>	<b>Discussions</b>

<b>13:30 – 15:10</b>	<b>SESSION 7B – DAILY AND SEASONAL ASPECTS OF HYBRID SYSTEMS</b>
08:30 New York   09:30 Rio de Janeiro   13:30 London   14:30 Berlin   18:00 New Delhi   19:30 Jakarta   21:30 Tokyo   22:30 Sydney	
> Session Chair	Oskar Lindberg (Uppsala University, Sweden)

<b>13:30 – 14:50</b>	<b>Presentations (20 min. each)</b>
<ul style="list-style-type: none"> <li>• <b>Optimizing a Solar-Battery-Plant for Peak-Time (9am–10pm) Operation with Constant Power Output</b> B. Schropp, I. Caschetto (SMA Solar Technology, Germany) (Submission-ID HYB23_014)</li> <li>• <b>Obtaining Value from Sub-seasonal to Seasonal (S2S) Renewable Power Forecasts for Hybrid Power System Applications</b> J. W. Zack (MESO Inc., USA) (Submission-ID HYB23_052)</li> <li>• <b>Long-Duration Energy Storage in Hybrid Wind and Solar Power Plants</b> V. Gevorgian (National Renewable Energy Laboratory – NREL, USA) (Submission-ID HYB23_037)</li> <li>• <b>Distributed Energy Resources and the Future of Distribution Utilities</b> F. Siohansi (Menlo Energy Economics, USA) (Submission-ID HYB23_003)</li> </ul>	
<b>14:50 – 15:10</b>	<b>Discussions</b>



**15:10 – 15:30 COFFEE BREAK**

<b>15:30 – 16:30</b>	<b>SESSION 8 – CLOSING SESSION</b>
<b>10:30 New York   11:30 Rio de Janeiro   15:30 London   16:30 Berlin   20:00 New Delhi   21:30 Jakarta   23:30 Tokyo   00:30 Sydney</b>	
<b>&gt; Session Chair</b>	<b>Eckard Quitmann (Enercon, Germany)</b>
<b>15:30 – 16:00</b>	<b>Panel discussion</b>
<b>Topics addressed: Batteries vs. Pumped Hydro vs. Hydrogen – When Suits What?</b>	
<b>Panelists:</b>	
<ul style="list-style-type: none"><li>- <b>Torsten Birth</b> (Fraunhofer IFF   University of Applied Sciences Hamburg, Germany)</li><li>- <b>Benjamin J. Braun</b> (Fluence Energy, Germany)</li><li>- <b>Vahan Gevorgian</b> (NREL, USA)</li><li>- <b>Terji Nielsen</b> (SEV, Faroe Islands) – TBC</li></ul>	
<b>16:00 – 16:20</b>	<b>Discussions</b>
<b>16:20 – 16:30</b>	<b>Closing Remarks</b>