Task 6 Request for Proposals: *Open Task*

2025

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 the published Task 1-5 problem statements to 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 at WERC will provide an air sample containing the pollutant; the team will run this through their bench-scale apparatus and collect the resulting air sample (that should now be cleaner).
   c. The WERC staff will send this "cleaned" 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 results may total no more than 48 hours, subject to ESP approval.

3. Plan a bench-scale demonstration that does not require a person to tend the apparatus overnight, since we cannot monitor overnight processes.

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

Problem statement

Your team will identify a real-life environmental challenge in an emerging technological area, design the solution to the problem, and identify the potential 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 implementing the 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.
- Develop, demonstrate and present a complete package that includes technical performance as well as financial, regulatory, and safety information.
- Provide a process-flow diagram (PFD), complete with quantified inputs/outputs and mass and energy balances for the designed process (if applicable). If a PFD does not apply to your project, provide diagrams that illustrate each component in your design and include a description of its function. Waste streams, if any, should be addressed in the diagrams.
- 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.).
- Build an experimental apparatus to demonstrate your process.
- Identify an analytical testing protocol that will be used to evaluate your solution at the contest. Share this with the WERC staff in your ESP.
- Present a business case for your technology, including potential incentives from appropriate levels of government and supporting economic metrics.
- Techno-Economic Analysis.
    - Teams are advised to create a multi-disciplinary team by inviting a business major to help draw up economic plans for full-scale implementation of your designs.
    - If your solution is for a one-time build, followed by maintenance of a process, present a Techno-Economic Assessment and Analysis (TEA) to construct a full-scale operation for your chosen technology.

      The TEA will include your estimate of capital costs (CAPEX) and operational costs (OPEX) for a full-scale solution and appropriate graphical representation of your cost data.
        - Capital expenses typically include, but are not limited to, equipment, pipes, pumps, etc. Do not include costs of buildings and appurtenances to the treatment process.
        - Operating expenses (OPEX) should include, but not be limited to, materials needed, including consumables (chemicals, sacrificial components, etc.). In addition to other operating costs that your team identifies, include these operating costs:
          staff labor rate of $70/hour; solids disposal costs ($50/ton); energy requirements using an electricity rate of $0.10/kWh. If your full-scale solution requires natural gas as an energy source, research and use up-to-date prices.
        - 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.
        - Visualization tools: Sensitivity analyses, etc.
    - If your team is designing a device, instead of developing a TEA, your team will present a rudimentary business plan. Include: *(List subject to change, according to your device.)*
        - Costs, cost-recovery structure, recovery rate and schedule.
        - Level of profit to show viability to a prospective lender (as an indication of ability to pay off a loan needed to set up the manufacturing process).
        - Projected sales forecast, market potential, potential market share

  - Reduction in the marginal cost of each device as manufacturing progresses over successive years (to reflect economies of scale: i.e., the cost of manufacturing a single car is $50M, but the cost of manufacturing 5M cars is $30,000 each).
- Discuss your plan's adherence to appropriate federal (USA), state, and local laws and regulations. Attend WERC's EH&S Short Course for tips for addressing regulatory issues. (See website.)
- Include a Public Involvement Plan, as applicable (see Team Manual).
- Identify waste streams, if any, for your design and plans to address them.
- Identify the hazards of the proposed solution and approaches to mitigate the them.
- Address safety aspects of operating your technology. Safety issues for both the full-scale design should be addressed in the written report. Safety issues for the bench-scale demonstration should be addressed in both the written report and the Experimental Safety Plan (ESP).
- Discuss the intangible benefits of the product or process, if any.

Bench-Scale Demonstration

During the bench-scale demonstration, your team should present a functional bench-scale model that clearly conveys the proposed solution.

Your ESP will serve as your detailed plan for operating the bench-scale demonstration at the contest. In addition to including safety aspects in your ESP, you need to include details to help WERC prepare to help you run and test your bench-scale demonstration at the contest. In the ESP, include:

1. A detailed list of analytical testing needed for WERC to evaluate the bench-scale results. (Do we need to send your resulting samples to a lab? What laboratory analyses will be needed? What will the samples likely contain? Will we need to make measurements at your booth? Etc.)
2. An estimate of the time needed to run the bench-scale demonstration.
3. An estimate of the time required for WERC to analytically test results from your bench-scale results.

Note that the time for the above items #2 and #3 must not exceed 48 hours, due to contest time limitations.

Evaluation Criteria

Each team is advised to read "Evaluation Criteria" and "Contest Scoring" in the 2025 Team Manual for a comprehensive understanding of the contest evaluation criteria. For a copy of the Team Manual, Public Involvement Plan, and other important resources, visit the WERC website: Guidelines | werc.nmsu.edu

In addition to evaluation criteria that applies to every task, Judges will evaluate your team's response to:

- Potential for real-life implementation, including expected reliability and maintainability and reasonable cost of setup and ongoing operations. Cost/benefit of your solution will be compared with those of other teams.
- Thoroughness and quality of the PFD or Process Diagram(s).
- Thoroughness and quality of the economic analysis for scale up.
- Originality, innovation, and real-world need represented by the proposed technology.
- The quality of your bench-scale results.
- Other specific evaluation criteria that may be provided at a later date (watch the FAQs).

Experimental Safety Plan (ESP) and Required Short Course.

See team manual for details. Due dates are listed below.

Dates, Deadlines, FAQs (*dates subject to change—watch website FAQs*)

- Today: Email us to let us know you are interested in this task. We will contact you with breaking news.
- October 15, 2024 - December 31, 2024 – Early Bird Registration (discount applies).
- December 1, 2024 - February 20, 2025: Mandatory On-demand Course: Preparing the Experimental Safety Plan. See website and Team Manual for information.
- February 17 - 26, 2025: Experimental Safety Plan (ESP) due. Include requests for volume of brine concentrate and ancillary equipment needed at the contest.
- March 7, 2025: Final date to register a team.
- March 31, 2025: Technical Report due
- Weekly: Check FAQs weekly for updates:
    - Task-specific FAQs: 2025 Tasks/Task FAQs
    - General FAQs: 2025 General FAQs
- All dates or task requirements are subject to change. Check FAQs for updates online.