17th INTERNATIONAL SEMINAR ON HYDROPOWER PLANTS

Pumped Storage in the Context of Renewable Energy Supply

21st – 23rd November 2012
University of Technology Vienna, Austria

Conference program
Tagungsprogramm
SESSION OVERVIEW

Wednesday - 21/11/2012

08:00am - 09:30pm Registration at the conference-office

09:30am - 11:55pm Opening Session

11:55am - 12:00pm Opening of the Exhibition

12:00pm - 01:30pm Lunch Break

01:30pm - 03:00pm SESSION 1.1 Austria-Nepal Workshop Small Hydro 1 Hydropower Resource Management

03:00pm - 03:30pm Coffee Break

03:30pm - 05:20pm SESSION 2.1 Sustainability Aspects Small Hydro 2 Design and Numerical Calculation of Hydraulic Components 1

07:00pm - 12:00pm Evening program

Thursday - 22/11/2012

09:00am - 10:30am SESSION 3.1 Pumped Storage 1 Design and Numerical Calculation of Hydraulic Components 2 Hydrokinetic Turbines

10:30am - 11:00am Coffee Break

11:00am - 12:30pm SESSION 4.1 Pumped Storage 2 Design and Numerical Calculation of Hydraulic Components 3 Workshop Open Source CFD

12:30pm - 01:30pm Lunch Break

Friday - 23/11/2012

09:00am - 10:30am SESSION 7.1 Pumped Storage 5 Design and Numerical Calculation of Hydraulic Components 6

10:30am - 11:00am Coffee Break

11:00am - 12:30pm SESSION 8.1 Pumped Storage 6

12:30pm - 01:30pm Closing Session

FLOORPLAN

Theatre Marshall room Franz Josef room Kronprinz Rudolf room

Marshall room Exhibition Meeting room Conference desk Entrance Meeting room Buffet Franz Josef room Kronprinz Rudolf room
CONFERENCE PROGRAM

Wednesday - 21/11/2012

08:00am  Registration at the conference-office

09:30am  Conference Opening Session
Location: Theatre, Chair: Prof. Dr.-Ing. C. Bauer (TU Wien, Austria); Dr. St. Burtscher (TU Wien/ TVFA GmbH, Austria)

Conference Opening
C. Bauer, TU Wien, Institute for Energy Systems and Thermodynamics, Vienna, AUSTRIA
Opening Address
St. Burtscher, TU Wien, Institute for Testing and Research (LTD) Vienna, Austria

Nepal's Hydropower Resources and Policy
Dean B.R. Pahari, Institute of Engineering, Tribhuvan University, NEPAL

Turnaround in Energy Policy and Electricity Market - A Contradiction?
H. Mennel, Vorarlberger Illwerke AG, Bregenz, AUSTRIA

Contribution of Pumped Storage Plants to the Turnaround in Energy Policy
K. Wimmer, VERBUND Hydro Power AG, Wien, AUSTRIA

11:55am  Opening of the Exhibition

12:00pm  Lunch Break

01:30pm  SESSION 1.1 - Austria-Nepal Workshop
Location: Theatre, Chair: Prof. B. R. Pahari (Institute of Engineering, Tribhuvan University, Nepal)

Comparison between the Energy Situation in Austria and Nepal
C. Bauer, TU Wien, Institute for Energy Systems and Thermodynamics, Vienna, Austria

Current Energy Scenario of Nepal: An Overview
A.M. Nakarmi, Center for Energy Studies, Institute of Engineering, Tribhuvan University, Kathmandu, NEPAL;
T. Mishra, R. Banerjee, Indian Institute of Technology Bombay, Mumbai, INDIA

Presentation of APPEAR - Austrian Partnership Programme in Higher Education & Research for Development
J. Lichtkoppler-Moser, Austrian Agency for International Cooperation in Education and Research (OeAD-GmbH), AUSTRIA

Development of Academic Program on Energy System Planning and Analysis in Tribhuvan University
T.R. Bajracharya, Center for Energy Studies, Institute of Engineering, Tribhuvan University, Kathmandu, NEPAL
01:30am SESSION 1.2 - Small Hydro 1
Location: Marshall room, Chair: Prof. D. Das (Indian Institute of Technology, Roorkee, India)

Towards a Sustainable Development of Small Hydropower Plants, from the Olympus Mountain to the Valley of Sperchiros River
A. Stergiopoulou, V. Stergiopoulos, K. Kainourgiou, A. Koukou, D. Tsivolas, ASPETE, Higher School of Pedagogical and Technological Education, Athens, GREECE

Project Development and Management Challenges of Small Hydro in Bosnia and Herzegovina
H. Dzafo, Department for renewable energy projects implementation, JP Elektroprivreda BiH dd-Sarajevo, Sarajevo, BOSNIA and HERZEGOVINA

Optimization of Power-Specific Investment Costs for Small Hydropower
P.F. Pelz, M. Metzler, Technische Universität Darmstadt, Institute for Fluid Systems Technologies, Darmstadt, GERMANY

Smart Unit for Powerdistribution – A Nobel Concept for Mini-Grid in Rural Areas

01:30am SESSION 1.3 - Hydropower Resource Management
Location: Franz Josef room, Chair: Dr. B. List (Voith Hydro, Austria)

J. Schuol, K. Krüger, B. Fischer-Aupperle, Voith Hydro Holding GmbH & Co. KG, Heidenheim, GERMANY

Plant and Operational Safety of Hydropower Plants
K. Hirtenlehner, ZT Hirtenlehner, AUSTRIA

Cooling of Hydropower Plants in Closed Cycle Cooling Systems
St. Kunert, VERBUND Hydro Power AG, Vienna, AUSTRIA

New Technologies to Recover Energy in a Desalination Plant: Stainless Steel Turbine
C. Castro Otero, BALIÑO S.A., Vigo, SPAIN; S. Holmgren, Undenås TurbinTeknik A.S., Undenås, SWEDEN

03:00pm Coffee Break
sponsored by ABB

03:30pm SESSION 2.1 - Sustainability Aspects
Location: Theatre, Moderation: M.Sc M. Langthaler (Brainbows, Austria)

Guiding Sustainability in Pumped Storage: The Hydropower Sustainability Assessment Protocol
C. Ironside, D. Smith, S. Howard, International Hydropower Association, UNITED KINGDOM

The Hydropower Sustainability Assessment Protocol in Practice: Lessons Learned from its First Application in Europe – A Utility’s Perspective
B. Möstl, K. Engels, E.ON Global Unit Generation, Landshut, GERMANY

Hydropower Development and Operation in Basin Contexts
J. Meng, WWF, Berlin, GERMANY

Equipment Solutions Measurably Enhance Sustainability in Hydropower
J. Schuol, B. Fischer-Aupperle, N. Riedel, Voith Hydro Holding GmbH & Co. KG, Heidenheim, GERMANY

Financing Sustainable Hydropower - Mission Impossible?
W. Schmied, OeKB - Oesterreichische Kontrollbank Aktiengesellschaft, Vienna, AUSTRIA
03:30pm SESSION 2.2 - Small Hydro 2
Location: Marshall room, Chair: Dr.-Ing. A. Ruprecht (University of Stuttgart, Germany)

Study of the Performance of Three Different Aerator Designs for Low-Head Hydropower Using a Siphon System
E. Mardiani-Euers, M.B. Widden, Lancaster University, Department of Engineering, Lancaster, ENGLAND

Design and Optimization of Small Hydropower Type Series for Surface Watercourse
M. Metzler, P.F. Pelz, Technische Universität Darmstadt, Institute for Fluid Systems Technologies, Darmstadt, GERMANY

03:30pm SESSION 2.3 - Design and Numerical Calculation of Hydraulic Components 1
Location: Franz Josef room, Chair: Dr. J. Prost (HTL-Eisenstadt, Austria)

Use of Standard Centrifugal Pumps as Turbines
B. Mellacher, Andritz Hydro Ltd., Graz, AUSTRIA

05:00pm End of Session

05:15pm Shuttle Bus to Vienna

06:30pm Evening Program
Palais Lichtenstein, Fürstengasse 1, 1090 Vienna

Cocktail reception
Guided tour of the Princely Collections
<p>| 06:30pm - 12:00pm |</p>
<table>
<thead>
<tr>
<th>Time</th>
<th>Session 3.1 - Pumped Storage 1</th>
<th>Location: Theatre, Chair: Dr. P. Angerer (Andritz Hydro GmbH, Austria)</th>
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<tbody>
<tr>
<td>09:00am</td>
<td>Scheduling of Wind and Pumped Storage Plant under Day Ahead Market</td>
<td>J. Dhillon, A. Kumar, S.K. Singal, Alternate Hydro Energy Centre, Indian Institute of Technology Roorkee, Uttarahand, INDIA</td>
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<td></td>
<td>Hydraulic Storage Demand for a Full Regenerative Electrical Power Supply of Austria</td>
<td>M. Boxleitner, TU Wien, Institute for Energy Systems and Electrical Drives, Vienna, AUSTRIA</td>
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<td>Counter-Rotating Type Pump-Turbine Unit Cooperating with Wind Turbine to Stabilize Instantaneously Power Supply (Simulations in Hydroelectric Work)</td>
<td>K. Komaki, G. Takano, R. Kasahara, Kyushu Institute of Technology, Graduate School of Engineering, Fukuoka, JAPAN; T. Murakami, T. Kanemoto, Kyushu Institute of Technology, Faculty of Engineering, Fukuoka, JAPAN</td>
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<tr>
<th>Time</th>
<th>Session 3.2 - Design and Numerical Calculation of Hydraulic Components 2</th>
<th>Location: Marshall room, Chair: Dr. S. Burtscher (TU Wien / TVFA GmbH, Austria)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00am</td>
<td>The Renewal of the Pressure Shaft for the High Head Hydropower Plant Kaunertal in Austria: Civil Engineering and Civil Works</td>
<td>P. Bonapace, TIWAG – Tiroler Wasserkraft AG, Innsbruck, AUSTRIA</td>
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<td>The Renewal of the Pressure Shaft for the High Head Hydropower Plant Kaunertal in Austria: Preliminary Testing for the Constructional Steelwork</td>
<td>R. Maldet, TIWAG – Tiroler Wasserkraft AG, Innsbruck, AUSTRIA</td>
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<td>The Renewal of the Pressure Shaft for the High Head Hydropower Plant Kaunertal in Austria: Measures for the Quality Approving</td>
<td>V. Jelen, A. Lukyanets, TEMAT d.o.o., Slovenska Bistrica, SLOVENIA</td>
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<td>Validation of Acceptable Defect Sizes in Penstocks with Fracture Mechanics Methods</td>
<td>R. Huber, TU Wien, Institute for Testing and Research (LTD), Vienna, AUSTRIA</td>
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<th>Time</th>
<th>Session 3.3 - Hydrokinetic Turbines</th>
<th>Location: Franz Josef room, Chair: Prof. Dr.-Ing. P. Pelz (TU Darmstadt, Deutschland)</th>
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<tr>
<td>09:00am</td>
<td>Hydraulic Development of Hydro Kinetic Turbines</td>
<td>A. Ruprecht, A. Ruopp, N. Bauer, S. Riedelbauch, University of Stuttgart, IHS Institute of Fluid Mechanics and Hydraulic Machinery, Stuttgart, GERMANY</td>
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<td>Connecting an Array of Tidal Turbines to the Grid</td>
<td>A. Lechner, Andritz Hydro GmbH, Vienna, AUSTRIA; R. Bauernhofer, Andritz Hydro Hammerfest, Glasgow, UNITED KINGDOM</td>
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<td>Test Facility for Low Potential Pumped Storage Power Plants and Hydrokinetic Turbines</td>
<td>D. Surek, Hochschule Merseburg, An-Institut Fluid- und Pumpentechnik, Merseburg, GERMANY</td>
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<td>09:00am</td>
<td>Open Source CFD Workshop</td>
<td>Kronprinz Rudolf room</td>
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<td>10:30am</td>
<td>Coffee Break</td>
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| 11:00am| SESSION 4.1 - Pumped Storage 2              | Theatre                  | Prof. Dr.-Ing. habil. R. Schilling (TU Munich, Germany) | Small Hydro Approach for Pump-Turbines - Is a Modular Concept a Possible Solution?  
P. Unterberger, E. Doujak, C. Bauer, TU Wien, Institute for Energy Systems and Thermodynamics, Vienna, AUSTRIA  
Concept of Small and Mid-Size Pump Turbines  
J. Krenn, H. Keck, M. Sallabander, Andritz Hydro Ltd., Zürich, SWITZERLAND  
Modeling of Hydro-Pneumatic Energy Storage Using Pump Turbines  
E. Ortego, A. Dazin, G. Caignaert, O. Coutier-Deligosha, Arts et Métiers ParisTech Lille, Mechanics Laboratory (LML), Lille, FRANCE; F. Colas, Arts et Métiers ParisTech Lille, Laboratory of Electrical Engineering and Power Electronics (L2EP), Lille, FRANCE;  
Strategies for Avoidance of Transient Low Pressure in Complex Pump-Turbine Schemes  
K. Kiniger, B. List, Voith Hydro GmbH & Co. KG, St. Pölten, AUSTRIA |
| 11:00am| SESSION 4.2 - Design and Numerical Calculation of Hydraulic Components 3 | Marshall room             | Dr. A. Königsberger (Andritz Hydro, Austria) | Ageing of Stator Windings Due to Start and Stop Transients in Lifetime Estimation of Hydro Generators and Generator-Motors  
V.I.J. Kokko, Fortum Power and Heat Oy, Leppiniemi, FINLAND  
PSP Kühtai: Refurbishment of a 176 MVA – Motor Generator / Particular Topics Relating to Lifecycle Investigations of the Runner and Special Themes Concerning to Dismantling and Re-Assembling  
W. Kofler, K. Vanicek, TIWAG – Tiroler Wasserkraft AG, Innsbruck, AUSTRIA  
Efficiency Improvements of Existing Hydro Power Plants  
J. Mayrhuber, J. Schernthanner, VERBUND Hydro Power AG, Vienna, AUSTRIA |
| 11:00am| SESSION 4.3 - Hydropower Plant Assessment    | Franz Josef room          | Prof. Dr. Th. Staubli (Hochschule Luzern, Switzerland) | Application of Multi-Frequency Acoustics to Estimate Concentration of Suspended Sediments from Jurong Lake, Singapore  
J. Skripalle, HydroVision GmbH, Kaufbeuren, GERMANY; Th. Hies, Y. Liu, H.H. Nguyen, DHI Water & Environment (S) Pte Ltd, SINGAPORE  
O. Betz, systec Controls, Mess- und Regeltechnik GmbH, Puchheim, GERMANY  
Practical Experience with Manual Testing Used Phased Array Ultrasonic  
A. Kurtin, H. Muth, TU Wien, Institute for Testing and Research (LTD), Vienna, AUSTRIA  
Development of a Systematic Approach for the Data Collection and Assessment of Hydro-Electric Equipment During Site Inspections  
Th. Weiss, A. Heimann, U. Wünsche, Andritz Hydro Ltd., Kriens, SWITZERLAND |
11:00am Open Source CFD Workshop
Location: Kronprinz Rudolf room

Practical session (Preprocessing - Solving - Postprocessing) - Part I
Sandro Erne, TU Wien, Institute for Energy Systems and Thermodynamics, Vienna, AUSTRIA;
Ivana Buntic Ogor, Technical Computing & Consulting Services, Munich, GERMANY

12:30pm Lunch Break

01:30pm SESSION 5.1 - Pumped Storage 3
Location: Theatre, Chair: Prof. Dr. P. Tschernutter (TU Wien, Austria)

New Developments on the Fatigue Strength of Openings Used for Grouting in Steel Linings
A. Lechner, R. Greiner, Graz University of Technology, Graz, AUSTRIA

New Insights into the Design of Steel Linings of Pressure Shafts
A. Lechner, R. Greiner, Graz University of Technology, Graz, AUSTRIA; G. Innerhofer, Konsulent, AUSTRIA

Guideline for the Design and Operation of High-Stress Components in Hydropower Plants - Part I - Recommendation for Design and Operation
W. Kofler, TIWAG – Tiroler Wasserkraft AG, Innsbruck, AUSTRIA

Guideline for the Design and Operation of High-Stress Components in Hydropower Plants - Part II – Assessment of Fatigue Strength – Calculation Concept and Calculation Report
R. Huber, Institute for Testing and Research (LTD), Vienna University of Technology, Vienna, AUSTRIA

Guideline for the Design and Operation of High-Stress Components in Hydropower Plants - Part III – Assessment of Fatigue Strength – Calculation Concept and Calculation Report
X. Schuler, Materialprüfungsanstalt (MPA) Universität Stuttgart, Stuttgart, GERMANY

01:30pm SESSION 5.2 - Design and Numerical Calculation of Hydraulic Components 4
Location: Marshall room, Chair: Dr. B. List (Voith Hydro, Austria)

“New Pelton Concept” Up to Six Nozzles Horizontal
J.M. Erlach, Erlach & Erlach GmbH, Ravensburg, GERMANY

Best Practice in Rehabilitation of Pelton Turbines as Applied at Vermuntwerk M5
A. Karakolcu, Andritz Hydro Ltd., Zürich, SWITZERLAND; J. Erhard, Andritz Hydro Ltd., Graz, AUSTRIA; B. Wittwer, Vorarlberger Illwerke AG, Schruns, AUSTRIA

Suspended Sediment and Pelton Turbine Wear Monitoring: Experimental Investigation of Various Optical and Acoustic Devices and Begin of the Case Study Fieschertal
D. Felix, I. Albayrak, R. Boes, Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zurich, SWITZERLAND; A. Abgottspon, P. Gruber, Hochschule Luzern, Luzern, SWITZERLAND

Theoretical Interpretation of the CORDIER-Line for Cross-Flow Turbines
R. Willinger, M. Köhler, TU Wien, Institute for Energy Systems and Thermodynamics, Vienna, AUSTRIA
Transient Behavior at Hydropower Plants
R. Shrestha, D. Bastakoti, H.K. Karn, I. Khadka, K.C. Khadananda, Mechanical Engineering Department, Institute of Engineering, Tribhuvan University, Kathmandu, NEPAL

Creating a Hydraulic Simulation Program for Hydropower Plants in Matlab/Simulink® with Special Interest on the Surge Tank Behaviour and the Hydraulic Instability of Pump Turbines
A. Hammer, H. Götsch, TIWAG – Tiroler Wasserkraft AG, Innsbruck, AUSTRIA; K. Käfer, Institute for Energy Systems and Thermodynamics, Vienna University of Technology, Vienna, AUSTRIA

Hybrid Modeling of a Large Surge Tank
W. Richter, J. Schneider, G. Zenz, Graz University of Technology, Institute of Hydraulic Engineering and Water Resources Management, Graz, AUSTRIA; St. Kolb, Schluchseewerk AG, Laufenburg, GERMANY

A Transient Study of a Complex Hydro-Electrical Power Generation System
J. Hell, A. Lechner, R. Schürhuber, Andritz Hydro GmbH, Vienna, AUSTRIA; Y. Vaillant, Andritz Hydro Ltd., Zürich, SWITZERLAND

Design Criteria and Structural Aspects of Pumped Storage Hydropower Plants (PSHPP)
P. Tschernutter, I. Kampel, S. Wallner, TU Wien, Institute of Hydraulic Engineering and Water Resources Management, Vienna, AUSTRIA

The Expansion of the Kaunertal Power Station
W. Stroppa, TIWAG – Tiroler Wasserkraft AG, Innsbruck, AUSTRIA

Hybrid Pump Storage Hydropower Plant: Site Selection, Economic Analysis and Water Hammer Calculation
H. Benigni, H. Jaberg, S. Höller, Institute for Hydraulic Fluidmachinery, Graz University of Technology, Graz, AUSTRIA

Pumped Storage Plant under a Head of 700 m: Considerations for the Selection of Pump-Turbine and Motor-Generator
H. Götsch, TIWAG – Tiroler Wasserkraft AG, Innsbruck, AUSTRIA

Experimental and Numerical Investigation of Rotating Stall in Radial Pumps
R. Neubauer, A. Ruprecht, S. Riedelbauch, E. Göde, University of Stuttgart, IHS Institute of Fluid Mechanics and Hydraulic Machinery, Stuttgart, GERMANY

Numerical and Experimental Analysis of Instability Phenomena in Pump Turbines
Ch. Gentner, M. Sallaberger, O. Braun, Ch. Widmer, M. Bauer, Andritz Hydro Ltd., Zürich, SWITZERLAND

Improving Measurements in Power Plants Using Numerical Flow Simulation
T. Staubli, S. Hug, Hochschule Luzern, CC Fluid Mechanics & Hydro Machines, Horw, SWITZERLAND

Numerical Simulation and Refurbishment Options for a Moody Draft Tube
E. Doujak, TU Wien, Institute for Energy Systems and Thermodynamics, Vienna, AUSTRIA; J. Nicolle, Hydro-Quebec Research Center, Qc., CANADA
**SESSION 6.3 - Hydropower Environmental Management**

Location: Franz Josef room, Chair: Prof. Dr. B. Pelikan (University of Natural Resources & Life Sciences, Austria)

- **Sustainability in Hydropower Generation**
  J. Wall, A. Passer, Graz University of Technology, Institute of Technology and Testing of Building Materials, Graz, AUSTRIA

- **Lessons Learned from Net GHG Emissions from the New Eastmain 1 Reservoir (Québec, Canada)**
  A. Tremblay, Hydro-Québec Production, Montréal (Québec), CANADA; M. Demarty, Environnement Illimité, Montréal (Québec), CANADA

- **Impact of Newly Impounded Diversion Bays on Greenhouse Gas Emissions from a Young Boreal Hydroelectric Reservoir**
  M. Demarty, J. Thérien, Environnement Illimité, Montréal (Québec), CANADA; A. Tremblay, Hydro-Québec Production, Montréal (Québec), CANADA

- **Evaluation Criteria for Optimal Design Parameters of the Project with New 15 SHPPs in Same Catchment Area – Actual Case Study**
  H. Dzafo, Department for renewable energy projects implementation, JP Elektroprivreda BiH dd-Sarajevo, Sarajevo, BOSNIA and HERZEGOVINA

**05:00pm** End of Session

**05:15pm** Shuttle Bus to Vienna

**07:00pm** Evening Program

*"Heuriger" Fuhrgasl - Huber, Neustift am Walde 68, 1190 Vienna*

Evening reception at the "Heurigen" in Neustift am Walde
| 07:00pm - 12:00pm |

**Friday - 22/11/2012**

**SESSION 7.1 - Pumped Storage 5**

Location: Theatre, Chair: Dr. A. Königsberger (Andritz Hydro GmbH, Austria)

- **Benefits of Variable Speed Operation: Tehri Pumped Storage Scheme (India) – A Case Study**

- **Adjustable Speed Pumped Storage Plants – Innovation Challenges and Feedback of Experience from Recent Projects**
  T. Kunz, A. Schwery, G. Sari, ALSTOM Switzerland, Birr, SWITZERLAND

- **The Motor Generators for the Power Plant Reißeck II**
  J. Schernthanner, K. Zikulnig, VERBUND Hydro Power AG, Vienna, AUSTRIA; W. Scheidl, Andritz Hydro GmbH, Vienna, AUSTRIA; R. Kirchengast, Andritz Hydro GmbH, Weiz, AUSTRIA

- **Medium Sized Pumped Storage Applications with Full Size Converter**
  R. Schürhuber, J. Hell, A. Lechner, M. Pichler, Andritz Hydro GmbH, Vienna, AUSTRIA; Y. Vaillant, Andritz Hydro Ltd., Zürich, SWITZERLAND
09:00am  SESSION 7.2 - Design and Numerical Calculation of Hydraulic Components
Location: Marshall room, Chair: Prof. Dr.-Ing. habil. R. Schilling (TU Munich, Germany)

Rehab of Low Specific Speed Francis Turbine
U. Henggeler, J. Krenn, Ch. Gentner, Andritz Hydro Ltd., Zürich, SWITZERLAND; Ch. Angerer, Andritz Hydro GmbH, Linz, AUSTRIA; A. Züger, A. Züger, AG Kraftwerk Wägital, Siebnen, SWITZERLAND

Field Feedback from a Double-Runner Francis Turbine
J. Gale, Zel-En d.o.o., Research Centre, Krško, SLOVENIA; D. Dolenc, G. Alic, M. Kovacic, A. Bergant, S. Cizełj, Litostroj Power d.o.o., Ljubljana, SLOVENIA

Numerical Engineering for Advanced Francis Turbine Design
M. Becker, Stellba Hydro GmbH & Co KG, Herbrechtingen, GERMANY

Numerical Prediction of Sediment Erosion on Francis Turbine Components
H.P. Neopane, Department of Mechanical Engineering, Kathmandu University, NEPAL; O.G. Dahlhaug, Norwegian University of Science and Technology (NTNU), NORWAY; M. Cervantes, Luleå University of Technology (LTU), SWEDEN

10:30am  Coffee Break

11:00am  SESSION 8.1 - Pumped Storage
Location: Theatre, Chair: Prof. Dr.-Ing. C. Bauer (TU Wien, Austria)

PSP Roßhag - Two Stage Storage Pumps: Refurbishment Based on CFD and Model Test
B. Mayr, Voith Hydro Holding GmbH & Co. KG, Heidenheim, GERMANY; G. Penninger, VERBUND Hydro Power AG, Vienna, AUSTRIA; M. Geyer, Voith Hydro GmbH & Co. KG, St. Pölten, AUSTRIA

Storage Pump Koralpe: Experience with a SFC Launched, Three-Stage Storage Pump
S. Leitner, G. Berger, KELAG – Kärntner Elektrizitäts-Aktiengesellschaft, Klagenfurt, AUSTRIA

Pumped Storage Plant Limberg II – Results from Start-Up and First Operation Experience
J. Mayrhuber, J. Scherntthanner, G. Penninger, P. Stering, K. Zikulnig, VERBUND Hydro Power AG, Vienna, AUSTRIA

12:30pm  Conference Closing Session
Location: Theatre, Chair: Prof. Dr.-Ing. C. Bauer (TU Wien, Austria)

Closing Session
Christian Bauer, TU Wien, Institute for Energy Systems and Thermodynamics, Vienna, AUSTRIA

01:30pm  Conference close
01:45pm  Shuttle Bus to Vienna