

# Adam M. Witt

## Curriculum Vitae

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### Education

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#### PhD, Civil Engineering

University of Minnesota, Minneapolis, MN ..... 2014  
Dissertation: Analytical and Numerical Investigation of an Air Entraining Hydraulic Jump  
Advisors: John Gulliver and Lian Shen

#### MS, Civil Engineering

University of Minnesota, Minneapolis, MN ..... 2012

#### BA, Physics

Carleton College, Northfield, MN ..... 2006  
Cum laude, Concentration in French and Francophone Studies

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### Hydropower Research Experience

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#### Postdoctoral Research Associate

Energy Water Resource Systems Group, Oak Ridge National Lab, Oak Ridge, TN .....2014-present

My research is focused on developing, analyzing, and deploying innovative and environmentally sustainable water power and energy storage technologies and solutions. Major initiatives include:

- 1. Lead the engineering and ecological design and analysis of advanced hydropower technologies**  
Currently leading a technical team of hydropower engineers, electric machine design experts, aquatic ecologists, and hydraulics and sediment specialists from three research groups at ORNL and two research groups at the University of Tennessee to conceptually develop exemplary design specifications for modular hydropower technologies. This project intends to couple eco-design with concepts in standardization and modularity to initiate a new paradigm in hydropower facility design and development aimed at lowering cost and environmental barriers to deployment. Major project tasks include coordinating, managing, guiding, soliciting, and integrating input from a team of 19 technical experts and authoring a technical report on project findings.
- 2. Design and implement cost assessment methodologies for modular pumped storage hydropower**  
Spearheading a multi-year effort to investigate the feasibility of small, distributed scale pumped storage hydropower facilities and concepts through a variety of site-specific case studies, development of parametric cost models, revenue modeling and simulation in targeted power markets, and advanced financial modeling. Major tasks include conceptual engineering reference design and take-off cost estimating of modular pumped storage projects, development of linear programming software subroutines to simulate energy storage revenue potential, development of a scalable cost model and financial analysis tool, communication with industry experts to generate and verify cost and engineering assumptions, and authoring annual and quarterly technical reports and memos documenting project results.
- 3. Develop and implement environmental impact mitigation software and forecasting tools for the mid-Columbia River cascade hydropower system**  
Gather and analyze historical data from fixed monitoring stations at multiple locations, and develop, calibrate, and validate a reduced order model for predicting the uptake of total dissolved gas at hydropower facilities. Major tasks include authoring a publication to be peer-reviewed,, analysis of complex and imperfect data sets, coordination of methods and analysis with engineers from the University of Iowa and University of Colorado, Boulder through workshops, email, and phone discussions, development of appropriate case studies in RiverWare to show added value of software to hydropower asset owners, and communication of results via presentations and technical reports.

4. **Conduct technical assessments and training of plant personnel at multiple hydropower facilities in Southeast Asia in collaboration with the US DOE, DOI, and USAID**

Gathered and analyzed historical data on plant operations, unit condition, and unit characteristics at hydropower plants in Thailand and Laos to quantify energy, revenue, and water optimization opportunities that could be realized through process and operational improvements. Major tasks include site visits, utilization of complex optimization and automated efficiency analysis software, communication of technical optimization concepts with plant personnel, executive management teams, and non-technical project sponsors, training plant personnel on the use and benefits of optimization software, and authoring technical reports on relevant findings and analyses.

5. **Develop a methodology to estimate the economic benefits of federal multipurpose hydropower reservoirs**

Led a collaborative research effort to gather economic benefit valuation methodologies and historical data on hydropower generation and five additional non-energy services from three federal agencies and synthesize into a common methodology for analysis. Major tasks include authoring technical reports and conference proceedings, communication with inland waterways experts at the University of Tennessee and hydropower experts at the US Bureau of Reclamation, developing robust analysis methods based on limited and imperfect information, and development of rich graphics and visualizations for dissemination of results through conference presentations.

**Graduate Research Assistant**

Civil Engineering, St. Anthony Falls Hydraulic Laboratory, Minneapolis, MN ..... 2010-2014

Developed analytical, computational, and numerical models to characterize the hydrodynamics of air entraining hydraulic jumps. Major research activities carried out include:

- Designed, ran, and analyzed turbulent, unsteady, multiphase, massively parallel computational fluid dynamics (CFD) simulations in OpenFOAM and FLUENT.
- Developed algorithms in MATLAB for multi-physics assessments of bubble-water interactions and bubble clustering, and rich visualization of turbulent structures and bubble-turbulence interactions.
- Developed an improved analytical model for predicting dissolved oxygen transfer at hydropower plants.
- Evaluated the feasibility, design, and performance of stream restoration projects through field studies.
- Designed a social venture and business plan to improve water access in poor New Delhi communities.
- Earned a certification in Stream Restoration in Science and Engineering.

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**Business Experience**

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**Account Executive**

Travelers, San Francisco, CA ..... 2006-2010

- Managed a \$4.3 million portfolio of executive risk liability insurance.
- Ranked 1/42 nationally for new sales in 2008, meeting 183% of annual premium generation goal.
- Built strategic partnerships with brokers (Ranked 1/58 for new business leads in 2008).
- Met regularly with C-level executives of publicly traded companies to flesh out risk exposures that may have been buried in public financial statements.

**National Software Analyst**

Travelers, San Francisco, CA ..... 2008-2010

- Lead business unit contact for the executive liability portfolio of publicly traded software companies.
- Developed underwriting strategy, conducted detailed market analyses, and forecasted industry trends to mitigate exposure to loss in the \$12 million public software company book of business.

### Peer-Reviewed Publications

1. **A.M. Witt**, J. Gulliver, and L. Shen, 2015. Simulating air entrainment and vortex dynamics in a hydraulic jump. *International Journal of Multiphase Flow* 72, 165-180.
2. **A.M. Witt** and J. Gulliver, 2012. Predicting oxygen transfer efficiency at low-head gated sill structures. *J. Hydraulic Res.*, 50(5), 521-531.
3. **A.M. Witt** and J. Gulliver, 2012. Method for predicting oxygen transfer at low-head dams. *Hydro Review*, 31(4), 58-65.

### *In preparation*

4. **A.M. Witt**, T Magee, K. Stewart, B. Hadjerioua, D. Neumann, E. Zagona, M. Politano. Development and implementation of an optimization model for hydropower and total dissolved gas in the mid-Columbia River System. *Journal of Water Resources Planning and Management*. Expected submittal: October 2016.
5. **A.M. Witt**, K. Stewart, B. Hadjerioua. Technical Note: Total dissolved gas transport in reservoir systems. *Journal of Hydroinformatics*. Expected submittal: November 2016.
6. **A.M. Witt**, D. Chalise, B. Hadjerioua. Development and implications of a predictive cost model for modular pumped storage hydro. Targeted Journal: *Applied Energy*. Expected submittal: December 2016.

### Technical Reports

1. **A.M. Witt**, D.R. Chalise, B. Hadjerioua, N. Bishop, M. Manwaring. Development and Implications of a Predictive Cost Methodology for Modular Pumped Storage Hydropower (m-PSH) Projects in the United States. ORNL/TM-2016/590.
2. **A.M. Witt**, R. Brink, D.R. Chalise, B. Hadjerioua. Preliminary Feasibility Study of a Hybrid Solar and Modular Pumped Storage Hydro System at Biosphere 2. ORNL/TM-2016/591.
3. **A.M. Witt** et al. 2016. Exemplary Design Envelope Specification for Standard Modular Hydropower Technology. ORNL/TM-2016/298.
4. B. Smith, **A.M. Witt**, et al., 2016. A Multi-Year Plan for Research, Development, and Prototype Testing of Standard Modular Hydropower Technology. ORNL/TM-2016/102.
5. B. Hadjerioua, **A.M. Witt**, P. Wolff, 2016. U.S. - Laos Smart Sustainable Hydropower Project (SSHP) – Technical Assessment and Training Findings and Recommendations. ORNL/TM-2016/149.
6. **A.M. Witt**, B. Hadjerioua, R. Uria-Martinez, N. Bishop, 2015. Evaluation of the Feasibility and Viability of Modular Pumped Storage Hydro (m-PSH) in the United States. ORNL/TM-2015/559.
7. B. Hadjerioua, **A.M. Witt**, 2015. SMART INFRASTRUCTURE FOR THE MEKONG (SIM) PROGRAM Sustainable Hydropower in Lower Mekong Countries: Technical Assessment and Training Findings and Recommendations. ORNL/TM-2015/649.
8. M. Bonnet Acosta, **A.M. Witt**, K.M. Stewart, B. Hadjerioua, M. Mobley, 2015. The Economic Benefits of Multipurpose Reservoirs in the United States-Federal Hydropower Fleet. ORNL/TM-2015/550.
9. K.M. Stewart, **A.M. Witt**, B. Hadjerioua, 2015. Total Dissolved Gas (TDG) Prediction and Optimization in RiverWare. ORNL/TM-2015/551.

### *In preparation*

10. K. Lee et al. Testing and Validation Capability for Standard Modular Hydropower Technology. Expected submittal: September 2016.

### Conference Proceedings (\* indicates presentation)

1. **A.M. Witt**, D.R. Chalise, B. Hadjerioua, N. Bishop. 2016. Can Innovation and Targeted Cost Reductions Encourage the Feasibility of Modular Pumped Storage Hydro (m-PSH) in the United States? Proc., HydroVision International Conference, Minneapolis, MN.
2. B. Hadjerioua, **A.M. Witt**, J. Kern, M. Christian. 2016. Hydropower Generation Performance Testing at Two Hydropower Plants in Thailand and Two Hydropower Plants in Laos. Proc., HydroVision International Conference, Minneapolis, MN.
3. K.M. Stewart, **A.M. Witt**, S. T. DeNeale, A. Maloof, B. Hadjerioua, M. Politano, T. Magee, M. Bender. 2015. Total Dissolved Gas Prediction & Implementation within an Optimization Scheduling Model for the Mid-Columbia River System. Proc., HydroVision International Conference, Portland, OR.
4. **A.M. Witt**, B. Hadjerioua, R. Uria-Martinez, N. Bishop. 2015. Economic Feasibility in U.S. Markets for Modular Pumped Storage Hydro (m-PSH). Case Study Preliminary Results: Coal Mine and High-Rise Buildings. Proc., HydroVision International Conference, Portland, OR.
5. B. Hadjerioua, **A.M. Witt**, K. Stewart, M. Bonnet. 2015. The Economic Benefits of Multipurpose Reservoirs in the United States: Case Study of the Cumberland River System. Proc., HydroVision International Conference, Portland, OR.

6. B. Hadjerioua, **A.M. Witt**, K. Stewart, M. Bonnet, M. Mobley. 2015. The Economic Benefits of Multipurpose Reservoirs in the United States: Case Study of Federal Agencies. Proc., HYDRO 2015, Bordeaux, France.
7. **\*A.M. Witt**, J.S. Gulliver, L. Shen. 2014. CFD modeling of bubble dynamics at a hydraulic jump. Proc., HydroVision International Conference, Nashville, TN.
8. **\*A.M. Witt**, J.S. Gulliver, L. Shen. 2013. Void fraction and bubble size in a simulated hydraulic jump. Gallery of Fluid Motion. Bulletin of the American Physical Society, 58 (18), Pittsburgh, PA.
9. **\*A.M. Witt**, J.S. Gulliver. 2012. Predicting oxygen transfer at low-head dams. Proc., HydroVision International Conference, Louisville, KY.

#### **Presentations (\* indicates invited talk)**

*HydroVision International Conference, Minneapolis, MN .....	<b>2016</b>
*Laos Ministry of Energy and Mines, Vientiane, Laos .....	<b>2016</b>
*Thailand Ministry of Energy, Bangkok, Thailand .....	<b>2015</b>
HydroVision International Conference, Portland, OR.....	<b>2015</b>
HydroVision International Conference, Nashville, TN .....	<b>2014</b>
Annual Meeting of the A.P.S. Division of Fluid Dynamics, Pittsburgh, PA .....	<b>2013</b>
HydroVision International Conference, Louisville, KY .....	<b>2012</b>
International Junior Researcher and Engineers Workshop on Hydraulic Structures, Logan, UT .....	<b>2012</b>
*TextRA Investor Pitch, Acara Summer Institute, Bangalore, India.....	<b>2011</b>

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#### **Honors, Awards, and Fellowships**

Third Place, Research Symposium Poster Session, Oak Ridge Postdoctoral Research Association.....	<b>2016</b>
Technical Paper of the Year, Second Place, HydroVision International Conference .....	<b>2015</b>
Technical Paper of the Year, Third Place, HydroVision International Conference.....	<b>2015</b>
Sommerfeld Fellowship, Civil Engineering Department, University of Minnesota .....	<b>2013</b>
Hydro Research Foundation Fellowship, Department of Energy .....	<b>2010-2013</b>
Acara Challenge Scholarship, Bangalore, India .....	<b>2011</b>
Minnesota Cup Business Competition Semifinalist .....	<b>2011</b>
Distinction in Senior Thesis, The Physics of the Piano, Carleton College .....	<b>2006</b>
Captain, Four-year letter winner, 2004 All-Conference, Varsity Football, Carleton College .....	<b>2002-2005</b>

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#### **Professional Activities**

Technical Reviewer, Journal of Environmental Fluids Mechanics .....	<b>2016</b>
Executive Committee, Research Chair, Oak Ridge Postdoc Association.....	<b>2015-2016</b>
Expert Reviewer, DOE SBIR and STTR Water Power Program grant proposals .....	<b>2015</b>
St. Anthony Falls Laboratory Student Council, Co-founder, Member .....	<b>2011-2014</b>
Certified Property and Casualty Underwriter, Underwriting Professional Designation .....	<b>2009</b>

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#### **Software Skills**

**Microsoft Office** – Technically proficient in PowerPoint, Excel, and Word

**CFD solvers and visualization tools** - OpenFOAM, FLUENT, ParaView

**Mathematical programming environments** - MATLAB, Python, limited experience with C++

**Visualization and design tools** - Google SketchUp, Photoshop

**Water scheduling and operations optimization** - Hydroplant Performance Calculator, limited experience with RiverWare