

2016 Topics and Areas of Interest for the Hydro Research Awards Program

Awards under the Research Awards Program in 2016 will focus on topics directly related to the improvement of **conventional hydropower and pumped storage hydropower** technologies and operations. Research topics submitted for consideration in applications for the awards should strongly relate to one or more of the topics in the following list.

Research categories of interest and topics within categories are listed in order of preference (i.e., first listed are highest priority for the 2016 funding). Topics marked with an asterisk (*) note the top priorities within the industry from a 2014 study conducted by the Hydro Research Foundation and the National Hydropower Association.

Applicants should identify the topic number(s) to which their proposal most directly relates on their application form.

Advances in Hydropower Equipment

1. *Tools to assess the role of hydropower in power system stability and reliability
2. *Predictive Maintenance/Repair and Condition Monitoring
3. *New technology to increase water-use efficiency
4. Advanced turbines for energy efficiency and environmental performance
5. Design of standardized low-head turbines (e.g. drop-in turbines) having minimal environmental impact
6. Resource assessment for power potential at closed conduits
7. Advances in instrumentation and controls [protection, automation, governors, Supervisory Control and Data Acquisition (SCADA)]
8. Generator design for quick start and frequent cycling
9. New technology to increase energy efficiencies of turbines under a wide range of operating conditions, particularly related to support of intermittent energy sources
10. Innovative methods to reduce the cost of underground excavation in project construction
11. Advances in Pump-Turbines, and Related Technologies for use in pumped-storage hydropower and renewable energy storage
12. Improvements in pumps and/or reversible pump-turbines
13. Improvements in variable speed generators
14. Advances in generators for use with low-head turbines
15. Improvements in pumped storage planning and design
16. Inline turbines for installation in pressurized water distribution or conveyance systems
17. New technology to enhance downstream water quality
18. Innovative integration and control mechanisms for power systems with various types of renewable energy
19. Advanced high-efficiency generator designs (superconducting technology, etc.)
20. Modular pumped storage designs (<100MW size range)

Advanced Material Applications

21. Innovations in coatings for water conveyance structures
22. Cavitation and erosion-resistant materials
23. Improvements to environmentally compatible oils and lubricants

24. Advances in generator insulation systems
25. Advances in stator core materials
26. Application of additive manufacturing for the production of hydropower machinery

Environmental and Societal

27. *Technology to improve fish passage and protection of migratory species
28. *Mitigation effectiveness studies
29. Management strategies for invasive species
30. Atmospheric emissions from Reservoirs, including GHG's and evaporation
31. Adaptation to climate change and variability/extreme events
32. Improving environmental flow requirements, especially at peaking projects
33. Resolution of conflicts with tribal/indigenous peoples perspectives
34. Sedimentation and erosion control
35. Shoreline and land management/recreation
36. Tools for environmental optimization
37. Water quality management and mitigation
38. Endangered species and habitat protection

Project Implementation, Management and Operations

39. Cavitation detection methods- identifying damaging cavitation from non-damaging
40. Hydraulic performance testing and improved flow measurement
41. Hydraulic performance testing and improved flow measurement
42. Operational improvements to maximize ancillary benefits
43. Innovations in pumped storage design and operation
44. New technology for cost effective, faster hydro project implementation
45. Improved methods for knowledge capture and transfer in hydropower workforce transitions
46. Turbine/generator equipment failure forensics and root-cause analysis
47. Innovations in planning and strategies for rehabilitation for increases in efficiency and capacity
48. Human factors considerations for safe operation of hydropower facilities- including noise reduction and arc flash detection
49. Cost reduction strategies for maintenance of facilities

Protection of Critical Hydropower Infrastructure

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

Market Trends and Strategies

53. Innovative market structures that recognize hydropower's ancillary benefits
54. Certification and verification of hydropower as green energy (Renewable Energy Credits, etc.)
55. Operational costs to hydro for supporting intermittent renewables
56. Resource assessment and validation
57. Economics of pumped storage
58. Renewable energy integration strategies using pumped storage and conventional hydro
59. Pricing of hydroelectricity and cost recovery for hydroelectric generation projects

Simulation and Optimization Tools

60. Simulation and optimization models for machine and operational improvements
61. Optimization tools for realizing the full potential of pumped storage projects for provision of grid services.
62. Physics-based modeling and real-time analysis of hydropower systems integrated with other non-hydro renewables, fossil, and/or nuclear power systems.
63. Optimization models and strategies to predict short-term water availability and efficient water use.

Water Management Innovations

64. Long-term forecasting for precipitation, runoff, and storage, particularly Probable Maximum Precipitation/Probable Maximum Flood
65. Multi-purpose water management systems, including use of off-channel water storage
66. 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.
67. Structural and geotechnical aspects of hydropower dam safety
68. Advanced weirs for flow re-regulation and aeration

New Research Topics

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