Task 6: Open Task

2021

Background

The Open Task was developed to allow teams to identify their own real-world environmental challenge and address it through research, design, and development of a fully operational bench-scale demonstration of the solution.

Response to a current issue of national importance is highly encouraged, as is the participation of multi-disciplinary teams from STEM fields.

Topic Selection

Topics should focus on environmental issues, including, but not limited to, energy, food, air, and water. The topic chosen must maintain the goals of the contest: the pursuit of real-world technically challenging, demonstrable, innovative solutions that are economically feasible and could be put into practice on a large scale. To help teams design a project that is rigorous and will be competitive during judging, teams are encouraged to refer to Tasks 1-5 to generally understand the expected scope and outcomes of contest tasks.

When selecting a task, teams should be mindful that:

1. The design must produce measurable results that serve as proof-of-concept for the design.

   For example: If the project has the goal of cleaning up a particular type of air pollution:
   a. The team will bring their pollution-removing bench-scale model to the contest.
   b. The contest staff will provide an air sample containing the pollutant; the team will run this through their bench-scale model and collect the resulting air sample.
   c. The contest staff will send this air sample to NMSU labs to validate the team's results.

2. The total time allowed for the bench-scale demonstration + analytical testing of the demonstration may total no more than 48 hours. Overnight tending of the bench-scale apparatus should not be needed.

3. Computer simulations should not be the primary means of demonstrating the design.

Problem Statement

Your team will identify a real-life environmental- energy- or water-related challenge in an emerging technological area, design the solution to the problem, and identify the market for your solution.

You team will build an apparatus to demonstrate a bench-scale version of your proposed solution, evaluate the cost of building and operating a full-scale version of your proposed solution, and consider regulations and implications for implementation of a full-scale solution.

Design Considerations

Your proposed design should provide specific details and outcomes as follows:

- Describe the product or process and explain why it is valuable to society and the environment.
- Discuss the advantages and disadvantages of your solution versus both current technologies and other possible approaches (consider cost, ease of operation, elegance of design, waste minimization, energy efficiency, etc.).
- Create an experimental apparatus to demonstrate your process.
- Identify an analytical testing protocol which may be used to evaluate your solution and share this with the WERC staff in your Preliminary Report.
- Present a business case for your technology, including potential incentives from appropriate levels of government and supporting economic metrics.
- Provide a process-flow diagram, complete with quantified inputs/outputs and mass and energy balances for the designed process.
- Estimate the capital costs (CAPEX) to build a full-scale plant. This includes, but is not limited to, equipment, buildings, land use, construction costs, engineering mark-up, etc.
- Estimate the operating costs (OPEX) (calculated as $/m3 of product produced, or other units, as appropriate) on an annual basis for a full-scale plant, including, but not limited to, any consumables used (chemicals, sacrificial components, etc.), labor, and energy requirements assuming industrial electricity rates.
- Include a financial analysis of any potential product salable value. Note that plant location in reference to raw materials and final consumers will have a major impact on the cost of the final product.
- Document success in improving energy efficiency, pollution prevention, and/or waste minimization, as it applies to your project to qualify for the P2E2 Award. Place this in a separate section of the report.
- Discuss your plan's adherence to appropriate federal (USA), state and local laws and regulations. Attend WERC's webinar for helpful tips for addressing regulatory issues. (See website or email us for webinar info.)
- Include a Public Involvement Plan, as applicable (see Team Manual).
- Identify the hazards of the proposed solution and approaches to mitigate the issue
- Address safety issues in both the written report and the Experimental Safety Plan (ESP). Attend WERC's webinar for helpful tips for addressing health and safety issues. (See website or email us for webinar info.)
- Discuss the intangible benefits of the product or process.

Bench-Scale Demonstration

During the bench-scale demonstration, your team should plan to present a functional bench-scale model that clearly conveys the proposed solution. Your team should develop, demonstrate and present a complete package that includes technical performance as well as financial, regulatory, and safety information.

Preliminary Report—Task Plan and Testing Plan

Submit a detailed plan by January 25, 2021. This will help contest staff prepare to analytically test your design. The plan should include:

1. The official title of the project
2. A description of the engineering problem that the team plans to solve
3. A description of the approach the team plans to take to solve the problem
4. A detailed list of analytical testing needed to evaluate the bench-scale demonstration at the contest.
5. An estimate of time needed to run the bench-scale demonstration
6. An estimate of the time required for WERC to analytically test results from your team's bench-scale results. Note that the time for #5 + #6 must not exceed 48 hours, due to contest time limitations.

Technical Report Requirements

The written report should demonstrate your team's insight into the full scope of the issue and include all aspects of the task and your proposed solution including: background research, description of your team's solution, test data, and scale-up (costs, environmental/waste issues, public acceptance, schedule for implementation. The report will be evaluated for quality of writing, logic, organization, clarity, reason, and coherence. Standards for publications in technical journals apply.

In addition to the listed requirements, your report must address in detail the items highlighted in the Problem Statement, Design Considerations, Evaluation Criteria, and 2021 Team Manual.

The required page formatting has changed this year—check the 2021 Team Manual for more information.

Evaluation Criteria

Refer to the 2021 Team Manual for a comprehensive explanation of the evaluation criteria.

Additionally, your proposed design will be evaluated on the following:

- Technical fundamentals, performance, safety, and other issues stated in the problem statement
- Potential for real-life implementation
- Thoroughness and quality of the economic analysis (Scale-up CAPEX and OPEX)
- Originality, innovativeness, functionality, ease of use, maintainability, reliability, and affordability of the proposed technology
- How well the bench-scale design represents your full-scale design concept
- Other specific evaluation criteria may be provided at a later date.

FAQs/Deadlines

- Teams are expected to watch for FAQs online for any updates in the task requirements.
- Due 25 January 2021: Preliminary Report (Task Plan and Testing Plan).
- Due 1 February 2021: Experimental Safety Plan (ESP).
- Due 29 March 2021: Written Report.

Awards

Each year, the WERC Environmental Design Contest and its sponsors award more than $25,000 in cash prizes. Successful completion of every stage of the design project qualifies each team for the following awards.

1. Task awards (First, Second, Third Place; minimum amounts: $2500-$1000-$500, respectively).
2. Virtual Desktop Study Awards (awarded independently of the full bench-scale designs). Amounts TBA.
3. WERC Resources Center Pollution Prevention/Energy Efficiency Award (P2E2) ($500)
4. Judges' Choice Award ($500)
5. Peer Award ($250)
6. Terry McManus Outstanding Student Award. (Minimum: $500, according to funding).
7. Additional awards may be announced at a later date.

Award amounts listed are minimum amounts and may increase with available funding. Detailed award criteria: https://iee.nmsu.edu/outreach/events/international-environmental-design-contest/guidelines/