

IEEE EMPOWER A BILLION LIVES

2027 COMPETITION GUIDE

v1

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EMPOWER A BILLION LIVES

OVERVIEW



The Challenge: To Accelerate Scale in Energy Access

IEEE Empower a Billion Lives (EBL) is a recurring global competition that challenges teams worldwide to develop innovative solutions that provide affordable access to clean, modern energy and its life-transforming impact on billions of unserved and underserved people. The competition encourages a holistic approach by evaluating technology, social impact, and business models for competing solutions. Winning teams will demonstrate success through field testing and a path to rapidly scaling their solutions. For more information, visit www.empowerabillionlives.org.

Need for the Competition

Grand Challenge:

Three billion people worldwide live in severe energy poverty, including 685 million without electricity access and 2.1 billion without clean cooking. Providing affordable energy access can dramatically impact living standards, health, education, productivity, and the ability to be a part of modern society. Many programs and initiatives have been doing stellar work tackling energy poverty, but much remains to be done. It is estimated that at the current rate of progress, 660 million people will still live without access to electricity in 2030, and 1.9 billion people will still cook on dirty fuels, causing 3 million deaths each year.

The centralized electricity grid is not the optimal choice for remote and rural contexts due to environmental impact, cost, mismatch to user needs, and challenges around financial feasibility, yet the grid is receiving over 99% of energy access finance. Decentralized solutions, such as solar home systems and microgrids, have emerged as a response to shortcomings of the centralized grid approach, but affordability, scalability, inclusiveness, societal and technical sustainability, and viability of business models remains a challenge. Decentralized scalable solutions that can be rapidly deployed can also enhance energy resiliency for communities impacted by climate change or significant societal disruptions and displacement and also impact energy poverty and energy equity beyond energy access contexts. New affordable and sustainable solutions that can scale and provide just and inclusive energy access are needed!

Our Approach:

IEEE Empower a Billion Lives (EBL) is a recurring global competition organized by the IEEE Power Electronics Society[1] to crowdsource regionally relevant innovations to accelerate the deployment of energy access solutions in underserved areas.

It is anticipated that fast-moving 21st-century technologies with rapidly declining prices[2] can allow a holistic approach to the design of energy solutions to address the needs of families and communities suffering from energy poverty in the broadest sense. Effective solutions should be economically viable today and should be able to provide continuing value to families and communities and enable them to improve their lives.

A primary focus for EBL is to help develop new energy-access, energy-equity, and energy-resiliency solutions with reduced technology and market risk. Another is to prove out new business models which show impact and scale can be achieved with economically viable and environmentally sustainable solutions. To this end, EBL is encouraging value-adding as an approach towards economic viability and increasing impact.

The EBL-2027 Competition:

Competing teams will develop and demonstrate technically innovative solutions in target communities to address the needs of the rapidly growing global energy access market of 3 billion people. These solutions must also demonstrate business viability and the potential for rapid scaling. The competition consists of two online rounds, followed by a regional field-testing round and concluding with a global final round.

- **Round 1—Concept Paper Submission:** Teams will submit Concept papers online. Teams meeting the requirements, as noted by judges, will be invited to submit full proposals of their solution for the Second Round. Teams will also be provided feedback to improve their proposal.
- **Round 2 - Full Proposal Submission:** Teams will be invited to submit their full proposals. Teams meeting the requirements, as noted by judges, will be invited to

field-test their solution. In the case of teams participating in the 'Student Team' category, demonstration of solution capabilities in an equivalent laboratory setting may be acceptable.

- **Regional Field-testing**: Accepted teams will field-test their solutions and utilize a data logger, if provided, for verification. Teams will also be interviewed in the field to discuss their field-testing data and end-user experience. Customers can also be invited to the interview (over a Zoom-type platform). Successful teams will be invited to the EBL 2027 Global Final at the discretion of the EBL Judges. The top few student teams may also be invited to the Global Final.
- **Global Final**: Invited teams will compete in the Global Final. The total anticipated prize purse will be at least $300,000 and has historically been over $500,000.

Impact:

Ongoing competition cycles will drive a continuous learning process, leveraging past learnings and rapid technology advances to deliver tremendously impactful solutions. EBL believes that rapidly changing technologies offer a unique opportunity to crowdsource innovation globally with cross-disciplinary teams to spark creativity that can generate unexpected outcomes – the heart of the competition is this WOW! Factor. Teams offering affordable and innovative solutions to energy access can win recognition on a global stage and see financial success.

The impact of affordable energy access on families and communities can be profound, providing positive outcomes in health, food security, resilience, access to water, education, increased productivity, digital and financial inclusion, and livelihood and lifestyle changes.

1-The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest technical organization, with over 420,000 volunteers in 160 countries**. 2**-'Exponential' technologies may include PV solar, energy storage, power electronics, the Internet of Things, decentralized control, communications, edge computing, pay-as-you-go, mobile wallets, blockchain, data analytics, etc.



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IEEE EMPOWER A BILLION LIVES COMPETITION

Accelerating Scale in Energy Access

COMPETITION PARTICIPATION GUIDELINES & METRICS

EBL 2025 – COMPETITION SCHEDULE:

Empower a Billion Lives Competition (EBL 2027) will consist of two competition rounds in three or four stages: a non-mandated Concept Paper Round, a Full Proposal Round, a Field Testing Round, and a Global Final Round. After the Full Proposal round for selected teams, field testing will be carried out. The Global Final round for EBL 2027 is anticipated to be held in Nairboi, Kenya in December 2027. EBL is a recurring two-year competition, with on-line rounds followed by field tests and the global final in the second year.

COMMON REQUIREMENTS:

The Empower a Billion Lives competition invites teams to submit proposals addressing key challenges in scaling energy access solutions. A key EBL objective for energy-impoverished families and communities is to facilitate their digital and financial inclusion in society and to stimulate productive uses of energy to support local and regional development and participation in the global economy.

From a technical viewpoint, proposed solutions are likely to address key issues such as real-time control and operation of the system, load management, and system optimization. They should meet both current and future customer needs. However, EBL is seeking innovative (WOW!) ideas that fulfill the energy access needs of the families and communities, possibly in a completely different manner. Solutions that enable value-adding to energy supply as a means to scale are highly encouraged. In all cases, solutions must address business issues such as capital and operating costs and show an economically viable business model. Solutions should provide at least the equivalent of ESMAP Tier 2[1] Access in terms of the functionality enabled, which is a minimum of 50W capacity and more than 200Wh per day.

COMPETITION TRACKS:

EBL specifically targets two groups as consumers of energy access solutions – the single-family and the community. The typical family earns less than $1500 per year and lives in a low-population-density rural community, which has 20-1000 homes (see Appendix I for more details). Successful EBL solutions will solve energy access problems for both groups – some in a decentralized, bottom-up manner and some in a centralized, top-down manner. The traditional approach has been through electricity generation and delivery, but other solutions may take a completely different approach and still achieve the desired objectives. EBL would like to encourage teams to focus on broad goals and offer solutions that demonstrate impact and solve the technology and business issues.

Solutions can range from an entire power generation, delivery, and management system to appliances (productive use of energy, clean cooking, mobility) or an enabling technology solution that addresses some of the key challenges in energy access (interoperability, scalability, sustainability, affordability).

[1] This holds for the electricity access. For the clean cooking category Tiers 4 and 5 are allowed. Reference to ESMAP Multi-tier Framework: https://mtfenergyaccess.esmap.org/

Many teams with technological solutions find they require the partnership of last-mile distributors. For EBL 2025, we are introducing a track for local entrepreneurship. EBL will facilitate technology solution teams to partner with last-mile distributors through our website, webinars, and in-person sessions. We are also inviting large Energy Sector Corporations to participate for recognition through the presentation of Use-Case Papers, Best-Practice Papers, and Future Trends Studies 8, including leveraging synergies and opportunities between energy transition and energy access. Teams can compete along the following tracks, noting that solutions may fit into more than one track:

- **Track T: Technology Provider**
  - **Energy Supply**
  - **End-Use (incl. Productive Use, Clean Cooking, Mobility)**
  - **Enabling Technologies**
  - **Control, Automation, and Cyber-Physical Systems**
- **Track L: Local Entrepreneurship**
- **Track R: Energy Resilience**
- **Track S: Student Teams**

New for 2027 SouthStar
A track for teams from academia, research labs, and companies. SouthStar is a technology based, open-source design of a flexible, affordable, inclusive Energy Access platform.

Technology Provider (Track T): The proposed solution can belong to several categories:

Energy Supply can follow decentralized, centralized, or innovative models serving single households and communities. A decentralized model will typically serve single households and may be built on and expanded as needed to share resources, improve reliability, provide community-level services, and realize operational and cost efficiencies. The centralized model typically serves communities and follows utility models for operations and billing. Innovative solutions that address the challenges of both models and enable value stacking, interoperability, and applicability in diverse contexts are particularly encouraged. An example could be battery-swapping solutions able to power a variety of end-use applications, including 2- and 3-wheelers, productive use, or household needs. A successful solution will show technical viability and the business model needed to reach scale.

End-Use Solutions will address appliances that enable productive use of energy and clean cooking solutions. Examples of productive use appliances for the agri-food value chain (irrigation, cooling, agri-processing, livestock/poultry, etc.), appliances enabling commercial activities (entertainment, retail, workshops, etc.), mobility solutions, etc. Clean cooking solutions should be at Tier 4 or Tier 5 and exhibit scalability and affordability advantages compared to the existing solutions. The solution can be aimed at a single-user solution (e.g., household stoves, solar water pumps for irrigation, refrigerators, hairdressers and tailors tools, etc.) or the community level (e.g., cold-storage rooms, agri-food processing hubs, institutional cooking stoves). Similar to the tracks above, a successful solution will show technical viability, the business model needed to reach scale, and demonstrate the social and environmental impact of the solution.

Enabling Technologies invites solutions that do not address the entire energy system but enable solving some of the key challenges of energy access solutions, such as scaling, affordability, sustainability, and interoperability. The competing solution can be a component (e.g., novel battery technology, parts suitable for recycling) or sub-system (e.g., battery management system, systems for remote control, monitoring, health and data analytics, digital payments, etc.). An example could be an automation

solution allowing sophisticated solutions to be adopted and operated in communities with insufficient technical capacity and/or skilled support infrastructure and, by doing so, enhance technical sustainability. Similar to other categories, a successful solution will show technical viability, the business model needed to reach scale (including how the solution fits in the value chain),and demonstrate the social and environmental impact of the solution.

Control, Automation, and Cyber-Physical Systems: The proposed solution is enabled by modern control systems and automation techniques with the underlying advantage of autonomous operations demonstrated via increased scale, resilience, robustness, simplicity, or a combination thereof. Challenges related to the cyber-physical design and implementation of the proposed technology, such as those arising from communication, computing, and cyber-security, if any, should be highlighted and addressed. An example is a self-governed interconnection of smaller power systems, interconnected via high-speed communication links and computing platforms, thereby allowing safe, secure, and sophisticated solutions to be adopted by communities with insufficient technical exposure and/or skilled support infrastructure. If applicable, issues related to the unavailability of accurate power system models, and lack of reliable power system data and load data, with possible alternative solutions achievable by AI-driven control systems, should also be discussed. A successful solution must demonstrate technical viability and an underlying business model that addresses scalability. This track prize is sponsored by the IEEE Control Systems Society (CSS), and the winner may be invited to a future CSS Conference**.**

Local Entrepreneurship (Track L): This track will present innovative solutions that stimulate localization of the energy access sector and address persistent challenges in reaching last-mile remote and rural customers, such as affordability, last-mile delivery profitability, last-mile logistics, after-sales customer service and support, etc. Examples of solutions could be innovative consumer financing, innovative local entrepreneurship models, innovative partnerships, digital customer relationship management and business analytics, innovative demand generation solutions, etc. Solutions can also be aimed at reaching particularly vulnerable populations: the poorest of the poor, displaced persons and host communities, marginalized and discriminated communities, and individuals including but not limited to women and girls. Examples of solutions could be innovative solutions for closing the affordability gap, innovative delivery models for reaching populations in refugee settlements, innovative partnerships, creating opportunities for engaging women in the energy access sector, etc.

Energy Resilience (Track R): This track invites solutions that provide access to energy to communities affected by natural disasters, conflict, climate change, and other potential crises and threats to help them meet basic needs in the short term and increase resilience in the long term. These solutions should be rapidly deployable, reliable, resilient, and able to operate independently from the existing power infrastructure.

Student Teams (Track S): This track is open only for teams composed of tertiary education institutions. Any of the above categories can cover the proposed solution in this track. The main difference with the other categories is in the requirements for field-testing — student teams are not required to demonstrate their solution in a target community (as this can be difficult for a student team to execute due to constrained resources) but can perform field-testing in a suitable environment within their reach. However, a student team can choose to compete in one of the other categories if they can comply with the field-testing requirements.

SouthStar (Track SS): This track invites solutions that provide an open-source energy access platform that is built to specifications outlined on the SouthStar page https://empowerabillionlives.org/ requirements. These specifications include: power sources, loads, lights and mobile, open-source, affordability, and support.

Solutions are expected to target different levels of energy access with varying levels of technical and business sophistication. The best performers will provide the highest level of performance and functionality at the lowest cost with a viable business model and the ability to scale rapidly in this market segment. The same metrics will apply throughout the competition but with increasing rigor through the field evaluation and the global final. A team may state their preferred participation track; however, the EBL Judges can assign the final track designation, and their designation will be final. Judging for teams depends on the ability to provide value, both at the single-family and community levels. Decentralized solutions have traditionally served a single family's needs with higher capital efficiency, but cost-effectively expanding system capacity and service levels to serve community needs has been challenging. Centralized solutions are traditionally better able to provide community-level services but with much higher capital and operating costs, typically requiring oversized infrastructure. End-use solutions provide income-generating or health and life quality-improving opportunities on both the single-household and community level. Enabling Technology solutions would preferably be usable in a wide variety of energy access solutions and contexts. Achieving economic viability for smaller communities, or for communities where the needs grow rapidly, has also been challenging. Winning solutions will likely use technology and new business models to offer the best features – low capital cost, good asset utilization, flexibility, economic viability, and system expansion ability as needed.

ASSESSING SUCCESS:

Participating teams will submit entries to the EBL competition using the process outlined in the next section. The review and judging process will reflect the competition's goals and objectives. Appendix II shows a basic Judging Rubric. Judges will use this rubric to guide their scoring of the proposed solutions. The rubric is available for competitors to ensure they have addressed relevant criteria in their proposals.

The Online Round will have a simple, two-stage submission format. Teams will initially submit a short 3-page proposal; this is not mandatory but strongly advised. The 3-page proposal will go through the first screen and receive valuable feedback from reviewers. Teams will then be informed if they are encouraged or discouraged to submit a full proposal. The teams that continue will then submit the full mandatory proposal, including a field test plan. The full proposals will be reviewed, and then teams may have an interview with the competition judges. Teams passing this stage will then be selected to carry out field testing, and following this step, which includes a field-test report and field interviews, teams will be selected to participate in the Global Final. Teams should use the guide in Appendix I and prepare solutions and presentations, as judges will use the guide in the selection process.

Existing solutions and strategies may not be enough, and new thinking is required. The judges will be actively looking for the **WOW!** Factor in each topic area that shows novel cross-disciplinary thinking, which may provide new strategies for solving the scaling problem. These approaches include, but are not limited to, frugal engineering (ultra-low-cost but fully featured solutions), the use of technologies such as PV solar, batteries, power electronics, decentralized control, cybersecurity, communications, IoT, cloud, AI/machine learning, edge-computing, block-chain, pay-go, mobile wallets, data analytics, etc., and new business models.

HOW DO WE BUILD A TEAM – AND WHO CAN PARTICIPATE:

EBL teams can include individuals from small and medium-sized enterprises (SMEs), academic institutions, start-ups, research labs, NGOs, large corporations, or interested individuals. Appendix I provides details on how to participate in EBL.

EBL invites companies that commercially offer products meeting the competition criteria to participate. The simplified process for such companies is to provide product details and specifications, evidence of operation and impact in the field, financial data as appropriate, and a review of the scaling potential. The Judging Rubric in Appendix II provides further details.

EBL specifically invites people currently involved with energy-access efforts in the target communities (see Appendix I and II) to become involved and bring their first-hand knowledge of the needs and aspirations of people in these communities to EBL teams. EBL also invites student teams from across the globe to participate. Faculty support in an advisory role is permitted. Still, it must be declared and should not trigger a conflict of interest or intellectual property (IP) ownership issues as defined in the Official Contest Rules. EBL is also interested in fostering the development of 'open platforms' and 'open-source' software to enhance collaboration and promote creativity.

Solving complex problems can appear challenging for small teams with limited access to resources or newer technologies. EBL is establishing collaboration mechanisms so individuals and organizations seeking to partner can connect and collaborate.

People not allowed to participate in or to contribute directly to the solutions proposed or implemented by an EBL team are outlined in the EBL Rules and include IEEE employees, members of the EBL Global Steering Committee, individuals who have a direct role in enforcing the metrics and rules for the competition, and any other category of persons outlined in the contest rules. Individuals who cannot participate in EBL may be competition sponsors and/or advisors. The team must declare this support and be approved in writing by the EBL Rules and Judging Committee. Review of submitted proposals will follow IEEE guidelines, typically used for reviewing technical papers, for conflict of interest management. If there are questions regarding an individual's eligibility to be a part of an EBL team, the decision of the EBL Rules and Judging Committee will be final.

Please visit the EBL website at www.empowerabillionlives.org to review the Official Contest Rules for teams submitting entries into the competition.

APPENDIX I
DETAILED INSTRUCTIONS FOR SUBMISSION OF EBL ONLINE PROPOSALS

INSTRUCTIONS FOR PROPOSAL SUBMISSION

ONLINE ROUND 1: February 1, 2027

Teams will register through the Team Registration Link on the EBL resource page at https://empowerabillionlives.org/compete/resources/

Team Registration

- Fill out an online form indicating the team's 'Intent to Participate' in the competition as soon as possible.
- It is recommended that Team Names be aligned with the names teams would use should they receive a prize in the competition, which requires documentation for Award Agreements and Bank Transfers.
- Team Leaders will receive the links and instructions for submitting their proposals to the Open-Water proposal submission system. Teams will be assigned a Nomination Application Identification Number, which will be placed at the top right of their proposal.
- A Team Leader can only submit one proposal. The submission platform allows Team Leaders to reenter their submission and update information. Please do not start a new submission if changes need to be made.

Concept Paper Submission

- EBL review leaders will review the 'Intent to Participate' primarily to see alignment with EBL goals and objectives and may provide guidance to the team.
- There is a concept paper template under resources on the EBL website.
- A concept paper is optional but strongly encouraged for all teams that have not competed in prior EBL challenges.
- Each team must submit a Concept Paper by the above-stated deadline. The Concept Paper should be in the format specified and must conform to the following requirements:
  - The Concept Paper must not exceed 3 pages in length, including graphics, figures, and/or tables.
  - The Concept Paper must be submitted in Word.doc or Adobe PDF format.
  - The Concept Paper must be written in English.
  - Page 1 should include the Nomination Application Identification Number, Team Name, Title, Target Track, Concept Summary, Relevance with EBL Goals, Team Organization, and Capabilities, and may have photographs to support the Concept Paper.
  - Pages 2 and 3 are for the main body of the Concept Paper, including Challenges, Innovation, Proposed Work, and Impact.
  - All pages must be formatted to fit on an 8 1/2 by 11-inch (or A4) paper with margins of at least 3/4 inch on every side. The text must be in at least font size 10 (except for figures and references), and the team must ensure that the Reviewers can easily read the Concept Paper.

- The Concept Paper must be registered on the EBL submission platform, and the EBL Control Number (the Nomination Application ID# next to the Team Name at the Top of the submission page) should be included in the right-side header of every page.
- The Concept Paper submission must be uploaded anytime starting 1 January, 2027. Submissions will not be accepted after 11:59 pm EST (US) on **1 February 2027**.

Concept Paper Decision Process: 1 February 2027 - 28 February 2027

- A panel will review team submissions to check for alignment with EBL 2027 goals and objectives, and the teams will receive an ENCOURAGE/DISCOURAGE/OUT-OF -SCOPE response. This feedback and guidance are anticipated to be provided by 30 November 2024.
- The review criteria for Concept Papers are:
    - Alignment with EBL Goals and Criteria
    - Impact of Successful
    - Overall Technical Viability
    - Business Model
    - Field testing readiness
    - WOW Factor

Full Proposal submission and decision process (1 March - 1 May 2027)

- Submission of a full proposal, including a Field-Testing plan by qualified teams by **1 May 2027**
- **Team Leaders and newly registered teams will receive a link for the Full Proposal submission on the OpenWater Platform and be assigned a new Nomination Application number for the Full proposal.**
- The Full Proposal must not exceed 10 pages in length, including the cover page, graphics, figures, and/or tables.
- The full proposal should contain Technical Solution, Impact, Business Model, and field testing sections. Teams are encouraged to study the Judging Rubric (Appendix II) as they formulate their entry.
- The full proposals will be reviewed, and the selected teams may undergo an interview with Judges (anticipated to take place May - June 2027. Then, selected teams will carry out field testing. Teams invited to participate in the Global Final will be instructed regarding their final presentations.
- The reviewers will score the entries with guidance from the Judging Rubric shown in Appendix II.

Field Testing: June- August 2027

Final details on the process for the Field-testing Round will be released before the close of the Full Proposal Round but are expected to include the following elements.

- Participation of team representatives in the Field-testing Round is mandatory (for all but Student Teams), and it includes demonstrating a working solution, interviewing community members and consumers, and preparing a presentation to a panel of judges for the Global Final.
    - During your field testing, the Reviewers may set up a field interview over a platform such as Zoom.
    - Teams competing in the Resilience Track must field test, but doing so in an energy access community is not mandatory. Thus, they can use a representative community that is not in the Global South, such as a remote community or refugee camp.

Devices in the field may use independent third-party data acquisition to obtain data on device and system performance, which will be shared with Teams.

GLOBAL FINAL ROUND: December 2027

The teams that successfully complete the Full Proposal Round and pass the Field Evaluation will be eligible for selection in the Global Final Round in December 2027. The Empower a Billion Lives Judges will make the final determination of the selected teams.

Final details on the Field Evaluation and Global Final will be released before the Full Proposal Deadline.

The prizes at the Global Final will include a Global Grand Prize Winner, a Student Team Award, track prizes, and sub-track prizes, should suitable submissions be made for the tracks and sub-tracks, and potentially additional prizes.

EBL may provide data loggers used in the Field-Testing Round and will provide some funding to offset travel costs for one Team member to attend the Global Final for invited teams. EBL will also provide a letter of support to accepted teams so they may fundraise to offset the costs of field testing and travel for team members to the Global Final if they are invited.

APPENDIX II

JUDGING RUBRIC

INFORMATION FOR COMPETITORS AND JUDGES/REVIEWERS:

Proposals will be judged on the quality of plans presented in the proposal, the likelihood that a team will successfully meet the EBL objectives, technical and production feasibility, degree of innovation, and meeting the "WOW!" factors that will generate community excitement and acceptance. Other vital criteria are evidence of each team's commitment, capability, experience, and resources to implement their solution in alignment with the metrics provided throughout the entire competition.

Proposal instructions are outlined in Appendix I. Teams invited to participate in field testing, and the Global Final are expected to adhere to the basic plans described in their proposals. Only one proposal per team.

This Judging Rubric guides reviewers and judges who will be evaluating proposals submitted by competing teams in the Empower a Billion Lives competition. It also provides transparency and alignment between competitors and reviewers/judges. The team's success will be assessed using three factors –

- **Impact Score:** measures the solution's impact on the family, the community, and the environment.
- **Technology Score:** measures how technology solves key challenges, including scaling, interoperability, automation, sustainability, and affordability.
- **Business Score:** assesses the business model, including economic viability, scaling & sustainability.

Each factor has various sub-factors, with examples provided herein to guide the competitors and judges. It should be understood that these are examples, and teams can use other criteria that they feel are compelling for their proposed solution. The total score will be the sum of the three individual scores and will be a key factor the judges consider in making their final determination of the Teams moving forward in the Online Round to field testing and the Global Final Round.

Important note: Not all the requirements and criteria presented below will apply to all the tracks, notably End-Use Energy and Enabling Technologies. In most cases, the requirement's applicability to a Track is obvious and not explicitly indicated.

BROAD SOLUTION REQUIREMENTS:

Qualification Requirement: The proposed set of products or services must meet the customers' growing needs. Proposed solutions should provide at least Tier 2 electricity access (Tier 2 is defined by the ESMAP Multi-Tier Framework for household electricity supply as a minimum 50 W peak for 30 minutes or a minimum 200 Wh daily supply capacity). Anticipate that a target family may start below a Tier 2 level but may grow over several years to Tier 2 consumption levels. The solution should be able to meet the energy needs of the Target Household and the Target Community through this journey.

Target Community:

- 20-1000 homes per community with low population density

- Average purchasing power $1500/year per household
- Currently off-grid with little to no penetration of solar lanterns (Tier 0-1)
- Possibility of a poor grid on a 7-10 year horizon for some locations
- Mostly residential and agricultural, some small commercial, light manufacturing activities present – seeking to transition to a community with much higher income earning potential
- Less than 50% of households have bank accounts, and less than 30% have smartphones

Target Household:

- A typical target household consists of five people including two parents under forty years of age, with three children under the age of 10. Parents typically have no formal education or crafts training. The family's primary language is a regional language. Their average income is $2.15 per person per day or $1,500 per year for the whole household. (Calculated on a purchasing power parity basis.) Child labor is not allowed.

LOW ENERGY USE FAMILY: Minimal System Performance with Proposed Solution	**HIGH ENERGY USE FAMILY:** Expanded System Performance as Family Situation Improves
▪ Min 200 Wh/day and min 50 W peak power ▪ Available min of 4 hrs/day, and 2 hrs/night ▪ Lighting and phone charging are high-priority ▪ Digital inclusion & productivity enhancement ▪ Family is financially constrained, using services when funds are available	▪ Min 1,000 Wh/day or min 200 W peak power ▪ Minimum of 6 hrs/day, and 4 hrs/night ▪ Lighting and phone charging are high-priority ▪ Appliances and productivity are important ▪ Family aspires to grow, productivity, and community services are increasingly important

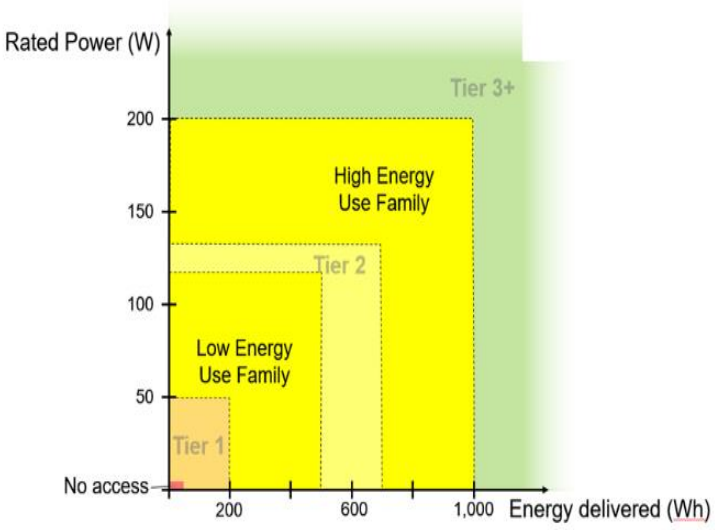


Fig 1: Tier 1 and Tier 2 usage as defined by ESMAP multi-tier framework

Impact Score

It is anticipated that many teams will not have fully informed answers on the Impact Score section during the Full Proposal Submission Round. Judges/reviewers expect the teams to show an understanding of the problem, a pathway to a proposed solution, and preliminary results that show that the team has a viable approach and knowledge of the technology areas they intend to use. The Field Test Review and the Global Final will take an increasingly rigorous assessment of the factors shown below.

Table 1.1 below shows the various factors that judges will consider in assessing a team's Impact Score.

Table 1.1 – Impact Score

	Key Factors to Consider
Creates Value for Family and Community	Meets basic LOW-ENERGY USE family residential needs
	Expands to meet HIGH ENERGY USE family needs (including clean cooking, digital inclusion, and basic comforts in an energy-constrained context
	Improves livelihood and enhances income earning potential for single-family
	Meets community needs, including productive use.
Easy for Target Family to Use	Simple to deploy and use for target family
	Allows family to affordably meet increasing energy needs
Affordable	Meets family cost and service targets and expandability
	Flexible pricing/payment options, PAYG, subsidized payments
Creates positive social impact	Health and well-being improvements, gender inclusivity
Environmental impact	Reduces or avoids GHG emissions, reduces e-waste, enables circular design
Resiliency	Suitable for providing energy access in communities impacted by climate change, political and social instabilities
WOW factor	WOW factor

As an illustrative example, here are some possible impact issues competitors can consider. Competitors are encouraged and free to use metrics that are consistent with their solution and storyline.

- **Creating Value for Family**:
  - **Basic Low-Energy Use examples**: Space lighting, cell phone charging, radio, television, etc.
  - **High-energy use examples**: Digital access (laptop or tablet), fan, refrigerator, smart cooking
  - **Enhances single-family income earning potential**: Enhances existing non-electrical occupations (dairy, pottery, masonry, weaving, agriculture, sewing, food packaging, etc.); increased income from agri-food activities (irrigation, food processing, cooling, livestock/poultry machinery), new income from activities requiring electricity (advanced sewing, power looms, food stalls, refrigeration, printing, internet café, etc.); new income from energy infrastructure (sharing energy resources, technical and non-technical support jobs)

    - **Meeting critical community needs examples:** Public lighting. water pumping & purification; education including digital access, lighting, and cooling; health facilities (local health centers, telemedicine); job creation through light manufacturing.
- **Easy for Target Family to use**:
    - **Simple to deploy and use**: No local technical support needed; Suitable for users with no education (including illiterate users); Rugged in typical use scenarios.
    - **Allows Target Family to affordably meet increasing energy needs (example)**: Building blocks allow growth to high-use whenever family needs and can afford; Simple to use wiring and connectors to interconnect discrete elements; Allows use of energy and resources from others in the network to minimize family investments and costs.
- **Affordable examples**:
    - **Meeting Target Family cost, level of service, and expandability objectives: Estimate the cost per year for the family at the minimum use level; show an affordable pathway to grow as family needs and ability to pay increase; is it easy for the family to transition from low-use to high-use in 5 years? Preserve the value of the investment as the** grid (finally) arrives.
    - **Flexible Pricing/PAYG:** Allows pay-as-you-go billing or equivalent functionality; No bank account needed, mobile payments, micro-finance, credit history; Supports electronic wallets – e.g., PayG, or use of cryptocurrencies; Reduces family cost by providing value to external stakeholders
- **Environmental impact examples:**
    - **Reducing e-waste** by extending the lifetime of components and systems; use of recyclable, abundant, and non-toxic materials; facilitating repairability, reuse, and recyclability of components and systems
    - **Avoiding or reducing GHG emissions** by replacing polluting energy sources with clean ones
- **Resiliency**
    - **Easily deployable solutions** in contexts of displaced populations and communities affected by extreme events caused by climate change.
- **WOW factor**:
    - Provides new and unexpected insight and novel ways of creating value for target customers.

Tech Score

It is anticipated that many teams will not have fully informed answers on the Tech Score section during the Online Round. Judges/reviewers expect the teams to show an understanding of the problem, a pathway to a proposed solution, and preliminary results that show that the team has a viable approach and knowledge of the technology areas they intend to use. The Field Test review and Global Final will take an increasingly rigorous assessment of the factors shown below.

Table 1.2 below shows the various factors that judges will consider in assessing a team's Tech Score.

Table 1.2 – Tech Score

	Key Factors to Consider
System Specification	Generation and energy storage *Meets min Tier 2 requirements*
	Power delivery, control, and monitoring
Scalable	Technology enables rapid scaling and large device fleet management
Expandable	The system expands as needs grow without large upfront investment
Operations and sustainability	Ease of installing, commissioning, maintaining, and servicing system and fleet of devices and wires (if needed)
Interoperability	Enables use of solutions from different vendors at the end-user level; stimulates standardization of hardware, software, and architectures; enables integrated power system of the future
Cloud Connectivity	Novel low-cost communications backbone (or similar function without connectivity)
Advanced Features	System optimization and analytics
WOW factor	WOW! factor

As an illustrative example, here are some possible impact issues competitors can consider. Competitors are encouraged and free to use metrics that are consistent with their solution and storyline.

- **System Specification examples**:
  - **Generation and energy storage:** Peak watts; watt-hours per day; availability on-demand; cycle efficiency, life, charge-discharge cycles, size, safety
  - **Environmental system footprint**: Delivers Tier 2 power and energy with low carbon footprint; compact and lightweight; easy and intuitive to install, commission, & operate; operates in target environment; fully recyclable at the end of life.
- **Scalability examples:**
  - Measurement, bill delivery, and dues collection in target community; minimizing the cost of managing fleet of energy devices in multiple regions; remote stop and start service upon theft, non-payment, or non-compliance; Not dependent on region-specific service providers.
- **Expandability examples**:
  - Ability to expand with family/market growth and need.

    - Easy interconnection of single-family home sources and storage to create a higher capacity system to meet community needs.
    - Fully plug and play, modular, easy in-field upgrades, expand loads/sources
- **Operations and sustainability:**
    - Easy install & commission process without the need for trained field personnel; Servicing/maintenance by local people with minimal technical training; automated fleet management process, including remote diagnostics; managing regional compliance needs.
- **Interoperability examples:**
    - Appliances of different vendors compatible with the energy system; interoperability with other types of energy systems (microgrids, SHSs, grid); open-source solutions that enable scaling.
- **Cloud Connectivity examples:**
    - Benefits of cloud and internet connectivity, asset tracking, fleet management, additional value delivery from external stakeholders, ability to realize these functions without Cloud Connectivity
- **Advanced Features examples**:
    - **System optimization & Data Analytics**: estimate energy availability over a week, learn profiles; Cloud connectivity and fleet data access for superior optimization; Advanced data analytics across device fleet, allows 'sharing economy' model.
- **WOW Factor**:
    - Uses technology in novel ways to provide exciting new value and has game-changing potential.

Business Score

It is anticipated that many teams will not have fully informed answers on the Business Score section during the Online Round. For the Online Round, the judging metrics are intended to guide the teams and the judges on factors that are considered important and to have the teams express how they are thinking about these issues.

Table 1.3 below shows the various factors that judges will consider in assessing a team's Tech Score.

Table 1.3: Business Score

	Key Factors to Consider
Financial Model	Simple financial model, including key assumptions. *The target is to serve two representative communities - of 100 homes and 1,000 homes, where consumption grows from LOW-USE to HIGH-USE in 5 years.*
	Economic viability
	Value Stacking
Scaling	Billing and Collection Model
Resilient	Dropping prices
	Sporadic income streams
External Funding	Subsidies
	Novel funding models to help scaling
	Value for external stakeholders
WOW factor	WOW! factor

As an illustrative example, here are some possible impact issues competitors can consider. Competitors are encouraged and free to use metrics that are consistent with their solution and storyline.

Business Score Factor Examples:

- **Financial Model examples**: Estimate of cumulative capital expenses needed through Year 1 and Year 3 (includes total product, plant, poles, meters, civil works, and other costs); total operating and financing costs estimated through Year 1 and Year 3 (includes distribution, sale, commissioning, maintenance, servicing, fuel, etc.); Total revenues expected through Year 1 and Year 3, and assumptions on price of energy and customer billing model.
- *Teams are expected to have increasingly complete business models and information as they get closer to the Global Final competition.*
- **Economic Viability examples:** Price of energy delivered to customers to reach breakeven for 100 home LOW-USE community; Price of energy delivered to customers to reach breakeven for 1000 home HIGH-USE community; show when breakeven occurs.
- **Value stacking:** enabling and creating multiple value streams.

- **Scaling example:**
  - Purchase or service/lease model with Pay-Go and remote disconnect; mobile wallet, bank-less transactions, microfinance, credit; ability to bill and compensate prosumers who own generation and storage; automated to enable scaling to 1 million total customers.
- **Resiliency example:**
  - **Dropping prices:** Impact of rapidly dropping prices of PV solar, batteries, and other technologies on the economic viability of the business model
  - **Sporadic income streams:** Ability of the business model to handle a customer base whose income can be sporadic and unreliable (pay when they can)
- **External Funding factors:**
  - **Subsidies:** Subsidies or grants used, and plan for economic viability without subsidies
  - **Novel funding models for scaling:** Novel funding and operational models (e.g., peer-peer funding, crowdsourcing) for rapid scaling & economic viability
  - **Value for external stakeholders:** Value generated for external stakeholders (financial institutions, credit monitoring, digital inclusion, others), and the impact on the financial model.
- **WOW factors:**
  - Uses business model innovations to provide unexpected value and improve chances of reaching scale.