Task 6D: Open Task—Desktop Study

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.

With limitations on laboratory access at many institutions, this "Desktop Study" version of the Open Task was created to give students an opportunity to showcase their design ideas and discuss them with the contest judges, without the need for building a bench-scale apparatus.

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, soil, water quality, and mitigation or cleanup of environmental hazards. 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.

Teams are welcome to use computer simulations to explore their design plans.

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 conduct a desktop study of your solution, including computer simulations, if applicable. Important to your design is the evaluation of the cost of building and operating a full-scale version of your proposed solution, with consideration to regulations and implications for implementation of a full-scale solution.

The process flow diagram (PFD) will be the featured element of your report, and particular care should be made for completeness (see Design Considerations).

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 current technologies and other possible approaches (consider cost, ease of operation, elegance of design, waste minimization, energy efficiency, etc.).
- Present a business case for your technology, including potential incentives from appropriate levels of government and supporting economic metrics.
- Provide a detailed and accurate Process Flow Diagram (PFD). This is the key feature of your design. The PFD should include all selected treatment processes and/or measures taken in the design. The PFD must include mass and energy balances (input and output rates, reactants, and reaction rates, etc., as applicable). See the 2021 Team manual for an example of an acceptable PFD.
- Your analysis may include a computer simulation, but it must be based on the PFD.
- List all equipment, materials, and/or chemicals that would be needed for the full-scale operation, and indicate all efforts to reduce costs.
- List all vendor sources, and report and reference all performance data for each piece of equipment or materials.
- Estimate the capital costs (CAPEX) to build a full-scale solution. This includes, but is not limited to, equipment, buildings, land use, construction costs, engineering mark-up, pretreatments, 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.
- Discuss your plan's adherence to appropriate federal (USA), state and local laws and regulations. Attend WERC's Safety and Environmental Regulations Short Course 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. 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.
- To qualify for the P2E2 award, in a separate section of the report, document success in improving energy efficiency, pollution prevention, and/or waste minimization, as it applies to your project.

Brochure/Poster Discussion

During the brochure discussion, your team will have the chance to discuss your designs in more detail than you were able to with the oral presentation. You may either email the judges a pdf of your brochure, or have one team member display a conference-size poster for you to refer to during the discussion.

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
Submit a detailed plan by February 22, 2021. This will help contest staff prepare for your submission.
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

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, and scale-up (costs, environmental/waste issues, public acceptance, and 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
- 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 22 February 2021: Preliminary Report (Task Plan).
- 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/