HYDRO 2017

Shaping the Future of Hydropower

organised by
THE INTERNATIONAL JOURNAL ON HYDROPOWER & DAMS

will take place in Seville, Spain
9 to 11 October 2017

The stunning city of Seville in the autonomous community of Andalucia, southern Spain, will provide an ideal setting for the HYDRO 2017 International Conference and Exhibition.

Delegates will engage in discussions on all topical issues relating to hydropower, with emphasis on international collaboration: working together in project planning and implementation to shape the future of world hydropower development.

SUPPORTING ORGANIZATIONS INCLUDE:

For more information please visit: www.hydropower-dams.com
HYDRO 2017 HOST COUNTRY AND CITY

The Aqua-Media team is delighted to be bringing the annual hydropower conference back to Spain, following successful events in Barcelona (1995), Granada (2007) and Bilbao (2012).

Spain has been, and continues to be, among Europe’s leading countries for water resources development, hydropower and pumped storage. Unevenly distributed water resources, with southern areas suffering severe droughts, led the country to develop a comprehensive water management strategy and in particular a National Hydrological Plan.

The country’s history of dam construction dates back to the second century of the Christian era, with several Roman dams still in operation for water supply, such as Prosperina and Cornalvo.

Today there are 1082 large dams in operation, by ICOLD’s definition, providing a total storage capacity of 56.5 km³. About 20 per cent of the dams have hydro production as their sole purpose, and a further 12 per cent are multipurpose, with hydro production as one of the functions.

Spain’s installed hydro capacity currently stands at about 20 GW, which represents 19 per cent of the total. Among the major Spanish hydro plants are Aldeadavila (1139 MW, see photo above right) and Alcantara (915 MW). The largest of the country’s 25 pumped-storage plants is Cortes-La Muela (1720 MW). Hydro produces around 43 TWh/year, which is about 17 per cent of total production. Spain is a major developer of other renewable sources of energy, particularly wind and solar power.

The Spanish Government, principal utilities and industry warmly welcome the world hydro community to Seville, where there will be a chance to learn about Spanish past and present water resources development, and to visit some of the most important hydro and pumped-storage installations.

ARRIVING IN SEVILLE

Seville’s San Pablo airport is 10 km northeast of the city. It is served by flights connecting with at least 40 major European cities, among which are the main hubs for inter-continental travellers. The city also has excel-
**Sunday 8 October**

- From 08.30 hrs: Conference Registration opens
- 09.00 hrs: Exhibition set-up for custom stands only
- 10.45 hrs: Tour of city landmarks and monuments (including lunch)
- 14.00 hrs: Access to stands for exhibitors
- 19.00 hrs: Chairmen's Meeting followed by 19.30 hrs: Speakers' Briefing at the FIBES I Congress and Exhibition Centre
- 20.00 hrs: Welcome Reception and networking party at Melia Laberrosa hotel (transport will be provided)

**Monday 9 October**

- 08.30 hrs: Opening Plenary Session: Welcome addresses
- 09.00 hrs: Keynote addresses
- 10.45 hrs: Parallel Sessions: 1 - Risk management 2 - Cross border collaboration 3 - Hydraulic machinery: Research 4 - Civil works: design
- 12.00 hrs: Lunch
- 13.45 hrs: Parallel Sessions: 5 - Unlocking investments in private hydropower 6 - Managing GHG emissions (IEA session) 7 - Hydraulic machinery: Design & operation 8 - Civil works: Construction and materials
- 16.00 hrs: Coffee
- 17.00 hrs: Parallel Sessions: 9 - Contractual issues 10 - Climate 11 - Civil works: Upgrading
- 19.00 hrs: Coffee
- 20.00 hrs: Welcome Reception and networking party at Pabellón de la Navegación (Maritime Museum) Seville

**Tuesday 10 October**

- 08.30 hrs: Parallel Sessions: 12a - Pumped storage 13 - Hazard and risk 14 - Project planning and implementation 15 - Capacity building
- 10.45 hrs: Parallel Sessions: 12b - Pumped storage 16 - Powerplant safety 17 - Challenging sites 18 - Students and young engineers
- 12.00 hrs: Lunch
- 13.45 hrs: Parallel Sessions: 12c - Pumped storage 19 - Gates and valves 20 - Dam safety 21 - Environmental issues
- 16.00 hrs: Coffee
- 17.30 hrs: Freshenments in the Exhibition Halls (Evening free for private parties)

**Wednesday 11 October**

- 08.30 hrs: Parallel Sessions: 24 - Intakes and penstock 25 - Upgrading and refurbishment - I 26 - Small hydra: R&D 27 - Sedimentation management
- 10.45 hrs: Parallel Sessions: 28 - Energy and water services (IEA session) 29 - Upgrading and refurbishment - II 30 - Small hydro: Case studies 31 - Grid issues
- 12.00 hrs: Lunch
- 13.45 hrs: Parallel Sessions: 32 - Social issues 33 - Operation and maintenance 34 - Tunnels 35 - Electrical engineering
- 15.30 hrs: Coffee
- 17.00 hrs: Closing Plenary Session: Summary and outcomes Welcome to ASIA 2018, Danang, Vietnam and HYDRO 2018, Poland
- 19.00 hrs: Conference Dinner Hacienda San Miguel de Montelirio Co-hosted by ENDESA

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- J. Weitz, Switzerland
- C.V.J. Venma, India
- D.A. Williams, UK
- G. Zenz, Austria
- John Zenz, Austria
PRE-CONFERENCE SMALL HYDRO WORKSHOP

Design a small hydropower project in one day (Sunday 8 October)

Many factors are considered in the design and construction of the optimum hydropower project. All parts of a scheme are interrelated and interdependent. Change one component and all others are affected. This workshop, following the successful one held at ASIA 2016 in Vientiane, Laos, is aimed at people who are, or will be, involved in hydropower development as part of rural electrification programmes. It will cover run-of-river hydro projects in the ‘pico’ to ‘mini’ range: approximately 1 kW to 1 MW capacity.

As this is a diverse form of energy production, there are always areas which are unfamiliar to people, despite many individual specialisms. This workshop aims to fill in the gaps, and help people to gain a good basic grounding in the topic. All relevant aspects will be covered, from rainfall to energy evaluation, including:

• Analysis of scheme location and definition of potential catchments
• Turning rainfall into an available flow range from a catchment and development of a flow duration curve
• Power and energy generated calculation
• Intake structures, channel and/or pipeline routes and sizing
• Powerhouse design and equipment
• Turbine selection
• Generator, controls and switchgear options
• Grids, national and local

This will be a ‘hands-on’ workshop, which will involve the participants, working in groups, in developing an actual hydropower project during the day. After presentations on the individual scheme aspects, the groups will put together the components of the project. This will follow through to the completed design. Feedback from the workshop in Laos included the comment: “Extremely useful and informative – hands on approach is best!”

Sunday 8 October

Half-day excursion

As usual, on the day of arrival and registration for the conference, a local excursion has been arranged to give all participants the opportunity to see some of the most important sights in the host city, and to enjoy lunch together.

The excursion will depart mid-morning from the FIBES Congress Centre, and will begin with a walking tour of the magnificent Alcázar Royal Palace, originally developed by Moorish Muslim kings. Today the Alcázar has sections which demonstrate the architecture of four eras: Moorish (11th and 12th centuries), Gothic (13th century), Mudejar (14th century), and Renaissance (15th and 16th centuries).

There will be a chance to stroll through the peaceful patios and gardens, and to see the oldest part, Patio del Yeso, dating from Moorish times, as well as the House of Trade, within the Renaissance Palace, where Columbus signed his contact with Queen Isabella. Italianate features, such as marble arches and columns, were added in the 16th century.

At the Palace of Don Pedro I, which represents a fusion of Moorish and Christian features, there is a sunken garden, and the famous Patio de las Doncellas.

Lunch will provide an opportunity to sample the local cuisine of Andalucia.

In the afternoon, the excursion will continue with a guided tour through the streets of the St Cruz quarter. This part of town, a labyrinth of narrow streets, is the former Jewish quarter of the medieval city, and is bordered by the Jardines de Murillo, the Real Alcázar, Calle Mateos Gago, and Calle Santa María La Blanca/San José. A recommended area to see is the Barrio de San Bartolomé.

The group will return to the Congress Centre in the late afternoon, in good time for meetings taking place for chairmen and speakers.

AMl HYDROPOWER FOUNDATION

This is an independent charitable foundation, governed by an international board of trustees, set up in 2007 with the principal aim of facilitating the participation at the annual Hydro Conferences of delegates from the less developed and developing countries, and others with current economic difficulties.

Details of the application process for funding can be found on the dedicated web page, at:

www.hydropower-dams.com

Fully completed applications, with supporting references, must be received by the organizers at least 10 weeks prior to the date of the conference, to allow sufficient time for processing by the trustees.

Successful applicants will normally be granted assistance to cover the conference registration fees, and in some cases accommodation. Travel expenses will generally not be covered, although in some exceptional cases, contributions towards travel costs may be granted.

If you or your company would like to make a donation to the Foundation, you will have the opportunity to do so at the time of registration.

Co-sponsored by:

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CONFERENCE SESSIONS

Monday 9 October

Opening plenary session

Introduction to HYDRO 2017: Alison Barile, Aqua-Media International Ltd
Welcome messages from the Spanish co-hosts, and officers of the professional associations
Keynote addresses from experts in the profession

Parallel sessions

Session 1 – Risk

Chairperson – Dr. J. Plummer-Braeckman, University of Cambridge, UK
Putting sound risk management into practice: A case study – K.J. Canade, Aqua Energia LLC, USA; P.H. Parraza, ENIDE Services et Constructions, Bolivia
Have we got better at controlling time and cost overruns since 2000? – J. Plummer-Braeckman, University of Cambridge, UK; University of Cambridge, UK; K. Kirchner, Utrecht University, The Netherlands; T. Drostváth, London University, Germany
Sustainability: Financial implications for the design and operation of dams – R. Hotchkiss, Brigham Young University, USA
Special aspects of design and construction of the Sendje hydropower plant in the Republic of Equatorial Guinea – R. Malzdersky and A. Berner, Daglas Alliance Ltd, Ukraine

Session 2 – Cross border collaboration

Chairman – J-M. Devernay, Consultant, France
As transboundary lake and river basins cover nearly half of the Earth’s land surface, and account for an estimated 60 per cent of global freshwater flow, the need for countries to collaborate in the development of their hydropower potential at the regional scale to maximize water, energy and climate services is likely to grow in the future. Genuine opportunities also exist for the export of clean and cheap electricity generated by hydropower countries in areas with an untapped potential exist to energy-hungry neighbouring countries, to foster the development of more climate resilient and efficient regional electricity systems.

This new session will explore a number of success stories of hydro projects developed as a result of regional collaboration, in particular in the Himalayan region, in the Mekong basin, in Africa and in Europe. It will also highlight the specific challenges that future regional projects will face. The role of multilateral banks as potential conveners and facilitators of the dialogue between their client countries will also be discussed.

- Transboundary hydropower projects in the Gambia river basin – L. Fratini, High Commission, OMVG
- Power development in Southern Africa – T. Ydgaard and P.M. Heggli, Norconsult AS, Norway
- Improvement of the Kems river environmental project through cross-border discussions – A. Barillier and A. Garnier, EDF, France
- Regional collaboration in hydropower projects on the Mekong river – Xayapassou Phomrosouph, Department of Energy Business, MEM, Laos PDR
- South Asia: Opportunities for cross border collaboration in electricity trade – C. Rizkin, Jokr Green Power Corporation Ltd, Bhutan

Session 3 – Hydro machinery research

Chairman – Prof. F. Avellan, EPFL-LMH, Switzerland
Experimental investigation and analysis of the spread valve design on the performance of Turgo impulse turbines – A. Zobian, S. Penley and G.A. Argubs, Lancaster University, UK; D.S. Benson, Matt MacDonald Ltd, UK; A. Papageorgiou, T. Nygaard and P.M. Heggli, Norconsult AS, Norway
- A CFD approach for assessing erosion on Francis runners – J.H. Massoudi, G.A. Harman, F.A. Hajar, M. Zehab-Din and I. Maukai, National Institute of Technology Srinagar, India; A. Jameel, Shri Mata Vashno Davi University, India
- Towards extending Francis turbine operation to very deep part load: Insights gained from the European HYPERBOLE project – P. Conrod, Dr W. Meyer, M. Neidhart and A. Jung, Voith Hydro Holding GmbH & Co. KG, Germany; J. Leefdeld, Voith Digital Solutions GmbH, Germany
- State of the art in Francis turbines design – R.J. Bracke, Professor Emeritus, NTNU, Norway
- Relationship between wave propagation velocity and singular pressure variation at load rejection – S. Yamato, K. Shimokawa, S. Nakamura and M. Nakai, Voith Fuji Hydro, Japan
- High part-load fluctuations in Francis turbines and the applicability of model test data – T. Neidhardt and M. Magnoli, Voith Hydro Holding GmbH & Co. KG, Germany; J. Guerrier, Hydro-Consult Pty Ltd, Australia
- Optimal blade design and model test validation for the developments of a diagonal turbine – R. Lestriez, Wimibarrus, Spain; C. Cottin, Mhylab, Switzerland
- Detection of vortex frequency in the draft tube of a high-head pump turbine by ultrasound – R. Agne, P. Guber, S. Denzi and P. Odermatt, Lucerne University of Applied Sciences and Arts (HSUL), Switzerland

Session 4 – Civil engineering: Design

Chairman – R. Rogers, MWH, USA

Session 5 – Unlocking investments in private hydropower

Co-Chairs – L. Canale, Senior Hydropower Specialist, The World Bank; C.R. Head, Consultant, UK
Introduction to the key challenges in developing private hydropower (by the Co-Chairs)
- The Private Sector Window (PSW): or a new World Bank facility to support PPPs – H.J. Sans, World Bank
- The GETL (Finance, Engineer, Lease and Transfer) concept: A new business model to unlock private investment – M. McWilliams, Mott MacDonald, UK
- A Q&A session and panel discussion will follow. The panel of experts will offer their views on the best ways of attracting the private sector in the implementation of hydropower projects, based on some specific examples of their international experience.

Panelists will include: O. Trico (Energy Department, European Investment Bank); P. Kunert (Boulevard, UK); J. Dumas, (EDF, France); B. Guigley, (Stucky, Switzerland); and, M. McWilliams (Mott MacDonald, UK).

Key issues for discussion will include risk-sharing and mitigation; achieving a balance between commercial needs and long-term sovereign interests; equitable sharing of benefits; sustainability of long concession arrangements in changing conditions; reducing the lead time for the private investor; and alternative procurement models for the private partner.

Session 6 – GHG emissions (IEA session)

Chairman – N. Nielsen, IEA Hydro, Australia
Potential issues associated with GHG emissions from reservoirs are important to the hydropower industry, where carbon footprints are receiving increased scrutiny. The IEA Hydro Annex on ‘Managing GHG Reservoir Emissions’ is a leader in this initiative, and will launch its third Volume of Guidelines on Management, Mitigation and Modelling at the Conference. (This follows the launch of Guidelines Volume 1 on Measurement Programs and Data Analysis at HYDRO 2017 and Volume 2 covering Modelling at HYDRO 2015). The session will launch Guidelines Volume 3, and overview the Annex. Alternative methodologies to reduce emissions, where possible, and allocate them to the various users of multipurpose reservoirs, will be outlined. Presentations will then be given.

- IEA Hydro Annex XIII: Managing the carbon balance in freshwater reservoirs – Dr J. M. Damazo, CEPEL, Brazil
- Approach to the manage, mitigate and allocate GHG emissions from hydropower reservoirs – M.M. Nielsen, IEA Hydro, Australia
- Pre-impoundment GHG emissions from the China Three Gorges reservoir – Prof Li Zhao, Changing Institute of Green and Intelligent Technology Research, China
- Gross GHG emissions from the newly created Romaine 2 reservoir in Boreal Quebec, Canada – Dr A. Tombrily, Hydro-Quebec, Canada; P. del Giogio, Quebec University, Canada
- A leading practice example: Greenhouse gas monitoring at the Theun-Hinboun Hydropower Company, Nam Nongmu reservoir, Laos – Voanghaveth Inlay and J. Milgate, IHPP, Laos

A panel discussion will follow an IEA’s Guidelines for Quantitative Analysis of Net GHG Emissions from Reservoirs, Volume 3, ‘Management, Mitigation and Allocation’, led by Dr Damazo, CEPEL, Brazil.

Session 7 – Hydraulic machinery: Design and operation

Chairman – J. Gummer, Hydro-Consult Pty Ltd, Australia
Measures to improve fish survival in axial turbines – J. Michalick and S. Weissenberger, Andritz Hydro GmbH, Austria; M. Richardson, Pacific Northwest National Laboratory Richland, USA
- Design and implementation experience with oil-free Kaplan runners – S. Kröter, H. Huthdank, D. Dövel and D. Dolenc, Litostroj Power d.o.o., Slovenia
- Advantages of SAM turbines over other low or medium head small hydro turbines – A. Monteyrand, O. Teller and P. Pepin, GE Renewable Energy, France
- Investigation of regulated Darrieus turbines for tidal powerplants – Y. Kuznetsov, G. Semenov, R. Romov and I. Kuznetsov, Power Machines, LMZ, Russia
- Turbine abrasion: When a shut-down profitable – T.Y. Agrawal, Sequential Scientific, Inc, USA
- Francis technology to operate reliably from 0 to 100 per cent – J. Brammer, P.Y. Lowes, D. Fuchspach, M. Thibaud, K. Wheeler, J. Bremond and R. Guillaume, GE Renewable Energy, France
- Effect of passage modification in high-head Francis turbines – E. Tong, NTNU/EDB Medeco, Norway; P. Stori, NTNU, Norway; M. Holst, EDB Medeco, Norway
- Numerical investigation of effects of the guidevane tip clearance on the high-head Francis turbine performance quantities – G. Semenov, A. Smirnova and A. Zakharov, Power Machines, LMZ, Russia
- Composite bearing design with improved tribology and machinability for aggressive applications – M. Kim and E. Wagner, GGB Bearing Technologies, USA
- Reducing maintenance through implementation of water-lubricated turbine guide bearings: Design principles and case studies – G. Auger and G. Renn, Thordon Bearings Inc., Canada
Session 8 – Civil works: Materials and construction
Chairman – Dr M. Dunstan, M&amp;A Associates, UK

Experiences and challenges in shaft construction at the Uma Oya project, Sri Lanka – A. Rahard Farshtab and B. Alha Manali, Faro Co, Iran; P. Smit, Marti Contractors Ltd, Austria; D. Dudgeon, Malabah Ghds Consulting Engineering Co, Iran; E. Eccles Pöyry Switzerland Ltd, Switzerland.

The application of BIM 5D during the construction of the powerhouse at the Golen Gol hydropower plant in Pakistan for monitoring purpose – C. Susme, Fichtner GmbH, Germany.


Aesthetic cores: Making embankment dams truly waterfront – D. Müller, Walo International AG, Switzerland; D. Wilson, Walo UK Ltd, UK.

Session 9 – Contractual issues
Chairman – P. Roe, P.J. Roe Consulting, Canada

Why do power purchase agreements sell energy – C. Grant, Multiconsult UK Ltd, UK.


Development of Pakistan’s power potential through independent power producers (IPPs) using the example of the 1174 MW Kohala hydropower plant – Dr R. Siefel, Lahmeyr International GmbH, Germany; Zhang Jun, Kohala Hydro Company Ltd, China; Yi Lu, Changjiang Institute of Survey, Planning, Design and Research Co Ltd, China.

Critical success factors in a contract regarding the rehabilitation retrofit of an existing hydropower plant: Contractual strategies to minimize project-related risks – B. Geissler, Geissler Law, Germany.

Session 10 – Climate
Chairman – Prof A. Schleiss, EPEF-LCH, Switzerland, and President, ICOLD

World Bank guidelines on climate change and natural disasters resilience for hydropower projects – B. Trouille, Matt MacDonald, USA; K. Macpherson and M. Kent, Matt MacDonald, UK.

Integrated geohazard assessment as part of climate change resilience and disaster risk management in the hydropower sector in high mountain environments – J.M. Reynolds, Reynolds International Ltd, UK.


Assessment of potential increase of seasonal energy storage to mitigate the impact of climate change in Switzerland: Case study of the Grande Dixence dam – P. Mauro, A.J. Schleiss and D. Jujaldes, EPEF-EMA-EIC-LCH, Switzerland; B. Monney, Sticla SA, Switzerland; M. Zappa, Swiss Federal Institute for Forest, Snow and Landscape Research, Switzerland.

Perpetual supply of water: Climate change and sustainable development – G. Annandale, George W. Annandale, Inc., USA.

Session 11 – Upgrading of civil structures
Chairman – Prof L. Berga, Hon. President, ICOLD, Spain

Civil engineering: Research, development and innovation for the maintenance of water channels – A.B. Martin Vacas and A. Millán Mattern, Iberdrola Generación Hidráulica, Spain.

Underwater work at the Pant dal Gumm – E. Kauppinen, Hydro Exploitation SA, Switzerland; M. Roth, Ingineur Kraftwerke, Switzerland.

Sealing of leakage in the Prada pressure gallery, Spain – Zaw Min San, Ministry of Public, Belgium.

Underwater rehabilitation of existing hydropower plants – K. Vereide, L. Lye and O.H. Havrevoll, NTNU, Norway; W. Richtner, Graz Technical University, Austria; T. Jakobsen, SediCon, Norway.


Tuesday 10 October

Session 12(a) – Pumped storage: Lessons learned I
Co-Chairs – B. Trouille, Matt MacDonald, USA; J. Freites, EDP, Portugal


Water and air waves in very long underground pumped-storage reservoirs – E. Pummer, Aachen University, Germany.

Challenges during the pump-turbine rehabilitation of Bolivarque II – C. Widmer, Andritz Hydro AG, Austria; A. Cabrer, Andritz Hydro AG, Austria; J.I. Alonso, Andritz Hydro SL, Spain.


Design and implementation of the Solamaande II hydroelectric project – P. Santos, L. Gamasó and H. Fangueiro, COBA Engineering and Environmental Consultants, Portugal; J. Sousa Costa, EDP, Gestão de Produção de Energia, SA, Portugal.


Session 12(b) – Pumped storage: Lessons learned II
Co-Chairs – B. Trouille, Matt MacDonald, USA; and M. Ordóñez Fernández, ENDESA, Spain

Inguia pumped-storage scheme: Project lessons learnt during the design, procurement and construction – C. Logun, and N. Okwoma, Gibb Pty Ltd, South Africa.

Increasing the safety of the hydraulic structures at the Dreisbich pumped-storage plant using an automated monitoring system – V. Hryshko, Hydrotechproject Ltd, Ukraine.

Investigation of the special behaviour of delayed load rejections on a 3 x 150 MW pumped-storage plant – J. Junginger, Dr A. Ruprecht and Prof. S. Riede, University of Stuttgart, Germany; S. Kohl, AF-Consult Switzerland Ltd, Switzerland; S. Vogel, Nost de Drance SA, Switzerland.

Integration of the Reiffelk II pumped-storage plant into the operation of the Malta power system, Austria – J. Mayrhuber, Verbund Hydro Power GmbH, Austria.

Session 12(c) – Pumped storage: New storage concepts
Co-Chairs – B. Trouille, Matt MacDonald, USA; E. Solo Álvarez, Iberdrola, Spain

The role of pumped storage in improving the integration of generation from renewable sources: The case of Germany – F.K. Tedla and I. Gilles, AECOM, UK; Prof. S. Wielprecht, University of Stuttgart, Germany.

Investigation of unsteady phenomena in high-head-stage pumped-turbines for heads of up to 800 m – R. S. Akulaev, A. V. Abushik, A. D. Zubov, I. L. Kuznetsov and V.M. Salemnik, Power Machines LM2, Russia.


Hybrid and symbiotic solutions for a combination of intermittent RES with storage and pumped storage plants – Dr K. Krueger and Dr C. Munde, Völta Hydrowald GmbH & Co, KG, Germany; Prof. A. Slocum, MIT Cambridge, USA.

Calculation of the power loss and compensation in shared tunnels for a pumped-storage plant with variable speed pumps – Jinhong Kong and H.I. Skyldrepid, Sentel Energy Research, Norway; H. Abgottopou, Aspo Trading AG, Switzerland.


Session 12(d) – Pumped storage: Potential, plans and case studies
Co-Chairs – B. Trouille, Matt MacDonald, USA; J. Baxton Moreno

Gas Natural Fenosa, Spain

Is there a case for new pumped storage in the UK? – T. D.J. Pendrey, Matt MacDonald, UK; B. Trouille, Matt MacDonald, USA.

Successful energy transition in Germany: The contribution of increased pumped storage – K. Krueger, Völta Hydrowald GmbH & Co KG, Germany; A. Mayer, Aachen University, Germany.

Site selection and feasibility study for a pumped-storage plant in Uruguay – J. Baxton Moreno and P. Baxton Moreno, Gas Natural Fenosa, Spain.


Enhancing power generation at the 7 Forks cascade with a pumped-storage scheme – J.A. Swabu and T.M. Bakashka, Kenya Electricity Generating Co Ltd, Kenya.
Session 13 – Natural hazard and risk

Co-Chairs – Prof J. Reynolds, Reynolds International Ltd, UK; and P. Pradhan, Batval Power Company, Nepal

Risk assessment for dams of different types and purposes in OECD and non-OECD countries with a focus on time trend analysis – A. Kalimina, T. Socco, M. Spada and P. Burgherr, Paul Scherrer Institut, Switzerland

Lake Sarez could unravel southern Tajikistan’s hydro potential – A. Palmeri, Consultant, Italy; P. Droz, Stucky SA, Switzerland

Discovery of a hidden and completely dry-filled syn-glacial valley with severe impact on a hydro power project in the foothills of the Central Swiss Alps – T. Dürler, Pierry Switzerland Ltd, Switzerland

Modelling inflow to hydro power reservoirs in sub-arctic, glaciated watersheds with complex terrain and volcanic surface geology – S.O. Palmstrøm, H. Sigurjonsson, A. Gudmundsson and E.M. Myer, Vatnaskil Consulting Engineers, Iceland

Perception analysis of public awareness and preparedness in preparing early warnings for dam safety: A case study in the Cameroon Highlands – S. Muda Rahsidi, TNB Research Sdn. Bhd, Malaysia; I. Tikumain, M.R.R. Hussian and I. Zen, International Islamic University, Malaysia

Session 14 – Project planning and implementation

Chairman – H.I. Aker, Dolsar Engineering, Turkey

The complex management of the waters of the Nubia river in Chile – R. Basso and F. Cevallos, Lombardi Eng. Ltd, Switzerland; S. Bonanni and P. Buonanno, Astaldi SpA, Italy

Serial hydro power development plan on Nyirongo river basin: The Namolang hydro power project – W. Htn, Ministry of Electriciti and Energy, Myanmar

Harnessing hydro power for SCORCE: A success story of Murum hydroelectric plant – J.A. Janggo, M. Hussian and P. Wong, Sarawak Energy Berhad, Malaysia

Nachtigal: A 420 MW hydro project dedicated to Cameroon’s national grid – O. Flamand, Nachtigal Hydro Power Company, Cameroon; R. Baudoet, D. Magnan, and P. Grillo, EDF National Hydro Engineering Center, France

Management of the early impounding of Gibe III dam in Ethiopia – P. de Barmon and M. L’Hostis, Tractebel Engie, France; S. Amedo, ELC Electroconsult, Italy; A. Anzak, EDF, Ethiopia

Lúcia hydro power project, Angola: Impounding and commissioning – J. Horn, Lahmyer International GmbH, Germany; E.D. Estévão, GABEC – Gabinete de Aproveitamento do Médio Lake Sarez, Angola

The role of BIM during the tender phase of a powerhouse structural design: A practical case – R. Ando, C. Ferrerria, C.M. de Lima, A. Alexandre, F. Marques and L.M.C. Gaspar, EDF, Gestão da Produção de Energia, SA, Portugal

Session 15 – Capacity building

Co-Chairs – M. de Vivo, Secretary-General, ICOLD; and A. Nome, Hon President, ICOLD, Burkina Faso

Training on dam safety, operation and maintenance: Some practical thoughts – M.G. de Membrilla Ortuñio and O. Perez Arroyo, Oftec, Portugal

Working against capacity building and training: We are getting it wrong – Dr. A. Hughes, Atkins, UK

Capacity building for hydro plants: Perspective for Sarawak Energy’s operational excellence – H.M. Pershi and M. Hussian, Sarawak Energy Berhad, Malaysia

Dam Engineers in Indonesia – T. Hartanto and A.P. Wahyudi, Ministry of Public Works and Housing, Republic of Indonesia

Session 16 – Hydro plant safety

Chairman – O. Westberg, Sivilingenior Ole A. Westergard AS, Norway

Cyber-security in hydro plants: Implementation at a 1 GW pumped-storage scheme – W. Voigt and R. Buerer, Lahmyer International GmbH, Germany; J. Menting, Laboratory, Belgium

New hydroelectric control centre: Integrating the past, preparing for the future – L. Pertierra and R.A. Soares de la Puentte, Gas Natural Fenosa Generacion, Spain

Surge tank design in Austria: Dimensioning philosophy for flexible hydropower – W. Richter, H. Koonhaub and G. Zenz, Graz University of Technology, Austria

Safety and reliability of hydraulic structures during the construction of the Kakhovka 2 hydro plant – A. Zhakun, Ukrhydroproject PJSC, Ukraine

Hydro plant security: Transient flow simulation associated with records of transient sensors – J-L. Koeny, Optydro Concept, France

A risk-based programme to improve public safety downstream of powerplants – C. Todee, Group R, Switzerland; and B. Gehani and R. Lecerf, Grand, France

Session 17 – Challenging sites

Chairman – L. Mouvet, Hydro Operation International, Switzerland

Challenges faced during the construction of a 38 m-diameter surge shaft in Himalayan geology at Rampur – R.N. Monga, M.K. Sharma and B. Sharma, SVINA, India

Underwater heightening of the intake at the Gres-dam – A. Kaufmann and Y. Decalliet, Hydro Exploitation SA, Switzerland

Implementation of the dam complex at Upper Atbara, Sudan, in challenging site conditions – E. Zollner and Y. Schmid, Lahmyer International GmbH, Germany; M. Mushar, Dams Implementation Unit (DIN), Sudan

The renaissance of the Banja hydropower project – X. Lorrain, F. Ferranti and Y. Felix, Tractebel Engie, France

Session 18 – Planning for the next generation of hydro experts

Co-Chairs – Dr A. Hughes, Atkins, UK; and J. Palmijn, SPANCOLD, Spain

Part One – International hydro experiences of students and young engineers

In addition to supporting and supervising Bachelor and Master Theses, the initiative ‘Multiconsult for Students’ (MCS) aims to recruit talented and committed students to bring new knowledge to the company.

Every summer, Multiconsult’s Department of Renewable Energy engage three to four students for the Must Renewable Energy International Hydropower summer program. The students form a multidisciplinary team set to working on a project for an actual client.

The Must team is formed by four highly qualified students with backgrounds ranging from civil engineering to industrial economics and technology management, all with a keen interest in renewable energy.

The project is a pre-feasibility study for the potential of a cascade of small-scale hydropower plants downstream of the existing Kikuletw a hydro power station on the Kikuletw a river, northeast Tanzania. The clients are the Danish investors Frontier Energy and Arusha Technical College. Northeast Tanzania suffers from a major energy deficit, with large distances to the areas with power production. As a result of the large distances, technical power losses are significant. The power produced by a cascade of small hydropower plants will constitute a small, but valuable contribution towards reducing the critical energy deficit in this region of Tanzania.

The students will present their analysis of economic, financial, social, environmental and technical aspects of the cascade scheme.

Part two – Panel discussion from mentors and employers

A panel discussion with contributions by senior representatives from organizations including Atkins Global, SPANCOLD, and Multiconsult will explore the approaches and challenges of attracting, training and retaining young engineers in the workforce.

Session 19 – Gates and valves

Chairman – P. Erbisti, Consultant, Brazil

Options for improving the safety of spillway gates – B. Layland, Consultant, New Zealand

Head gate commissioning: A stressless method to confirm flow cutoff capability – P. Grillo and S. Janati, EDF-CEH, France


Enhancement of the operating system for the spillway gate at Victoria dam, Sri Lanka – W.M.M.S. Wansigsekara, Mahaweli Authority, Sri Lanka

Innovative approach for the main inlet valve design at the Reissmek II pumped-storage plant – A. Antzuk, TB Hydro Sp Z o.o., Poland

Session 20 – Dam safety

Chairman – Dr H. Kreuzer, Consultant, Switzerland

Assessing the security of the All-to-Loireau pre-stressed concrete dam using quantitative risk assessment techniques – P. Masen, MWH UK Ltd, UK; S.J. King, SPC plc, Engineering Centre, UK; A.C. Morrison, CH2M Hill, UK

Two main risks that are often overlooked – F. Lampaereira, Hydrocoop, France; M. Ho Ta Khanh, CBFR, France

The use of IS&G data to monitor slope stability: The case of Camelles hydropower dam, Spain – J. Raveitgen, A. Candela, B. Salva and J.M. Garcia, TRE-Alhama, Spain; M. Chacín and E.J. Conesa Rabin and J. Segarra, Endesa Generacion, SA, Spain; J.M. Garcia, IIC Ingeniería e Instrumentación, S.L., Spain

Evaluation of dam performance under seismic loads with linear time history analysis: Case study of Grand Ethiopian Renaissance RCC main dam – M. Assietta, A. Bezzi, C. Fontana and A. Fiorani, Studio Mascalzi, Italy

Seismic optimization of concrete gravity dams using isolation layers – M. Parzani Khiali and A. Ghaedrahmati, University of Mahagheh Ardabil, Iran

Session 21 – Environment
Chairman – Prof M. Aufleger, University of Innsbruck, Austria

Environmental monitoring of hydroelectric reservoirs to predict the behaviour of water quality parameters – J. Agis Iglesias, J.A. Soto Varela and D.C.G. González, Gas Natural Fenosa, Spain

Flood risk management at Scottish Power Galloway Hydros – S. Farns, Scottish Power, UK

Methods to assess environmental flow for sustainable power generation: Case study of the Yeywa hydro plant, Myanmar – Min Khai Hang, Ministry of Electricity and Energy, Myanmar

Synergizing hydropower development with wildlife management in Uganda: Case of the Karuma hydro project – J. Asiimwe, A. Byaruhanga Musoke, H. Muhikanga and G. Moses, Uganda Electricity Generation Co Ltd, Uganda

Investment prioritization in hydraulic infrastructures to ensure sustainability – F. Pardo-Bosch, ESABDE Business School, Spain; A. Blanco, Smart Engineering SL, Spain; A. Aguado, Universitat Politècnica de Catalunya, Spain

Importance of environmental and socio-economic aspects during the simultaneous construction of three dams – S. Hoya White and J.J. Dupama Goméz, Iberdrola, Spain

Session 22 – Spillways and penstocks
Chairman – Prof M. Mason, MWH, UK

Rositas dam, Bolivia: Design of the surface spillway – M. Pereira, Ende Corporacion Bolivia; J. Ortes, B. Arau and L. Bisio, Eptisa Consulting, Spain; C. Granell and A. Duge, Jesus Granell Ing Consultores, Spain; J.J. Rebollo and D. Lopez, Codex Hydraulique, Laboratory, Spain

Spillway problems on some elderly structures: Often on the bits that have been repaired – Dr A. Hughes, Atkins, UK

Corrective measures to guarantee the stability of the stilling basins and downstream rockfill in the Cestona-Levye dam – J. Fernandez, C. Lima, J. dos Silva and M. Duarte, EDG Gestao da Produção de Energia, Portugal; L. Caldeira and J. Mola, LNEC National Laboratory for Civil Engineering, Portugal

Emergency spillway for the Mt Coffee hydropower plant in Liberia – M. Stangl and A. Trilkovic, Fichtner GmbH & Co KG, Germany; W. Hakim, Manitoba Hydro International Canada

Plunge pool physical hydraulic models: Challenges and cases study – G. Barso, J-C. Girad, F. Ferranti, Y. Oukid and A. Lara, Tractebel Engin, France

Session 23 – Fish protection
Chairman – M. Reeder, CK Power Public Company Ltd, Thailand

Fish protection using electrified flexible fish fences – B. Brinkmeier, M. Aufleger and H. Böttcher, University of Innsbruck, Austria

State-of-the-art fish pass facilities enhance sustainability at Xayaburi, Laos – C. Andrade, M. Pasbani Khavi and F. Paro-Bosch, ESABDE Business School, Spain

Spillway attraction flows and the upstream migration facility for additional energy generation at the Xayaburi hydros plant – Dr M. Rosaler, M. Ausklin/Kajarna and P. Mathomai, CK Power Public Company Ltd, Thailand

Innovative facilities for fish migration restoration: Case study of the Schiffahrtskanal-run-of-river plant on the Aare river, Switzerland – M. Müller, M. Mende, Y. Keller and P. Billeter, IUB Engineering Ltd, Switzerland; W. Bürsich, IBI Industrielle Betriebe Interlaken, Switzerland

Wednesday 11 October

Session 24 – Intakes and penstocks
Chairman – B. Leyland, Consultant, New Zealand


Estimation of diversion headloss at hydropower surface intakes – D. Sanchez, Hatch Ltd, Canada

Innovative and environmentally friendly penstocks and intakes for the Inchoknib small hydro scheme, New Zealand – D. Mackay, Inchokinb Hydro, New Zealand; P. Press, Mechanical Engineer, New Zealand; B. Leyland, Consultant, Engineering New Zealand

Installation of sensors inside a penstock for use of the pressure/time method – P. Ševcik, OSC a.s.; R. Rop, G. Rolandse, EDG/DIG, France; F. Noces, Necco – Works at heights, s.r.o, Czech Republic

PU foam in buried penstocks – N. Johnson and S.L. Anker and L. Litw, SINTEF, Norway; M. Kullberg, Multiconsult ASA, Norway; G. Harris, Penstock BV The Netherlands; T.O. Svanesen, Statkraft Energi AS, Norway

Realization of steel penstocks with banded pipe technology for high head hydropower and pumped-storage plants – Dr C. Curris, Consultant, Switzerland; D. Branzetti and S. Calvo, Lombardi Engineering Ltd, Switzerland

Design and construction of the penstock at Chancay adjusted to unfavourable geotechnical and morphological conditions – B. Zdravkovic, Sinersa, Peru; B. Petrov, Colpex Project SA, Peru

Estimating technical conditions and the residual life of metal shell penstocks – Yu. V. Shevchenko, K.I. Vashchenko and S.M. Levina, JSC Vodoneem VNII, Russia

Session 25 – Upgrading and refurbishment I
Co-Chairs – W. Hakim, Manitoba Hydro International, Canada; H. Obermoser, AF Consult, Switzerland

Rehabilitation of the Pulgrí hydro plant in Haiti – V. Brast and T. Turk, Fichtner GmbH & Co KG, Germany; L. Racine, Electricité d’Haiti, Republic of Haiti

Turbine upgrade at Theun-Hinboun: Increasing capacity and efficiency – T. Bylund, K-T. Fjardvold and E. Mercando, THPF, Laos

The challenges of a rehabilitation project: Experience from the commissioning of the Mount Coffee generating units, Liberia – K. Gjøvik, Multiconsult UK Ltd, UK; O. Skunk, B. Barvesen, and B. T. Brunes, Multiconsult, Norway

Reconstruction of the Zokura hydro plant with a capacity increase, and with continuous powerplant operation – J. Martinac, Projektbroen Split, Croatia; M. Djumovski and I. Marozić, HEP – Production, Croatia

Session 26 – Small hydro technology
Co-Chairs – Prof D. Williams and G. Black, Learning Hydro, UK

A small hydro plant with highly variable flow in a drinking water supply system: A case study – A. Samulini, A. Spagnoli and D. Pilato, Tamanini Hydro S.r.l., Italy; G. Cavazzoni, University of Padova, Italy

Flapping fails as efficient hydrikinetic turbines: First steps of CD modelling – L. Duarte, N. Dellingers, G. Dellingers, A. Terous and A. Ghenaim, INSIA, France

Understanding why hydropower plants in general and small hydropower plants in particular often fail to deliver the expected power production – G-H. Kipselous, Multiconsult ASA, Norway;

A. Bjork, Blåfjäll AS, Norway; A. Dop-Lyenn, Aquila Capital, Norway

Experimental investigation of the factors affecting Archimedes screw generator power output – S. Simmons, K. Songin and W. Lubitz, Guelph University, Canada

Pressure relief and energy dissipation systems installed at the Sam Miguel small hydro plant – C-E. Ramirez Gonzalez and E.J. Arbeleche Montoya, HNW Ingenieros, Colombia; R. Aguere, M. Kondo and C. Aguere Telleria, Yoith Hydro S.L., Spain

Renovation of a small bulb turbine – J-L. Koony, Opytero Concept, France

Session 27 – Sedimentation management
Co-Chairs – Dr G. Amundade, Consultant, USA; and S. Alam, Consultant, France

Successful sediment management at the Jirau run-of-river project on the Rio Madeira, Brazil: Transporting 500 000 × 10^6 tonnes/year of sediment – S. Alam, Independent Consultant, France; O. Casasalit and P.E. Laisel, Artelia Eau et Environnement, France; C. da Silva Souto and P. Trindade, Energia Sustentável do Brasil; and, A.L.E. Abreu Jorge, EISA Consultants, Brazil

Challenges of sediment in hydropower plants in Bhutan: Sediment study from 2011 to 2016 – U. Rinzin, Druk Green Power Corporation, Bhutan

Fine sediment routing in a cascade of alpine reservoirs; Influence of the inlet angle on settling of fine sediments – S. Guerino-Leudin, F. Marso and A.J. Schleiss, EPFL, Switzerland

Contribution to sediment management at the Drin river hydropower cascade, Albania – M. Efthymiou, P. Schafé, H. Hildebrand and S. Pail, Fichtner GmbH & Co KG, Germany; F. Bondo, Albanian Power Corporation, Albania

Mapping of sediment-related costs at eight hydro plants in operation – H. Navik, Multiconsult, Norway; S. Stoksæter, Statkraft AS, Norway; H. Ståle, Sediment Systems, Norway

Sediment challenges at the Cheves hydro plant, Peru – A. Luvall, Moreconsult AS, Norway

Sediment transport through the power waterway and hydro-abrasive erosion on turbines – D. Felix, I. Alvary and R.M. Boer, VWH, ETH Zurich, Switzerland; A. Albygstrup, HSLU

Session 28 – Valuing hydropower services (IEA session)
Chairman – A. Beckitt, Hydro Tasmania, Australia

Multipurpose hydropower schemes provide significant benefits both to the electricity network and to other users of the water resource. However, this broad range of services have generally not been explicitly valued, nor reimbursed by the beneficiaries. With the penetration of variable renewables increasing in many jurisdictions, hydropower is becoming an important provider of balancing services. Similarly, there is increasing awareness and take-up of the water management services that multipurpose reservoirs provide. The session will start with the launch of the IEA Hydro Summary Report on Valuing Hydropower Services, followed by an overview of the Annex. The work programme covered the energy and water management services provided by hydropower and enhanced the understanding of their economic values and costs, with appropriate methodologies to estimate their value.

Valuing energy and water management services – N.M. Niessen, IEA Hydro, Australia

The role of pumped-storage in providing energy services in the western USA – V. Kuritaov, Argonne National Laboratory, USA
Conference Sessions

Session 29 – Upgrading and refurbishment II
Co-Chairs – Prof L. Lise, NTNU, Norway; F. Coelho da Rocha e Silva, Senior Advisor for REN (Portugal), Mozambique

- How a combination of hydro expertise, condition monitoring, and digital technology provides more flexible hydro turbines — V. Bouillot, P.Y. Louys, A. Andre and P. Papiot, GE Renewable Energy, France
- Taroej power station generating unit refurbishment: Challenges derived from diagonal flow turbine guidevane design — V. Sanchez, Iberdrola Generacion, Spain
- Technical challenges of refurbishment and upgrading of two bulb units — M. Hrovat and D. Dolenc, Litostroj d.o.o., Slovenia
- Thermodynamic efficiency tests to improve upgrading projects — E.P. Brand, Sweco Norge AS, Norway
- Refurbishment of a Kaplan turbine with new optimized blades, oil-less Kaplan hub and new lubrication and regulation systems — E.S. Recondo and L.L. Angos, ENDESA Generacion, Spain; R.T. Martinez and J.R. Infanzón, Valtia Hydro SL, Spain

Session 30 – Small hydro: national case studies
Co-Chairs – Prof B. Pelikan, University of Natural Resources and Applied Life Sciences, Austria; V. Denis, Milhyab, Switzerland

- Rehabilitation of the Thumphu mini hydro plant in Bhutan — P. Wannakarn, EGAT, Thailand
- Current small and mini hydro development in Sarawak — J.B.C.T. Assen, M. Hussain, H.E. Young, T. Kamarov Soak, J. Jentry and J. Blandis, Sarawak Energy Berhad, Malaysia
- Small hydro power development for local communities — M. Kashiwayagai, Electric Power Development Co Ltd, (J Power), Japan; T. Miyamaga, Central Research Institute of Electric Power Industry (CRIEPI), Japan
- Small hydro installations in Albania: A benchmark case study — F. Tartaro, S. Ierodia and M. Sebastiani, Hydro Energia, Italy
- Hydropower potential study in the water supply and wastewater collection networks in Tbilisi, Georgia — D. Kikmaridze and B. Guigar, Steky Ltd, Switzerland; G. Macharadze, Steky Gazeus Ltd, Georgia; G. Akhvlediani and T. Kardadze, and Z. Machkhlomov, Georgian Water & Power Ltd, Georgia; M. Ruscic and M. Goetschi, Steky Ltd, Switzerland
- Expansion of micro hydra: A key component towards energy transition — H. Terry and F. Rieder, Turbiwat, France

Session 31 – Grid issues
Chairman – Ø. Johansen, Ministry of Petroleum and Energy, Norway

- Benchmarking of hydroelectric generator compliance for the European network code on requirements for grid connection — P. Farin Montero, Iberdrola, Spain; L. Rouco Rodriguez, Universidad Pontificia Comillas, Spain
- Integration of battery storage systems in hydroelectric plants for supplying primary frequency control — F. Patrizi and M. Pettina, S.T.E. Energy SpA, Italy
- Governor retrofit improves grid stability on an isolated microgrid in Western Africa — R. Clarke-Johnson, American Governor Company, USA
- Co-existence of inlaid and parallel operation mode in 2 MW small hydro plant to supply electricity to rural villages: Problems and optimization of the design — L. Papetti and D. Cazzago, Studio Frosio S.r.l., Italy; G. Marchioretto, Zeco Srl, Italy

Session 32 – Social aspects
Co-Chairs – Dr S. Sparks, Statkraft, Norway; L. Nielsen, IREA Hydro, Australia

- Long-term planning for social mitigation — Dr S. Sparks, Statkraft AS, Norway
- Special fish and canoe facility to reduce social and environmental impacts at the Mariposaul hydropower plant — M. Valada, Voltalia SA, France; G. Le Maux, Voltalia Guyane, French Guiana; V. Lemay, Hydrodanladyum, France
- Livelihood restoration planning for sand mining workers: Practical insights from the Nachtigal hydropower project, Cameroon — C. Gouyou and G. Prudent-Richard, Artelia Eau & Environnement, France; F. Nathan, EDF-CIF, France
- The Mt. Coffee rehabilitation project, Liberia: Unique approaches and lessons learned on social safeguards — K. Stroup, Manitoba Hydro International, Canada; B. Lammens, Calypso GmbH, Germany
- Lessons learned from the Murum resettlement and livelihood restoration programme, Malaysia — J. Abdullah, J. Chia Yan Tan, A.A. Kifan, B. Surang and Z.E. Hillson, Sarawak Energy Berhad, Malaysia

Session 33 – Operation and maintenance
Chairman – D. Paschini, EDF, France

- Implementation of a monitoring platform at Endesa — F.J. Conesa Baños and M. Chacon Caso, Enel, Italy; S. Hoppa and L.A. Sober, Oilfé, Spain
- Aloea: A system for surveillance and safety of hydraulic structures — P.-H. Fauré and F. Zons, CNR, France; V. Morisseau, Siseno Digital, France; V. Ghiorzyck and V. Digezuels, Société Hydroélectrique du Midi, France
- The use of modern mathematical tools and OPC technology for monitoring and maintenance of — A. Picone et al. — D. Kranjac and M. Reznik, MeNEM—Drava River Power Company, Slovenia
- Mitigation of algae growth in hydropower canals using a novel overlay mortar with biocide activity — I. Segura, Smart Engineering Ltd, Spain; F.J. Conesa, Endesa Generacion SA, Spain; M.A. Calvo, Barcelona University, Spain; A. Agudo, University of Catalonia, Spain
- Modelling the virtual age of hydropower assets based on inspection, maintenance and replacement actions — B. Galaz, A. Jordan and M. Genoud, Hydro Exploitation, Switzerland; B. Valery, Alpiq Suisse, Switzerland
- Correlation between vibrations and acoustic emissions at a hydropower plant — J.M. Nista Diaz and Dr F. Fleming, Valtia Digital Solutions GmbH, Germany; Dr K. Engels and K. Kunkel, Uniper Kraftwerke GmbH, Germany

Session 34 – Tunnels
Chairman – Dr Y. Thanopoulos, Consultant, Greece

- Hard rock tunnelling solutions for hydropower projects — P. Schmaeh and Dr M. Peters, Herrenknecht AG, Germany
- Development of a portable communication solution for tunnels inspection — A. Quadrrelli and F. Ferrari, Enel Green Power SpA, Italy
- Geomembranes to increase safety and decrease head loss in pressure tunnels and shafts — A. Scovone and G. Vassallo, M. Scovone, Cartal Tech, Switzerland
- Design review of the tunnel for the Miquielas EPC hydropower project — P. Peraza and C. Carvall, ENDES Y Construcciones, Bolivia
- Construction challenges encountered in the headrace tunnel at the Dagachhu project, Bhutan — L.M. Dhungay and B.N. Pradhan, Druk Green Power Corporation Ltd, Bhutan; T. Dorji, Bhutan Hydropower Services Ltd, Bhutan
- Considering first world alternatives in augmenting the supply of Muthaha dam, South Africa — M. Wainstein and H.E. Tluczek, Gabb, South Africa

Session 35 – Electrical engineering
Co-Chairs – R. Bucher, Lhmeyer International, Germany; Prof J.J. Simond, EPFL, Switzerland

- Machine-learning technique applied to condition-based monitoring of hydro plants — A. Bagioli, ABB SpA, Italy
- RIPASE: An innovative automation platform for powerplants — C. Mann, Andritz Hydro, Austria
- Required inertia in hydro generators: Design and solutions — J.R. Argos, O&I Argos, Gamesa Electric SAU, Spain
- Optimized cooling of the refurbished hydro generators at Tierfeild: Challenges with cooling the generators at higher power output — H. Baumeister, S. Baumeister and P. Toonnie, GE Renewable Energy, France
- Improving energy efficiency at hydro and pumped-storage plants by decreasing the electric power consumption for auxiliaries — S. Ivanov and K. Fanina, Ukrhydroproject PSJSC, Ukraine
- Upgrading and refurbishment of the generators at the Bingo hydropower plant: Achieving an increased output of 48 per cent — Z. Milojkovic, V. Paljic and M. Bracic, Koncar Generators and Motors Inc, Croatia
- Digital substation 2.0: Overview on reference installations up to 400 kV and how to familiarize with the technology — R. Bucher and A. Schneider, Lhmeyer International GmbH, Germany
- Commissioning and grid operation of the Mt Coffee generators on the small Monrovia grid — M. Parmeshwaran, Multiconsult, Norway

Closing plenary sessions

Session outcomes, presented by some of the Chairpersons
- Welcome to ASIA 2018 in Vietnam, and to HYDRO 2018 in Poland.
As usual a full cultural and social programme is being arranged for HYDRO 2017 participants. On the evening of Sunday 8 October, there will be a reception for chairpersons and those presenting papers, beside the pool of the Melia Lebreros hotel.

The HYDRO 2017 Welcome Reception, on the evening of Monday 9 October, is planned to take place at the Pabellón de la Navegación (Maritime Museum), housed in an impressive riverside building which was originally designed for the World Expo of 1992.

The entrance hall features a display of 14,000 LEDs, which simulate rolling ocean waves. Exhibits include scale models of ships, from the legendary Santa Maria of Columbus, to modern 20th/21st century vessels. A buffet supper will be served, and this will be a chance to relax with friends from the international hydropower community.

On Tuesday 10 October, the exhibition hall will have extended opening hours, and a networking party will be held around the exhibition stands.

A buffet supper will be served, and this will be a chance to relax with friends from the international hydropower community.

The HYDRO 2017 Farewell Gala Dinner, with musical entertainment, will be held on the evening of Wednesday 11 October, at the elegant Hacienda San Miguel de Montelirio, a short drive from the city.

From the Calle Betis, beside the river, there are fine views across to many of the key sights of Seville, such as the Torre del Oro (Golden Tower) and the Giralda. After lunch there will be a visit to Seville’s charming Flamenco Museum, housed in an 18th century building, which also incorporates a small theatre. The visit will provide an insight into the history of Flamenco, and the group will learn how students today are taught about the rhythm of the dance, as well as how to perform the elaborate and expressive hand movements which are characteristic of Flamenco dancing.

The Hacienda is surrounded by lush vegetation and elegant patios. Its large olive grove has been called the ‘Hospice of the Indies’, from the time when the building was the residence of an Order of Jesuits. Today the Hacienda houses a unique collection of antique carriages, which can be viewed on arrival, before the aperitif and supper.

Monday 9 October

The day will begin with a tour of the Roman ruins at Italica, about 9 km north of Seville. Italica was the birthplace of three emperors, and one of the earliest Roman settlements in Spain, founded in 206 BC. It rose to military importance in the 2nd and 3rd centuries AD. Throughout the Middle Ages, the ruins were used as a source of stone for Seville, but some remarkable mosaics, and the amphitheatre, have survived.

There will then be a visit to Seville cathedral (Catedral de Santa Maria de la Sede), which is the largest gothic cathedral in the world. It is registered as a UNESCO World Heritage Site.

After lunch together in a local restaurant, the group will have a walking tour of the spectacular Plaza de Espana, built for the Ibero-American Exhibition of 1929, and the surrounding Maria Luisa Park, beside the Guadalquivir river.

The group will travel by coach to the beautiful city of Jerez de la Frontera, in the province of Cadiz, which is famous for its sherry and its horses. Jerez dates back to Moorish times and has a charming old town, with palm lined squares. The 11th century Moorish fortress (Alcazaba), has been partly restored. Of special interest is the church, originally built as a mosque.

There will be a sherry tasting at a picturesque bodega, lunch, and the day will also include an equestrian show at one of the town’s famous riding schools.

The third day will start with a guided walking tour of the Triana region of Seville, on the west bank of the Guadalquivir river, which is considered to have its own identity.

Visits will include Santa Ana Church, and the Arenal quarter. Triana is particularly famous for its ceramics. Almost any tile which can be seen in Seville’s churches, hotels and bars, as well as Plaza de Espana, will have been made in Triana. The group will have a chance to participate in a ceramics workshop, and to learn about the techniques involved in this local craft.

Wednesday 11 October
POST-CONFERENCE STUDY TOURS

Three post-conference study tours have been arranged, to give participants the opportunity to visit multipurpose dams, hydro stations and pumped-storage plants in either Andalucia, Spain, or in neighbouring Portugal.

Some final details are subject to confirmation, and full itineraries, as well as tour prices, will be announced shortly.

**TOUR A (One day) SOLD OUT**

**GUILLENA PUMPED STORAGE, SEVILLE**

This tour will visit the Guillena pumped-storage plant, on the River Huelva, a 30 minute drive from Seville. Owned and operated by ENDESA, Guillena has a capacity of 210 MW from three reversible Francis units, making it the second largest capacity hydro plant in Andalucia.

There will be a guided tour of the plant, followed by lunch in a local restaurant. Tour A participants will return to Seville after lunch.

**TOUR B (Three days)**

**THE ‘GOLDEN TRIANGLE’ OF ANDALUCIA**

**Day One**

The tour will begin with the trip to the Guillena pumped-storage plant, as described above.

After lunch, Tour B will continue to La Minilla gravity dam, also on the river Huelva, in the municipality of El Garrobo (41 km from Seville). The 61.5 m-high dam, with a crest length of 257 m, is owned and operated by the Confederacion Hidrografica del Guadalquivir.

The group will travel on to the Cordoba for dinner and an overnight stay. Cordoba, on the River Guadalquivir, was an important Roman city and a major Islamic centre in the Middle Ages. It is best known for La Mezquita, a large mosque dating from 784 AD, featuring Byzantine mosaics. The city is a UNESCO World Heritage Site.

**Day Two**

After breakfast the group will depart for the Iznájar multipurpose gravity dam, which has a 79 MW hydro plant, as well as providing for irrigation and flood control, and, Tajo de la Encantada dam, which has recently been upgraded. It is part of a 360 MW pumped-storage plant.

In the late afternoon the tour will proceed to Granada, a stunning city in the foothills of the Sierra Nevada mountains, for dinner and an overnight stay.

**Day Three**

After breakfast the group will travel by coach to the Malaga area, for visits to: the 101 m-high Iznájar multipurpose gravity dam, which has a 79 MW hydro plant, as well as providing for irrigation and flood control, and, Tajo de la Encantada dam, which has recently been upgraded. It is part of a 360 MW pumped-storage plant.

In the late afternoon the group will continue to Alqueva in Portugal, where lunch will be served in a restaurant at the dam site, with a panoramic view of the reservoir.

In the afternoon there will be a technical briefing and tour of some of the highlights of EDP’s Alqueva multipurpose scheme on the River Guadiana. The Alqueva arch dam was completed in 2002, and the first 256 MW powerplant was commissioned in 2004. The second stage, Alqueva II, was completed in 2012. This scheme now also has two 256 MW reversible Francis units. Alqueva reservoir has an area of 250 km², which makes it one of the largest man-made lakes in Europe. It provides drinking and irrigation water, and is a popular tourist site. The lower reservoir is impounded by Pedrógao dam, where a mini hydro plant is also installed (2 x 5.2 MW).

In the late afternoon the group will continue to the scenic town of Evora, where there will be a chance for a short walk in the city centre to view the main square (Piazza Giraldo) and the 13th century cathedral, before dinner and an overnight stay.

**TOUR C (Two days)**

**ALQUEVA, PORTUGAL**

**Day One**

After breakfast the group will depart from Evora’s Roman temple and baths, as well as Roman and Moorish walls, before travelling on to Lisbon (a coach journey of slightly more than one hour).

In Lisbon a short city tour may be organized, subject to minimum numbers, before the tour ends. Transfers can be arranged to the airport.

**Day Two**

After breakfast the group will have a short guided tour of Evora’s Roman temple and baths, as well as Roman and Moorish walls, before travelling on to Lisbon (a coach journey of slightly more than one hour).

In Lisbon a short city tour may be organized, subject to minimum numbers, before the tour ends. Transfers can be arranged to the airport.
A major element of the HYDRO 2017 event will be the Technical Exhibition, running for three days alongside the conference sessions. The spacious, and purpose-built exhibition pavilion will be the main hub for business networking, between delegates and the industry representatives who will be exhibiting their supplies and services. Exhibitors typically comprise consultants, contractors, manufacturers, developers and professional associations.

All lunch and refreshments will be served in the exhibition pavilion, with catering points arranged to ensure that delegates will move around the whole area regularly during the three days. Feedback from previous events indicates that delegates maximise the opportunities to circulate in the exhibition, and that valuable contacts are made, which are maintained after the event.

The pavilion will remain open for a networking event after the conference sessions on Tuesday 10 October, to provide extra opportunities for business meetings in an informal atmosphere.

Stands are sold in units of 6 m² and 9 m², and multiple units can be combined to create larger displays. Standard or custom-built stands can be arranged. Sponsorship packages are available for various items associated with the event, and this can be a memorable way of bringing your company to the attention of the international delegates. Details are available from our Sales & Marketing team (see contact details on the next page).
BOOKING CONDITIONS

The Conference HYDRO 2017 - Shaping the Future of Hydropower, is being organized by The International Journal on Hydropower & Dams with ASK Event Management Ltd.

On-line Registration
You can register on-line via the Hydropower & Dams website at: www.hydropower-dams.com. This is a secure site. Registrations will be handled by ASK Event Management on behalf of Aqua-Media. You will receive an acknowledgement of registration on completion of this process; however, this is not a confirmation (until payment is received).

We encourage all delegates to register on-line, using the newly upgraded system which provides more information during the registration process.

In the unlikely event of any difficulties using this system, please contact ASK Event Management (see contact details below).

Picking up conference documents and badges
The desk will be open from 08:30 hrs on Sunday 8 October 2017, at the FIBES I Conference Centre. Pre-registration is generally required, by one of the methods mentioned above.

Payment
Payment for all services (fees, hotels, tours) must be made in Euros (€) and received in advance of the Conference. Payment is possible by the following methods:
• On-line by Visa or Mastercard
• Banker’s draft to ASK Event Management (see details on the registration form).

All fees paid by credit card will be charged in Euros (€).

Accommodation
The Conference organizers have negotiated rates at hotels in several price categories in Seville. Accommodation bookings are being handled by ASK Event Management. Please include your hotel booking at the time of registering (using the on-line booking system). Beware of scam accommodation bureaux who are operating this year, falsely claiming to represent HYDRO 2017. We recommend that you do not pass credit card details to them. We anticipate a high demand for HYDRO 2017 accommodation, and strongly recommend that bookings are made as soon as possible, and at the latest before the end of September. Payment must be made in full at the time of booking.

Disclaimer
All best endeavours will be made to present the programme as printed. The HYDRO 2017 organizers and their agents reserve the right to alter or cancel, without prior notice, any arrangements, timetable, plans or other items relating directly or indirectly to HYDRO 2017 for any cause beyond its reasonable control. The organizers and agents are not liable for any loss or inconvenience resulting from such alteration. The Conference and Tours are subject to minimum numbers. Four places are subject to availability on a first-come-first-served basis. Full payment for tours must be received at the time of registration.

As soon as a registration is confirmed, a number of expenses are incurred by the organizers; therefore the following cancellation conditions apply:

<table>
<thead>
<tr>
<th>Date cancellation received</th>
<th>On or before 18 August 2017</th>
<th>From 19 August to 17 September 2017</th>
<th>On or after 18 September 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration for the Conference</td>
<td>10% of fee will be forfeited</td>
<td>50% of fee will be forfeited</td>
<td>No refund</td>
</tr>
<tr>
<td>Technical Excursions (Study Tours)</td>
<td>10% of fee will be forfeited</td>
<td>No refund unless place can be resold</td>
<td>No refund</td>
</tr>
<tr>
<td>Accommodation</td>
<td>10% of fee will be forfeited</td>
<td>No refund unless place can be resold</td>
<td>No refund</td>
</tr>
</tbody>
</table>

NB: Separate booking conditions apply to Exhibition Stands, and these will be sent directly to Exhibitors by our Sales & Marketing Department.

A reduced registration fee is available for current subscribers to Hydropower & Dams. See booking information form for details.

CONTACT DETAILS
For enquiries concerning registration and accommodation, contact:

ASK Event Management Ltd
Abigail Stevens or Keta Hunt, Co-Directors
hydro 2017@askeventmanagement.com
Tel: +44 (0)1725 519287
On-line registration via: www.hydropower-dams.com

For further details of the programme, please contact: Mrs Margaret Bourke at: Hydropower & Dams, PO Box 285, Wallington, Surrey SM6 6AN, UK.
Tel: + 44 (0)20 8773 7244 • Fax: + 44 (0)20 8773 7255 • Email: hydro2017@hydropower-dams.com
Website: www.hydropower-dams.com

Cancellations
Cancellations must be made in writing to ASK Event Management. Cancellation charges will be payable as shown in the Table below. Substitution of delegates after a reservation has been made is acceptable before the Conference, and no extra fee is payable. Any necessary refunds (see Table below) will be made after the Conference.

Liability/Insurance
The registration fees do not include the insurance of participants against personal accidents, sickness, cancellations by any party, theft, loss or damage to personal possessions. The organizers accept no responsibility for death, injury, loss or accident, delays arising from any act or default of any person, or any other matter arising in connection with Conference services or transport. The organizers make no warranty in this connection.

All services provided are subject to local laws. Arrangements for the Conference have been made in accordance with UK and Spanish Law.

Delegates, exhibitors and tour participants are strongly advised to take out adequate personal insurance to cover risks associated with travel, accommodation, cancellation and theft or damage to personal belongings.

The organizers reserve the right to amend any part of the Conference programme or arrangements, if necessary. In the very unlikely event that it is necessary to cancel any of the Conference arrangements, an appropriate refund will be made and thereafter the liability of the organizers will cease.

The organizers reserve the right not to accept applications for attendance (for example, but not exclusively, if applicants are not working in the field of hydrop and, or if there could be a conflict of interest with the mission of the conference, the organizers, or any policy of the host country).

Passport and Visa Requirements for Spain
Spain is a member of the European Union, and is a signatory to the Schengen Agreement. It is the responsibility of all participants to check their own passport and visa requirements. Please contact the Spanish embassy or consulate in your country if in doubt about requirements, or visit: www.exterioresex.es/Pala

Applying for a letter of invitation to support a visa application
In some cases, letters of invitation from Aqua-Media in the UK and one of our partner organizations in Spain may be necessary, as well as special clearance from the relevant authorities.

The process could take several weeks, so we strongly urge participants requiring visas to start the application process in good time.

If you require a letter of invitation to facilitate your visa application, please let us know at the time of registering. Please note that letters to assist with obtaining visas can only be provided to registered or invited participants, and these letters do not imply an invitation to the Conference without payment of registration fees. If you need a letter from the host country, as well as the organizers, please notify us as soon as possible and supply your full name, date of birth, passport details, and proposed dates of arrival and departure.
The online HYDRO 2017 registration is now open, and bookings can be made via: www.hydropower-dams.com. The system is simple to use, but in the event of any difficulties, please contact ASK Event Management. Email: hydro2017@askeventmanagement.com ~ Tel: +44 (0)1725 519287.

Prices for each delegate category and conference activity are given below.

**FULL DELEGATE FEE:** Includes attendance of the Conference and Exhibition; documentation; conference papers on a USB stick; morning and afternoon refreshments; lunches during the Conference; full social programme

€1180 (from 19 Aug)

**REDUCED DELEGATE FEE:** For existing subscribers to Hydropower & Dams.

€1110 (from 19 Aug)

**FEE INCLUDING NEW SUBSCRIPTION TO H&D:** (6 issues from No. 5, 2017 + Atlas + Maps)

(This represents a saving of about 35 per cent on the normal H&D subscription rate).

€1305 (from 19 Aug)

**SPEAKER FEE:** Includes all facilities described above for Full Delegates, plus an additional reception on Sunday 8 October.

NB: This fee applies to one person per paper (main author or presenter).

€615

**FIRST EXHIBITOR FEE:** (One full participant fee is included with exhibition booking).

€0

**SECOND + THIRD EXHIBITOR FEE:** (Fee per person for up to two additional exhibitors).

(Includes all benefits available to full delegates).

€745

**SMALL HYDRO TRAINING SEMINAR** (Full day on Sunday 8 October - Design a small plant in one day).

€50

**ACCOMPANYING PERSON FEE:** (For family members, partners or friends not colleagues attending the Conference or Exhibition).

The fee includes the excursions each day, with lunch, and the evening social events. The cost for registering as an accompanying person is €475.

**HALF DAY EXCURSION:** The details of this are presented on a previous page. The cost for joining the tour including lunch, is €85 per person.

**OPTIONAL DONATION TO THE AMI HYDROPOWER FOUNDATION:** As in past years, there will be opportunity when registering online to make a donation to the AMI Hydropower Foundation. This is a charitable foundation, set up by Aqua-Media and governed by a board of international trustees. It exists to facilitate the participation of delegates from the less developed countries at the annual Hydro Conferences.

**TECHNICAL TOURS:** Prices include all transportation, meals, guides, entrance fees during sightseeing trips, and accommodation.

**Tour A - 1 day:** Guinella pumped storage plant near Seville, and lunch

€110 per person

**Tour B - 3 days:** Dams and powerplants in Andalucia (and visits to Cordoba and Granada)

€795 per person, single room; €728 per person sharing double room

**Tour C - 2 days (1 night):** Alqueva multipurpose dam and pumped-storage scheme in Portugal

€390 per person, single room; €360 per person sharing double room

**DIETARY REQUIREMENTS:** These may be specified on the online registration system (including, for example, vegetarian, vegan, kosher, halal, gluten free, etc).

**VISA REQUIREMENTS:** This year, you will be able to apply for an invitation letter to support your visa application during the on-line registration process.

NB: Attendance of the Welcome Reception and Farewell Dinner are included within the registration fees for all participants. However, we request a nominal contribution of €15 per event for those wishing to attend, to encourage a firm commitment to participate. This is important to enable us to assess numbers for catering, and avoid food wastage.
HYDRO 2017 HOTELS

Melia Lebreros, 4* Superior
Location: Calle Luis de Morales 2, 41018, Seville
Distance to FIBES Congress Centre: 4.3 km (approx. 15 min drive)
Check in: from 15.00 hrs / Check out: by 12.00 hrs
This is a modern stylish hotel in the commercial Nervión area. The historic centre can be accessed by bus or tram. The bedrooms were renovated in 2016, and are of a good size with a functional work space. All rooms are equipped with television, air conditioning and complimentary WiFi. The Melia Lebreros has an outdoor swimming pool set in gardens, as well as a gym and spa.
The international breakfast buffet has a wide selection of hot and cold items.
Single occupancy: €125.00
Double occupancy: €138.00
www.melia.com

Melia Sevilla, 4* Superior
Location: Calle Dr Pedro de Castro 1, 41004, Seville
Distance to FIBES Congress Centre: 6.2 km (approx. 20 min drive)
Check in: from 15.00 hrs / Check out: by 12.00 hrs
The Melia Sevilla is a newly refurbished modern business hotel, located near the historic centre of Seville. Guests have access to free WiFi and all rooms include a television, minibar and ironing facilities. The hotel has two restaurants and a lounge bar. There is also an outdoor pool with pool bar, where guests can enjoy views of the Plaza España. An international breakfast buffet is included, with a wide selection of hot and cold items.
Single occupancy: €123.00
Double occupancy: €135.00
www.melia.com

NH Collection Sevilla, 4* Superior
Location: Avenida Diego Martinez Barrio 8, 41013, Seville
Distance to FIBES Congress Centre: 6 km
Check in: from 14.00 hrs / Check out: by 12.00 hrs
This is a modern business hotel, and bedrooms, which are of a good size, include complimentary WiFi, a coffee machine and television. Many rooms also offer panoramic views over the city. The hotel provides a buffet breakfast with a wide selection of hot and cold items, and guests can also enjoy refreshments from the hotel bar or restaurant. There is also an outdoor swimming pool and fitness centre. A buffet breakfast is included with a wide selection of hot and cold items. Basic computer and printing facilities are available in the lobby.
Single occupancy: €127.00
Double occupancy: €138.00
www.nh-collection.com/hotel/nh-collection-sevilla

Hesperia Sevilla, 4*
Location: Avenida Eduardo Dato 49, 41018, Seville
Distance to FIBES Congress Centre: 4.8 km (approx. 15 min drive)
Check in: from 15.00 hrs / Check out: by 12.00 hrs
The hotel has a selection of classical Andalusian and contemporary styled rooms, which are of a good size. All have complimentary WiFi. All guests have access to a health club with an indoor pool and gym and the Porta Coeli Bar-Café, which is open from 08.00 – 23.30 hrs, serving drinks, tapas and à la carte lunch and dinner. A buffet breakfast is included with a wide variety of items.
Single occupancy: €106.00
Double occupancy: €118.00
www.nh-hotels.com/hotel/hesperia-seville

MA Hotel Sevilla Congressos, 4*
Location: Alcalde Luis Urriuela 2, 41020, Seville
Distance to FIBES Congress Centre: 0.4 km (approx. 5 min walk)
Check in: from 14.00 hrs / Check out: by 12.00 hrs
This is a standard business hotel, located some distance from the historical part of the city, but close to the FIBES Congress Centre. The hotel was renovated in 2014, and all rooms include free WiFi, air conditioning, and television. A business centre is available for guests.
There is an à la carte and buffet restaurant, café and lounge, as well as a large outdoor pool with solarium.
Single occupancy: €110.00
Double occupancy: €128.00
www.hotelssevillacongresos.com

Novotel Sevilla Marques de Nervión, 4*
Location: Avenida Eduardo Dato 71, 41005, Seville
Distance to FIBES Congress Centre: 4.7 km
Check in: from 14.00 hrs / Check out: by 12.00 hrs
This is a business hotel in the commercial area of Nervión. All rooms are of a good size, and include complimentary WiFi, television and tea/coffee making facilities. There is a well equipped fitness centre and a bar, as well as a rooftop swimming pool and restaurant serving Mediterranean cuisine.
The buffet breakfast offers a wide selection of hot and cold items.
Please note: This hotel does not offer twin rooms with two single beds.
Single occupancy: €97.00
Double occupancy: €107.00
www.novotel.com

Rooms have been blocked in the following hotels for HYDRO 2017 participants. Options range from standard business, to 4* superior hotels. Most are located in the city centre, so a shuttle bus service is being organized. Full details are available on the registration website, which was launched in early July. Assistance with budget and luxury accommodation may be given on request.

ASK Event Management
Contacts: Abigail Stevens or Keta Hunt, Co-Directors Tel: +44 (0) 1725 519287
hydro2017@askeventmanagement.com
Unit 7, Town Farm Workshops, Sixpenny Handley, Salisbury SP5 5PA, UK