

PROJECT IDEA SUBMISSION – RESEARCH

LABORATORY INFORMATION

Name: David Warsinger and Jose Garcia-Bravo Date: 09-06-24

LABORATORY'S LIAISON CONTACT INFORMATION

Name: Jose Garcia-Bravo

Title: Associate Professor E-Mail: jmgarcia@purdue.edu

Phone: () 4-7312 Cell: () Fax: ()

Address: 401 North Grant St Room/Suite #
Street Address / P.O. Box

West Lafayette IN 47907
City State ZIP Code

PROJECT NAME

Hydropower Collegiate Competition (HCC)

GENERAL PROJECT DESCRIPTION

The aim of this project is to implement novel methods for electricity generation using hydropower while addressing the environmental implications of the system. The methods to deploy include multistory reservoirs to separate the streams for power generation from those dedicated to transfer of species and regeneration of hydrostatic power using pump-turbine coupling devices. For this year's (HCC 2025), we will enhance the design of the hydropower systems by optimizing the performance of the systems based on the temporal electricity demand. Such investigation requires modeling and testing hydraulic devices, optimization of the system components, data and cost analysis.

WHAT IS THE MECHANICAL ENGINEERING PROBLEM (APPARATUS) YOU ARE WANTING SOLVED (BUILT)?

Build a scaled prototype of the Hydropower generator concept and perform a series of tests

WHY IS THIS PROBLEM (APPARATUS) WORTH SOLVING (BUILDING)? (Value Proposition)

Build an effective prototype that will be tested in a lab or tank for performance and will deliver measured results. Teams have the discretion to decide what to test and where to perform tests

WHAT ARE THE MOST IMPORTANT FUNCTIONAL REQUIREMENTS AND SPECIFICATIONS FOR THIS PROJECT?

Req 1: Teams perform a site selection process and then develop a feasibility assessment for the selected site

Req 2: Teams either create a conceptual design of their selected site or complete a final design for a component or system

Req 3: Consideration of environmental factors for construction of hydropower plants ...

Spec 1: Open and dependent upon site chosen

Spec 2: Budget limited to \$15k including travel to competition

...

WHAT DO YOU ANTICIPATE THE STUDENTS DESIGNING, ANALYZING, BUILDING/PROTOTYPING AND TESTING? BE AS SPECIFIC AS POSSIBLE.

Design: A hydropower generator based on a site chosen approximately 4.4 MW, design methods to deploy include multistory reservoirs to separate the streams for power generation.

Analyze: Potential Dam retrofitting that incorporates fish passage technology to preserve the local ecosystem and simultaneously generate hydropower. The potential target site is Brookville Lake Dam

Build: Scale down version of multistory reservoir generator

Test: Feasibility of the design and performance of the design

WHAT IS YOUR BEST ESTIMATE OF THE COST OF THE HARDWARE, COMPONENTS, MATERIALS, ... OF THE PROPOSED PROTOTYPE?

Total \$ 15,000

Hardware Costs: \$2,000

Component Costs: \$3,000

Material Costs: \$5,000

Travel Costs: \$5,000

HOW MUCH TIME AND EFFORT WOULD YOU EXPECT TO SPEND ON THIS PROJECT IF YOU WERE DOING IT INTERNALLY?

Calendar Months: 10

Total Hours (Engineering, Shop, ...): 100 hrs.

DO YOU BELIEVE THE PROJECT CAN BE COMPLETED WITH EXISTING TECHNOLOGY, IF NOT, ELABORATE ON NEEDED DEVELOPMENTS?

Yes, focus is on design and testing a scaled down prototype

CONCERNS OR OTHER RELATED INFORMATION ASSOCIATED TO THE PROPOSED PROJECT?

Concerns: New concept, design needs to done early, and construction of prototype is different than actual dam design

Other Info: <https://www.herox.com/hydropower-collegiate-competition-2025>

ATTACH ANY APPROPRIATE SKETCHES, DRAWINGS, STANDARDS, DATA, PHOTOS, ... USEFUL IN JUDGING APPROPRIATENESS AND SCOPE OF PROPOSED PROJECT.

Instructions are on website for the competition

ARE YOU WORKING WITH ME SENIORS WHO YOU WOULD LIKE ON THIS PROPOSED PROJECT? YES/NO (If YES, provided what information you can.)

| NAME | PUID | PHONE | EMAIL |
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Save this filled out .docx with the following naming nomenclature: "RESEARCH_ *project name* – *student point of contact full name*.docx" where the *italic strings* get replaced with appropriate actual text strings.

If you have any questions concerning a proposed project or completing this form please contact Professor Greg Jensen.

To submit this document for consideration, please complete the survey using either the QR code or the link below.



https://purdue.ca1.qualtrics.com/jfe/form/SV_bkCjo7jyE5Wb7ro

C. Greg Jensen, PhD

Director of Senior Design
Professor of Engineering Practice
School of Mechanical Engineering, Room 2195
Purdue University
585 Purdue Mall
West Lafayette, IN 47907-2088

Office: 765-496-0214

Cell: 801-367-6145

Fax: 765-496-1114

E-mail: jensen23@purdue.edu