

Tips on how to go about the challenge: Sustainable Energy

The Sustainable Energy Challenge asks teams to develop and test ideas for interventions that could help tackle specific context-dependent sustainable energy challenges. To do this, you should take the following steps:

Steps

1. **Choose and Frame your Sustainable Energy Challenge.** You will define the energy problem and scope.
 2. **Gather Evidence.** You will collect data that helps you map the system, identify dynamics, and any vulnerabilities.
 3. **Design & Prototype.** Your team will create and test a real-world intervention.
 4. **Reflect & Learn.** You will rapidly iterate your prototype, refining the design based on stakeholder feedback and performance data
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Step 1: Choose Your Sustainable Energy Challenge

In this step, your team will identify a specific challenge. This helps you to

- Narrow a broad issue into a concrete, manageable project scope, enabling targeted analysis and action
- Ensure your challenge is contextually relevant. Energy challenges differ significantly by place and influence appropriate solutions, e.g. energy poverty in rural sub-Saharan Africa vs. high carbon emissions from fossil fuels in industrialized cities.
- Align stakeholders towards a common vision. A shared understanding of the problem guides engagement by ensuring everyone works on the same, explicitly stated problem

What to Do

1. **Select a tangible, energy-related issue to tackle. Example themes include:**
 - o Transition to renewable energy (e.g., barriers to solar/wind adoption, grid integration of intermittent renewables)
 - o Scalable energy storage (e.g., low-cost battery solutions for off-grid communities, seasonal storage for solar-powered regions)
 - o Building energy optimization (e.g., inefficient heating/cooling in old buildings, smart energy management for high-rise apartments)

- o Energy equity (e.g., unequal access to affordable electricity, energy poverty in low-income neighbourhoods)

2. Define the *geographic* and *temporal* context:

- o Decide whether you're focusing on a rural village, urban district, industrial zone, or national grid.
- o Set the timeframe for your study (e.g., a winter heating season, a 5-year transition to renewable targets).

3. Frame the problem clearly:

- o Specify the “what,” “where,” and “why now.”
- o Identify the impacts you intend to address (e.g., health from indoor air pollution, economic costs of energy imports, carbon emissions, energy access for education).

Illustrative Example (you'll need to be more detailed)

Element	Example
Energy Issue	Unreliable electricity access due to poor grid connectivity and high fossil fuel dependency
Location	Rural village in Rajasthan, India, 10km from the nearest grid line
Timeframe	Dry season (April–June), when diesel generator costs spike due to high demand
Problem Statement	“During the dry season, 80% of households experience 4+ hours of daily power outages, relying on costly diesel generators that increase air pollution and financial burdens.”

- If you have a clear and targeting focus and framing, this will help you with the next steps.
- For example, in the Gather Evidence phase, your team might measure daily electricity usage, track diesel generator costs, survey households on outage impacts, or map existing renewable energy potential (e.g., solar irradiance levels). This data will inform your intervention design.

Step 2: Gather Evidence

In this step, your team will gather evidence, data, and information to help you better understand your challenge. The better you can understand the situation as it is today and how it affects the communities, the more relevant your intervention can be. You could collect the data yourselves, use secondary data from publications and reports, or use proxy data from public datasets.

The evidence also gives you a baseline for estimating the impact that your intervention may have. Baseline data may include:

- ✧ **Technical/energy system data:** Electricity generation mix (fossil fuels vs. renewables), grid stability metrics (outage frequency/duration), renewable energy potential (solar irradiance, wind speed), energy storage capacity.
- ✧ **Social/economic impacts:** Household energy expenditure (percentage of income), health issues from indoor pollution (e.g., respiratory illnesses), school/clinic operations disrupted by outages.

You should aim to map the interactions and vulnerabilities using simple system visuals. This will help you see the complexity of the energy system and avoid unintended consequences. Mapping may include causal-loop diagrams to help you identify feedback loops, thresholds (e.g., carbon emissions affecting air quality). or the “5-Whys” method to help you trace root causes (es.catapult.org.uk).

Illustrative Example

In a rural village dependent on diesel generators, teams measure daily electricity usage, track generator fuel costs, and interview residents. A causal-loop diagram reveals that high diesel costs lead to reduced electricity use, which limits income-generating activities (e.g., small-scale farming equipment, sewing machines). Reduced income further restricts households from investing in solar solutions, perpetuating reliance on generators—a reinforcing feedback loop that deepens energy poverty.

Step 3: Design & Prototype your Intervention

In this step, your team will develop an intervention that helps communities, regions or nations adapt to the issue you identified in step 1. It should be informed by the evidence you collected in step 2 and the causal loop diagram that you drew.

Examples of intervention could be physical artefacts (e.g., a **community solar microgrid**), a financial tool (e.g., pay-as-you-go solar plans), a policy (e.g., **subsidies for renewable energy in rural areas**). There will be many other ideas that you could develop.

In this step, you should

- Use your causal-loop diagram to brainstorm 3–5 interventions targeting system leverage points (e.g., storage capacity, policy incentives, community behaviour). Focused interventions on leverage points (e.g., reducing upfront costs of solar systems) are more effective than superficial fixes.
- Ensure equity: Prioritize benefits for the most vulnerable (e.g., low-income households should not bear additional costs).

- Evaluate feasibility, stakeholder support, equity, and potential co-benefits/trade-offs (e.g., a solar intervention might reduce pollution but require initial funding).
- Build a minimal prototype (e.g., a scaled model of a solar microgrid, a draft policy proposal, or a mock-up of a pay-as-you-go app) to test assumptions.
- Define indicators to measure effectiveness (e.g., “percentage reduction in diesel generator use” or “increase in daily electricity access hours”).
- You should develop indicators that allow you to assess how effective your intervention may be.

Illustrative Example

The team prototypes a “community solar share” system: a 5kW solar panel array with shared battery storage, paired with a simple app to track energy usage and costs. They test the prototype by installing it in 5 households, measuring how many hours of reliable power are provided daily and comparing costs to diesel generators. The key indicator is “cost per kWh saved compared to diesel.”

Step 4: Reflect & Learn

Refine your prototype using feasibility assessments, stakeholder feedback, and performance data. Rapid iteration ensures your intervention stays grounded in real-world needs.

Identify key stakeholders (e.g., village leaders, local energy cooperatives, households) to review your prototype. Gather quantitative feedback (e.g., “battery lasts 3 hours vs. 5 needed”) and qualitative input (e.g., “app is too complex for elderly users”). Use this data to improve the design.

Document findings, changes, and future directions—energy systems are dynamic, and adaptability is critical (es.catapult.org.uk/project).

Illustrative Example

Users of the community solar share system report that the battery drains too quickly on cloudy days, and the app is hard to navigate. The team collects data on solar irradiance and user interactions, then adapts the prototype by adding a backup biogas generator (for cloudy days) and simplifying the app to include voice commands. They document these changes, noting a 40% increase in user satisfaction and 25% longer daily power availability.

By following these steps, you’ll develop interventions that are contextually relevant, evidence-based, and adaptable to real-world challenges in sustainable energy.