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**GUIDELINES FOR PART IV DESIGN CONTEST AND RULES, SECTION 6 “WHAT TO SUBMIT,” QUESTIONS 1 AND 2**

This document provides supplemental information for use by the competitors in phase 3 (Design Contest) of the American Made Challenge: Solar Desalination Prize Contest for answering Questions 1 and 2 of Part IV, Section 6.

# DESIGN CONTEST GOAL (FROM RULES DOCUMENT, PART IV, SECTION 2)

Competitors will work to complete a detailed design of their proposed prototype that can generate at least 100 m3 of fresh water per day (see notes below), achieve the cost and performance targets that their end users require, and demonstrate that they are “shovel-ready” for a site in the United States or U.S. territories.

# ASSESSMENT CRITERIA (EXCERPT FROM RULES DOCUMENT, PART IV, SECTION 5)

* **Project Readiness** – Provide a complete and convincing package that includes all required documents, quotes, agreements, approvals, proof of adequate funding (excluding the prize), and evidence that all other barriers to installing the operational prototype have been retired. The package must convince a panel of industry experts that the team is ready to begin assembling the system at the identified location as soon as prize funding is awarded.
* **Validated Performance Metrics** – Identify metrics for commercially relevant performance of the proposed system, as well as testing plans to validate the success values of those metrics with the operational prototype. Competitors should demonstrate that the identified metrics have been thoroughly refined and validated by potential end users and will retire the key technical risks of the proposed solar-thermal desalination system. Successful competitors are likely to consider calculations for levelized cost of water (LCOW), product-water quality, thermal energy consumption, capital costs, operational costs, recovery ratio, annualized solar-to-desalination thermal efficiency, and impact on the environment, and to make a comparison to the state of the art.
* **Announcement** – Approximately one month after the Design Contest submission is received, the Prize Administrator will notify the competitor with the results of the review and request the necessary information to distribute cash prizes, if applicable. The Prize Administrator will then publicly announce the winner, who will then begin to install their prototype solar-thermal desalination facility.

# PART IV DESIGN CONTEST AND RULES, SECTION 6 “WHAT TO SUBMIT,” QUESTION 1 – TECHNICAL READINESS

The rules document lists the following as examples of the types of documents required:

1. Building permits and all necessary permits of operation (environmental and other)
2. Completed National Environmental Policy Acy (NEPA) determination
3. Proof of sufficient funding to complete the proposed work (funding contingent on prize award is acceptable)
4. All documentation required to initiate construction. This may include but is not limited to construction plans, fabrication drawings, subcontracts (draft), material requisitions (unawarded, if necessary), permits, site surveys, detailed schedules, work-breakdown structures, detailed scope and cost estimates, material procurement plans (including estimated lead times, delivery times, and on-site need dates), construction quantities, startup and energization plans, and test protocols (with acceptance criteria).
5. Key calculations of system performance and engineering design
6. Any additional required documentation to support the assertion that the project is ready to begin construction.

## FURTHER GUIDANCE

The following guidance is offered to competitors as additional guidance related to what might be provided to demonstrate “shovel-readiness” of the team’s prototype-scale demonstration. This list is not a list of requirements, and the teams are highly encouraged to tailor the list of documents provided based on the specifics of their efforts.

It should be noted that the scope of the work to be documented as “shovel-ready” should capture all of the work necessary to receive water from the identified source and dispose of both the product water (desalinated water) and the concentrated wastewater. This may include equipment needed for pretreatment of the water prior to entering the team’s innovation and equipment located after the team’s equipment to further condition either the product water or concentrated wastewater to the extent required for disposal.

## LIST OF POTENTIAL DOCUMENTS TO DEMONSTRATE PROJECT READINESS (“SHOVEL-READY:):

For the prototype-scale innovation at the host facility (all as applicable):

* PROJECT EXECUTION PLAN, including a general description of the innovation’s features, functions, and how it integrates into the facility. Also include the team’s organization chart, administration procedures (change management, field/office procurement, on-site personnel management), construction procedures (LOTO, safety, warehousing, shipping/receiving, laydown, security, spare parts, maintenance, debris removal, etc.), estimating, construction sequence, traffic and logistics, erection, heavy equipment rental, turnover, job closeout, equipment removal, documentation control, and reporting, as applicable.
* GENERAL ARRANGEMENT DRAWINGS (each skid)
* PLOT PLAN, showing a complete layout of the entire system
* WATER MASS AND ENERGY BALANCES (AT DIFFERENT OPERATING MODES) (e.g., day, night)
* DESIGN RANGE OF INLET WATER (BASE CASE WITH HIGH-LOW RANGE FOR EACH WATER CONSTITUENT)
* WASTEWATER EFFLUENT PROJECTIONS. As the water moves from source to pretreatment to desalination equipment to disposal, project the concentration of each element being regulated at each point for the base case and high and low ranges to ensure environmental compliance, including product water and waste streams for all relevant operating cases.
* WASTEWATER EFFLUENT LIMITS, based on the applicable permit
* OPERATION AND CONSTRUCTION, including items such as noise, fugitive dust, glare, wildlife, etc., and wastewater discharge permits, as applicable
* MECHANICAL EQUIPMENT LIST, with capacity and relevant specs of all equipment needed
* EQUIPMENT SIZING AND DESIGN CALCULATIONS to prove that the equipment is sized correctly. This is specifically relevant to chemical injection equipment, chemical usage, and chemical storage. This also applies to solar collectors, energy storage, volume storage, pressure drop, auxiliary power consumption, pump sizing, material stress, fatigue, corrosion rates, chemical interactions, pipe sizing, etc.
* LIST OF WORK NOT INCLUDED. List should include everything needed for the prototype to operate, but expected to be supplied by entities other than the teams
* TERMINAL POINT DETAILS. This includes type of connection, specific terminal point locations, connection scope of supply, etc.
* SCOPE OF SUPPLY
* ISOMETRICS, including pipe support drawings
* ORTHOGRAPHICS for underground piping, if any
* ELECTRICAL WIRING DIAGRAMS
* ELECTRICAL PHYSICAL DRAWINGS (cable trays, conduits, raceway, cabinets, etc.)
* LIST OF I/O POINTS
* CONTROL SYSTEM DESCRIPTION
* CONTROL SYSTEM LOGIC DIAGRAMS
* CONSTRUCTION SCHEDULE
* CONSTRUCTION DRAWINGS
* FABRICATION PLAN for items to be self-fabricated, including location, fabrication methods, materials, fabrication drawings, procedures, shop testing efforts, and sources of material
* WELDING PROCEDURES
* CONSTRUCTION CONTRACTOR SPECIFICATION
* CONSTRUCTION CONTRACTOR BID
* OPERATING AND COMMISSIONING PLANS, including emergency operation, cleaning, pressure testing, loop checks, megger checks, energization, and filling/draining procedures
* TOTAL BUDGET
* FIELD LABOR COST ESTIMATES AND MANPOWER PROJECTIONS. Include a narrative on the level of modularization to be done versus stick-built fieldwork
* BILL OF MATERIALS
* PROCUREMENT PLAN, including itemized contracts and purchase orders to be made, potential suppliers (bidders list), estimated material, estimated shipping costs, estimated installation costs, required lead times, and on-site need dates
* SUPPLIER QUALITY ASSURANCE PLAN. As applicable, detail the level of shop testing to be done on key components and the level of observation expected to be performed by the team as oversight
* O&M MANUALS FOR KEY COMPONENTS
* FOUNDATION DRAWINGS
* SOIL REPORTS for any permanent foundation work
* DESIGN BASIS AND PHILOSOPHY. This document defines the assumptions made regarding site conditions, atmospheric conditions, DNI, wind, rainfall, snow, etc. Document should also define basic assumptions regarding engineering decisions regarding methods of control, required O&M personnel, level of redundancy of equipment, applicable codes and standards, engineering units, language, and other project related items.
* KEY STUDIES that show the results of key modeling efforts such as pipe stress, water hammer, power flow, emergency operation, rotordynamic analysis of rotating equipment, etc.
* HVAC CALCULATIONS
* CIVIL CALCULATIONS (seismic, structural, soil bearing, and other calculations)
* TRAFFIC AND LOGISTICS PLAN that identifies most likely source of materials and expected delivery method to site, primarily for large deliveries
* FIRE PROTECTION AND HAZARDS MITIGATION PLAN
* BUILDING DESIGN DETAILS
* LIFTING, RIGGING, AND ERECTION DRAWINGS
* SAFETY PLAN
* 3D MODEL.

# PART IV DESIGN CONTEST AND RULES, SECTION 6 “WHAT TO SUBMIT,” QUESTION 2 – VALIDATED PERFORMANCE METRICS

The rules document lists the following as examples of the types of documents required:

1. Provide performance metrics, including a validation and testing plan, and justify that those metrics are relevant to identified commercial end users and differentiated from the existing state of the art
2. Describe how the values tested by the operational prototype will be extrapolated to commercial systems
3. Provide complete and convincing evidence that, once built, the operational prototype desalination facility and the associated validation and testing will provide the results partners need to continue toward broad commercial success. Include the work your team has done over the contest period to support demand for the output of the proposed solution. Identify any potential customers and end users that your team engaged.
4. Provide documentation on the status and outcomes of the work funded by the voucher awarded in the Teaming Contest and how it improved your likelihood of success.

## FURTHER GUIDANCE

Once again, the following guidance is offered to competitors as additional guidance related to what might be provided to demonstrate the validated performance metrics of the team’s innovation. This list is not a list of requirements, and the teams are highly encouraged to tailor the list of documents provided based on the specifics of their efforts.

## LIST OF POTENTIAL DOCUMENTS TO DEMONSTRATE “VALIDATED PERFORMANCE METRICS”:

* PERFORMANCE METRICS (PROTOTYPE-SCALE UNIT) – Calculate the LCOW, product-water quality, thermal energy consumption, capital costs, operational costs, recovery ratio, and annualized solar-to-desalination thermal efficiency of the prototype unit.
* PERFORMANCE METRICS (COMMERCIAL-SCALE UNIT) – Calculate the LCOW, product-water quality, thermal energy consumption, capital costs, operational costs, recovery ratio, and annualized solar-to-desalination thermal efficiency of the commercial-scale unit.
* VALIDATION AND TESTING PLAN – Document how the prototype unit’s performance results might be tested systematically once built. Discuss how those results are extrapolated to provide the performance metrics of the commercial system. Compare the extrapolated commercial system’s performance to the state-of-the-art competing technologies.
* WATER MASS AND ENERGY BALANCES AT DIFFERENT OPERATING MODES (e.g., day, night) – COMMERCIAL SCALE
* ENVIRONMENTAL IMPACT – Discuss how the wastewater effluent projections of the prototype might be extrapolated to the commercial-scale unit and how that compares to specific water effluent limits (e.g., World Bank limits or local water permit limitations for specific target markets)
* PLAN FOR FABRICATION – COMMERCIAL-SCALE SYSTEMS
* MARKETING PLAN (Target markets and size of markets)
* FINANCIAL PROJECTIONS OF SALES, PROFITS, AND EXPENSES FOR A POTENTIAL FUTURE COMMERCIAL INTEREST
* CAPITAL REQUIREMENTS AND CAPITAL SOURCING.