

## 2012 Topics and Areas of Interest for the Hydro Fellowship Program

Awards under the Hydro Fellowship Program for 2012 will focus on topics related to the improvement of **conventional hydropower and pumped storage hydropower** technologies and operations. Preference will be given to Mechanical and Electrical Engineering graduate students who are in their last year of completing their Masters degrees. Research topics submitted for consideration in applications for 2012 awards should generally relate to one or more of the topics in the following research topics listing. Applicants should identify the topic number(s) to which their topic most directly relates.

For your information, the following research topics are being addressed under fellowship awards in 2012.

*Topics in Electrical and Mechanical Engineering related to Advances in Generators, Turbines Transformers, and Electrical Systems such as:*

1. Advances in instrumentation and controls (protection, automation, governors, Supervisory Control and Data Acquisition (SCADA))
2. Tools to assess the role of hydropower in power system stability and reliability
3. New technology to increase energy efficiencies of turbines under a wide range of operating conditions, particularly related to support of intermittent energy sources
4. New technology to increase water-use efficiency
5. Advanced turbines for energy and environmental performance
6. Generator design for quick start and frequent cycling
7. Improvements in pumps and/or reversible pump-turbines
8. Advances in Pump-Turbines, and Related Technologies for use in pumped-storage hydropower and renewable energy storage
9. Improvements in variable speed generators
10. Advances in generators for use with low-head turbines
11. Design of standardized low-head turbines (e.g. drop-in turbines) having minimal environmental impact
12. Improvements in pumped storage planning and design
13. Inline turbines for installation in pressurized water distribution or conveyance systems
14. Turbines with environmental benefits such as improved fish passage survival rates
15. New technology to enhance downstream water quality
16. Resource assessment for power potential at closed conduits
17. Innovative integration and control mechanisms for power systems with various types of renewable energy
18. Predictive Maintenance/Repair and Condition Monitoring
19. Other topics
20. Advances in generator insulation systems
21. Improvements to environmentally compatible oils and lubricants
22. Cavitation and erosion-resistant materials
23. Advances in stator core materials
24. Innovations in coatings for water conveyance structures

Other topics that will be considered are:

*Simulation and Optimization Tools*

25. Simulation and optimization models for machine and operational improvements

26. Optimization tools for realizing the full potential of pumped storage projects for provision of grid services.

#### *Protection of Critical Hydropower Infrastructure*

27. Improvements in the assessment of effectiveness of critical hydropower infrastructure protection methods and technology
28. Development of risk assessment and management tools for critical hydropower infrastructure
29. Development of critical hydropower infrastructure protection strategies including physical security and cyber security for hydropower

#### *Market Trends and Strategies*

30. Economics of pumped storage
31. Innovative market structures that recognize hydropower's ancillary benefits
32. Assessment of conventional and pumped-storage hydropower's benefits to transmission systems
33. Operational costs to hydro for supporting intermittent renewables
34. Pricing of hydroelectricity and cost recovery for hydroelectric generation projects
35. Certification and verification of hydropower as green energy (Renewable Energy Credits, etc.)

#### *Project Implementation, Management and Operations*

36. New technology for cost effective, faster hydro project implementation
37. Innovations in planning and strategies for rehabilitation for increases in efficiency and capacity
38. Operational improvements to maximize ancillary benefits
39. Innovations in pumped storage design and operation
40. Hydraulic performance testing and improved flow measurement
41. Turbine/generator equipment failure forensics and root-cause analysis
42. Improved methods for knowledge capture and transfer in hydropower workforce transitions
43. Human factors considerations for safe operation of hydropower facilities

#### *Water Management Innovations*

44. Multi-purpose water management systems, including use of off-channel water storage
45. Structural and geotechnical aspects of hydropower dam safety
46. Reliable surveillance and monitoring of hydropower dams (even during power outages) including rapid notification of developing emergencies such as floods, structural problems, leaks, security breaches, etc.
47. Advanced weirs for flow re-regulation and aeration

#### *New Research Topics*

48. Other research topics that will directly contribute and be of value to the hydro industry