Water Storage and Hydropower Development for Africa

International Conference and Exhibition
will take place at the
Safari Court Congress Centre, Windhoek, Namibia
2 to 4 April 2019

Organizers:

in partnership with:

Local supporting organizations include:

International supporting organizations include:

For more information visit: www.hydropower-dams.com/africa-2019/
AFRICA 2019: INTRODUCTION

Our third African regional conference moves south

AFRICA 2019 will be the third international conference focusing on water storage and renewable energy development in Africa, co-hosted by Aqua-Media International and the International Commission on Large Dams.

Following the two previous regional conferences in Africa - which took place in Addis Ababa, Ethiopia in 2013 (under the auspices of the African Union), and in Marrakech, Morocco in 2017 (under the High Patronage of the King) - we decided to move south for AFRICA 2019, to a country with plenty of experience in a variety of hydraulic works. The location will help facilitate access from some of the neighbouring countries of Africa with major hydro development programmes under way: such as Angola, Mozambique, DRC, Zambia, and others.

Power and water utilities welcome AFRICA 2019

Namibia is a politically stable, touristically attractive country - with excellent infrastructure, a variety of dams, and spectacular flora and fauna. It is an ideal location for the international water and hydro community to meet. The two main utilities, NamWater and NamPower, welcome international experts to come and exchange experience on key topics relating to water storage and renewable energy.

Namibia has experienced a period of exceptional growth and economic stability (IMF Annual Report 2017), making it a prime destination for investments in the hydro sector. The hydropower potential of the country was re-evaluated in 2000 and, according to this study, the country has a hydropower potential of at least 10 000 GWh/year (equivalent to 2250 MW of capacity). The study indicated that, while all of this potential is technically feasible, only 11 per cent has been developed so far.

Supporting the case for development, the World Bank reported recently that “Namibia’s Government continues to exercise the requisite leadership in developing and financing the policies it needs to address its development challenges”.

Current and future hydro development

NamPower typically imports more than 60 per cent of its annual energy usage from the SADC region, while the remainder is generated mainly by the Ruacana hydro scheme, which in 2017 contributed 1593 GWh. A major refurbishment project was completed in October 2016. A study tour after AFRICA 2019 will visit Ruacana.

Meanwhile, a major new development is now progressing: the 600 MW Baynes binational project with Angola, in the Kunene river basin. A Permanent Joint Technical Commission is engaged in the necessary studies for this project.

Meanwhile, Salini Impregilo recently completed construction of the 78 m-high Neckartal RCC dam in the south of the country, which will principally provide for irrigation. A second study tour is planned to Neckartal, where impounding will be under way at the time of AFRICA 2019.

Access to Namibia by air

Major airlines serving Windhoek include: Air Namibia, Ethiopian Airlines, South African Airways, Qatar Airways, KLM and Lufthansa.

The Congress centre and accommodation in Windhoek

The elegant and well equipped Safari Court Congress Centre has been chosen as the venue, where two hotels will be available for AFRICA 2019 participants. Rooms have been reserved in other nearby world-class hotels, such as the Hilton and Avani, from which shuttle buses will run to the conference centre.

Who should attend?

All those involved or interested in helping African nations to unlock their vast hydro potential and to advance water resources development, should join the discussions. Speakers and delegates will include owners, operators, developers, financiers, researchers, consultants, contractors, teachers and students.
# AFRICA 2019 TIMETABLE

## Monday 1 April

- **From 09.00 hrs:** Conference Registration opens
- **Exhibition set-up for custom stands only**
- **10.45 hrs:** Excursion departs
- **Tour of city landmarks and monuments in and around Windhoek**
  - (with lunch included)
  - **14.00 hrs:** Access to stands for all exhibitors
  - **19.00 hrs:** Chair persons’ Meeting followed by
  - Speakers’ Briefing at the Safari Court Hotel
  - **20.00 hrs:** Speakers’ and Chair persons’ Reception


## Tuesday 2 April

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Activity</th>
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<tbody>
<tr>
<td>09.00 hrs:</td>
<td>Opening Plenary Session: Welcome addresses; Opening addresses (AU, UNECA, ICOLD, ICID, NIPAD, AfDB, World Bank)</td>
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<tr>
<td>14.00 hrs:</td>
<td>Coffee; Keynote messages</td>
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<tr>
<td>19.00 hrs:</td>
<td>Lunch; Parallel Sessions: 1 - Project preparation</td>
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<tr>
<td>19.30 hrs:</td>
<td>Coffee</td>
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<tr>
<td>20.00 hrs:</td>
<td>Parallel Sessions: 4 - Panel discussion on private investment</td>
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<tr>
<td>21.00 hrs:</td>
<td>Coffee</td>
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<tr>
<td>19.30 hrs:</td>
<td>Welcome Reception at Safari Court Hotel - Pool Area</td>
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## Wednesday 3 April

<table>
<thead>
<tr>
<th>Time</th>
<th>Session/Activity</th>
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<tr>
<td>09.00 hrs:</td>
<td>Parallel Sessions: 7 - Legal and contractual aspects</td>
</tr>
<tr>
<td>14.00 hrs:</td>
<td>Coffee</td>
</tr>
<tr>
<td>19.00 hrs:</td>
<td>Lunch; Parallel Sessions: 10 - Planning and development</td>
</tr>
<tr>
<td>19.30 hrs:</td>
<td>Coffee</td>
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<tr>
<td>20.00 hrs:</td>
<td>Parallel Sessions: 13 - Water resources management</td>
</tr>
<tr>
<td>21.00 hrs:</td>
<td>Coffee</td>
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<tr>
<td>17.30 hrs:</td>
<td>Networking party with refreshments in the Exhibition Halls (Evening free for private parties)</td>
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## Thursday 4 April

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<tr>
<th>Time</th>
<th>Session/Activity</th>
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<tbody>
<tr>
<td>09.00 hrs:</td>
<td>Parallel Sessions: 19 - Small hydro</td>
</tr>
<tr>
<td>21.00 hrs:</td>
<td>Environmental and social aspects</td>
</tr>
<tr>
<td>19.30 hrs:</td>
<td>Conference Dinner Windhoek Country Club</td>
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</tbody>
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## THE INTERNATIONAL STEERING COMMITTEE

- M. Abubak, Ethiopia
- D. Aubert, France
- H.I. Aker, Turkey
- G. Ammons, USA
- I. Arabi, Japan
- Azob Amanaka, Ethiopia
- M. Auffeug, Austria
- F. Aven, Switzerland
- E. Baskov, Russian Federation
- L. Berg, Spain
- P. Beo, UNESCO-IHE
- H. Breda, Norway
- R. Bucher, Germany
- R.C. Charlwood, USA
- G. Cleve, Namibia
- V. Denis, Switzerland
- L. Derue, France
- D. Desholey, Belgium
- A.M. Deverney, France
- M. De Vito, France
- O. Didier, France
- M.R.H. Dumont, UK
- L. Epo, Nigeria
- P. Eradi, Brazil
- P. de Felix, France
- J. Fenech, Portugal
- R. Grether, Germany
- K. Grub, UK
- P. Gruber, Switzerland
- J. Gummer, Australia
- W. Hokin, Canada
- C.R. Head, UK
- M. Heiland, Germany
- A. Hughes, UK
- E. Isambert, France
- R.E. Isse, Israel, USA
- Jiu Jinsheng, China
- D. Johnson, Norway
- C. Kayatokoro, Burundi
- H. Keusser, Switzerland
- A. Kumar, India
- T. Kanz, Switzerland
- U. Myo Myint, Myanmar
- R. Lafitte, Switzerland
- K. Loksir, Sri Lanka
- E. Lembêrie, France
- B. Leyland, New Zealand
- L. Liu, Norway
- L. Li, China
- E. Malick, Poland
- P. Mason, UK
- L. Mauvret, Switzerland
- S. Mayenge, Mozambique, Namibia
- N. and L. Hicken, Australia
- A. Namdeo, Burkina Faso
- A. Noorad, Iran
- H. Obermoser, Switzerland
- A. Palme, Italy
- D. Puzetti, China/Lao PDR
- B. Pelikan, Austria
- J. Plummers-Berckmoyn, UK
- B. Popp, Romania
- P. Pradhan, Nepal
- J. Poch,Russia
- V. Radchenko, Russian Federation
- P.J. Ross, Canada
- J. Reynolds, UK
- M. Rogers, USA
- F. Goelma de Roca, Portugal
- D. Roult, France
- A. Schleiss, Switzerland
- J.J. Simon, Switzerland
- J. Sivendra, Namibia
- J. Stehle, Namibia
- J. Steller, Poland
- B. Tardieu, France
- J. Javre, France
- B. Trouille, USA
- O. Westerg, Norway
- B. Tardieu, France
- D.A. Williams, UK
- X. Zeping, China
- G. Zein, Austria
DESIGN A SMALL HYDRO PLANT IN A DAY

Full day training workshop
The next in a highly successful series of small hydro training workshops will take place in Windhoek, prior to AFRICA 2019. The workshop is aimed at people who are, or will be, involved in hydropower development as part of rural electrification programmes. It covers run-of-river hydro projects in the ‘pico’ range (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 special areas of expertise. Aspects to be covered include:
• 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 generation calculation
• intake structures, channel and/or pipeline routes and sizing
• powerhouse design and equipment
• turbine selection
• generator, controls and switchgear
• grids, national and local.

This will be a ‘hands-on’ workshop, which will involve participants working in groups, to develop an actual hydro scheme during the day. The group will discuss the elements of the schemes, and this will follow through to final design.

THE ROLE OF THE PRIVATE SECTOR IN FUTURE HYDRO INVESTMENT

Hydropower is cost effective and can offer many additional benefits beyond power generation. However, projects are highly capital-intensive and site-specific, with a long preparation phase, lengthy construction period, and multiple environmental and social concerns. As a result, they are often regarded as risky investments, especially by private sector investors, making it difficult to attract financing for new projects. Yet hydro accounts for the largest share of renewable energy generation globally and will play a key role in facilitating the transition to a zero-carbon economy and improving energy access in emerging markets. It could also support the transition to a greater proportion of intermittent renewables through providing energy storage and grid stability services. The limited nature of public resources means that more private sector financing will be needed in the future to facilitate this transition.

The University of Cambridge Institute for Sustainability Leadership (CISL) will present this workshop - bringing together a diverse and knowledgeable group of financial stakeholders to discuss the role that the private sector may play in future investment in hydropower. In particular, it will review the risks and possible risk mitigation strategies.

The discussions will offer the participants an opportunity to consider the current thinking around these topics, and to have an input to the subsequent stages of this research on the financing of hydropower projects.

The FutureDAMS consortium is a team of researchers across 14 institutions in the UK and overseas, with a broad agenda to improve the design, selection and operation of dams to support sustainable development. As part of the FutureDAMS project, CISL and IIED are exploring the opportunities and barriers to attracting capital into sustainable hydropower infrastructure.

RESERVOIR AND RIVER YIELD ANALYSIS IN ARID AND SEMI-ARID AREAS

In arid and semi-arid areas, where precipitation and runoff are highly variable - resulting in long periods of drought, storage reservoirs are required to regulate river flows and to manage the negative impact on water supply. Many countries that face these challenges have long been involved with the development of practical methodologies to manage droughts, including the planning, design, operation and management of reservoirs and water supply systems. These methodologies may be diverse and vary in complexity and sophistication, but essentially address one or more of the following basic aspects: the assessment of the water supply potential (or ‘yield’); the need for, and size of, regulation storage; the dam and system operations; managing risk; and, planning for the possible impacts of climate change.

The objective of the special session will be to: present an introduction to these basic aspects; provide the opportunity for sharing experiences; and, represent a first step in the establishment of guidelines for the assessment of reservoir and river yields in arid and semi-arid countries.

The session will address: the concept of yield; modelling and yield determination; assessing the need for, and sizing of, regulation storage; risk-based planning and the role of stochastics; dam and water resources system operation; climate change; and, case studies.

There will be supporting technical documentation.

PRE-CONFERENCE EXCURSION

Windhoek City & Township Tour
This excursion combines a detailed sightseeing tour of Windhoek city centre with a visit to Katutura township.

The tour will set off from the Congress Centre in the late morning. Visits will include: historical buildings, monuments and museums within Windhoek, Christus Church, Tintenplast (the seat of both chambers of the Parliament), Alte Fest (the Old Fort), and Heinitzburg Castle.

Delegates will have a panoramic view of Windhoek from Lovers’ Hill and will then visit the Namibian Craft Centre.

After lunch together at a local restaurant, the group will visit Katutura, Windhoek’s former black township, and will walk along Eveline Street before reaching the tranquility of Penduka - a project where less-privileged women produce and sell beautiful Namibian handicrafts on the shore of Goreangab reservoir.
The following pages present the status of the AFRICA 2019 programme in December 2018. Some additional invited papers are still being confirmed and will be announced shortly. Please visit our website for the most up-to-date programme details.

Tuesday 2 April - Morning

Opening Plenary Session

- Welcome to AFRICA 2019 and preview of the programme – A. Bartle, Director Aqua-Media International Ltd
- Opening address – M. Rogers, President, ICOLD
- Welcome messages – Officers of the Government of Namibia, including NamPower and NamWater
- Session messages – Officers of the African Union, UNECA, the African Development Bank, the World Bank, NEPAD, the International Energy Agency, ICID and others.

Session 1 ~ Project preparation

- Due diligence in renewable energy projects: A dimension of project sustainability – V. Kisembo and M. Mwapeza, UEGCL, Uganda
- Project preparation – a many challenges. The dilemma of whether to take shortcuts to minimize investment which can jeopardize reaching financial closure – G. dos Santos Cruz Rocha, Worley Parsons, Brazil; T. Gaskel, Worley Parsons, South Africa
- Bringing small and medium sized hydropower projects to bankability in Africa – D. Albertani, R20: Regions of Climate Action, Switzerland; N. Crettenand and M. Wickenhäuser, BG Consulting Engineers, Switzerland; J. Faunier, Alpin Ltd, Switzerland

Session 2 ~ Civil engineering: Design and construction

- Modelling, design and construction monitoring of Neckartal dam, Namibia – L. Coetzee, Knight Piésold Consulting (Pty) Ltd, South Africa; F. van Vuuren, University of Pretoria, South Africa
- Technique for treating the foundations of earth dams in Burkina Faso – E. Somda and A. Nombre, IVEC, Burkina Faso
- Soupapit: A large regional hydropower project under construction in Guinea – A. Lecocq, Tractebel Engineering SA, France
- Design and performance of the underground hydraulic circuit for the Laúca plant in Angola – P. Tha, Fugro, Brazil; S.B. Katereniuk and H. Mubikanga, UEGCL, Angola
- Progress and challenges with construction works at Karuma, Uganda – O. Voborny and S. Cowie, AF-Consult, Switzerland; A.M. Byaruhanga and H. Mubikanga, UEGCL, Uganda
- Ngonye Falls hydropower project on the Zambezi in Zambia: The challenges and opportunities – B. Darling and J. Chesterton, Moit MacDonald, UK; T. Kaulu, Western Power Co Ltd, Zambia
- Head losses on unlined power tunnel: Comparison between theoretical and measured values at Laúca – F.D. Levis and R.E. Bertol, Interzione Consultores, Brazil

Session 3 ~ Hydro plant equipment

- Luica, Angola: Development and commissioning of Francis turbines equipped with high performance ring gates – M. Kautt and D. Lauffer, Arrizyt Hydro, Germany
- The importance of selecting the correct turbine at an early stage – A. Eaton, Gikas Hydro, UK
- Intelligent turbine control, powerplant management system and IoT SCADA provide solutions for today's challenging hydropower operation – T. Stütz, Global Hydro Energy GmbH, Austria
- Refurbishment of generating units and auxiliaries at Kamburu in Kenya: challenges and successes – S. Kaleb and J. Sydarević, Koncar Power Plant and Electric Traction Engineering Inc, Croatia
- Upgrade of the penstock inlet valve and governor for units 1 to 3 at the Bucura hydro station, Namibia – M. Hange, Nampower, Namibia
- Nkula rehabilitation project, Malawi: Challenges and opportunities of fast track rehabilitation with timely limited funding – R. Endler, H. von Büren and R. Guimond, Fichtner GmbH & Co KG, Germany

Session 4 ~ Private finance: Risks and challenges

This panel session will discuss the complexities and risks of private finance for large hydropower projects. Much of the world's unexploited hydropower resource lies in countries in emerging markets with limited access to capital. Governments are increasingly turning to the private sector to finance dam development, but investors are wary of the high risk profile of construction and long-term risks such as hydrology. The financial structure of privately financed, large hydropower projects can be far more complex than a traditional public finance model.

Session 5 ~ Challenging sites

- Overcoming challenges in the design of the 8 km-long headrace and penstock for the Taisla Falls hydro plant – C. Fynn, N. Vahed, J. Ehlers and R. van Wyk, AECOM, South Africa
- Souk Tleta dam: Challenges and solutions – A. Si-Chaib, J-L. Cervetti, Q. Julien and G. Lorach, Tractebel Engineering, France; M.K. Abidi, Cab El Djazair, Algeria
- The Isima hydropower plant in Uganda – S. St-Pierre, C. Riegel and J. Jost, Arteria Eau & Environnement, France; B. Touilleb, Engineer, Malawi; H. Mubikanga, UEGCL, Uganda
- The dam complex of the Upper Albara multipurpose project, Sudan – F. Zoellner and Y. Scheid, Lahmeyer International, Germany; M. Mukhtar, Ministry of Water Resources, Irrigation and Electricity, Sudan

Session 6 ~ O&M, monitoring and powerplant safety

- O&M in hydropower: A practical approach based on partnership and capacity building – L. Oriel and B. Graff, CNR, France; D.K. Isingoma, M. Mukulu and H. Mubikanga, UEGCL, Uganda
- Design of the ring gate and fire extinguishing system and ventilation system for the Karuma hydropower project in Uganda – Liu Xijun, Powerchina Huadong Engineering Co Ltd, China; Wu Haifeng, Liu Qihuha, Huang Jingqian, Xu Zhang, Yan Jiaming, Lu Xing, Chen Qingli and Wang Di, Huadong Engineering Corp Ltd, China
- Optimizing operation of hydro plants with the help of artificial intelligence – A. Arambura, Omeetam, France
- Study on the hydraulic transient process at Karuma, with a low head, large flow and long tailwater system – Li Gaohui, Zhang Mengjie and Zhou Tianchi, Powerchina Huadong Engineering Corp Ltd, China
- Practical experience of privatization of large hydro schemes in Nigeria: Implications for O&M – L. Audu and J. Villegas, Mainstream Energy Solutions, Nigeria; A. Vetter and M. Fuchs, Pöyry Group, Switzerland

Session 7 ~ Legal and contractual issues

- Planning, structuring and monitoring a hydropower project: Some key legal issues – B. Geisseler, Geisseler Law, Germany
- Towards robust procurement processes on Phase II of the Lesotho Highlands Water Project – S.R. Christie and M.R. Matchett, Lesotho Highlands Water Project, Lesotho
- Using international standards for the tender specification development of a small hydropower project – H.J. van Staden, R. van Wyk, and D. Breytenbach, AECOM, South Africa

Session 8 ~ Civil engineering: Materials

- Trial mix programme for the Mwache multipurpose RCC dam in Kenya – K. Tieto, Ministry of Water and Sanitation, Kenya; J. Fukuwatari, Nippon Koei Co Ltd, Japan; Dr M.R.H. Dunstan, MDA, UK; A. Karuge, MIBP Ltd Consulting Engineers, Kenya
- Key factors in the mitigation of RCC dam construction delays – M. Conrad and C. Rohr, AF-Consult Ltd, Switzerland
- Construction innovations for RCC dams to speed up construction and reduce costs – M. Goltz, Pöyry Ltd, Switzerland; G. Escobar, B. Forbes and J. Potts, Consulting Engineers, Australian
CONFERENCE SESSIONS

Session 9 ~ Cross-border collaboration
- Coordinated operation of cascade dams in a transboundary river: the Eastern Nile approach – M. Abebe, ETCOLD, Ethiopia; H. Lohr, Hydro Consult GmbH, Germany
- Cross-border hydropower development: Return of experience on African projects – S. Le Clerc and B. Yon, Artelia Eau & Environnement, France
- Lesotho Highlands Water Project (LHWP): More than 30 years of bilateral cooperation – T. Tente and M. Phakoe, Lesotho Highlands Development Authority, Lesotho
- The Baynes hydropower project – Muyenga Muyenga, PJCT, Namibia

Session 10 ~ Planning and development
- Spatial altitude to assess hydropower potential of the Congo basin – S. Legrand and B. Griff, CNE, France; B-L. Tondo, Cicos, Central African Republic; C. Brachet, OIEu, France
- A multi-criteria decision making approach to select potential hydropower sites in the Democratic Republic of Congo – S. Salumu Zahera and M. Fuamba, Ecole Polytechnique Montréal, Canada
- The Nachigal scheme in Cameroon: Project development and salient features – R. Baudet, X. Mourrat, D. Magnan and P. Grillot, EDF-CIF, France
- Optimization of the turbocharged volumes of the hydropower cascade system of the middle Kwanza – A. André, Agostinho Neto Faculty of Engineering, Angola; C. João, Ministry of Water Resources, Angola

Session 11 ~ Civil engineering: Rehabilitation
- Nangbeto hydropower plant, Togo, Benin: A rehabilitation project under an EPC approach – F. Armand and G. Duc, EDF Hydro Engineering, France; Y. Sahut, ISL Ingénierie, France
- Working with international geological and access conditions for civil works rehabilitation projects – D. Jullien and T. Bourguin, Tractebel Engineering, France
- Flood damage repair to the Mambeti lower dam spillway – P. Gouws, PG Consulting Engineers, South Africa; J-L. De Beer, Maccalferri Africa, South Africa
- Rehabilitation of the Kariba spillway – S. Wingrove and N. Crosby, KGA Consulting Engineers, UK; M.C. Munodawafa, Zambezi River Authority, Zambia; J. Ribeiro and B. Quigley, Stucy SA, Switzerland; P. Manso and G. De Cesare, EPFL, Switzerland

Session 12 ~ Lesotho Highlands Phase II:
- From planning and feasibility to current progress
  - Planning hydropower development for Lesotho: LHWP phase II feasibility studies – T. Mochaba, Lesotho Highlands Water Project, Lesotho
  - The journey before construction – G. Mokone, Lesotho Highlands Development Authority, Lesotho; M. Kumalo, Lesotho Highlands Water Project, Lesotho
  - Understanding contractual arrangements on Phase II of the Lesotho Highlands Water Project – M.R. Matchett and A. Bartsch, Lesotho Highlands Water Project, Lesotho
  - Developing advance infrastructure for a megaproject in developing countries: Balancing project needs and sustainability of infrastructure – J.G. Chivese, Lesotho Highlands Water Project, Lesotho

Session 13 ~ Water resources management
- Versatile pumping technology to handle water scarcity and excess – U. Seebacher, Andritz AG, Austria
- Historical assessment of water resource management and development in Windhoek and the central area of Namibia – H. Bruce and G.J. Burger, Lund Consulting Engineers, Namibia
- How Hawal interbasin water transfer dam project can help to ameliorate water needs in Nigeria’s northeast region and Lake Chad – I. Ekpo, Mike Consult Ltd., Nigeria
- Sustainable water resources planning analysis of multipurpose water resource schemes in a changing environment: Two case studies – C.E. Tala and P.G. van Rooyen, WRP Consulting Engineers (Pty) Ltd, South Africa
- The role of rubber dams in Ivory Coast’s M’Bahiakro rice growing project – G. Topalian, Dyrrholf Ltd, UK; S. Dadio Diao, Souleymane Dadio Diao, Ivory Coast

Session 14 ~ Civil engineering: Safety
- The need for thorough dam safety reviews on existing structures – D. Cameron-Ellis, M. Blaesser and H.J. Wright, ARQ Dams Pty Ltd, South Africa; C. Prisci, Anglo American, Chile
- Seismic risk analysis of large storage dams in the Awash basin of Ethiopia – Ali Aman and T. Mammo, Addis Ababa University, Ethiopia; M. Wieland, Pöyry Ltd, Switzerland
- The design of a 80 m-high fill dam and hydropower plant exposed to high seismic loading – K. Omböck, S. Pausz, M. Smesnik and M. Verdián, Pöyry Austria GmbH, Austria
- Safety assessment studies of embankment dams: Their benefits for safety improvement and economic performance – J-R. Courivaud and B. Girard, EDF Hydro Engineering Centre, France
- Major challenges for sustainability of hydropower development in Ethiopia with particular emphasis on Koka dam – E. Binoga and E. Araya, Addis Ababa University, Ethiopia
- Static liquefaction: How can it be assessed? – M. Barker, A. Litwinowicz, M. Laxman and A. L. GHD, Australia
- Dam safety: Case study of the River Nile cascade, Uganda – K.G. Opolot, Global Power Generation, Uganda; O. Geatano, Busitema University, Uganda

Session 15 ~ Hydrology and flood management
- New flow forecasting systems to support hydropower operations at the Zambezi and Niger rivers – H. Kling, B. Wipplinger and M. Fuchs, Pöyry Austria; P. Miwanga, Zambezi River Authority, Zambia; S. Ndthlovu, Zambia Electricity Supply Corporation (ZESCO), Zambia; J. Villegas Garcia and A. Adekunjo, Mainstream Energy Solutions, Nigeria
Session 16 ~ Sustainable water storage to meet water, food and energy development goals

(Convened by UN-IHE, Delft)

Storage to stabilize water availability is essential to sustain water, food and energy production, reduce hazards, and adapt to climate change. Regulation of water resources using dams and reservoirs played a major role in the socio-economic development of northern countries during the 20th century, but practices of the time often led to undesired environmental and social impacts. Thousands more dams and reservoirs are planned for construction in the next decades, mainly in Asia, Africa, and Latin America, and there is a threat that many of the unwanted impacts experienced in the last century could be repeated in this new wave of dam construction, perhaps with even more severe consequences. A thorough analysis of, and debate on, the approaches to sustainable multipurpose storage, including definition of environmental flows, sedimentary management, ecology continuity, and socio-economic adaptation, among others, is needed. Targeted development outcomes include improved catchment management for water, food, and energy security that is socially and environmentally sustainable and contributes directly to Agenda 2030.

In response to this global development challenge, this session will bring together the community of engineers, scholars and scientists, which form a common platform with interest in the planning and design of dams and reservoirs and on the evaluation and mitigation of their undesirable effects. Subjects for discussion will be improved approaches to sustainable multipurpose storage including decision-support tools that have the potential to make a measurable impact on sustainable development. Specific outputs such as consolidated or under development improved decision support tools for basin-scale planning of new storage infrastructure, and tools for improved design and operation of individual facilities, are foreseen. The best contributions will be invited to submit their work to a special technical publication which will be prepared.

This session is promoted within the framework of a thematic research programme on Sustainable Hydropower and Multipurpose Storage to meet Water, Food, and Energy Development Goals: A Program for Collaborative Research and Innovation, supported by the Programmatic Cooperation between the Directorate-General for International Cooperation (DGIS) of the Dutch Ministry of Foreign Affairs and IHE Delft in the period 2016 - 2020, also called DUPC2. The activities are focused in the Irrawaddy Basin of Myanmar, Zambezi Basin of Southern Africa, and Magdalena Basin of Colombia.

Session 17 ~ Capacity building and training

A session and panel discussion will be led by ICOLD Hon President Adama Njome, Burkina Faso, and ICOLD Vice President Michael Abebe, Ethiopia, on some specific needs and challenges in relation to capacity building in African nations. Current training opportunities and experiences will be reviewed. Papers on training will include:

- The link between learning needs and training methods: An analysis of case studies and guidelines for decision making processes — M. Henkes and C.G. Trudel-Ferrari, Voith Hydro, Germany

(Additional papers to be announced)

Session 18 ~ Climate issues and mitigation strategies

- Increasing awareness of climate change implies new challenges for dam and reservoir community: a review — P-Y. Bourgin and M. Riffard-Chenet, Tractebel Engineering, France
- Projections of climate change impacts on natural inflows discharge for Democratic Republic of Congo hydropower generation — M. Fuamba and S. Salumu Zahera, Ecole Polytechnique Montreal, Canada
- The implications of climate change on the ocean coastal areas of Namibia and South Angola, and its implications in the future precipitation in the Namibia Desert — A.A.M. Semedo, IHE Delft, The Netherlands

(Additional papers to be announced)

Session 19 ~ Small hydro

- How to make bankable studies for small hydropower projects — A. Köksæter, Multiconsult AS, Norway
- Small hydro development and potential in Uganda — R. Batra, Voith Hydro Holding GmbH & Co. KG, L. Buljan, Berkley Energy, Kenya
- Small hydro as a power supply for industrial applications in Africa — S. Fiset and M. Harbach, Andritz Hydro GmbH, Germany
- Challenges in planning small hydropower projects in Africa: A case study of the 48 MW Muzizi hydropower power project, Uganda — M. Anguyo and J.E. Ongodia, UEGCL, Uganda
- An innovative low-cost rural distribution system — B. Leyland, Leyland Consultants, New Zealand
- Small low-head hydro in a container — P. Ruschmann, University of Munich, Germany; D. Godde, n2gos Consult GmbH, Germany; A. Sepp, Hydroshaft GmbH, Germany
- Africa’s awakening: how mini hydropower might contribute to the economic progress of the continent — C. Marton and P. Daus, Voith Hydro Holding GmbH & Co. KG, Germany
- The added value of turbine manufacturer for optimization of small hydrot at the feasibility stage — D. Gamba, Zeco Hydropower, Italy

Session 20 ~ Dam safety management

As countries in Africa, and elsewhere, develop their dams for hydroelectric power, irrigation and other purposes, it is essential that the dams are built to appropriate safety standards and operated safely. This session will present a comprehensive approach to establishing a suitable dam safety management programme based on experience in the Eastern Nile countries and subsequent international peer review.

The session will address:

- The need for dam safety management: Historical perspectives and case histories
- The role of regulatory and organizational frameworks: What governments need to do
- Generic dam safety guidelines that can be adapted to suit countries
- Owners’ dam safety programmes: What owners need to get in place
- Necessary supporting technical documentation: What information should be available
- Safety inspections and reviews: Who should do them and how often
- Potential failure modes analysis: A useful tool to focus the programmes
- Surveillance and monitoring programmes: Visual and instrumentation
- Emergency action programmes: Preparedness and response
- Remedies: Engineering and rehabilitation

Session 21 ~ Environmental and social aspects

- Dam! I forgot the E&S clauses in the contract: The E&S management chain from ESIA to construction — G. Prudent-Richard, Artelia Eau & Environnement, France
- Kafue Gorge Lower: A low-impact addition to an existing hydropower cascade in Zambia — R. Zwahlen and V. de Genot de Naukerken, Pöyry Switzerland Ltd, Switzerland; L.K. Kahongo, Zesco Ltd, Zambia

Thursday 4 April ~ Morning
Environmental and social management of the impounding of Lom Pangar reservoir: Water quality monitoring – A. Emadak, T. Nsangou, A. Towa and A. Yobo, Electricity Development Corporation, Cameroon

Developing hydropower in a sensitive area: Kinguélé Ava hydro power plant in the Monts de Cristal National Park – G. Prudent-Richard and F. Matthieu, Artelia Eau & Environnement, France; F. Nathan, EDF – CIH, France; E. Mundela, Meridiam, Senegal

Environmental flow assessment for the Mpatamanga hydropower project, Malawi – J-F. Mercier, IRCI, Senegal; J. Stave, Multiconsult, Norway

Investigation of the impacts of the proposed Noordoewer/Vioolsdrift dam in the Orange river estuary in Namibia and South Africa – J.K. Vonkeman, D.E. Bosman and G.R. Basson, Stellenbosch University, South Africa

Working with project-affected people in the framework of the environmental and social impact assessment for hydraulic projects – N. Tomczak, Tractebel Engineering SA, France

Greenhouse gas emissions from the Lom Pangar reservoir, Cameroon – A. Emadak, T. Nsangou, and A. Towa, Electricity Development Corporation; Cameroon; V. Chanudet, EDF-CIH, France; M. Darmarty, C. Deblois and J.D. Simard, Engelbrecht Corporation, Canada

Friday 5 April ~ Afternoon

Session 22 ~ Hydro in synergy with other renewables

Mitigation of drought impacts on reservoirs using hybrid solar/hydropower – J. Alveoira and M. Allen, Stantec, USA

Hydro-solar: A storage solution for solar energy with competitive cost – J. Partiot and L. Deroo, ISL Ingénierie, France; X. Mayau, Consultant, France

The hybridization of the 404 MW Bui generating plant using a solar panel – P. Achampong and A.B. Osofo-Kissi, Bui Power Authority, Ghana

Hybrid power plant systems in Africa: Introduction of hybrid PV-Hydro in Zambia – A. Wetzel, Ch. Scholz, S. Palt and M. Stickel, Fichtner GmbH & Co. KG, Germany

The role of hydro-solar hybrid systems in the development of rural Africa – I. Labiano, Ingeteam Power Technology SA, Spain

Floating PV on reservoirs: A threshold analysis based on a cost-benefit appraisal referencing various potential sites across Africa – G. Reithe and J. Großmann, Lahmeyer International GmbH, Germany

Session 23 ~ Sedimentation management

Reservoir sedimentation analysis of the proposed Noordoewer/Vioolsdrift dam on the Orange river and the evaluation of sediment control mitigation measures – G.R. Basson, O.S. Sawadago and J.K. Vonkeman, Stellenbosch University, South Africa

Automatic equipment to control sediment intake and water control for run-of-river hydropower schemes – J.F. von Holdt, Amanziflow Projects (Pty) Ltd, South Africa

(Additional papers to be announced)

Thursday 4 April ~ Afternoon

Session 24 ~ Pumped storage

What is the best peaking generation option, gas turbines or pumped storage? – C. Van Dongen, R. Van Wyk and D. Braytenbach, AECOM, South Africa; C. Venter, Eskom Generation, South Africa

Promoting pumped storage for sustainable power generation – J. Kenfack and U. Nzotcha, University of Yaoundé, Cameroon

Development of pumped-storage plants in Morocco: A contribution to achieving the national strategy objective – K. Peissner, Fichtner GmbH & Co. KG, Germany

Pumped-storage projects in active seismic zones along the Jordan Rift Valley, Israel – M. Levin, Geotope Ltd, Israel

Session 25 ~ Spillways

Maximizing the storage capacity of Osplas dam during enlargement – D.J. Hagen, C. Starke and W.M.E. van Deijl, Ingerop SA, South Africa

Automatic self-actuating spillway gates to gain additional water storage for hydropower generation – P. Townshend, Amanziflow Projects (Pty) Ltd, South Africa

Guidelines for assessment of scour in unlined spillways – S.E. Pells, Pells Sullivan Meynink, Australia; K. Douglas, UNSW, Australia

Diversion scheme, spillway and bottom outlet of the Laúca hydro project – J.F. Pinheiro Machado, R. Grube and C.T. Dalmora, Intertechnique Consultores, Brazil

Design of the spillway of Polihali project – A. Pitton-Rossillon and S. Fray, Tractebel Engineering SA, France; A. Lara, HLC, France

Session 26 ~ Electrical engineering

Implementation of unitised auxiliary power supply and a fast transfer facility – M. Stehle, Nampower, Namibia

Modern generator technology for Angola’s recent hydro power plant at Lúaca – W. Lestädter, A. John and A. Hasenhüttl, Andritz Hydro GmbH, Austria

Mozambique national dispatching centre – F.J. Coelho da Rocha e Silva, REN, Portugal; F.A. Massingue, RB. Saidiane and N. Pelembe, EDM, Mozambique

Closing plenary session

Summaries and Outcomes of the AFRICA 2019 sessions

Closing of the Conference

Welcome to HYDRO 2019 in Porto, Portugal

AMI HYDROPOWER FOUNDATION

This is an independent charitable foundation, governed by an international board of trustees. It was set up in 2007, with the principal aim of facilitating the participation of delegates from the less developed countries, and others with current economic constraints, at Aqua-Media’s conferences.

Details of the application process for funding can be found on our website: www.hydropower-dams.com/foundation

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 not usually be covered, although in some exceptional cases a contribution towards travel costs might be granted.

If you or your company would like to make a donation to the Foundation, there is an opportunity to do so when completing the online registration process.
EVENING EVENTS
A full social programme has also been organized, to provide many additional networking opportunities for the international participants in a relaxed atmosphere.

The pre-conference reception for speakers and chairpersons will be held, as usual, at the conference venue on the evening before the conference begins. This will be on a terrace of the Safari Court Hotel, and will include a light supper.

The **AFRICA 2019 Welcome Reception** will be held at the pool-side area in the gardens of the Safari Court Hotel. After aperitifs, a buffet supper will be served, and there will be some entertainment, as well as time to talk.

The **Conference Gala Dinner** will be held in the ballroom and gardens of the elegant Country Club in Windhoek, located close to the city centre. After a welcome cocktail, there will be some musical entertainment, and a buffet dinner with a chance to taste local specialities. The dinner will be a memorable ending to AFRICA 2019.

ACCOMPANYING PERSONS’ PROGRAMME

**TUESDAY 2 APRIL**
N/a’an ku sê (Naankuse) Lodge and Ancient San Skills Academy

The academy was established in 2013 as a joint venture between the N/a’an ku sê Foundation and the Nyae Nyae conservancy. It is a reciprocal training venture, where visiting groups from the Nyae Nyae Conservancy stay at the reserve to display their cultural heritage and skills to the resident San community at N/a’an ku sê; at the same time, San from the Nyae Nyae can apply for training in a specific vocation through the Foundation. The academy is sustained through tourists from N/a’an ku sê Lodge and Ondekaremba Guest Farm visiting the Academy on the reserve. While visiting the Academy, participants will learn of San activities such as signs and tracks of the veldt, fire making with traditional San fire sticks, making bows and arrows, jewellery and craft making and hunting in the traditional San way.

**WEDNESDAY 3 APRIL**
GocheGanas Nature Reserve

Perched on a hilltop close to Windhoek, the GocheGanas Reserve and Wellness Village offers stunning views over the surrounding mountain ranges and the city.

The group will enjoy a game drive in the private reserve to view some of the wildlife species such as: white rhino, giraffe, eland and wildebeest.

With 25 wildlife species on the 6000 ha of GocheGanas, the game drives are a very popular activity. A qualified guide will give information on fauna and flora, including some interesting bird species.

The GocheGanas Wellness Village is the leading spa in Namibia. It has a heated indoor swimming pool, a variety of treatment rooms, a cave-like sauna, a hydrotherapy bath and a fully equipped gym.

The group will be offered a complimentary massage, to provide a relaxing end to the trip before the return to hotels.

**THURSDAY 4 APRIL**
N/a’an ku sê (Naankuse) animal reserve

The third excursion will begin with a ‘baboon walk’ at N/a’an ku sê, to learn more about these primates. All the baboons came to N/a’an ku sê either after becoming orphaned or having been rescued from incidents of abuse.

Lunch will be provided.

In the afternoon there will be a drive through the N/a’an ku sê reserve, where there will be opportunities to see caracals, lions, cheetahs, wild dogs and leopards, and to watch them being fed by experienced guides.

This will be followed by a scenic drive, with a good chance of spotting some of the other wildlife on the reserve; and the group will learn about the conservation and work done at N/a’an ku se.

The group will return in good time to relax before the farewell dinner in the evening, at the Windhoek Country Club which is a short distance from the Safari Court Hotel.
AFRICA 2019 HOTELS

Safari Court Hotel
Adjacent to Congress Centre
This world class 4* hotel is the main headquarters hotel of AFRICA 2019, adjacent to the conference centre. Bedrooms overlook either the garden and pool, or the city. Free WiFi is available. The restaurant offers a buffet with local specialities as well as local cuisine, and there is an outside terrace and nearby snack bar. Amenities also include a fitness centre and spa.

Per person, single occupancy: US$ 120
Per person sharing twin/double: US$ 80

Hotel Safari
Adjacent to Congress Centre
Hotel Safari offers 3* accommodation, and the convenience of being adjacent to the Safari Court hotel and Congress Centre. Two categories of room are available; although the accommodation is more basic, delegates can share the amenities of the Safari Court hotel, and be a few minutes walk from the Congress Centre.

Business category room:
Per person, single occupancy: US$ 102
Per person sharing twin/double: US$ 60

Standard room:
Per person, single occupancy: US$ 90
Per person sharing twin/double: US$ 55

Windhoek Country Club
Windhoek City
This 4* luxury resort hotel is set in a landscaped garden within the city, and a short shuttle bus ride to the Safari Court. There are business facilities, a health club and outdoor pool, and all rooms have a balcony or terrace. There are three restaurants, serving local and international cuisine, and 24 hour room service.

Single occupancy: US$ 160
Double occupancy: US$ 98

Hilton Windhoek
City Centre
The Hilton Windhoek is a stylish and comfortable world class hotel, with five restaurants offering a wide range of local and international cuisine, bars and lounges, including a rooftop bar with a panoramic view of the Windhoek skyline. There are full business facilities, as well as a fitness centre, spa and rooftop pool. A shuttle service will be available to the Safari Court Congress Centre.

Executive room:
Per person, single occupancy: US$ 225
Per person sharing twin/double: US$ 125

Standard room:
Per person, single occupancy: US$ 165
Per person sharing twin/double: US$ 98

Avani Hotel
Windhoek City Centre
Avani is a business hotel in the centre of the city, with bedrooms overlooking either the city or the mountains. The hotel has a restaurant offering an international buffet with live cooking stations, or a deli-style café for snacks. There is a rooftop pool. A shuttle service will be available to transfer delegates to the Safari Court Congress Centre.

Single occupancy: US$ 182
Double occupancy: US$ 105

Protea Furstenhof
Windhoek City Centre
Protea is a recently refurbished 3* hotel, and is part of the Marriott group. This modern hotel is located in the business district of Windhoek. The restaurant has a terrace and a bar, and room service is available from 06.30 hrs until 22.30 hrs. The hotel has facilities. A shuttle service will be available to transfer delegates to the Safari Court Congress Centre.

Single occupancy: US$ 132
Double occupancy: US$ 76

Room rates include breakfast.
We recommend booking early to ensure your first choice of hotel is available.
TOUR A : 4 days
South of Windhoek, to Naute, Oanab, Neckartal and Hardap dams
The group will travel by luxury coach to the south of the country.
The first technical visits will be to the Oanab and Naute dams. Oanab is a 50 m-high double curvature arch dam, completed in 1990. It has a reservoir capacity of $34 \times 10^6$ m$^3$.
Naute dam, completed in 1972, is a 37 m-high concrete arch dam. It impounds water from the Löwen river, a tributary of the Fish river.
The next day, the group will travel on to visit the recently completed 76 m-high Neckartal RCC dam which will be impounding at the time of the visit. The purpose of the dam is irrigation water supply; the reservoir will have a full gross capacity of $857 \times 10^6$ m$^3$. The concrete volume of the dam, being built by Salini-Impregilo for the Ministry of Agriculture, Water and Forestry, is about $1 \times 10^6$ m$^3$. The project is designed to support the development of the area by irrigating 5000 ha of land for cultivation, generating employment for hundreds of local people.
On the third day, the tour will continue to the Hardap dam, a 34 m-high CFRD with an asphaltic concrete facing. It has a central concrete spillway equipped with four radial gates.

TOUR B : 5 days
North of Windhoek, to Etosha and Ruacana
The group will travel by luxury coach north from Windhoek to Tsumeb, passing through Okahandja and Otjiwarongo, stopping for a visit to Otkikoto lake.
The overnight stay will be at Tsumeb, "the gateway to the north".
After an early breakfast on the second day, the tour will head on to the Ruacana hydro station, via Ondangwa and Oshakati.
Originally commissioned in 1978, the underground Ruacana plant was equipped with three Francis turbines with a total installed capacity of 240 MW. A fourth unit was added by Andritz Hydro in 2009.
After more than 33 years of operation, NamPower decided in 2013 to refurbish the original three turbines to improve the hydraulic performance of the runners, in terms of their efficiency and maximum power output.
A new control system has also been provided.

After breakfast the group will leave for Windhoek, and transfer to the airport or a city hotel.
The overnight stay will be at the Ruacana Eha Lodge.
The third day will feature a visit to the world famous Etosha National Park, where there will be a full-day game drive, before an overnight stay at Okaukuejo Camp (chalet accommodation).
On the fourth day, the group will travel back to Windhoek for a farewell supper and overnight stay at the Hilton Hotel.

Itineraries may be subject to minor modifications, but the technical visits will remain the same. Tour prices are inclusive of travel by luxury coach, with water on board and English speaking guide, accommodation and meals, and entrance fees.
The modern and spacious Safari Court Ballroom will provide a magnificent setting for the AFRICA 2019 Exhibition, which will take place in parallel with the AFRICA 2019 Conference.

Exhibition space is generally sold in units of 6 m² (with some areas reserved for larger pavilions). Each space reserved includes white panelling, a table, two chairs, spotlights and, a company name sign. The price for each stand space (6 m²) is US$ 3585. Lunch and refreshments will be served each day in the Exhibition hall, to ensure that international participants have plenty of time to visit all exhibitors. Various opportunities will also be available to sponsor or co-sponsor social activities, such as apéritifs, lunches, receptions and coffee breaks. This is a pleasant and memorable way of bringing your organization to the attention of the international participants.

If your organization is actively involved in water resources or hydropower development in the African region, you should not miss this opportunity to be represented at this event, which will bring together high-level delegations in a region of the world with very great potential for future development.

For more details of the Exhibition or sponsorship opportunities, contact: sales@hydropower-dams.com

Single stand prices: 3 x 2 m (6 m²) = $3585

AFRICA 2019 SPONSORS (AS OF DECEMBER 2018)

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<td>8</td>
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<td>29</td>
</tr>
<tr>
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<td><a href="http://www.dolsar.com.tr">www.dolsar.com.tr</a></td>
<td>63</td>
</tr>
<tr>
<td>Dyrhoff Ltd, UK</td>
<td><a href="http://www.dyrhoff.co.uk">www.dyrhoff.co.uk</a></td>
<td>25</td>
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<td>17</td>
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<td>Geokon LLC, USA</td>
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<td>66</td>
</tr>
<tr>
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<td><a href="http://www.gibb.co.za">www.gibb.co.za</a></td>
<td>16</td>
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<td><a href="http://www.gilkes.com">www.gilkes.com</a></td>
<td>33</td>
</tr>
<tr>
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<td><a href="http://www.gugler.com">www.gugler.com</a></td>
<td>81</td>
</tr>
<tr>
<td>GWF Technologies GmbH, Switzerland</td>
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<td>79</td>
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<tr>
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<td>55</td>
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<td>80</td>
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<td>32</td>
</tr>
<tr>
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<td><a href="http://www.hmservice.ch">www.hmservice.ch</a></td>
<td>56</td>
</tr>
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<td>28</td>
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<tr>
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<td>21</td>
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<tr>
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<td>53</td>
</tr>
<tr>
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<td>76</td>
</tr>
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<td>19</td>
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<td>18</td>
</tr>
<tr>
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<td>43</td>
</tr>
<tr>
<td>NamWater, Namibia</td>
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<td>43</td>
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<td><a href="http://www.norwep.com">www.norwep.com</a></td>
<td>61</td>
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<td>27</td>
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<td>Omexom, France</td>
<td><a href="http://www.omexom.com">www.omexom.com</a></td>
<td>34</td>
</tr>
<tr>
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<td><a href="http://www.en.powerchina.cn">www.en.powerchina.cn</a></td>
<td>55</td>
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<td>54</td>
</tr>
<tr>
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<td>67</td>
</tr>
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<td>15</td>
</tr>
<tr>
<td>Sweco International, Sweden</td>
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<td>64</td>
</tr>
<tr>
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<td>65</td>
</tr>
<tr>
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<td><a href="http://www.tractebel-engie.com">www.tractebel-engie.com</a></td>
<td>41</td>
</tr>
<tr>
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<td><a href="http://www.voithhydro.com">www.voithhydro.com</a></td>
<td>59</td>
</tr>
<tr>
<td>Vortex Hydra, Italy</td>
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<td>68</td>
</tr>
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<td>73</td>
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<td>26</td>
</tr>
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To receive further details of the exhibition and/or sponsorship opportunities, please contact:
Dr Lukas Port or Mrs Maria Loredo

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Alternatively, we invite you to book exhibition space online at: www.hydropower-dams.com/africa-2019/exhibition-plan
The Conference AFRICA 2019 - 3rd International Conference on ‘Water Storage and Hydropower Development for Africa’ is being organized by Hydropower & Dams (Aqua~Media International) in partnership with the International Commission on Large Dams, with event management by The Conference Collective.

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 The Conference Collective on behalf of Aqua~Media. You will receive an acknowledgement of registration on completion of this process; this is not a confirmation (until payment is received).

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 hydro, or if there could be a conflict of interest with the mission of the conference, the organizers, or any policy of the host country).

In the unlikely event of any difficulties using this system, please contact The Conference Collective (see contact details below).

Picking up conference documents and badges
The registration desk will be open from 09.00 hrs on Monday 1 April 2019, at the Safari Court Conference Centre, and bags can be collected from 14.00 hrs. Pre-registration is generally required, by one of the methods mentioned above.

Payment
Payment for all services (fees, hotels, tours) must be made in US dollars (US$) and received in advance of the Conference. Payment is possible by the following methods:

- On-line by Visa or Mastercard
- By bank transfer (see details on the registration form);
- All fees paid by credit card will be charged in US dollars (US$).

Accommodation
The Conference organizers have negotiated rates at hotels in several price categories in Windhoek.

Accommodation bookings are being handled by The Conference Collective. Please include your hotel booking at the time of registering (using the on-line booking system). Beware of scam accommodation bureaux who falsely claim to represent AFRICA 2019. We recommend that you do not pass credit card details to them. We strongly recommend that bookings are made as soon as possible, and at the latest before the end of February. Payment must be made in full at the time of booking.

Disclaimer
All best endeavours will be made to present the programme as printed.

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>Registration for the Conference</th>
<th>Technical Excursions (Study Tours)</th>
<th>Accommodation</th>
</tr>
</thead>
<tbody>
<tr>
<td>On or before 15 February 2019</td>
<td>10% of fee will be forfeited</td>
<td>10% of fee will be forfeited</td>
<td>10% of fee will be forfeited</td>
</tr>
<tr>
<td>From 16 February to 11 March 2019</td>
<td>50% of fee will be forfeited</td>
<td>No refund unless place can be resold</td>
<td>No refund unless place can be resold</td>
</tr>
<tr>
<td>On or after 12 March 2019</td>
<td>No refund</td>
<td>No refund</td>
<td>No refund</td>
</tr>
</tbody>
</table>

No refund unless place can be resold

Contacting Exhibitors
Exhibitors who have paid in full can cancel until 15 February 2019.

Cancellations
Cancellations must be made in writing to The Conference Collective. Cancellation charges will be payable as shown in the Table below.

No refund unless place can be resold

Payment
Fees paid by credit card will be charged in US dollars (US$).

The AFRICA 2019 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 AFRICA 2019 for any cause beyond its reasonable control. The organizers and agents are not liable for any loss or inconvenience resulting from such alteration. The Tours are subject to minimum numbers. Tour places are subject to availability on a first-come-first-served basis. Full payment for tours must be received at the time of registration.

Cancellations
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 Conference Collective, with event management by Aqua~Media in the UK and one of our partner organizations in Namibia may be necessary. 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, and provide your full name, date of birth, passport details, and proposed dates of arrival and departure. 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.

Passport and Visa Requirements for Namibia
It is the responsibility of all participants to check their passport and visa requirements. Please contact the Namibian embassy or consulate in your country if in doubt about requirements. In some cases, letters of invitation from Aqua~Media in the UK and one of our partner organizations in Namibia may be necessary. 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, and provide your full name, date of birth, passport details, and proposed dates of arrival and departure. 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.

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

CONTACT DETAILS
For enquiries concerning registration and accommodation, contact:

africa2019@conferencecollective.co.uk  •  Tel: +44 (0) 20 8977 7997

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: africa2019@hydropower-dams.com

Regular updates and on-line registration via: www.hydropower-dams.com
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.

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REduced DELEGATE FEE  For existing subscribers to Hydropower & Dams.

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FEE INCLUDING NEW SUBSCRIPTION TO H&D  Six issues from No. 1, 2 or 3, 2019 (please circle as applicable) + Atlas + Maps (This represents a saving of about 40 per cent on the normal H&D subscription rate).

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SPEAKER FEE  Includes all facilities described above for Full Delegates, plus an additional reception on Monday 1 April. NB: This fee applies to one person per paper (main author or presenter).


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

SECOND + THIRD EXHIBITOR FEE  (Fee per person for up to two additional exhibitors). This includes all benefits available to full delegates.

SMALL HYDRO TRAINING SEMINAR  (Full day on Monday 1 April)

WORKSHOP ON PRIVATE INVESTMENT  (Full day on Monday 1 April)

WORKSHOP ON RIVER/RESERVOIR YIELD ANALYSIS  (Full day on Monday 1 April)

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.

Cost for registering as an accompanying person:

HALF DAY CITY EXCURSION  (on 1 April; includes lunch). Cost per person:

DONATION TO THE AMI HYDROPOWER FOUNDATION:  There will be opportunity when registering to make a donation to the AMI Hydropower Foundation, 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 less developed countries at the annual Hydro Conferences.

TECHNICAL TOURS  Prices include transportation, meals, guides, entrance fees on sightseeing trips, and hotels

Tour A - South to Neckartal dam  
See website for price

Tour B - North to Ruacana and Etosha National Park  
See website for price

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

VISA REQUIREMENTS:  You can 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 US$ 10 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.
**SUBSCRIPTION APPLICATION FORM**

Subscribers are entitled to discounted registration fees at AFRICA 2019

<table>
<thead>
<tr>
<th>Title(s)</th>
<th>First name(s)</th>
<th>Last name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization</td>
<td>Position/Dept</td>
<td>Address</td>
</tr>
<tr>
<td>Zip/Post code</td>
<td>Email</td>
<td>Country</td>
</tr>
</tbody>
</table>

Your general field of interest (tick one box or more)
- [ ] Hydropower
- [ ] Dams
- [ ] Water resources

Your organization’s main activity (tick one box or more)
- [ ] Developer
- [ ] Owner
- [ ] Plant Operator
- [ ] Government Department
- [ ] Contractor
- [ ] Manufacturer
- [ ] Supplier
- [ ] Design Engineering
- [ ] Management
- [ ] Consultancy
- [ ] Finance
- [ ] Legislation
- [ ] Insurance
- [ ] Library
- [ ] Research
- [ ] Environmental Specialist
- [ ] Society/Association
- [ ] Other (please specify)

How often do you visit the H&D website (www.hydropower-dams.com)?
- [ ] Frequently
- [ ] Occasionally
- [ ] Never

Would you like to receive further details about HYDRO 2019 (in Porto)?
- [ ] Yes
- [ ] No

Would you like to receive details about all our future events by post?
- [ ] Yes
- [ ] No
- [ ] by occasional emails?
- [ ] Yes
- [ ] No

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