Sunset overlooking the east side of the Las Cruces Organ Mountains from White Sand National Park Monument.

2025 TEAM MANUAL

Your one-stop source for:

- WERC policies
- Specifications, requirements, and judging rubrics for:
  - Written report
  - Oral presentation
  - Bench-scale demonstration
  - Poster presentation
  - Flash Pitch Competition
  - Preparing and submitting the ESP
- Helpful hints for a successful contest experience.

Know the contest requirements

- Read the entire manual aloud as a team.

New this year:

- Updated dates and deadlines
- The only short courses available this year are the 1) ESP Prep (required of all team members and advisors) and 2) Hydrogen Safety (required for Task 2) There is no Environmental Topics Short Course this year.
- The 30% Project Review is not required unless specifically stated in the Task Problem Statement
- Updated Rubrics: for Task 2 and Flash Pitch
- Updated content since 2024 Manual are on pp. 4 (short courses) 5 (dates), 8 (dates), 16-24 (p. 17 is all-new), 26 (new award).

2025 WERC Environmental Design Contest Team Manual

Table of Contents *(with hyperlinks)*

PART I: POLICIES AND PROCEDURES

Page Topic

PART II: HELPFUL HINTS

Page Topic

PART I: POLICIES AND PROCEDURES

Contest Structure and Philosophy

Contest entries go beyond a simple science-fair-type display. Teams demonstrate their working bench-scale process and plan for full-scale implementation that considers cost, waste, schedule, feasibility, safety and regulations, public acceptance, etc. WERC analytically tests the teams' processes/designs in our own independent labs.

Scoring for the main contest is in four stages:

1. A technical report
2. An oral presentation
3. A bench-scale-process demonstration
4. A poster board presentation

An additional event, The Flash Pitch, is scored independently.

Contest Philosophy: Contest events are modeled after an engineering Request for Proposals.

The WERC Environmental Design Contest simulates the problem-solving process an engineer might encounter on the job. It follows the Request for Proposal (RFP)– a format that companies often use to solicit new engineering designs. When answering the contest (or any) RFP, consider opportunities to add value to the client (See Part II: Helpful Hints)

RFPs vary from company to company. We have selected elements of RFPs that provide effective ways for students to learn about the engineering design process.

How each stage of the contest is modeled after an engineering RFP.

Task Problem Statement: RFP: task statement is published, soliciting engineering solutions to a problem.
Design Contest: WERC publishes task problem statements from which teams select a project.

Written Report: RFP: Competing engineering teams submit a written report discussing their proposed solution, expected performance, test results to show efficacy of the solution, data on expected costs, environmental and waste issues, safety and health issues, plans for public involvement and/or gaining public acceptance of the solution, full-scale implementation plans, a techno-economic analysis, and audits from professionals.
Design Contest: Teams submit a 25-page written report containing all elements listed above.

Oral Presentation: RFP: Selected applicants orally present their proposed solution to a technical review committee.
Design Contest: All teams orally present their solutions to the judges.

Bench-scale Demonstration: RFP: The technical review committee often pays for a pilot-scale system to confirm that the planned system is effective on a small scale.
Design Contest: Teams build working bench-scale models of their designs and demonstrate them during the contest. WERC conducts independent tests to confirm the teams' results.

Poster Presentation: RFP: The poster presentation is utilized during proposal presentations to allow the engineer to quickly refer to the most important facts and conclusions.
Design Contest: Teams create and present a conference-style poster containing their project's essential figures, data, and conclusions. The poster is used as a stand-alone communication of the project as well as a reference during the bench-scale presentation.

Cash Awards: RFP: A company wins the contract.
Design Contest: Winning a cash award is analogous to winning the engineering contract.

Flash Talk Competition

The Flash Talk Competition is separately judged; cash awards are independently awarded. The competition hones entrepreneurial skills and helps schools fulfill ABET Student Outcome #3: Ability to communicate with a range of audiences. Learn more: Flash Talk Competition.

Contact Information

- **WERC policies, operations, or task questions:** werc@nmsu.edu or gscarbro@nmsu.edu
- **Ginger Scarbrough cell: 575-312-7623**
- **Safety Officer:** miljgh@nmsu.edu
- https://werc.nmsu.edu**:** Website. Find FAQs, published tasks, and general information.
- https://wercteams.nmsu.edu**:** Team site. (Register, submit reports, view judge scores & comments)

Contest Overview

1. **One-hour Video Conference recording** helps first-time teams understand what judges are looking for: https://www.youtube.com/watch?v=_lInYq9oBH4

2. **Specified Task vs the Open Task**. The five specified tasks are designed by engineering professionals to meet an immediate environmental need. The Open Task allows teams to choose their own topic; teams are responsible for setting all parameters for designing and testing their solution for the Open Task.

3. **The projects are student-run**–entirely organized, designed, and built by students, with faculty serving as mentors for the teams. Faculty advisors are expected to take a "hands-off" approach, serving only as advisors.

4. **Questions about the contest or about a specific task**. The student Team Leader should contact us directly through the website "Contact Us" or at the email addresses listed above. Check our FAQs weekly. We have three FAQ locations:
    - General FAQs.
    - Task-specific FAQs

5. **Project Length.** Some teams start their research in the fall semester and build their bench-scale models in early Spring. But many teams wait until Spring to begin the project. Both models have been equally successful.

6. **Pre-contest requirements and submissions.**
    - **Short courses.** Watch website for dates. Team Leader: please email us to request a link to the courses.
        - Developing an Experimental Safety Plan. Mandatory on-demand course required of all team members.
        - WERC Hydrogen Safety. Mandatory for all teams participating in Task 2.
    - **Team Photos:** Submit at least one photo immediately after registering. We request that you submit both a "traditional" and a "fun" photo.
    - **Experimental Safety Plan:** Due late February. Required of ALL teams to operate your bench-scale apparatus at the contest. Prior to attending the contest, follow your institution's safety protocols for laboratory work.
    - **30% Project Review:** Not required unless specifically required by your task problem statement. If required, it will be due early March. Not scored.
    - **Check computer connections** 3 weeks prior to contest, order connectors if needed.
    - **Audits:** 3 weeks before paper is due, send draft report to three separate auditors (economics, legal, and health & safety). Correct report as needed.
    - **Equipment Transportation Form:** Submit 10 working days before contest if shipping equipment to Las Cruces.
    - **Technical Report.** Requirements outlined in the task problem statement and in this document.
    - **Flash Talk slides.** See requirements outlined in this document.

Contest Dates and 2025 Deadlines

Date	Action Item	Details
Now	Reserve your spot	Email us to let us know which task you are planning to work on.
10/15/24 thru 12/31/24	Early Bird Registration	• Register on WERC Team site (wercteams.nmsu.edu) • $100 discount/team for Early Bird Registration
Upon Registration	Team Photos	• Upload a Traditional & a Fun photo after registering.
Fall Semester	Research, design, order materials, outline report.	• Prior to the contest, follow your institution's safety protocols for laboratory work. • Begin to look for auditors
12/15/24 thru 02/20/25	Complete On-Demand courses	Team Leader: Email us for the course link(s). ○ *Developing an ESP*. Required of all team members. ○ *Hydrogen Safety*. Required of Task 2 participants only. All WERC teams are welcome.
Feb. 17 – 26, 2025	Submit ESP	Required of all teams. Email to Safety Officer (See ESP course).
March 10, 2025	Request Audits no later than this date	Send draft report to three separate auditors (economics, legal, and health & safety). Correct report as needed.
March 17, 2025	Check computer connections	Order connectors if needed.
March 24, 2025	Submit Equipment Transportation Form (optional)	Submit form 10 working days before contest if shipping items to Las Cruces.
March 31, 2025	Submit Tech Report	Submit through Team site
April 4, 2025	Flash Talk slides due	Submit through Team site
April 6 – 9, 2025	Bring to the contest:	Oral presentation, poster, bench-scale apparatus.
April 6, 2025		Check in, Flash Pitch, Banquet
April 7, 2025		Oral presentations, Lunch, Poster Session
April 8, 2025		Bench-scale demonstrations, lunch, Game night
April 9, 2025		Morning: Free time for teams (judges deliberate) Evening: Awards banquet

7. **Registration:**
    a. Registration opens online in mid-October at the WERC Team Site.
    b. A faculty advisor creates teams by entering student/co-advisor names & email addresses; students and co-advisors are emailed an invitation to register. Once all members are registered, the advisor pays the registration fee. The fee covers less than 1/4 of our costs, but helps us tremendously.
    c. Roles and access/privileges on the WERC Team Site:
        1. Advisor:
            - Faculty member who will attend the contest in person.
            - Registers all participants from an institution (self, students, and Co-Advisors) to qualify for the multiple-team discount.
            - Able to upload files for all teams (in case of emergencies—this is primarily the Team Leader's responsibility).
            - The Advisor is the only person that can pay for registration online.
        2. Co-Advisor(s):
            - Additional faculty member(s) who plan to attend the contest in person (or who would like to have a t-shirt and jacket from the contest). The Advisor should assign the Co-Advisor to the smallest team to potentially reduce registration fees, since fee structure is based on the number of people per team.
            - Has access to all teams set up by the Advisor in the WERC team site, although is assigned to only one team for registration purposes.
            - Able to upload files for all teams that were set up by the Advisor (in case of emergencies—this is primarily the Team Leader's responsibility).
        3. Team Leader:
            - One student team member appointed by the Advisor.
            - Primarily responsible for uploading files to the WERC team site.
            - The only student on the team that can upload files.
            - Has access to only their own team's file submissions, status, and scores.
        4. Team Members: Student team members. Can log in to the WERC Team Site to check deadlines, check to see if their Team Leader has submitted files, and view team scores after the Awards Ceremony. They have access to only their own team's status and scores.
        5. All roles above:
            - Are included in the team-member count when computing registration fees.
            - Can log in to the WERC team site to check deadlines, submission status, and view team scores after the Awards Ceremony.

d. Registration Fees. Teams can be of any size. Fees are based on the date of registration, number of teams registered under the same advisor, and the number of people per team (Advisors + Co-Advisors + Leaders + Students).
   - Refer to the table below for team fees, discounts for early registration, discounts for additional teams that are registered under the same advisor, and fees for additional members per team.
   - Payment. The Advisor will pay by credit card through the WERC Team Site. Contact us to make other payment arrangements (werc@nmsu.edu)
   - Registration fees will not be refunded, except for unavoidable circumstances. In that case, the team will be reimbursed fees paid minus the team's portion of expenses incurred at the point they exit the contest, including cost of materials ordered for your team and cost to ship items to your team, if applicable.

Registration Date	**First Team Fee** (base fee for up to 6 people on the team)	**Additional teams under same Advisor** (base fee for up to 5 people per team)	**Fee per additional person on the team** (above the base number)
Oct. 15 – Dec. 31, 2024	$880	$780	$170
Jan. 1 – Feb. 5, 2025	$980	$880	$170
Feb. 6 – Mar. 8, 2025	$1180	$1080	$170

e. Profiles. During team registration, each person creates a profile. The team cannot be fully registered and paid for until every profile is complete. The profile includes such items as demographics, meal preferences, emergency contact information, long-term email address, and for students includes a pre-contest survey.
   - Meals.
     - WERC provides a Welcome Dinner on Sunday evening, lunch on Monday and Tuesday, a Taco Bar on Tuesday evening, and an Awards Banquet on Wednesday.
     - Please help us plan and reduce food waste by indicating which meals you plan to attend.
     - Dietary preferences: When completing your profile, please indicate dietary preferences. Note that we serve chicken, beef, and cheese dishes at the contest. We never serve pork.
       - ✦ If we are able to accommodate your needs, we will email you with instructions for working with our caterers during the contest.
       - ✦ If your restrictions cannot be accommodated, we will email you to request that you arrange your own meals while in Las Cruces. Your safety and your standards are of highest priority to us, and we have learned over the years that some restrictions (such as Halal and severe allergies such as black pepper) cannot be safely accommodated, due to our caterer's limitations.
   - Emergency contact information: Make sure this is up to date when you arrive at the contest.
   - Long-term email address: If your team is invited to publish a paper for our IEEE conference, this should be the email address you want us to use to contact you about the publication.
   - Demographics: Required by many of our sponsors; we appreciate your helping us answer these questions!
   - Pre-contest survey: Please help us quantify WERC's contribution to your education by thoughtfully completing the pre-contest survey.

On-site Contest Schedule of Events – April 6 - 9, 2025

(Schedule subject to change)

Sunday, April 6:

- 1:00 – 4:00 PM: Check in; bench-scale setup; reserve a time to rehearse your Oral presentation
- 4:00 – 4:15 PM: Welcome and Opening Remarks
- 4:15 – 5:45 PM: Flash Pitch, Round I
- 5:45 – 6:45 PM: Dinner and Keynote Speaker
- 6:45 – 7:00 PM: Flash Pitch, Final Round
- 7:10 – 7:30 PM: Mandatory Safety Meeting for all faculty and teams
- 7:30 – 9:00 PM: Bench-scale setup and commissioning
- 9:00 PM: Bench-scale area closes

Monday, April 7:

- 8:00 AM – 8:00 PM: Bench-scale area open for equipment setup and operation
  (*Laboratory attire required all day in bench-scale area*: g*oggles, long pants, close-toed shoes*)
- 8:00 AM – 12:00 PM: Final commissioning; synthetic solutions distributed
- 8:30 AM – 1:00 PM: Oral Presentations (*business attire*)
- 1:00 PM – 1:45 PM: Lunch Served
- 2:00 PM – 4:00 PM: Poster Session (*business attire*)
- 8:00 PM: Bench-scale area closes

Tuesday, April 8:

- 8:00 AM: Teams may begin submitting Bench-scale sample results
- 8:30 AM – 12:00 PM: Bench-scale Demonstrations: judges visit booths *(Laboratory attire*)
- 12:00 PM– 12:45 PM: Peer Judging Session
- 12:45 PM – 1:30 PM: Lunch Served (Faculty Advisors Lunch Meeting)
- 2:00 PM: All bench-scale sample results due.
- 1:30 PM – 2:30 PM: Bench-scale Demonstrations, continued if needed
- 2:00 PM – 3:00 PM: Bench-scale area decommissioning and waste disposal;
  Advisors must be present for their team's decommissioning
- 4:00 – 5:30 PM: Reception: Music and games in the courtyard. Food Served. (*Casual dress*)

Wednesday, April 9:

- Morning and afternoon: Teams have free time while judges deliberate
- 5:30 – 8:00 PM: Awards Banquet and Ceremony. Dinner served.
- Thank you for joining us! Keep in touch.

8. **Judging:**
    a. Teams are judged by experienced engineering professionals who ask tough questions, but also encourage teams. They treat the teams as colleagues and introduce them to new ideas and approaches. Judges appreciate the teams' innovations and forward thinking.
    b. Each team will meet with the same group of 4-6 judges throughout every event of the contest, allowing teams and judges to get to know each other. If numbers permit, the same group of judges will evaluate all teams within a given task. If this is not possible, judges will be overlapped strategically.
    c. Scores are tabulated on the WERC Team Site. Teams can view their scores after the Awards Ceremony.
    d. Judges score the written reports before the team arrives at the contest.
    e. On Sunday evening teams participate in the Flash Pitch. They are judged by a separate set of judges who are experienced with economic development, technology transfer, and commercialization. Flash Pitch judges will not have read the technical report—they will judge solely on the Flash Pitch presentation.
    f. On Monday morning, judges listen to the 15-minute oral presentations. Judges will not interrupt the presentation–they are given 10 minutes after the presentation to ask questions. After all presentations for the same task are complete, judges apply final scoring to the oral presentations.
    g. On Monday afternoon, judges tour the Poster Session and ask team members questions.
    h. On Tuesday, judges visit the bench-scale demonstrations in groups of 2-3 judges at a time. A team will be visited 2-3 times by different sets of judges. Teams have the chance to show their apparatus to the judges and discuss the rationale behind each aspect of the design. Teams display their poster to use as reference during the bench-scale demonstrations. Judges delve more deeply into each team's design and teams are given the chance to answer questions they were not able to answer during their oral presentation. Students say this is their favorite part of the competition because their judges treat them as peers, rather than "judging" them.
    i. On Wednesday morning, teams have a free day to explore the local sites while judges convene privately to determine the awards in each category. Nearby sites: White Sands National Monument, Organ Mountains, Prehistoric Trackways, A Mountain, and many others (see Explore Las Cruces).

9. **Team logistics**
    a. Teams provide their own transportation to/from the contest as well as their own lodging. On our website ("Plan your Visit" tab), we provide travel tips and list hotels that are convenient to the contest venue.
    b. Some teams bring their bench-scale equipment with them (see below), others ship them to us about one week prior to the contest. Whichever way you bring your equipment, create a Parts Checklist to ensure that all parts are delivered to the contest. Use caution not to transport hazardous chemicals. We will have the test solutions/testing equipment specified in your task statement ready for you in Las Cruces.
    c. After check-in on the first day of the contest, teams will present their Flash Pitch, then enjoy a welcome dinner. Afterwards, all teams will present their Flash Pitch. Following that event, all teams and faculty advisors are required to attend the Safety Orientation meeting to discuss safety protocols.
    d. Main contest events are on Monday and Tuesday. Join us for Game Night/Karaoke on Tuesday evening and the Awards Banquet on Wednesday evening.

Transportation of Bench-scale Equipment

- Teams may decide how to transport their bench-scale equipment to the contest. Some bring it with them, but those traveling long distances usually prefer to ship their equipment to us.
- Teams that ship their equipment to us must complete an Equipment Transportation Form a minimum of 10 working days prior to the first day of the contest. The form is included with the safety forms on our website.

Remote Contest Contingency Plan

WERC has thirty-one years' experience running the contest onsite in Las Cruces, and two years successfully running the contest remotely. If necessary, due to national health protocols or other, we will transition to a remote contest (meeting via Zoom). In that case, an updated manual will be released.

Intellectual Property

Our task problem statements require innovative solutions to current environmental issues posed by our sponsors. We want to protect your intellectual property while allowing the task sponsors to further explore your team's ideas after the contest.

The WERC Environmental Design Contest Intellectual Property Policy:

1. The intellectual property produced as a result of participation in the WERC Environmental Design Contest:
   a. belongs to the team, its members, and/or its institution, according to the team's institutional policies.
   b. may be used without charge by NMSU and WERC task sponsors for their specific purposes.
2. Publication rights for the written report, or any publication that results from the report, belong to the team and/or its institution, according to the team's institutional policies. Teams that publish their results in IEEE *Xplore* will transfer copyright to IEEE, as per IEEE policy.
3. In cases where the intellectual property is used for commercial applications, the benefits and any potential income will belong to the contestant's college or university, according to the team's institutional policies.
4. Any IP previously established and used in the contest will remain the IP of the original owner.
5. NMSU/WERC does not warrant that any IP produced as a result of participation in the WERC contest would not violate any intellectual property rights owned by other parties.

Awards

Each year, WERC and its sponsors award more than $30,000 in cash prizes.
Successful completion of every stage of the design project qualifies teams for the following awards.
See Award Selection Criteria for information on the selection criteria for each award.

1. Task awards (First Place: $2500, Second Place: $1000, Third Place: $500).
2. Bench-scale Demonstration awards (contingent upon funding) (First Place: $1000, Second Place: $750, Third Place: $500)
3. New Mexico Space Grant Consortium Outstanding Team Award ($2500)
4. Freeport-McMoRan Innovation in Sustainability Award: $2500.
5. The Flash Pitch awards (First Place: $1000, Second Place: $750, Third Place: $500).
6. WERC Resources Center Pollution Prevention Award (P2 Award) ($1000)
7. Judges' Choice Award ($500). Up to three teams may win.
8. Peer Award ($250). Teams vote on their favorite designs. Up to three teams may win.
9. Terry McManus Outstanding Student Award. ($500). Faculty nominate a student from their team. Up to three students may win.
10. Additional awards may be announced at a later date.

Manuscript Preparation – Technical Report

1. **Page limit:** 27 pages, including report cover page, table of contents, executive summary, report body, figures, tables, references, and appendices. The audits are not included in the page count.

2. **Page order:**
   - Cover page
   - Table of Contents
   - Executive Summary
   - Body of Paper
   - References
   - Audits

3. **Cover page** (Title page):
   - ***Title:*** 2" top margin, 1" minimum side and bottom margins, 14-point type
   - ***Center:*** 12-point type. School name, team name, optional team logo, task number, advisor and team member names
   - ***Spacing*** between title entries (school name, team name, etc.): 1.5 line

4. **Table of contents**
   - ***All margins:*** 1" minimum
   - ***Type:*** 12-point type
   - ***Justification:*** Left and right justified
   - ***Spacing:*** 1.0 – 1.5 lines, as appropriate to your format

5. **Executive summary and body of paper**
   - ***All margins:*** 1" minimum; left justified with ragged right edge
   - ***Spacing:*** 1.5 lines
   - ***Type:*** Title: 14-point, Body: 12-point.
   - ***Page limit:*** Maximum of two pages. Preferably one page. Include mostly data and findings – no fluff.

6. **Footers:** Required on each page
   - ***School name and task number:*** Centered
   - ***Page number:*** Centered below school name and task number

7. **Headings:**
   - ***Title:*** Center, upper case, bold; 14-point type
   - ***Major Headings (Level 1):*** Flush left, Title Case, Bold, 12-point type
   - ***Subheadings (Level 2):*** Flush left, Title Case, Bold Italic, 12-point type
   - ***Sub-subheadings (Level 3):*** Indented, Bold, Title Case, End with a period, 12-point type
   - ***Fourth-level headings (Level 4):*** Indented, Bold Italic, Title Case, End with a period, 12-point type
   - ***Leading below headings:*** no more than 6 points. (Leading=vertical distance between lines of text)

8. **References**
   - ***In text***: Use superscript numbers when referring to references in the text.
   - ***Reference list:*** List and number all bibliographical references at the end of the paper.

9. **Equations**
   - ***Variables:*** Italicize variables in equations.
   - ***Placement:*** Center equations; right-justify equation numbers and enclose the numbers in parentheses. (*Hint for aligning these: enter equation and its number in a 1-row, 2-column table*)

10. **Figures and Tables**
    - ***Numbering:*** Number figures and tables consecutively within the text (Figure 1, Figure 2, etc.)
    - ***Figure Captions:*** flush left below the figure; include figure number; description in sentence case.
    - ***Table Titles:*** flush left above the table; include table number; description in sentence case.
    - ***Clarity:*** Lines and images within a figure should be sharp and easy to read. Include a legend where needed.
    - ***Legibility:*** All lettering should be large enough to be readable (minimum 10-point type)
    - ***Size:*** Illustrations should fit on an 8.5" X 11" page (with proper margins). Be sure all elements are readable.
    - ***Placement:*** Figures and tables should be placed in the document in the order in which they are referred, closely after (not before) they are referenced in the text.

11. **Symbols and Abbreviations**
    - ***Standard:*** Use only standard symbols and abbreviations in text and illustrations.
    - ***Defining:*** Define all abbreviations the first time of use by stating the full name and adding abbreviation in parentheses (even if you think the abbreviation is obvious, define it–it may not be obvious to every reader).

12. **Audits**
    - ***Format:*** Audits have no specific formatting requirements, but should be on company letterhead, if possible.
    - ***Voice:*** Auditors should format their audit in a professional manner that is appropriate to their field of expertise.

Submitting the Technical Report

- Upload one PDF of the complete report, including audits, to the team's WERC account.
- Only registered Advisors and student Team Leaders have access to upload the report.
- Deadline for Written Report submission**: 11:59 PM, March 31, 2025** (your time zone).
- Late reports will be penalized by 25 points per day.
- Re-submitting your report will replace the previous version and update the time stamp. Use caution if re-submitting after the deadline, as this might affect the late penalty.

Judging Criteria for the Technical Report

Rubrics for the technical report may be found in the section:

Contest Scoring (for Tasks 1, 3, 4, 5, 6)

Contest Scoring (for Task 2)

Required Elements of the Technical Report (*See details in Part II: Helpful Hints*)

1. The paper must include

- Report cover page identifying the task, team number, school name, advisor(s), and team members
- Table of contents (include page numbers)
- Executive summary (maximum of two pages) highlighting the proposed solution (see #2, below)
- Report body, including PFD, figures, illustrations, photographs, and graphs (see #3, below)
- References
- Audits (See #5, below)

2. Executive Summary

- Judges use the Executive Summary as a reference. It is a concise overview of the entire project.
- From the executive summary, the reader should understand the task, the options considered, the process selected, the project costs, performance, schedule, and the conclusions reached.

3. The body of the paper must include (See PART II for full discussions of these sections):

- Background research: options considered and discussion of alternative designs and situations in which those designs might be better than your team's proposal.
- Description of your team's solution
- Detailed process-flow diagrams with mass and energy balances, as appropriate. Include input and output rates, reactants, and reaction rates, etc., as applicable. To meet judge expectations, see PFD examples in Part II.
- Test data and technical evaluation of the performance of your team's solution.
- Bench-scale/prototype lab results
- Business Plan: Full-scale design description, calculations, CAPEX and OPEX, appropriate economic visualization tools, and implementation schedule.
- Waste report: address all wastes generated by the process, including the fate of all waste products.
- Adherence to Health, Safety, and Environmental regulations.
- Community Relations and Public Involvement Plans. See Hints.
- Conclusions

4. Rights: The report should be non-proprietary and omit product trade names.

5. Audits: Teams are required to include three separate third-party audits:

1) ***Economics and Business Plan*** (Auditor should have deep knowledge of economics/business)
2) ***Health and Safety Issues*** (Auditor should have deep knowledge of EH & S issues)
3) ***Legal and Regulatory Issues*** (Auditor should have deep knowledge of legal/regulatory issues)

- The third-party engineering audit is an important part of risk management at an engineering firm and ensures compliance to requirements and regulations. At the contest, it is especially helpful in the three areas listed above in which teams tend to have limited experience. A good auditor will help identify weaknesses that your team should address prior to submitting the final paper to WERC.
- Audits should be no more than 2 pages in length and will not be counted toward your page count. The audit should be on the auditor's company letterhead, if possible. Auditors should evaluate only the specific aspect of your work they are assigned (one of the 3 above). They should not edit the entire paper.
- Submit a rough final draft to auditors 3 weeks prior to the paper due date. Allow 2 weeks for auditor reviews.
- Selecting your auditors:
  - Judges look for high-quality auditors. Use third-party persons who are independent of the team's design planning and can provide unbiased assessments of the team's work.
  - Avoid faculty members from your university, but if they are truly the best choice to review your work, they may not be associated directly with the team nor any of its research planning or implementation.
  - Suggested auditors: industrial representatives, lawyers, business owners, experts, doctoral students, etc., and for the TEA: MBA students or Small Business Development Center (SBDC) near you.
- See Helpful Hints-Audits for more about the audits.

Oral Presentation Guidelines

Regulations and Logistics

1. ***Presentation Time Limit:*** 15 minutes
2. ***Question/Answer period****:* 10 minutes
3. ***Setup and breakdown time:*** total of 5 minutes (approx. 2.5 minutes for setup and 2.5 for breakdown)
4. ***Presentation locations and media:*** Multiple presentation rooms will be used at the same time. Presentation software (such as PowerPoint) must be on the team's computer. The computer will be plugged into the AV system at the venue. Check with us at least 3 weeks in advance for connection compatibility needs.
5. ***Type size.*** Type on the slides should be readable from 30' away (no smaller than 22 points). Ensure that figures are readable and that colors have sufficient contrast to be viewed from this distance.
6. ***Presenters:*** A maximum of four team members may present and answer judges' questions.
7. ***Intended Audience for the presentation:*** Judges will act as your client or plant manager; they will decide if your designs are technically, logistically, and economically viable and discuss modifications with you.
8. ***Allowed to attend:*** Other students from the participating school may attend. Avoid having the faculty advisor present, as it can hamper the students' presentations. Competing teams are not allowed in the room.
9. ***Goal****:* Convincing your client (a.k.a. the judges) that yours is the optimal solution for the task.
10. ***Logistics:*** First, the team leader introduces the team members, including those not presenting. The team gives the presentation, ending with conclusions. Next, the team leader asks the audience if they have questions. Develop a system for quickly determining which team member will answer a particular question.
11. ***Point deductions****:* 10 points deducted: a) per minute over the presentation time limit, b) if a faculty advisor attempts to give a part of the presentation or answer judges' questions, c) too many presenters.
12. ***Videotaping:*** Is not allowed.

Preparation:

1. On Sunday: Reserve a time to rehearse your presentation in your assigned room.
2. Dress in business attire (Dress for Success!)
3. Prepare a confident, technical and business-like discussion of your solution.
4. Do not read off of the slides. Use them only to remind you of the next topic.
5. Include all essential elements from the body of the written report (See Required Elements of Written Report).
6. Include citations at the bottom of each slide.
7. Use graphs, charts, and figures to illustrate trends and report findings.
8. Be concise. The judges have already read the report. Make the most important points.
9. Anticipate questions: The judges, like a manager or client, will usually identify a weak area in your logic or presentation and probe it. If you do not know the answer, do not bluff. Promise to look it up and discuss it during the bench-scale discussions on the following day. Judges appreciate humility.

Oral Presentation Judging Criteria

The rubric for the oral presentation may be found in the section:

Contest Scoring (for Tasks 1, 3, 4, 5, 6)

Contest Scoring (for Task 2)

Poster Guidelines

1. Maximum allowed poster size: 36” x 48”
2. Upon arrival, teams will mount their posters on mounting boards. WERC will provide the following supplies.
    a. 36” x 48” sturdy mounting board.
    b. Double-sided mounting tape for fixing poster onto the mounting board.
    c. Chains for hanging poster from the booth’s pipe-and-drape frame.
    d. Clips for attaching the poster board to the chains.
3. Poster mobility. To maintain safety protocols, posters will be hung from chains in the bench-scale demo booths. On Monday afternoon, they will be removed from the chains and moved to the banquet hall to be displayed on floor easels for the Poster Session. At the end of that session, they will be moved back and hung from the chains in the bench-scale area.
4. The cost for the preparation of poster displays should not exceed $250.

Poster Session Guidelines

1. Only one poster board will be displayed for each task.
2. The poster will be scored during the Poster Session on Monday afternoon.
3. Dress: Business attire.
4. Poster content: The poster should tell the whole story without a team member being in attendance.
5. Judges will be given a 50-minute closed session during which they will view all posters. After the closed session, teams will enter the room and stand by their poster to answer questions.
6. No more than 3 team members should attend the poster at one time, due to space constraints. Teams may rotate team members during the poster session.
7. The poster will be moved back to the bench-scale demonstration area for your use on Tuesday when talking to the judges.

Poster Session Judging Criteria

Rubrics for the poster session may be found in the section:

Contest Scoring (for Tasks 1, 3, 4, 5, 6)

Contest Scoring (for Task 2)

Bench-Scale Demonstration Guidelines

Teams must follow all safety regulations, as guided by the Experimental Safety Plan (ESP), next section. We are proud of our safety record. Do your part and keep it safe for all in attendance!

Safety

1. ***Pre-contest***
   a. When at your home lab, follow your institution's safety protocol for running all experiments.
   b. Attend WERC's Short Course, "Developing an Experimental Safety Plan (ESP)" by February 20, 2025.
   c. Task 2 teams will attend an additional on-demand course, "Hydrogen Safety."
   d. Submit the ESP by February 26, 2025 (Required to run a bench scale experiment at the contest).
2. ***At the contest: Commissioning and Decommissioning***
   a. *Setup:* Begin setting up your team's equipment when you arrive on Sunday.
   b. *Safety Meeting:* Held on Sunday. Attendance is mandatory.
   c. *Commissioning April 6 - 7:*
      i. Teams are not allowed to run their bench-scale demonstration until they have been commissioned by the Safety Officer or one of her delegates.
      ii. Commissioning starts Sunday. Safety Staff members compare equipment/chemicals in your ESP with your bench-scale demo. When approved, you will be commissioned to run the equipment.
      iii. Chemicals needed to run the bench scale (if needed) will be issued Monday morning.
      iv. Beginning Monday morning, lab safety PPE is required at all times in the bench-scale area. This includes safety glasses, long pants, and close-toed shoes. WERC will provide safety glasses.
   d. *Judge safety:* Provide judges with safety equipment, if needed. Sanitize safety equipment between judge visits. (Note: Judges consider your team's implementation of safety protocols in their scoring.)
   e. *Decommissioning:*
      i. *Teams:* Tuesday after bench-scale samples are submitted, teams dismantle their bench area equipment, clean the space, prepare any waste for disposal as instructed by WERC staff, and have their space inspected. After successful inspection, teams will move waste to the Waste Accumulation Point. After you move your waste to the Waste Accumulation Point, you are considered decommissioned.

Other Bench-scale Demonstration Regulations

1. The team's poster will be displayed in the booth at all times except during the Poster Session. For safety, posters must hang from the pipe-and-drape in the booth. No posters will stand on easels at the booths.
2. The poster should be in landscape orientation and fit on the provided 37" x 47" aluminum board. If the poster does not meet these criteria, the team is responsible for their own poster mounting and hanging.
3. Refer to your task problem statement for specifics about running the bench-scale demonstration. Otherwise, there are no regulations regarding the demonstrations, as long as safety protocols are met.
4. *Team Presentation:* Prepare and rehearse a brief demonstration for the judges, incorporating the poster. Be prepared to run the experiment in their presence, though this may not be feasible for each set of judges. Answer any un-answered questions from the oral-presentation.
5. *Judging*: You will present your results a minimum of three times for judges who come to your booth in smaller groups of 2-3 judges in three 30-minute shifts. Other teams and sponsors will likely visit your booth.
6. *Sample testing:* Conducted on Tuesday. The Task Problem Statement outlines how your bench-scale experiment will be tested. If required, WERC will hand you a pre-mixed solution and collect your final solution on Tuesday. The samples will be delivered to NMSU's analytical labs and results will be reported to judges during the Wednesday awards deliberations.
7. *Team meets team:* Teams are allotted time to visit other teams' bench-scale demonstrations to explore how others approached the same problem, or learn about other tasks. Teams vote for their favorite bench-scale design.

Bench-Scale Demonstration Available Equipment and Supplies

WERC-provided Bench-scale Supplies and Equipment

WERC is able to provide the items below at the contest. Request these items in the ESP; notify us no later than 3 weeks prior to the April contest.

- Pipettes
- Lab Scale
- Some hand tools
- Centrifuge & tubes
- Turbidity, pH, ORP meters
- Water pumps (hand and electric)
- Water, compressed air, and extra lighting.
- A labware kit containing assorted size plastic beakers and graduated cylinders

Chemicals that can be purchased at NMSU

NMSU's Main Stockroom (Andrea Coleman, Manager) has some chemicals available for purchase.

- Chemistry Stockroom: Chemistry/Biochem Building, Room 103.
- Cash or check accepted.
- Call for availability and pricing: 575-646-4330
- Hours (MT Time): M - Th 8:30 AM - 9:00 PM; Fri 8:30 PM - 5 PM

What is not available at the contest:

- Gas
- Fume hoods
- Electricity over 120 V
- Furnaces & Lab Ovens
- Pressurized water flow (e.g., hose fed)
- Gas regulators (we have a few, so please ask)

Judging Criteria for the Bench-Scale Demonstration

See Rubrics, next Section

Bench-Scale Demonstration: Booth size, Equipment, Permit Process

Time/Day	Event	Description
Sunday 1-5 PM & 7:30 – 9:00 PM Bench-scale area closes promptly at 9:00 PM.	Bench-scale set-up	**Booths: 10' X 10', bounded on 3 sides by 8' pipe-and-drape** Provided: 110V electrical outlets, 8' folding table 35" x 47" aluminum board for mounting poster, mounting clips, hook/chain assembly for hanging the poster in the booth. For larger posters, teams will provide their own mounting system. See previous page for additional equipment/supplies that can be requested. Contact: Juanita Miller (miljgh@nmsu.edu)
Monday 8 AM	Bench-scale Area Opens	Safety glasses, long pants, close toe shoes enforced in the bench-scale area at all times until decommissioning for all teams is complete on Tuesday.
	Sample distribution	As described in each task problem statement, synthetic water or other materials will be distributed following ESP commissioning.
Bench-scale area closes promptly at 8:00 PM.	Running the bench scale	Teams may run their bench-scale apparatus throughout the day. Your ESP will determine how to address your equipment overnight.
Tuesday 8 AM	Sample Evaluation	Samples will be taken, as outlined in the task statement. Samples will be evaluated using analytical equipment located on the NMSU campus or onsite at the contest. A secondary independent lab may be used to confirm first-place results. Team results sample due, at latest, by 2:00 PM on Tuesday.
4 PM	Bench-scale Area closes.	All equipment must be packed and removed, booth area cleaned and waste disposed as described in decommissioning.

Experimental Safety Plan (ESP) Overview

General Instructions

An Experiment Safety Plan (ESP) is required for every bench-scale experiment conducted at the WERC Environmental Design Contest. The ESP ensures the safety of all by identifying the safest possible methods to conduct an experiment. By signing the ESP, the individuals conducting the experiment, College of Engineering Safety Specialist (COE Safety), and the faculty advisor acknowledge responsibility for the following.

1) Appropriate Personal Protective Equipment (PPE) must be worn at all times in the bench-scale area. The minimum required PPE to enter the area on Monday & Tuesday is shown below. Additional PPE is dictated by your ESP.

1) long pants
2) closed toe shoes
3) safety glasses (provided at the contest)

2) No researcher is permitted to work alone in a lab or at the contest at any time, for safety reasons.

3) Two-phase ESP approval:

a. *Phase I*–Written safety plan. Online approval by College of Engineering (COE) Safety Officer is permission for the team to bring their experiment, equipment, and necessary chemicals to the contest. The ESP will establish controls of hazardous operations, ensure appropriate supplies, and establish expected waste streams.

b. *Phase II*–Approval on-site at the event: Requires evaluation of the assembled experiment and a "dry run" of the experimental procedure. Upon approval, the team may acquire sample solutions and begin operating their device.

Experimental Safety Plan (ESP) Instructions

Follow your school's safety procedures while conducting tests prior to attending the contest.

Teams will not be able to run a bench-scale demonstration at the contest if the ESP is not received by the deadline. To prepare to submit the ESP, every member of your team is required to complete the on-demand course, "Preparing the Experimental Safety Plan" on or before February 20, 2025. You will be emailed a link to access the ESP short course after your team registers for the contest.

The eight required submissions for the online ESP are listed below and described on the following two pages.

1. Experimental Scope
2. Drawing of Experimental Layout including P&ID
3. Normal Operation, Startup and Shut-down Procedures
4. Emergency Shutdown Procedures
5. Waste Management Procedure
6. Hazard Identification and Mitigation
7. Other Equipment Needs
8. Safety Data Sheets

1. Experimental Scope

1. Explain why the work is being performed and the goal(s) of the experimental design. If this is an update/revision of a previous ESP, describe all changes
2. Provide the stoichiometry of any chemical reactions and their heats of reaction.
3. Demonstrate the inherent thermal safety of your experiment through calculation or through the use of accelerating-rate calorimetry data. Attend the Short Course for preparing the ESP for more information.
4. Include a complete list of all chemicals (reactants and products) involved in the work.
5. Include a complete list of all equipment (e.g., autoclave, centrifuge, pump, heat bath etc.).
6. Include a timeline for this experiment including setup, sample runtime(s), and teardown. If the experiment is required to run after hours, explain how the after-hours run will be addressed (i.e., will the equipment operate autonomously, or be monitored remotely, or be monitored by someone onsite; if any of these, for how long? Or indicate other scenarios, as needed.)

2. Drawing of Experimental Layout including Piping and Instrumentation Diagram

Provide a detailed drawing of the experiment including P&IDs showing all flow of inputs and outputs for equipment and system. Note that this is required for all ESPs.

3. Normal Operation, Startup, and Shut-down Procedures

Provide a **step-wise** procedure that describes **in detail** how the work will be performed.

1. Begin and end the procedure with the equipment in the normal idle (inoperative) state.
2. Include a statement of the required PPE, starting at the beginning of the procedure and at every location in the procedure where the PPE requirements change.
3. Include details of how you will meet the required elements of your chosen task (e.g., run time, run rate, sample rate etc.)
4. Indicate where hazardous feedstock chemicals will be stored, how they will be transported to the location of the experimental work, how they will be transferred from storage vial into the experimental apparatus, and how they will be returned to storage.
5. Take into account those items for which you indicate "yes" on the WERC Lab Hazard Assessment Checklist (See the Attachment Tab on online submission).

4. Emergency Shutdown Procedures

1. Provide a step-wise procedure that describes how the equipment will be brought to a safe state in the event of an emergency. Consider emergency situations such as loss of power, leaks, fire in your equipment, fire in the surrounding lab area, etc.
2. Include a detailed explanation of how to attend to potential medical emergencies that may result.

5. Waste Management Procedure

Prepare a Waste Management Procedure that indicates the exact nature and estimated volumes of all wastes to be generated during the experiments. NMSU will provide containers and forms for proper disposal of materials. NMSU will dispose of on-site waste when placed in proper containers. (See website "Safety Forms" for examples of the NMSU Waste Tracking Form, NMSU Waste Sticker and photos of containers.)

6. Hazard Identification and Mitigation

Identify and discuss all HIGH hazards associated with the experiment. Use the WERC Lab Hazard Assessment Checklist as a guide. (See the "JHA Lab Hazard Checklist Example" on WERC website.)
When in doubt about whether something represents a HIGH HAZARD, ask COE Safety for a determination.

The Hazard Identification and Mitigation analysis must consider:

1. all sources of energy (electric, chemical, hydraulics, mechanical, compressed gases);
2. extreme conditions of pressure or temperature (from flame or steam to cryogenics);
3. chemical use and storage;
4. housekeeping;
5. fire potential;
6. biological hazards.

The discussion must include:

1. Description of the HIGH hazard;
2. Operational and engineering controls that will be used (based on identified industry best-practices used in addressing this safety hazard);
3. Required PPE (beyond minimum) when this HIGH hazard is present; and
4. Special training (beyond minimum) that is necessary.

7. Other Equipment Needs:

Provide a list and details of any equipment you require that will not, or cannot, be shipped to the event. We have several items available for use and can let your team borrow them, but you must notify us in advance.

Examples include scales, balances, electrical test meters, hand tools, secondary containment vessels (e.g., kiddie wading pool for water containment), easels, stands, brackets, clamps etc.

8. Safety Data Sheets

Provide SDS documents for all chemicals used at the event, including household and consumer products.

Flash Pitch Competition Guidelines

The Flash Pitch competition promotes entrepreneurship as teams pitch a business plan to potential investors and professionals who have experience with start-up companies. It is judged separately from the main contest.

- Mandatory 3.5-minute product pitch using a slide deck.
- Prepares students for entrepreneurship as teams pitch their design-contest solution to "investors."
- Scored independently from the other stages of the contest.
- Helps satisfy ABET Student Outcome #3: an ability to communicate effectively with a range of audiences.
- Awards cash prizes. No start-up funding will be issued.
- Engages 9 judges to score the competition.
- Cash Awards: First $1000, Second $750, Third $500, Honorable Mention $250.

Flash Pitch Slide Presentation Specifications

- *Team Identification*

  Select a name for your team that is independent of your WERC-assigned team name. Since many judges have regional interests, to maintain a level playing field during judging, teams will omit all reference to their university during the competition. Therefore, university names, colors, logos, slogans, etc. should not be included in any slides or clothing. School colors should not be worn during the presentation. WERC badges should be removed.

- *Slide Format:*
  - PDF format (to preserve formatting during the presentation). Other formats will be considered if the team has special needs. Contact werc@nmsu.edu to arrange.
  - Type: Minimum of 28-point type for body, 36-40 for headings. Viewable from 60' away.
  - Aspect ratio: 16:9
  - Use high-contrast colors to ensure readability from long distances.
  - Team Info: At the same location on every slide: place team name and brief project title to help judges keep track of your team. Omit university references. Point size for this may be smaller than 28 points.

- *Slide Content*
  - The Cover Slide is the only required slide. To be competitive, address each topic listed below with the goal of convincing a philanthropist to invest in your technology. You may add additional topics.
  - Cover Slide. Include title, presenter(s), names of all team members, and a team name that omits reference to your university.
  - Slide Topics (no more than 7 slides; slides may be organized in any order)
    - What is your product and why is it important? (Show an image/video of product)
    - What is your business and marketing strategy? (show clear plans for sales and revenue generation and well-targeting marketing strategies)
    - What is your estimation of this industry's worth and what percentage will you compete for?
    - How much $$ to get started? How long until your company is profitable?
    - Why you? What is your competitive advantage?
  - Slides may contain simple animations and may contain original video created by the team. If used, a video should not be longer than 1 minute. All animations and video must be easy to enable by the slide operator. If in doubt, contact WERC in advance and double-check on Sunday afternoon.

- *Slide Submission:* Slides due 11:59 PM Friday, April 4. Upload Flash Pitch slides to wercteams.nmsu.edu or send to werc@nmsu.edu via WeTransfer.

Contest Logistics

- *Dress:* Presenters may wish to bring a change of clothes for Sunday: One set for travel and bench-scale setup and the second set of professional dress to change into for the Flash Pitches.
- *Presenter(s):* We recommend that no more than two people present the Flash Pitch. More are allowed, but be wise and keep it to a minimum.
- *Non-presenting Team members:* Those who are not presenting will support their team from the audience. They may stand briefly while the cover slide is shown. This should be rehearsed with your team and presenters.
- *Slide Deck Check:* Sunday 1 – 4 pm (not mandatory). Your slide deck will be pre-loaded onto a WERC computer before you arrive on Sunday. At the registration desk, you may sign up to preview your slides prior to the Flash Pitch.
- *Slideshow operation:* Provide a teammate to advance the slides.
- *Round 1:* Teams will be assigned to one of 2-3 presentation rooms.
- *Welcome Dinner:* During dinner, judges select Round 2 teams. A representative from each team will draw to determine presentation order.
- *Round 2:* Final Round. After dinner. Presentations will be on center stage of Ventanas Ballrooms.
- *Timing for both Rounds:*
    - The presenting team will set up their slide deck while the next team gets "on deck."
    - 3.5-minute presentation
    - 2 minutes Q & A
    - 2 minutes for scoring (while the next team moves on stage and cues up slides).
- *The winners of the competition will be announced* on Wednesday, 10 April, 2025. At that time, the teams' universities will be acknowledged.

Audience

This is a business pitch. Your goal is to present a business plan to your primary audience, potential investors (the Flash Pitch judges). Also in attendance will be other Design Contest teams and advisors, main contest judges, and other invited guests, including members of local environmental groups. See Resources below for help preparing your business plan and pitch.

Flash Pitch Judges

The Flash Pitches are scored by a team of judges who are independent from the main Design Contest. Some are actual Angel Investors, and others are professionals with business acumen who will judge the viability for your plans to market your process/product. The judges' first exposure to your team's project will be during the Flash Pitch presentations. They will not read your team's technical report prior to the Flash Pitch Competition. Angel investors may wish to further explore your business plans with your team.

During the First Round, teams will be separated into two separate and comparable rooms to present their talk to a set of 3-4 judges per room. The judges will recommend the top two entries from their room to compete in the Final Round. The Final Round will be conducted in front of all teams in the main banquet hall. It will be judged by a fresh set of judges, with a total of 3-5 judges scoring the Final Round.

Judges may include:

- Angel investors
- Staff of Arrowhead Center an NMSU Community for Entrepreneurship and Innovation
- Business faculty, engineering faculty, and college administrators
- New Mexico environmental proponents (may include business owners, students, etc.

Flash Pitch Competition Rubric

0: least
5: best

Team #	**Comments** Comments will be typed and shared with teams.	**Points** **(0 – 5)**
School Anonymity -No reference to school name or color(s)		Disqualify Qualify
Clearly defined product/service -product/service clearly presented -creating market demand for product/service		
Business and Marketing Strategy -clear plans for product/service sales and revenue generation -well-targeted marketing strategies		
Profitability & Market Share - estimation of industry worth/market conditions - estimation of market share - timeline to profitability - future business sustainability		
Startup Funds Needed - estimated funds needed; funding source		
Competitive Advantage - product uniqueness - supports for business success and continuity (patents, intellectual property)		
Wow Factor - Audience Engagement -confident, fluid, professional -motivating/enthusiastic		
Content Preparation -organized and informative presentation -slides attractive, with clear content, and error-free -Understandable for non-technical audience		
Q & A: Ability to answer questions - knowledgeable, organized, pragmatic - poised, professional		
Point Total		

30% Project Review

If not specifically stated in your task problem statement, you task does not require a 30% Project Review. However, teams are urged to complete a 30% Review as a milestone in their engineering design process.

About the 30% Project Review

An engineering 30% Project Review outlines for the client an engineering firm's preliminary design. It provides the client an opportunity to suggest modifications for inclusion in the final design. The goal is to define the scope of the project, present a project schedule, report progress to date to meet the final deadline, and determine fatal flaws, if any.

The 30% Project Review is expected when answering an RFP. If your task requires the Review, your team will submit it in February. The report will be reviewed by the judges you will meet at the contest, but it will not be scored. It is intended to help you make course corrections in the final phases of your research and development. The more information you provide the judges, the more help they can give you.

What to include in a 30% Project Review

Below are items that should be in an engineer's 30% Project Review to provide the client with a clear picture of the project's feasibility.

1. A table of contents or outline of the final report.
2. A process flow diagram or schematic of your planned process =. This is the heart of the design. Write it with care. It should outline ALL inputs and outputs (mass and energy balances, waste streams, etc.).
3. A brief description of your project: A bulleted list outlining: planned solution to the problem and any anticipated drawbacks.
4. Preliminary data and/or calculations that support the proposed design. This might include expected chemical reactions (reactants, reaction times, etc.), flow volumes and rates, etc. If you do not yet have data, indicate how you plan to collect it.
5. A rough estimate of cost. Your design choices should be partially cost-driven. This will provide your client an opportunity to assess the feasibility of your design. If your data warrants it, report % cost savings expected. If you have no data, indicate how you plan to collect cost data.
6. A schedule for completion of the project, including progress to date.

30% Project Review Submission Guidelines

Page Limit: Four pages.

Audience: A potential client. Think of this preliminary report as a business document should be a business document.

Submission date: Submit the project review as early as possible. See your task problem statement for details.

Project modifications: You are allowed to change your plans after submitting the Project Review.

Assessments: Although the review is not scored, your team will receive feedback from the judges for improving your project. (The higher the quality of your Project Review, the more help you will get from the judges.)

Hints for preparing the 30% Project Review

1. Share what you know, and don't worry if you don't know everything yet. This is a review of your progress, not a final report.
2. Write from the perspective of sharing preliminary results in a formal manner. Do not waste words; avoid flowery prose. Keep it short and simple to help the reviewers quickly find important information.
3. If you do not have the data requested, do not avoid the subject. Address the issue directly. This will put the reviewers in the frame of mind to help you find what you need, if they are able.
4. If you are having difficulties with an aspect of the project (your apparatus is not performing as expected, your data is incomplete, etc.), do not be afraid to point out these difficulties. You may get some sage advice. We heard of a few instances last year in which a team was helped by the judges during this phase of the contest.
5. Use wisdom in following the reviewer's advice. If something seems "off" to you, consult your faculty advisor. It is possible that the reviewer misunderstood your intent.

What judges will look for:

1. Was it written from the standpoint of the designing team presenting preliminary findings to a client?
2. Are there any inputs/outputs missing in the flow/schematic diagram (waste streams, manpower, etc.)? Should the team consider adding more detail in the diagram, such as expected flow rates, volumes, etc.?
3. Did the team support their proposed designs with data/calculations? If the team does not yet have data/calculations, what plans do they have to collect this information?
4. Did the team include cost estimates? If the team does not yet have cost estimates, what plans do they have to collect this information?
5. Does the team appear to be on schedule? Are there any suggestions the judge can make to help streamline the process?
6. Does anything seem to be missing from the table of contents?

WERC Environmental Design Contest Award Selection Criteria

Judging Philosophy

In the real-world RFP, a good paper and oral presentation lets you in the door. To win the contract, you need good pilot study results and must stand out from your competitors in your design's cost, performance, simplicity, and low waste generation. Judges score teams in a similar way. If your solution is fabulous, but costs ten times more than the other teams, you will lose points.

Task Awards: First, Second, and Third Place awards for each task ($2500, $1000, $500)

The winning team is the one with the highest score in all elements of the task (Technical Content, Environmental considerations, Community Outreach, Audits, Written, Oral, Poster Presentation, and Bench-scale Demonstration).

The number of awards depends on the number of entries per task. We apply the one-half rule: No more than half of the entries will receive awards. For example, if there are 3 entries in one task, there will be a First-Place award only. If there are six entries, there will be First-, Second-, and Third-place awards, etc.

In the event that fewer than three teams enters a task category, for judging purposes those team(s) will be consolidated with other tasks, according to the closest fit. As is true with every scoring decision, each team will be judged on the merits of sound engineering judgement and the ability to express this to the judges, independent of the research topic. Note that the same judging principle is applied each year to the Open Task. It has a minimum of three completely different tasks competing for the same prizes.

Bench-scale Competition Awards: First, Second, and Third Place awards for each task ($1000, $750, $500)

A separate rubric is provided to the judges for the Bench-scale Competition Award. This award highlights the quality, performance, reliability, simplicity, and environmental sustainability of the bench-scale design. It is possible for a team to win First Place in both the Task Award and the Bench-scale Competition Award, but this does not frequently happen.

New Mexico Space Grant Consortium (NMSGC) Outstanding Team Award ($2500)

The NMSGC is seeking teams with outstanding projects with the following attributes.

- Impact Potential (35%) The proposed engineering design addresses a pressing engineering need.
- Innovation (25%) The design presented is a unique, creative solution to the identified problem.
- Feasibility (20%) The design is feasible and demonstrates credible, financially scalable research and results.
- NASA Mission Directorate Connection (10%) The design has potential to contribute to a NASA Mission Directorate* solution. The Outstanding team is not necessarily solving a NASA-guided task. Most teams will be able to connect their solutions to a NASA Mission Directorate. To be competitive, research how your project supports one of the Directorates, and point this out in your technical report.
- Quality (10%) The overall quality of the bench scale demonstration is high and it shows a high level of effort.

*The six NASA Mission Directorates are Aeronautics, Exploration Systems, Mission Support, Science, Space Operations, and Space Technology. These Directorates seek to develop and demonstrate new technologies and support technology transfer that can benefit NASA, commercial, and other government missions. They support scientific divisions that study astrophysics, biological and physical sciences, Earth science, heliophysics, planetary science, etc.

Freeport-McMoRan Innovation in Sustainability Award ($2500)

An award for the team that creates the best overall innovative product, process or solution to a land management, energy, water and/or air or other sustainability issue(s); and meets FCX's (Freeport-McMoRan's) approach to Sustainable Development and Resource Conservation. Selection Criteria:

- Potential for real-life use and implementation
- The degree to which the proposed product, process, or solution successfully addresses a land management, energy, water and/or air or other sustainability issue(s).
- Demonstration of Physical, Chemical and Ecological effects on Sustainable Development as it relates to land, energy, water, and/or air.
- Energy- and water-use efficiency.
- An understanding of the operational, environmental, and social impacts of product/solution or method including upstream and downstream issues.
- Affordability, cost effective operation, and maintenance; quality of cost/benefit analysis including all sustainability elements or selections made in developing the product/solution/method.
- Overall potential environmental, social, and economic benefits.

Judges' Choice Awards (Up to 3 awarded) ($500)

Judges select teams that distinguished themselves in all four elements of a task. Judges may elect to award the Judges' Choice to more than one team at the contest. Judges' Choice is often used for teams that experienced obstacles along the way, but persevered and submitted a noteworthy design.

Peer Award (Up to 3 awarded) ($250)

Teams will visit other team's bench-scale demonstrations/discussions and vote on the best solutions to current environmental issues. A team cannot vote within their own task.

Pollution Prevention Award (P2 Award) ($1000)

Teams should consider the concept of Pollution Prevention (P2) in their solutions and come up with cost-effective P2 efforts through improved operational processes which bring savings on all aspects of energy, environment, and economy.

The P2 award is based on the team's demonstration of an understanding and implementation of:

- significant reduction or elimination of wastes at their sources,
- reduced generation of greenhouse gases,
- reduced use of hazardous materials,
- conservation of water and air resources,
- utilization of sustainable materials, and/or
- energy efficiency measures.

Outstanding Student Award in Memory of Intel's Terry McManus ($500 per student)

To honor his memory, in 2006 Intel created the Terry McManus Memorial Award to be given to a student or students who demonstrates the same drive Terry had. Terry loved coming to the Design Contest every year and seeing students who shared his goals for environmental excellence. This memorial award is given to a student who demonstrates a passion for the environment. Up to three students may win the award each year.

Each team may nominate one student among their team. The name is given to the advisor.

The advisor writes a one-page nomination letter describing why the chosen student is deserving of the award. The writeup should demonstrate the student's commitment to environmental excellence and a passion to pursue global environmental improvements. Nominations should highlight the student's work in community projects, a history of research in environmental issues, etc.

Nomination letters should be submitted to the WERC team site by Tuesday night (the second day of the contest). They will be distributed to the judges for the final decision.

Flash Pitch (First, Second, Third Place awards: $1000, $750, $500)

The Flash Pitches are scored separately from the main competition by a separate set of judges who are primarily experienced in product design and development, business development, start-ups, and technology transfer.

The Flash Pitch judges encourage entrepreneurship as teams present a business pitch to judges who are primarily looking for a marketable product or process. A winning Flash Pitch will be engaging, present data from the bench-scale demonstration that illustrates the success of the design, and present economically feasible plans for scale-up. If it takes 10 years to realize a profit, judges will be concerned (unless the environmental contribution is so significant that it overshadows the profit margins. If that is the case for your product, you need to "sell" that idea to the audience). Judges appreciate a discussion of the triple bottom line.

Contest Scoring – Tasks 1, 3, 4, 5, 6

Below are the general scoring categories that judges will use.

- Items I through III are assessed across multiple events. Judges will continue to update your score in these areas as the contest progresses.
- Items IV and V are event-specific, with IV evaluating audits collected by your team and V covering Team Communication for each event (report, orals, bench, and poster).

Percent of Final Score

40% **I. Technical Content** (Written report, Oral presentation, Poster, Bench demonstration)

A. Background Research
B. Consideration of alternative technologies, justification for technology chosen, and discussion of situations in which alternative technologies may be preferable to your team's design
C. Innovativeness of chosen technology
D. Design thoroughness (mass & energy balances; process flow diagrams; waste stream management)
E. Quality, thoroughness, and reasonable results of Techno-Economic Analysis and addressing costs of alternatives.
F. Design practicality (cost-effectiveness; attainable with current technology, likelihood of implementation)
G. Lab results validate claims

20% **II. Environment** (Written report, Oral presentation, Poster, Bench demonstration)

A. Local environmental health and safety
    a. Safety considerations are appropriate and included in plans for construction and operation.
    b. Governmental regulations at all levels (federal, state, local) are accounted for and are appropriately applied to the project
    c. Reasonableness (i.e., do not require a hard hat when there are no head trauma hazards)
B. Natural environment
    a. Waste stream management
    b. Relevant agencies and permitting accounted for
    c. Long-term sustainability

10% **III. Community Outreach** (judging primarily focused on Written report & Oral presentation)

A. Effect on local area (quality of life; property values; pollution treatment or prevention)
B. Community Relations Plan: Plan and schedule for communication with local population to address perceptions. (i.e., overcoming perception that direct potable reuse is drinking toilet water.)
C. Public Involvement Plan (Community Acceptance Plan). Plans for engaging stakeholders in decision-making are sound.
D. Community outreach: Did the team post social media recognizing sponsor and WERC? (Judges will ask the team to show a social media post during the Bench-scale demonstration)

5% **IV. Audits** (written report)

A. Three audits are included (Economics, Health & Safety, Legal)
B. Auditor credentials (appropriate to the audit topic)
C. Auditor objectivity (should be far-removed from project development)
D. Team implemented auditor comments, as appropriate

Rubric for Tasks 1, 3, 4, 5, 6

V. Effectiveness of Team Communication (25% Total)

10% **A. Quality of Technical Report**

1. Spelling and other typographical errors
2. Proper grammar
3. Organization (appropriate section flow, clearly marked sections, page numbers included in Table of Contents)
4. Executive summary covers important points and omits non-essential information
5. Appropriate balance between background research and the final design discussion
6. Thorough and accurate process flow diagram (where applicable)
7. Effective use of figures and tables (Figures & tables aid communication; all text & graphics are readable)
8. Late reports are penalized by 25 points per day late.

5% **B. Quality of Oral Presentation**

1. Slides free of spelling and other errors.
2. Slide design (appropriate amount and types of content on each slide; readability from the audience)
3. Presentation is well planned: smooth topic flow, appropriate number of slides. Presentation does not seem rushed.
4. Quality of speakers' delivery (easy to hear; easy to understand; talked to audience, not the floor; etc.).
5. Appropriateness of attire (Team Manual specifies business attire).
6. Quality of answers to judges' questions.
7. Subtract 10 points for each minute over time or if there are too many presenters.
8. Subtract 10 points if faculty advisor speaks once the presentation begins.

5% **C. Quality of Bench-Scale Presentation**

1. Apparatus demonstrates proposed technology and works as intended.
2. Apparatus is safely operated at all times.
3. Team clearly explains how proposed technology works.
4. Team incorporates poster when appropriate for needed information.
5. Teams appropriately addressed questions outstanding from oral presentation (if applicable).
6. Quality of answers to judges' questions about the bench-scale demonstration.

5% **D. Quality of Poster**

1. Poster attracted the judge to read it.
2. Poster is free of misspellings, grammar, and similar issues.
3. Poster is not overly nor under-worded, has no large blocks of text; has sufficient white space with easy-to-follow flow.
4. Good ratio of text and graphics (graphs, tables, photos).
5. Poster can stand on its own to convey information.
6. Poster can be read from a reasonable distance away (i. e., viewer should not have to stand six inches away to read the text).
7. 10 points deducted if the poster exceeds 36” x 48”

Contest Scoring – Task 2

Below are the scoring rubrics that judges will use to score the contest. Task 2 has unique requirements that warranted a distinct rubric.

Items I through III are assessed across multiple events. The judges will continue to update your score in these areas as the contest progresses. Items IV and V are event-specific, with V covering Team Communication for each event (report, orals, bench, and poster).

Percent of Final Score

40% **I. Technical Content** (Written report, Oral presentation, Poster, Bench demonstration)

A. Demonstrated research and understanding of integrating an intermittent renewable resource with a hydrogen fuel cell to provide a firm dispatchable resource.

B. Successfully demonstrates integration of the hydrogen fuel cell with renewable energy sources.

C. Thoroughness and quality of operational protocol detailing how the utility will manage DER capacity and energy for dispatch, focusing on firm energy resources.

D. Reasonable and effective operational protocols for DER engagement that details how the utility will manage DER capacity and energy for dispatch, focusing on firm energy resources.

E. Algorithms for the overall system successfully respond to DERMS signals from the utility.

F. Algorithms successfully respond to PV system variability, ensuring that the firm dispatchable resource is as consistent as possible, with minimal DC ripple.

G. Innovativeness of technology

H. Demonstrates that the solution can be scalable from small residential size up to large-scale utility size.

I. Quality, thoroughness, and reasonable results of Techno-Economic Analysis for full-scale implementation of a DERMS grid-tied solution that integrates an intermittent renewable PV source with a hydrogen fuel cell to provide a firm dispatchable resource. Includes CAPEX, OPEX, and potential revenue, with graphical representations of cost data

J. Well-documented and reasonable predictions of the energy management improvements for grid operators based on the planned operational protocols.

K. Well-documented and reasonable predictions of energy and cost savings (in US dollars) for consumers and/or grid operators.

L. Design and implementation practicality (cost-effectiveness; attainable with current technology, likelihood of implementation)

M. Demonstrates significant impact on the grid per dollar spent: Energy or Demand effectively reduced/increased as needed (1=Below average effect on kWh, 5 = Superior effect on kWh)

10% **II. Environment, Health, Safety** (Written report, Oral presentation, Poster, Bench demonstration)

A. Implementation plan addresses and adheres to utility regulatory framework (FERC, NERC, NEC).

B. Discussion of how regulatory approval will be achieved.

C. Team identifies and quantifies direct environmental and ecological impacts of the solution, such as the energy and water needed for hydrogen production and for operating and maintaining the DERMS, as well as the impact of manufacturing and maintaining specialty equipment needed for this design.

D. Team identifies and quantifies indirect environmental and ecological impacts of the solution, including how the design will affect greenhouse gas emissions, water consumption, habitats, etc.

E. Team effectively considers long-term environmental and economic sustainability of the design.

F. Implementation plans include hydrogen safety protocols.

G. Implementation plans include safety considerations for the utility.

20% **III. Community Outreach** (Written report, Oral presentation, Poster, Bench demonstration)

A. Effect on local area (quality of life; water usage, property values; pollution treatment or prevention)

B. Public Involvement Plan (Community Acceptance Plan). As warranted by your design, include plans for engaging the community and stakeholders (hydrogen storage & Electric company) during initial design phases. The public involvement plan should address avenues for the public to express their concerns and provide input in decision-making.

C. Community Education Plan: Plan and schedule for communication with the local population to 1) educate them on how their choices can support the grid, including adjusting their usage during peak load events, contributing intermittent energy to the grid (rooftop solar, etc.); 2) educate the public about the safety and environmental impact of hydrogen production and storage (consider the specific hydrogen production (green-, blue-, or other) that your design uses).

D. The Community Outreach plans (Public Involvement Plan and Community Education Plan) are well-researched, written in non-technical language, and appropriately address community needs and concerns.

E. Did the team post social media recognizing sponsor and WERC? (Judges will ask the team to show a social media post during the Bench-scale demonstration—more than one post is even better!) The post should acknowledge the task sponsor.

5% **IV. Audits** (Written report)

A. Three audits are included (Economics, Health & Safety, Legal)

B. Auditor credentials (appropriate to the audit topic)

C. Auditor objectivity (should be far-removed from project development)

D. Team implemented auditor comments, as appropriate

Rubric for Task 2

V. Effectiveness of Team Communication (25% Total)

10% **A. Quality of Technical Report**

1. Spelling and other typographical errors
2. Proper grammar
3. Organization (appropriate section flow, clearly marked sections, page numbers included in Table of Contents)
4. Executive summary covers important points and omits non-essential information
5. Appropriate balance between background research and the final design discussion
6. Thorough and accurate process flow diagram (where applicable)
7. Effective use of figures and tables (Figures & tables aid communication; all text & graphics are readable)
8. Late reports are penalized by 25 points per day late.

5% **B. Quality of Oral Presentation**

1. Slides are free of spelling and other errors.
2. Slide design (appropriate amount of information on each slide; readability from the audience)
3. Presentation is well planned: smooth topic flow, appropriate number of slides. Presentation does not seem rushed.
4. Quality of speakers' delivery (easy to hear; easy to understand; talked to audience, not the floor; etc.).
5. Appropriateness of attire (Team Manual specifies business attire).
6. Quality of answers to judges' questions.
7. Subtract 10 points for each minute over time or if there are too many presenters.
8. Subtract 10 points if faculty advisor speaks once the presentation begins.

5% **C. Quality of Bench-Scale Presentation**

1. Apparatus demonstrates proposed technology and works as intended.
2. Apparatus is safely operated at all times.
3. Team clearly explains how proposed technology works.
4. Team incorporates poster when appropriate for needed information.
5. Teams appropriately addressed questions outstanding from oral presentation (if applicable).
6. Quality of answers to judges' questions about the bench-scale demonstration.

5% **D. Quality of Poster**

1. Poster attracted the judge to read it.
2. Poster is free of misspellings, grammar, and similar issues.
3. Poster is not overly nor under-worded, has no large blocks of text; has sufficient white space with easy-to-follow flow.
4. Good ratio of text and graphics (graphs, tables, photos).
5. Poster can stand on its own to convey information.
6. Poster can be read from a reasonable distance away (i. e., viewer should not have to stand six inches away to read the text).
7. 10 points deducted if the poster exceeds 36” x 48”

Contest Scoring – Bench-scale Demonstration Competition Tasks 1, 3, 4, 5, 6

A. Apparatus solves the problem outlined in the task.
B. Apparatus demonstrates all steps required in the task problem statement.
C. Analytical results validate claims made in reports and presentations.
D. Originality and craftsmanship of the apparatus.
E. Apparatus is efficient, simple, and easy to use.
F. Apparatus is reliable and robust.
G. Apparatus is safely operated at all times.
H. Design promotes environmental sustainability/minimizes waste.
I. Team presentation of the bench-scale apparatus was a well-organized group effort. Each team member was prepared to present specific aspects.
J. Team's proposals for improvements or next steps in their technology exhibit good engineering judgement.
K. Quality of answers to judges' questions, including answers to previous day's questions.
L. Team effectively refers to poster when needed, and poster contained the graphs/data needed to support the bench-scale demo.

Contest Scoring – Bench-scale Demonstration Competition – Task 2

A. Apparatus shows successful integration of the hydrogen fuel cell with renewable energy sources.
B. Demonstrates the ability of the system to respond to utility peak- load events.
C. Demonstrates the ability of the system to respond to utility excess-energy events.
D. Successfully emulates a utility signal by generating its own internet-based control signal.
E. Additional functionalities (if added by the team) improved system performance.
F. Originality and craftsmanship of the apparatus.
G. Apparatus is efficient, simple, and easy to use.
H. Apparatus is reliable and robust.
I. Apparatus is safely operated at all times.
J. Team presentation of the bench-scale apparatus was a well-organized group effort. Each team member was prepared to present specific aspects.
K. Team's proposals for improvements or next steps in their technology exhibit good engineering judgement
L. Quality of answers to judges' questions, including answers to previous day's questions.
M. Team effectively refers to poster when needed, and poster contained the graphs/data needed to support the bench-scale demo.

WERC IEEE Conference Proceedings

Waste Management Education Research Conference (WERC) Proceedings

The WERC Environmental Design Contest is an IEEE conference. Find our previous WERC proceedings here.

All technical reports that judges consider to be of sufficient technical merit and acceptable quality will be published in WERC's 2025 IEEE *Xplore* Conference Proceedings. The reports will be abbreviated versions of the original technical reports and will undergo a second review/revision process that may take up to two months after the contest ends.

There is no limit to the number of teams invited to submit papers, and a team need not win a prize to publish in the proceedings. The invitation will be based on the quality of the paper, as determined by the judges. All members of the team, their Faculty Advisor, and Co-Advisors, if any, may be listed as authors of the paper.

At the Awards Ceremony, WERC will announce the teams invited to submit their papers for additional review and potential publication. If your team is invited to submit a paper for the conference proceedings, we will email instructions to the Advisors and Team Leader after the contest.

IEEE *Xplore* Publication Timeline

- Judges identify papers that are of sufficient quality to be recommended for publication.
- At the Awards Ceremony, WERC invites teams to submit a paper for potential publication in IEEE *Xplore*.
- Invited teams should ensure their "Long-Term Personal Email" address is up to date in their contest profile.
- Teams are given two weeks to update their paper to IEEE format, cut it down to 10 pages, and address judges' comments made during the main contest.
- A review board is given one week to review the updated papers and return them to the teams.
- Teams are given one week for paper revisions.
- Teams are given one week to submit copyright transfer to IEEE while WERC conducts a plagiarism check.
- Teams convert their papers to pdf format through IEEE *PDF Xpress.*
- June 2025: The 2025 Waste Management Education Research Conference (WERC) Proceedings are published in IEEE *Xplore*.

IEEE *Xplore* Copyright Transfer

Submission to IEEE *Xplore* requires the authors to provide a transfer of copyright to IEEE.

IEEE *Xplore* Publication Fees

The IEEE El Paso Chapter is sponsoring the publication fee and WERC will cover the per-paper charge. These fees will total $1500 plus a per-paper charge to publish in *Xplore*. Please thank the El Paso Chapter of IEEE for sponsoring the publication.

IEEE Membership

Part of the requirement for the local IEEE Chapter to sponsor the WERC Environmental Design Contest is that we give an added benefit to IEEE members. WERC has chosen to offer a $50 discount to the first team registered under an advisor if at least one member of the team is a member of IEEE. This person can be either a faculty member or a student. Student membership is $32 (Students can register here).

About the IEEE Environmental Engineering Initiative

IEEE is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity. Although they started as an electrical engineering association, they are branching out to all areas of engineering. IEEE and its members inspire a global community through its highly cited publications, conferences, technology standards, and professional and educational activities. (https://www.ieee.org/)

The IEEE Environmental Engineering Initiative intends to create an interdisciplinary forum for the community interested in the area of environmental engineering.

PART II: HELPFUL HINTS

Want a better chance of winning? Find valuable hints here.

General Helpful Hints

We have gathered these ideas from watching the most successful (and less successful) teams.

Team Composition

1. The "Perfect" team is one that works well together and consists of members who have a strong work ethic and a plan to improve an engineering process. Your Advisor will guide team member selection.
    a. For some successful teams, every member is of the same major.
    b. Some successful teams are multidisciplinary. Students from multiple fields can work on the same team: Chemical, Civil, Environmental, Mechanical, Electrical Engineering, Science, Tech Writing, Economics (develop the TEA), Safety, Art (design the presentations), etc.
    c. Some teams place students on a team as sophomores, and each year give students increasing responsibility: becoming a Team Leader in the Junior year and a Co-Advisor in the Senior year.
2. Select a team leader who is organized and has leadership skills; has knowledge of laboratory procedures, safety, and chemical clean-up; and will help each team member find a niche on the team.
3. Identify and utilize the skills of each team member and trust them to do their part of the job.
4. Keeping the same advisor (and/or passing along helpful hints from year to year) is an advantage.

Financial Support:

Your task's sponsor (shown on the Task Problem statement) covers costs of venue rental, analytical testing, chemicals, cash awards, and trophies for your task. ***Recognize all sponsors:*** send thank-you notes, post about them on social media, post to their social media, display their names/logos at your bench-scale area.

Seek financial support from your community:

a. Ask companies that your team members worked for in summer internships/co-ops. Many teams have had success with this.
b. Seek out local businesses/organizations who are considered "Friends of the Environment" (or turn them into such "Friends" as they sponsor your team).
c. Hold campus fund raisers or GoFundMe. People like to buy treats or services to help an organization.
d. Submit grant requests to your academic department, college, or special student programs.

Contest in general:

1. Dress to impress; look, act, and dress as professionals. Don't just sell your process, sell yourselves.
2. Always be respectful. If you are concerned about how you are treated, tell the Program Manager immediately.
3. Set up a realistic timeline for the team and follow it.
4. Bring all of your team's research notes to the contest; it may be useful and if it is well organized, you will be able to answer questions from the judges you did not anticipate or put in the paper.
5. Network while at the contest. Bring a business card/QR code and ask others for business cards/contact info, whether they are students, judges, or faculty from other schools.
6. Bring extra copies of your paper with contact information, in case judges want to recruit you.
7. Bring your resume. If you are not graduating, there may be internships available. If you are graduating, there may be a job available. Have a pdf of your resume ready to share.
8. Track the hours spent on different areas of concern: research, testing, writing, etc. You can pass this along to future teams at your school to help them as well.
9. The first year of participation is the toughest because teams do not know what to expect. Keep entering every year and, during the "off season" ask our judges for help preparing. They are happy to help you!

Know the Task Problem Statement and Manual Contents:

1. Near the beginning of your preparation, read the entire manual aloud as a team to ensure that everyone understands all aspects of the contest.
2. Carefully read and discuss the Task Problem Statement aloud as a team at least once per week during early stages. Later on, review it aloud periodically. Make checklists to remember all requirements.

Understand the Task Problem Statement:

Judges report that the most common deficiencies in all aspects of the contest are:

1. Not understanding the problem statement.
2. Not addressing all required topics outlined in the problem statement.
3. Presenting a weak Process Flow Diagram (PFD). Your PFD may look very different from the examples. Its strength will be in its appropriateness, according to your project.

These issues will be prevented by frequently reviewing and discussing the problem statement with the entire team and your mentors, referring to our sample PFDs.

Focus on the needs of the Client:

When answering the contest (or any) RFP, consider opportunities to add value to the client: What potential benefits and/or additional resources are possible as a result of your team's design? In addition to decreasing costs of processing, transport, disposal, etc., explore ways to add new revenue streams. Since teams rarely do this, your judges will be IMPRESSED!

Team Organization:

1. Keep a tabbed binder in your lab that is accessible at all times containing: Task Problem Statement, Team Manual, Judging Criteria, FAQs, and Deadlines.
2. Ensure that everyone on the team reads all material.
3. Assign a team member to *check the website weekly*. Especially the FAQs.
4. Make check lists for everything: 1) judging criteria, 2) requirements, 3) equipment to pack and/or ship, etc.
5. Stay organized; have one person organize all research information logically and accessibly.
6. Learn to expect and deal with change. Don't sweat the small stuff. What's done is done–Move on.

Research:

1. Throw nothing away, even if it only touches on the project. Some of the most creative solutions come from minor points mentioned in papers.
2. Contact a mentor with expertise in each area early and often; he or she may help you gain insight and help you find research papers and other reference material.
3. Don't be afraid to go to the top to find information or resources; top people can help, and they won't look down on you–they will be excited if you are informed and enthusiastic.
4. Reach out to local engineering firms or businesses that may be interested in your task. Getting feedback and "what I wish this product would do" could take your team's solution to the next level, and **judges will be impressed** that you reached out for real-world input. But remember to be respectful of people's time.

Travel

1. The El Paso Airport is about an hour's drive away from Las Cruces.
2. Keep track of expenses to help with next year's budgeting.
3. Printers will be available at the contest, but you might want to bring your computer, printer, and other technology to the contest in case of need.
4. Consider renting a trailer or extra vehicle to carry equipment and luggage.
5. Put equipment and the bench-scale items in a secure place, along with a checklist of items needed.
6. If you are not bringing your equipment with you, ship it to us by USPS). Keep your tracking numbers. Use our Equipment Transport Form on our website. We will deliver your packages to the contest.
7. Check out spots to see in New Mexico: White Sands, Very Large Array, Sun Spot. Some teams even take the whole week and go to the Grand Canyon. Side trips enrich the experience and help bond the team.

Follow-up:
After the competition:

- Write down what you learned and pass it down to next year's teams at your school.
- Write thank-you notes to your WERC Task sponsors and your team sponsors. They will be impressed by your efforts and more likely to sponsor your team and the WERC contest next year.

General Paper Preparation Hints

- The Written Report sets the stage for your team's success at the contest and indicates your team's attention to detail. It is the first thing the judges see. They read and evaluate each paper against the judging criteria and against every other paper in the same task. Judges tell us that they can frequently predict whether a team will win/not win, based on the quality of the report.
- Pay attention to detail and follow all helpful hints. Refer often to the Written Report Requirements (See Part I).
- Use well-written professional papers as models for your paper organization. The judges are accustomed to reading scientific writing style–be succinct; omit flowery, undocumented writing.
- WERC's Guidelines page includes sample award-winning papers from previous years at the Design Contest.
- Cite sources as you go; you may not be able to find the source again–trust us on this!
- Seek feedback on your proposed solution from local engineers and end-users of your solution.
- Ensure that the paper flows in a logical way. Use proper headings to allow judges to find information.
- Include a timeline for the industrial installation, scaled up from the bench scale solution.
- Work carefully on the computations for the full-scale product. Remember that scale-up designs do not necessarily just multiply from your bench-scale design.
- Cost-effectiveness is a key issue; keep costs in mind as you refine your solution: Consult a professional, such as a city manager as you include permit fees, construction costs, architect fees, etc.
- Remember the Audits! Select your auditors carefully and early; the more expert the auditor, and the more aligned with the subject matter, the better the quality of the paper. Rough-finish the paper at least three weeks before the paper due date, in time for two weeks in the auditor's hands and a minimum of one week for the team to incorporate changes. You might need to do more research after the auditors respond.
- Make sure the paper includes all requirements, including the audits.
- Select several reviewers (in addition to auditors) with combined professional experience covering all elements of your paper. Make sure you cover these bases when selecting reviewers (and get as many reviews as you can): a strong editor, a strong technical background, and someone with no previous knowledge of the subject (you will know your paper successfully communicates when someone who knows nothing about your task can understand your paper).

Judges frequently note the following deficiencies with respect to technical writing and editing:

1. Spelling errors. Use the spelling checker.
2. Failure to have the paper reviewed by a technical editor.
3. Missing units altogether or poorly selected units, e.g., 0.001 Kg versus 1 gm.
4. Misuse of terms. Be sure you know the correct definitions of industrial terms.
5. Lack of figures, tables, and illustrations. Properly used, they make a paper significantly more understandable. Figure captions should clearly explain all elements in the figure. The text should reference all figures.
6. Poor use of figures, tables, and illustrations. Figures should add to the clarity of the text.
7. Incomplete process flow and mass balance diagrams. If you do not know how to prepare a PFD with mass balances (and if it applies to your project), look it up and/or ask an engineer. What is placed on the PFD is dependent on your process(es).
8. Illegible graphics. Ensure that all graphics can be interpreted by someone who is not familiar with your project. Take special care when reducing figure and table sizes to fit the page. When we are familiar with a figure, we may not notice that reducing the size makes it difficult to read. If in doubt, ask someone who knows nothing about the figure if they can read and understand it.

Hints for Writing a Great Report

- ***Executive Summary***

  The Executive Summary is a concise overview of the entire project. From it, the reader should be able to understand the task, the options considered, the process selected, the project costs, performance, schedule, and the conclusions reached.

  Common deficiencies in executive summaries noted by judges:

  1. Copying the problem statement from WERC's materials instead of restating it concisely in a manner that reflects knowledge of the problem.
  2. Devoting too much space to stating the problem. Spend most of the space on data, findings, solutions, costs, health, safety, waste, etc.
  3. Wasting reader's time with lengthy or over-stated doomsday problem-motivation statements. Spend no more than a sentence or two on the motivation for the project.
  4. Failing to cover all the aspects of the paper in a brief, concise manner. The summary should be a stand-alone document that fully summarizes the project.
  5. Going into too much detail. As a summary, it should be succinct. It should not exceed two pages, but one is better.

- ***Body of the Report***

  The body of the paper provides the details of your project. It must be complete and written in a logical order that leads the reader to your team's conclusions. It should include all of these:

  1. A discussion of the technological alternatives considered for the task.
  2. A discussion of the full-scale design, based on the bench-scale development and laboratory results.
  3. An economic analysis with cost, schedule, and performance data, and a business plan to put it into action.
  4. A discussion of health, safety, and environmental regulations.
  5. A community involvement/relations plan.

  Judges commonly observe the following deficiencies in the body of the report:

  1. Not enough research into the background/history of the problem.
  2. Insufficient research and discussion of viable technology alternatives. This section of the report should cover all the technologies considered, indicate pros and cons for each, and reflect the logical thought process by which your team designed the full-scale solution.
  3. Failure to address in what instances their chosen design might not be the best solution.
  4. Failure to cover all topics required by the problem statement.
  5. A weak justification for the technology selected.
  6. Data not clearly summarized.
  7. Insufficient discussion of laboratory-scale experimentation and/or insufficient laboratory data to validate the final claimed solution.
  8. Failure to communicate, such as difficult-to-interpret illustrations, missing data, unclear prose, etc.
  9. Poor paper organization. Make it easy for judges to find information by naming section headers appropriately and placing information under the proper section header. Include page numbers in Table of Contents!
  10. Lack of balance in paper. No single section should overpower another.
  11. Failure to follow auditors' recommendations, or poor selection of auditors.

- ***Full-scale Design Description (Scale-up)***

  The discussion of the full-scale design should reflect the logical process that led from the development of your bench-scale process to the full-scale design.

  Judges have noted the following deficiencies in the scale-up design section of the report:

  1. Failure to apply fundamental engineering principles and concepts (such as conservation of mass/energy, Laws of Thermodynamics, Physics, etc.).
  2. Failure to show, in a logical manner, how the solution meets the requirements.
  3. Poor documentation of the laboratory setup and results.
  4. Failure to provide sufficient data to reflect an understanding of the task and its solution.
  5. Ignoring secondary wastes, especially hazardous secondary wastes.
  6. Process flow diagrams that lack appropriate mass and energy balances. (See PFD examples below.) Submit your PFD in your 30% Project Review to ensure that it is sufficient.
  7. Failure to appreciate the physical and chemical issues related to scale up.
  8. Designing processes that cannot be scaled up from bench scale to full scale because of inadequate consideration for health, safety, or environmental hazards.
  9. Confusion between the bench-scale and full-scale processes. If using surrogates in the bench scale, there will likely be significant differences between the bench-scale and full-scale process.
  10. Exaggerating one hazard over another (e.g., being overly concerned about traces of plutonium when the real threat is a hazardous chemical present in the mix). Conversely, radiation at potentially lethal levels generally makes the presence of other hazardous substance immaterial. You must understand and evaluate these issues on a case-by-case basis.

- ***Sample Process Flow Diagrams that include Mass and Energy balances (as applicable)***

  Your PFD should show every process stream in your design **as appropriate to your problem.**

  Mass Balance: sum of mass of all input streams = sum of mass of all output streams

  Energy Balance: sum of energies entering the system = sum of energies leaving the system

  Quick guide: PFDs and Mass/Energy Balance Quick Start (External link takes you to pdfcoffee.com)

  Alongside the PFD you must include a table that includes the following, as they apply to your design:

  - Normal operating temperature and pressure. (These are the players in the "Energy Balance".)
  - Normal volumetric or mass flowrate. If multiple phases are involved, report flowrate for each phase.
  - Density at normal operating temperature and pressure conditions. If the stream has multiple phases, density for every phase should be reported along with the overall density.
  - Viscosity for each phase in the stream should be separately reported.
  - Vapor fraction should be reported if gases are present.
  - Specific heat ratio Cp/Cv and compressibility factor should be reported for the gaseous phase.
  - Molecular weight for each constituent should be reported separately.
  - Enthalpy flow for each stream should be reported, sometimes in KJ/hr.
  - Include waste streams. How much waste is generated? How will it be addressed?

  Be sure to:

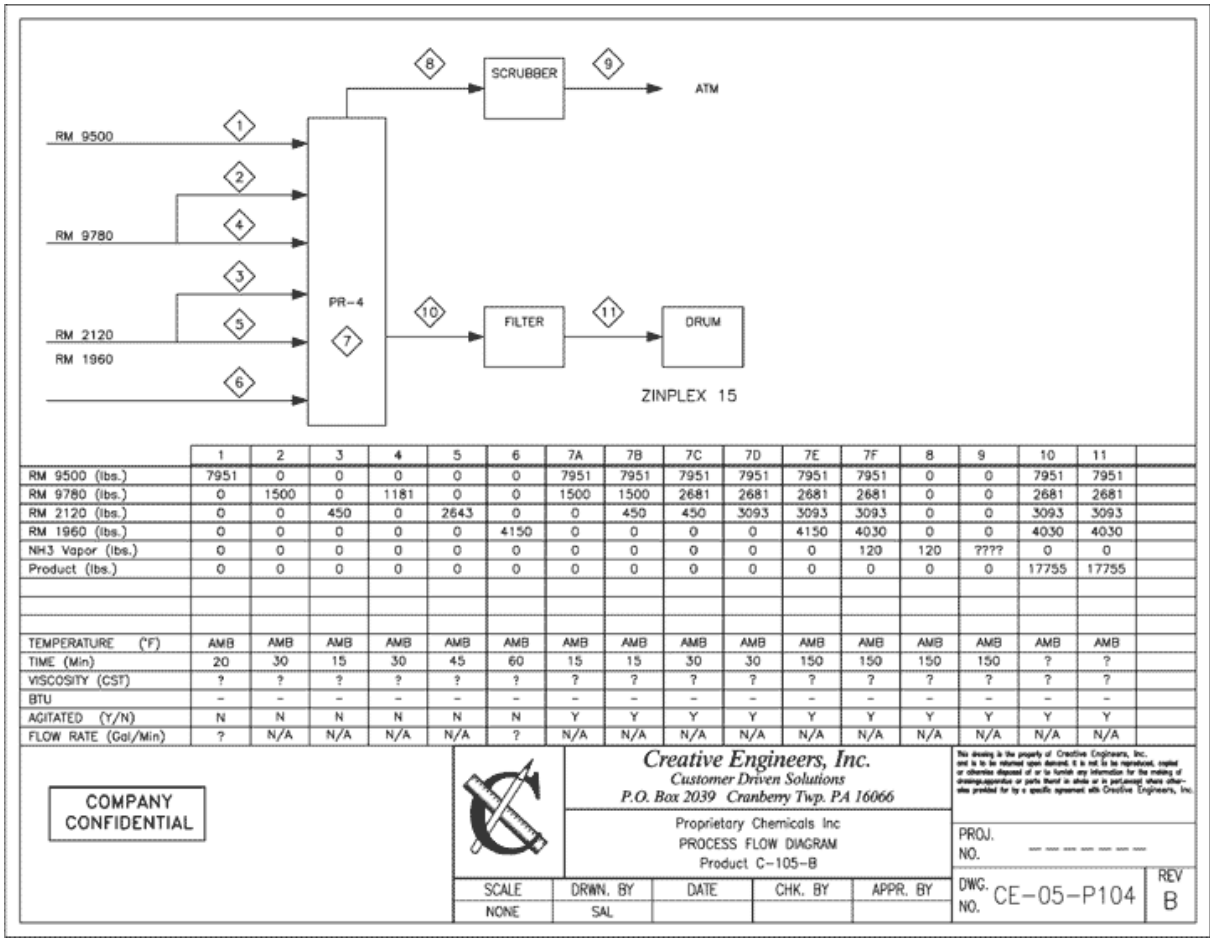
  - Define all abbreviations
  - Clearly label all streams. To help the judges quickly scan your PFD, use a descriptive label (such as "Distillation Column") rather than difficult-to-decipher coded labels.

  Find sample PFDs on the next page. They are not perfect and might not include all elements needed for your project–check the list above. In Example 1, we do not like the cryptic input labels (what is "PR-4"?).

Data-Flow Diagrams for Non-Chemical Designs, such as Sensors

- Follow protocols for your discipline.
- Designs involving sensors should include schematic diagrams and technical specifications for the device and each sensor, as well as data flow diagrams for the sensors and data logger (if applicable).

PFD Example 1. Found at Creative Engineer Inc. (You should use more descriptive labels than those on the left)



	1	2	3	4	5	6	7A	7B	7C	7D	7E	7F	8	9	10	11
RM 9500 (lbs.)	7951	0	0	0	0	0	7951	7951	7951	7951	7951	7951	0	0	7951	7951
RM 9780 (lbs.)	0	1500	0	1181	0	0	1500	1500	2681	2681	2681	2681	0	0	2681	2681
RM 2120 (lbs.)	0	0	450	0	2643	0	0	450	450	3093	3093	3093	0	0	3093	3093
RM 1960 (lbs.)	0	0	0	0	0	4150	0	0	0	0	4150	4030	0	0	4030	4030
NH3 Vapor (lbs.)	0	0	0	0	0	0	0	0	0	0	0	120	120	????	0	0
Product (lbs.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17755	17755
TEMPERATURE (°F)	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB	AMB
TIME (Min)	20	30	15	30	45	60	15	15	30	30	150	150	150	150	?	?
VISCOSITY (CST)	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
BTU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AGITATED (Y/N)	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FLOW RATE (Gal/Min)	?	N/A	N/A	N/A	N/A	?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

COMPANY CONFIDENTIAL

Creative Engineers, Inc.
Customer Driven Solutions
P.O. Box 2039 Cranberry Twp. PA 16066

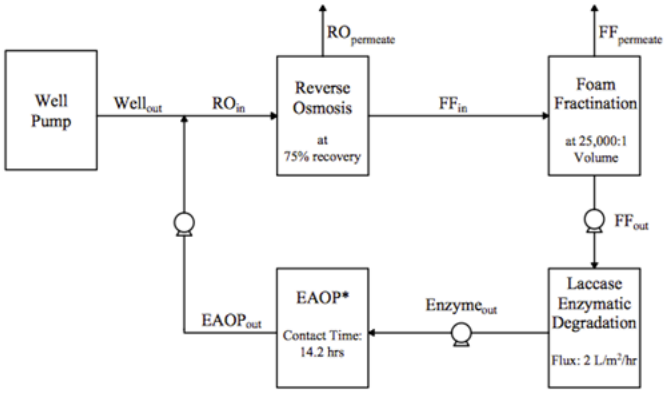
Proprietary Chemicals Inc
PROCESS FLOW DIAGRAM
Product C-105-B

SCALE	DRWN. BY	DATE	CHK. BY	APPR. BY
NONE	SAL			

PROJ. NO. ---------- DWG. NO. CE-05-P104 REV B

https://creativeengineers.com/process-engineering/process-documentation/process-flow-diagrams-pfd/

PFD Example 2. Recently submitted by a team at the contest. Process labels are clear or defined within the space.



Steam Name	Well$_{out}$	RO$_{in}$	RO$_{permeate}$	FF$_{in}$	FF$_{permeate}$	FF$_{out}$	Enzyme$_{out}$	EAOP$_{out}$
Volumetric Flow (gpm)	700	~700	525	175	~175	0.00347	0.00347	0.00347
PFOA concentration	50 ppt	50 ppt	0	200 ppt	0	5 mg/L	23.3 mg/L	24.5 ppt
PFOS concentration	50 ppt	50 ppt	0	200 ppt	0	5 mg/L	3.3 mg/L	24.5 ppt
Short Chain Concentration 0	1.49 ppt	0	0	0	0	0	3.5 mg/L	0.30 ppm
Absolute Pressure (psi)	14.7	60	14.7	14.7	20	14.7	14.7	14.7
Temperature (F)	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient	Ambient
Hydrogen Peroxide (mol/gal)	0	0	0	0	0	0	0.189	0
Sodium Sulfate (mol/gal)	0	0	0	0	0	0	0.378	0

*Electrochemical advanced oxidation process

Courtesy of California Polytechnic University, San Luis Obispo

Go to Table of Contents

- ***Economic Analysis and Business Plan***

  The Techno-economic analysis is critical to your design. It includes visualization tools to summarize your findings. No manager will support construction of a facility or process that is not economically sound. Find an auditor (and a technical reviewer) from industry to advise your team in the issues below.

  An economic analysis details the proposed cash flows, schedules, and ramifications of the various actions. A business plan sells your economic analysis. Include a business plan in your report. You need to convince the judges (and yourself) that your proposed solution is marketable and economically feasible. You should have two questions in the back of your mind as you "sell" your idea: 1) Who cares? (Is this really worth investing in?) and
  2) Why your team? (A lot of people claim they can save the planet–why should I choose you?)

  Judges have commonly noted the following deficiencies in teams' economic analyses:

  1. Costs listed are either poorly documented, out of date, or for the wrong industry sector. Judges often note that no sources are provided but cost estimates are often stated to the nearest penny.
  2. Project and construction schedules are missing.
  3. Critical market costs are missing references.
  4. Life-cycle cost analysis is missing. The construction project approach should not be too limited.
  5. Insufficient detail—cost elements such as overhead, maintenance, labor, utilities, operations, and equipment need to be itemized.
  6. Limited investment decision information and/or no return-on-investment calculations.
  7. Costs that are not compared with the cost of a current baseline technology. Your cost analysis should always compare your innovation with the current state of technology, and, if possible, with alternative technologies.
  8. A lack of understanding of the relationship between cost and the potential for implementation of a process.
  9. Failure to understand the relationship between cost and regulatory impacts such as negotiations and redesign.
  10. Costs attributed to engineering development need to be included.
  11. Failure to evaluate how regulatory considerations impact the cost, schedule, and overall feasibility of a process. If there are standards with abnormal effects on the process, design, or waste streams, be sure to note these effects and how you plan to reduce or mitigate their impact.

- ***Health, Safety, and Environmental Regulations***

  The health, safety, and environmental section of your paper should provide an overview of applicable regulations. However, just listing the applicable regulations is inadequate. Specific pertinent issues must be identified and discussed. For example, if a process uses an explosive chemical, a discussion of the special controls is essential.

  Judges have frequently noted the following deficiencies in health, safety, and environmental issues:

  1. Contestants know what laws apply, but fail to understand how those laws affect their project. Ask an expert who can help you understand this.
  2. Many papers address federal regulations, but ignore state laws. Your report should address both state and federal regulations according to the state your project focusses on.
  3. Failure to discuss how regulatory approval will be achieved.
  4. A lack of detail in plans for handling significant health and safety issues when processing at full scale.
  5. Failure to select a viable technology due to inadequate familiarity with the hazardous materials and conditions of the project.
  6. A lack of a well-rounded safety plan (i.e., physical, chemical, radiological, etc.) for the full-scale design.
  7. A misunderstanding of the regulatory drivers; i.e., why a certain project may need to be completed or why some technologies are not viable.

8. Failure to address the special concerns outlined in the problem statement (health & safety, regulatory, economics, radioactivity, etc.).

- ***Community Relations Plan***

At minimum, all team's Community Relations Plan should include outreach via social media. Task sponsors started requesting this in 2022. Your posts should be linked to the sponsor of your task if the sponsor's social media outlets are available. Your social media outreach is important because, as engineers, part of your job will include reaching out to the public for acceptance of your company and its projects.

Beyond social media outreach, a community relations plan is not required for every project. If your process will bring a hazardous operation to an area where none previously existed, or if cleaning up hazardous materials will create a public concern about the potential for a release, it is essential that you involve the community. Listed separately below is the Public Involvement Plan that will help you learn how to engage the community in making decisions of public concern. If your project does not require a public involvement plan, **state this explicitly in your report** and explain why this is the case.

The most common errors in this section:

1. Telling the community what you plan to do. You need to invite them to provide input on decisions.
2. Failure to explain why a community relations plan is not required, if needed.

- ***Public Involvement Plan*** **(a.k.a. Community Acceptance Plan)**

Projects conducted by federal agencies and the private sector must produce results that that will directly benefit the surrounding communities at project sites. Involvement of tribal and public representatives in the evaluation of technologies can ensure that these projects will not only be improved as a result of such collaboration, but will gain community acceptance in the long term.

Meaningful Partnerships

Tribal and public representatives should participate in:

1. technology assessment,
2. development activities,
3. deployment activities.

Although the public does not make final decisions, it is important that public representatives become partners in the decision-making process. Decisions developed through partnerships established early in the process will result in successful projects that will save dollars and other resources by solving problems early, before decisions become policy.

Meaningful approaches to creating decision-making partnerships must go beyond traditional public relations or community outreach activities and must do more than the regulations require.

Teams should note that for the contest, this is primarily a plan. It may/may not be appropriate to engage the community for this project. See your task for details and consult with your advisor for advice.

Objectives of the Public Involvement Plan

Identify the public participation objectives. Consider some or all of these objectives:

- **Action Plan**: Create an action plan that includes local public involvement (including tribal participation in the project, where applicable).
- **Decision Making:** Identify a clear definition of the decision-making process. A realistic expectation regarding all parties' roles should be considered.
- **Information Requirements:** Analyze the types and forms of information for effective participation.
- **Education:** Develop an educational element that addresses the needs of the group.
- **Accountability:** Establish a two-way accountability process. Include an approach for responding to all input received and documenting all actions. Define your plans to integrate public involvement in the process.

- **Schedules:** Create schedules, milestones and timelines for public involvement activities.
- **Resources and Costs:** Determine the resources required to implement the plan, including staffing and financial needs. Consider additional costs, such as travel and per diem.

- ***Conclusions***

  The conclusions in the technical report should be brief; they should state what you are going to do and why.
  The most common error: Reaching conclusions that are not supported by information in the report.

- ***Audits***

  A paper received at the WERC office without three audits is incomplete.

  The purpose of audits is to help you find weaknesses in your report. It is to your advantage to select auditors who have not been involved in your design process. Faculty at your college/university could qualify, but do not use anyone who is mentoring your team because they may not be able to see issues that fresh eyes could see.

  Ensure that your three auditors are qualified to review your paper based on the economic, legal, and health/safety issues, respectively. When possible, select auditors from the industry that would utilize your technology.

  - Give the auditors sufficient time to conduct their review
    - Rough-finish the paper at least three weeks before the paper due date, in time for two weeks in the auditor's hands and a minimum another week of work by the team to incorporate changes.
    - You might have to do more research after the auditors
  - Do not have anyone on your team, even advisors, perform the audits.
  - Ensure that the auditors write comments and make suggestions for improvement.
  - Request that the auditor place the audit on letterhead. Some may be uncomfortable with that. Respect their wishes and we will, too.
  - Finding auditors
    - Ask your advisor to identify and contact auditors or give you names of contacts.
    - Go to LinkedIn and seek engineers (especially your school's alumni!) in your geographic area and the task discipline.

  Judges have often noted the following deficiencies with respect to the audit section of the reports:

  1. The most significant error: not using the input from the auditors to improve the paper or project.
  2. The professional who performed the audit did not read the problem statement.
  3. Auditors submit a form letter "rubber stamp." This is not appropriate. They should list specific suggested improvements.
  4. The auditors are often professionals within the same areas of expertise. The auditors should come from the three disciplines required in the Guidelines and as many disciplines as required for your project.
  5. Audits should not be performed by persons within the team's university–they do not have the same credibility as outside audits, due to conflict-of-interest issues. Use internal auditors if it is your only option.

- ***Appendices***

  Appendices should be used very sparingly. Generally, only include information that is essential but is not appropriate in the body of the report; e.g., a letter quoting a price from a company willing to purchase either the product or the by-product from your process. Appendices are included in the page count.

- ***Submit the Technical Report on time***

In the real world, late submissions are not considered. At the Design contest, there is a heavy point-deduction for late paper submissions that may cost you an award.

Only the Team Leader or Advisor is able to upload the written report to the team's account. If you have any problems with submission, please contact werc@nmsu.edu immediately or call 575-312-7623 (24-hour cell).

Use caution when submitting: each new submission overwrites the previous time stamp. We once had a team continue to re-submit every day for 3 days past the due date. They thought they were making "extra sure" it was turned in, but each day, another 25 points was subtracted from their score.

Hints for Preparing the Oral Presentation

The Oral Presentations:

1. Have your oral presentation ready two weeks (minimum) before contest!
2. Try to relax before the presentation and enjoy presenting your team's results. If you focus on your great design, rather than yourself, your presentation will be much more enjoyable for all.
3. Show results and costs.
4. If you use something in the oral or poster presentation that you didn't use in the paper, cite it. Know your sources well enough to be able to cite them at any time.
5. Pause frequently during the oral presentations to let the judges process the information; well-planned pauses are effective in an oral presentation.
6. Practice presenting before various professionals, such as other faculty. Listen to their advice, and make corrections accordingly.
7. If you don't remember something while you are in the middle of a presentation, pause, but do not announce that you can't remember.
8. Be prepared to answer questions about applications of the process; how to market it, who would use it ("the target audience"). If you were employed by someone in industry, this would be of critical interest.
9. Judges will wait until your presentation is finished to ask questions. If you don't know the answer, don't try to make one up or fake it. Admit that you don't know. You can follow it up with, "I don't know, but think it might be … "or, "I don't know, but we will look it up and discuss the next time we meet."
10. Follow up on finding out the answers to questions you could not answer at the oral presentation. Judges will expect you to answer them during the bench-scale demonstration.
11. A limit of four students may present during the Oral Presentation. This limit is requested by judges based on their observation that having more than four presenters interrupts the flow of information, making it more difficult for them to "take in" the details of a presentation. They also find that too many transitions take excessive time from the presentation. If you have more team members who want presentation experience, they can be assigned to the poster session, the bench-scale demonstration, and/or the Flash Pitch.
12. It is best for the advisor not to attend the oral (or any other) presentation because the students tend to behave in a more inhibited way when the advisor is present. If the faculty must attend, they are to act as observer only. If an advisor speaks up or answers a question that the team should answer, there will be a 25-point deduction.

Hints for Preparing the Bench-Scale Presentation

For the Bench Scale setup:

1. Your bench-scale setup must align with your team's approved ESP. Last-minute substitutions are usually acceptable, but they will be checked to ensure safety of your apparatus.
2. Be very careful with safety concerns, and ensure that your setup is stable and safe. Judges will note safety hazards. Before you can be commissioned for your bench-scale process, your apparatus will be inspected by the NMSU Safety Officer.
3. Test your setup to check for leaks and stability. Make sure all hoses are tethered so they won't go flying off, spraying chemicals everywhere; tethers on pressure pipes are required.
4. Bring your own specialty PPE as needed (goggles, rubber gloves, aprons, lab coats, etc.) WERC will have some PPE available, such as safety glasses and nitrile gloves (see PPE list), but you may prefer (or may be required, based on your ESP) to provide your own.
5. If you are shipping your equipment, pack it very carefully. Often items are broken if packed in a large container without sufficient padding.

Hints for the Bench Scale Demonstration:

1. Thoroughly test the bench scale apparatus before you come, analyze your results, and report them in the written report and oral presentation.
2. Consider ordering a test kit to analyze your results to help you be independent of other labs to test your results.
3. Keep trying–if your first hypothesis does not prove correct, think, research, discuss solutions with your advisor, update your design, and try again, and again, and again.
4. Be persistent; there is a solution that will work, but it may take time.
5. Keep it simple, if possible, because there will be fewer things to potentially go wrong.
6. You will be able to set up your bench-scale demonstration on Sunday. We will begin commissioning on Sunday evening after the Safety meeting. Commissioning will continue on Monday morning. Teams will not be allowed to operate their equipment until Monday morning.
7. Testing samples (if needed to run the bench-scale apparatus) will be distributed to teams on Monday morning after they have been commissioned to run their apparatus.
8. Posters will be hung within the booth area. Teams refer to them during bench-scale discussions with the judges. Figures and tables will be particularly helpful during your discussions–make sure you include the most helpful data on your poster.

Hints for Preparing for the Poster Session

The poster must be available for both the Poster Session and the Bench-scale demonstration.

Elements of a good poster:

1. Stick to the size limitation. There is a 25-point deduction for a poster larger than 36" x 48".
2. Your poster should include only the most important data, conclusions, and references. Consider what information you will need to have handy when you discuss your process with the judges.
3. Graphics are the primary element of a good poster. Use them to illustrate your results (figures, tables, data, timelines, etc.).
4. Do not include large blocks of text. Use bulleted lists or numbered lists for text. Use full sentences only when absolutely necessary.
5. A poster or brochure should have plenty of "blank" space, and not look crowded.
6. Do not include large blocks of text. Yes, this is the second time we state this in this section. We hope that by repeating it, teams will actually follow our advice. Judges absolutely abhor large blocks of text on a poster, but teams keep doing it. Let's impress the judges this year and keep text to a minimum!

Poster Presentation Strategies

1. The Poster Session will take place on Monday afternoon. It will last about one hour. Judges are given 50 minutes to peruse the posters in a closed session. When they are finished, the teams will enter the room and stand by their poster.
2. No more than three team members should stand by the poster, due to space limitations, but feel free to rotate team members in and out.
3. Judges will come to your poster in small groups. Be prepared to answer questions if they ask.
4. The judges will likely ask questions and engage in discussion for a few minutes. Probably no more than 10.
5. At the end of the poster session, teams will move their poster back to their bench-scale demonstration area for use on the following day.
6. Don't memorize a poster presentation; perhaps the first introductory sentence, but no more. Be prepared to address what interests the judges.
7. Try to find something new to tell the judges that was not in the formal oral presentation.

Hints for Preparing for the Flash Pitch

The Flash Pitches are scored independently from the other stages of the contest, making it possible for a team to win first place in the Flash Pitch Competition and not place in the main four-stage Design Contest.

1. Convince a company to invest in your technology. Although you are "selling" your design, remember that it is not enough to give a good sales pitch–make sure that you have engineering, cost, and scale-up data to back up your claims.
2. Consider your audience. Judges include scientists, engineers, investors, tech investors, and community environmentalists.
   a. The event emphasis is on entrepreneurship, so the judges will be well-versed in entrepreneurship.
   b. Demonstrate that you can speak to a wide range of audiences. Define it! If a 6th grader would not be familiar with it, you need to define it, explain it, and repeat the explanations if they are key to your topic. Define acronyms before using them!
   c. Report on the triple bottom line to really "Wow" the judges.
3. Engage the audience.
   a. Make eye contact with audience members (or at least look at their eye level, and not above heads).
   b. Be interesting. Vary your vocal tone and inflections. Brighten your eyes. Be excited about your solution.
4. Present a motivating introduction: What is this about? Why this is important? Attract people's attention and make your audience care about your solution–Show how it makes an impact.
5. Answers the primary judging questions: 1) Why should I care? 2) Why should I fund your team?
6. Build anticipation of your solution.
7. Tell a story that will engage the audience: include a strong beginning, middle, and end.
8. Emphasize only one or two main points (do not try to throw all of the details at your audience).
9. Fit the talk to your own personality and style. Be who YOU are. Bring in humor, if it comes naturally.
10. Use graphics to tell your story: photos, tables, graphs ("A picture speaks a thousand words").
11. Use props (parts of your Bench-scale apparatus) if you wish.
12. Avoid distracting PowerPoint special effects. Use special effects only if they help explain your subject.
13. Use short blocks of text. Use bullet points, do not write in complete sentences.
14. Ensure that bullet points are grammatically parallel. (It is easier for the audience to quickly "digest" passages that are written in parallel with each other).
15. Time your presentation carefully. Practice over, and over again to ensure that you do not go over time.
16. Practice the introduction and the ending over and over until they flow naturally from you. That will get you off to a smooth start and ensure a strong finish.
17. Write a well-crafted closing statement: give a call to action, a strong summary of benefits, refer back to the original problem statement and describe how the problem can be solved using your technology, etc. Do not close with a weak, "that's all I've got." Or "I'm out of time."
18. Be ready to close at any point near the end of the talk, in case you are close to going over time. Have your final statement in your mind and practice jumping to it from different points near the end of the presentation. Trust us–sometimes a speaker will have an uncontrollable desire to add a "quick" unplanned thought that can shift the presentation off-schedule.
19. We recommend that you have a team member cue the presenter when the closing remarks must begin, in order to finish within the allotted time.
20. Any comments made after the bell will result in a point penalty.

Resources for helping you prepare a successful business pitch:

1. ***Video: Tips to preparing a successful 3-minute pitch:*** "Startup guide: A Winning 3-Minute Startup Pitch" (https://www.youtube.com/watch?v=q6bewrSolcY
2. ***Business Plan Builder: Tory Burch Foundation.*** *They provide templates for helping you create a business plan. In the MS Word version, very helpful information starts on p. 12:* https://www.toryburchfoundation.org/business-plan-builder/#classic-business-plan