#Solar4Future+

Guidelines for the Implementation of the #Solar4Future+ STEAM-Based Solar Energy Challenge in Secondary Education

Work package n°4 - Solar Energy Challenge

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Contents

1. Objective: Clear Purpose and Relevance to Local Energy Issues

1.1. Core Purpose of the Solar Energy Challenge

The primary purpose of this challenge is to move students from theoretical understanding to practical application. It is designed to be a capstone experience where pupils, working in collaborative teams, design an innovative, feasible, and impactful proposal that tackles a genuine energy-related issue within their immediate school or local community context, using solar power as the core solution.

This is not merely an academic exercise; it is a simulated real-world project that mirrors the processes used by engineers, urban planners, and sustainability consultants. The challenge demands that students synthesize knowledge from across the STEAM disciplines to create a holistic solution.

1.2. Breakdown of Purpose into Key Goals

To Apply STEAM Knowledge Integratively: Students must move beyond seeing subjects in isolation. A successful proposal will require:

- **S**cience: Understanding the principles of photovoltaics, energy conversion, and energy efficiency.
- **T**echnology: Selecting appropriate solar components (panels, batteries, inverters, charge controllers) and understanding their specifications.
- **E**ngineering: Designing a system that is structurally sound, electrically safe, and efficient (e.g., calculating energy needs, wire sizing, system layout).
- **A**rts: Creating an aesthetically pleasing design, producing compelling visualizations (sketches, digital renders), and effectively communicating the proposal's value.
- **M**athematics: Performing precise calculations for energy output, cost-benefit analysis, budgeting, geometric angles for optimal sun exposure, and quantifying environmental impact (e.g., CO_2 savings).

To Develop Critical 21st-Century Skills: The challenge is a vehicle for fostering:

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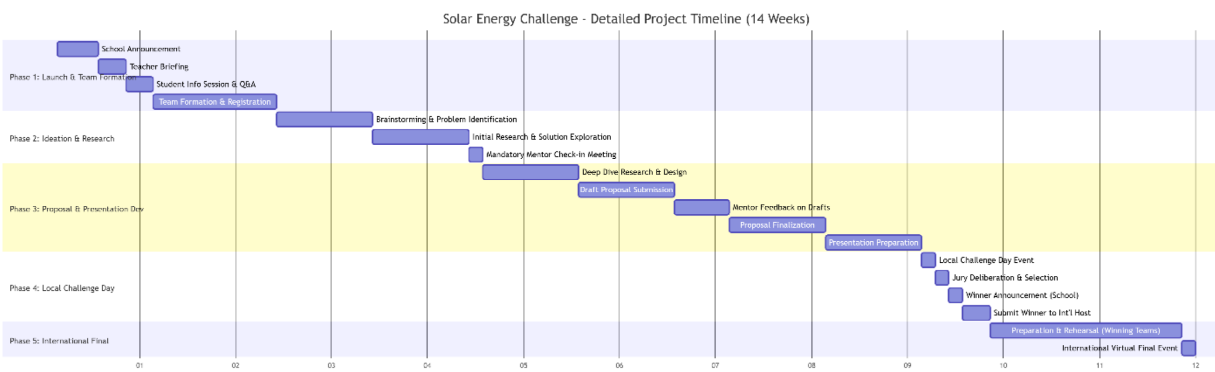
- Collaboration & Teamwork: Students must work in diverse teams, delegate tasks, and integrate different perspectives.
- Critical Thinking & Problem-Solving: They must analyze a problem, research solutions, and navigate constraints.
- Creativity & Innovation: Teams are encouraged to think outside the box to develop unique solutions.
- Communication: They must articulate their ideas clearly and persuasively in a written proposal and later in a presentation.

To Foster Agency and Active Citizenship: The challenge empowers students by showing them that they are not just future leaders but change-makers today. It demonstrates that their ideas have value and can contribute to a more sustainable future for their community.

The chart below visualizes the five phases of the Solar Energy Challenge, showing the sequence and overlap of key tasks from the initial launch to the international final.



1.3. Relevance to Local Energy Issues

The Solar4Future+ Challenge is designed to be deeply relevant by requiring student proposals to address tangible, observable energy issues within their own school or local community. This focus on local reality ensures the project is an authentic learning experience, moving beyond theory to solve real-world problems, which dramatically increases student engagement and investment in the outcomes.

Tackling High Operational Costs

Many schools struggle with the financial and environmental cost of outdated infrastructure. A highly relevant project could focus on designing a solar-powered LED lighting system with motion sensors for the school's parking lot or sports field, directly addressing the problem of high electricity bills and energy waste from inefficient, old fixtures.

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Powering Remote Locations

Schools often have sheds, greenhouses, or outdoor classrooms without access to the main power grid. Students can solve this by designing a small-scale, off-grid solar station to power essential tools like LED grow lights, irrigation pumps, or digital weather sensors, bringing clean energy to unused spaces.

Building Educational Awareness

A common issue is the lack of visible, engaging tools to teach about sustainability. A team could address this by creating a solar-powered phone charging station for the library or a solar fountain for the garden, alongside an educational plaque, making renewable energy a visible and interactive part of the daily school environment.

Greening Campus Mobility

For schools utilizing utility vehicles, a relevant challenge is to eliminate fossil fuel dependency for short trips. A proposal could outline a plan to integrate a solar-powered golf cart or e-bike for maintenance staff, including the design for a dedicated solar carport to ensure zero-emission charging and operation.

Electrifying School Events

Outdoor festivals and fairs often rely on loud, polluting gasoline generators. A practical and innovative solution is for students to design a portable, trailer-mounted solar generator system, providing clean, quiet power for speakers, lights, and concessions during school events, immediately improving the community experience.

2. Process: Step-by-Step Instructions, Timelines, and Tasks

The Solar Energy Challenge is structured into five distinct phases, moving from team formation to an international final. The entire process is designed to be completed over a 14-week period.

Phase 1: Launch & Team Formation (Duration: 2 Weeks)

- **Objective:** To officially kick off the challenge and form multidisciplinary teams.
- **Participants:** All interested students aged 14-18 from the four partner schools. The goal is to engage a minimum of 50 students per school.
- **Key Tasks & Timeline:**
    - **Week 1, Day 1: School Announcement**. The school coordinator announces the challenge via assembly, posters, and newsletters.
    - **Week 1, Day 3: Teacher Briefing**. The coordinator briefs participating teachers on their role as facilitators.

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- **Week 1, Day 5: Student Information Session.** Host a Q&A session to explain the goals and rules.
- **Week 2: Team Formation & Registration.** Students form teams of exactly 5 members, each choosing a primary STEAM role. The goal is to form at least 10 teams per school. Teams formally register with their school coordinator.

*Note: Each team must consist of **5 students**, with each member assuming a dedicated role to ensure deep, authentic integration of all STEAM disciplines:*

- ***The Scientist:** Focuses on the core **science** (e.g., energy conversion, environmental impact calculations).*
- ***The Technologist:** Researches and selects the specific **technology** (e.g., solar panels, sensors, components).*
- ***The Engineer:** Designs the **engineering** solutions (e.g., system layout, structural integrity, safety).*
- ***The Artist:** Leads the **arts** (e.g., visual design, aesthetics, proposal layout, and renderings).*
- ***The Mathematician:** Handles the **mathematics** (e.g., budget, cost-benefit analysis, geometric angles, efficiency calculations).*

*The final proposal must include a **"STEAM Breakdown"** section where each member summarizes their contribution, demonstrating the collaborative synthesis of all five disciplines. This breakdown is a critical part of the evaluation.*

Figure 1: Collaborative STEAM Learning: Students Tackling Climate Challenges Through Science, Technology, Engineering, Arts, and Mathematics

Phase 2: Ideation & Research (Duration: 3 Weeks)

- **Objective:** To identify a specific local energy problem and conduct initial research.
- **Participants:** All registered student teams (approx. 10 teams/school).
- **Key Tasks & Timeline**:

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  - **Week 3: Brainstorming & Problem Identification.** Teams select a specific, relevant energy problem within their school/community.
  - **Week 4: Initial Research.** Teams research the science of their problem and explore solar technology components.
  - **Week 5: Solution Exploration & Mentor Check-in.** Teams sketch initial ideas and have a mandatory meeting with their teacher-mentor.

Phase 3: Proposal & Presentation Development (Duration: 4 Weeks)

- **Objective:** To develop a comprehensive proposal and a compelling live presentation.
- **Participants:** All registered student teams (approx. 10 teams/school).
- **Key Tasks & Timeline:**
  - **Week 6: Deep Dive & Design.** Role-specific tasks: system design, calculations, budget, and visual presentation layout.
  - **Week 7: Draft Proposal Submission.** Teams submit a first draft of their proposal (a single PDF/PPT file) to their mentor/teacher for feedback.
  - **Week 8: Incorporate Feedback & Finalize Proposal.** Teams revise their written proposals based on mentor input.
  - **Week 9: Presentation Preparation.** Teams prepare a concise 5-minute live presentation (e.g., using posters, physical models, digital slides) to showcase their project on the **Local Challenge Day**. Mentors coach teams on public speaking.

Phase 4: Local Challenge Day & Judging (Duration: 1 Week)

- **Objective: To host a live event where all teams present their work, and to select the national winning team.**
- **Participants:**
  - Presenters: All 10 teams (50+ students) from the school.
  - Jury: Local Jury (comprising 2 teachers from the school and 1 external expert e.g., from a local energy company, university, or municipality).
  - Audience: Other students, teachers, parents, and school administrators are invited to attend.
- **Key Tasks & Timeline:**
  - **Week 10: Local Challenge Day** (Scheduled on one day this week):

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- ***Format:*** *A science fair-style event held in the school auditorium or gymnasium. Each team is given a booth/station.*
- ***Morning Session****: Teams present their projects simultaneously. The jury circulates among all booths, listening to the 5-minute pitches, examining prototypes or posters, and asking questions. Each jury member scores each team using the official rubric.*
- ***Afternoon Session****: The jury convenes in a private room to deliberate based on the aggregated scores and select the winning team.*
- ***End-of-Day Ceremony****: The winning team is announced and awarded a certificate. All participating teams receive a Certificate of Participation.*
- ***Post-Event:*** *The school coordinator sends the winning proposal and jury scores to the project leader (RTU) and the international final host (IDDA).*

Phase 5: International Virtual Final Event (Duration: Preparation + 1 Day Event)

- **Objective:** To showcase the four best projects and select the overall Solar4Future+ challenge winner.
- **Participants:**
    - **Presenters:** The four winning teams (one from each partner school). Each team consists of 5 students and 1 teacher-mentor.
    - **Jury:** Two jurors from each of the six partner organisations, forming an international panel of 12 experts.
    - **Attendees:** The broader project community is invited to watch the live stream.
- **Key Tasks & Timeline:**
    - **Weeks 11-12: Preparation.** The four winning teams refine their presentation for the virtual format. IDDA provides technical guidelines and organizes a rehearsal.
    - **Week 13 (or as scheduled)**: The Virtual Final Event (Hosted by IDDA, Turkey).
- **Agenda:**
    - Welcome by the host (IDDA).
    - Presentation slot for each team (5 min presentation + 3 min Q&A from the international jury).
    - Jury deliberation.

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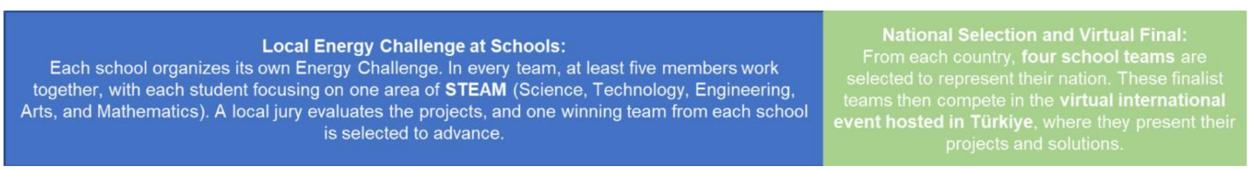
- Announcement of the overall winning team.

- **Award:** The overall winning team receives a digital Certificate of Excellence.

In **Figure 2**, the overall process of the Local Energy Challenge across participating countries is illustrated, culminating in the final virtual event in Turkey. In the first phase, all schools organize the challenge locally, with each team—comprising at least five students—working on a STEAM-related topic. A local jury then selects one winning team from each school. In the second phase, four teams from each country advance to the final stage, where they compete in the virtual event.



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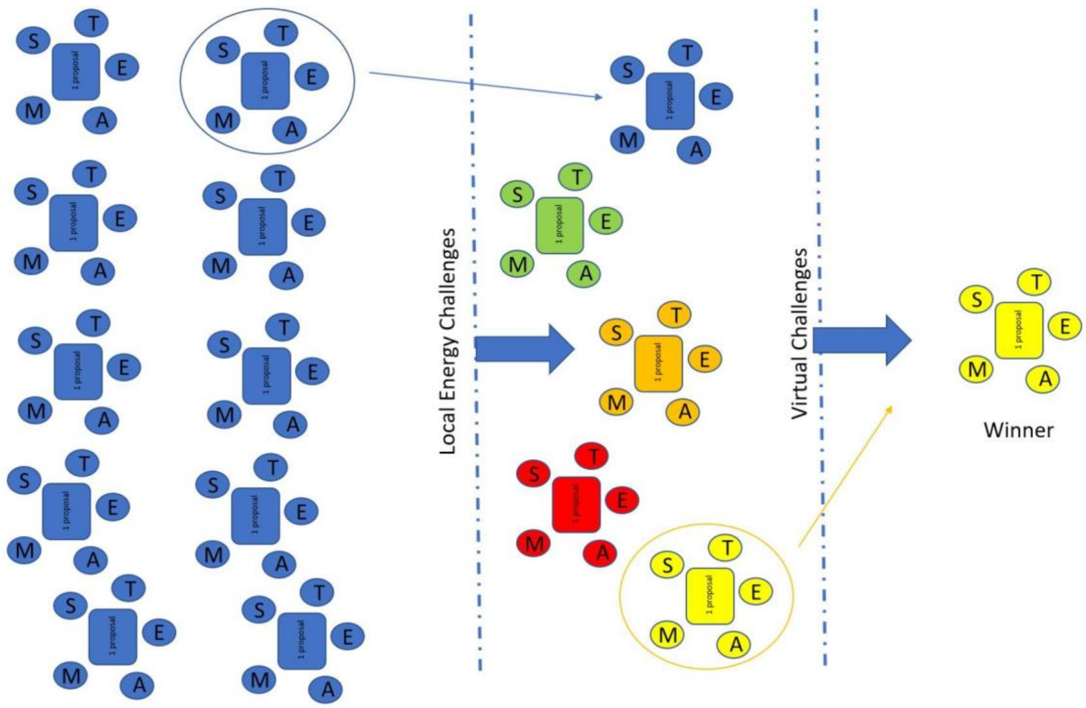

Figure 2: General Steps of the Local Energy Challenge and Final Virtual Event in Türkiye

3. Resources: List of Materials and Tools Required

To ensure all teams can participate equitably and have access to the necessary materials for both research and practical demonstration, the following resources are recommended. Resources are categorized by their purpose.

A. Core Research & Proposal Development Resources (Essential for All Teams)

These are fundamental resources needed for the ideation, planning, and documentation phases.

- **1. Information & Knowledge Resources:**
    - Access to the **#Solar4Future+ Digital Toolkit** (developed in WP3).
    - The **Solar Energy Curriculum** (developed in WP2).
    - Internet access for researching:
        - Scientific principles of photovoltaics.
        - Specifications and costs of solar components (panels, batteries, etc.).
        - Case studies of existing solar projects.
    - Library resources (books on renewable energy, engineering design).
    - Contact information for local experts (optional but encouraged).

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- **2. Digital Tools & Software:**
    - **Word Processing & Presentation Software:** (e.g., Microsoft Word, Google Docs, PowerPoint, Google Slides) for writing the proposal and creating presentation slides.
    - **Spreadsheet Software:** (e.g., Microsoft Excel, Google Sheets) for creating budgets, performing calculations, and making data graphs.
    - **Design & Modeling Software:** (e.g., free options like Canva for infographics, Google SketchUp for simple 3D models, Tinkercad for circuit design).
    - **Cloud Storage:** (e.g., Google Drive, OneDrive) for team collaboration and backing up work.
- **3. Basic Stationery & Presentation Materials:**
    - Notebooks, pens, pencils, markers.
    - Large flip charts or whiteboards for team brainstorming.
    - Poster board and art supplies for creating visual aids for the Local Challenge Day.

B. Practical Demonstration & Prototyping Resources (For Physical Models)

These resources are for teams that wish to build a physical scale model or working prototype of their solution for the Local Challenge Day. Not all teams are required to build a prototype, but it is highly encouraged.

- **1. Basic Electronics & Solar Components (Example Kits):**
    - **Small Solar Panels:** (e.g., 5V - 12V, 1W - 10W panels).
    - **Rechargeable Batteries:** (e.g., 18650 Li-ion cells or sealed lead-acid batteries).
    - **Charge Controllers:** Small PWM solar charge controllers suitable for the panel and battery voltage.
    - **DC Motors / LED Lights / Small Pumps:** Components to demonstrate the application (e.g., a small fan, LED strip, or water pump).
    - **Wiring & Connectors:** Alligator clips, jumper wires, basic soldering kits (for advanced teams under supervision).
    - **Multimeters:** For measuring voltage and current to test system performance.
- **2. Materials for Building the Structure:**
    - **Craft Materials:** Cardboard, foam board, wood scraps, plastic sheets, glue, tape.
    - **Basic Tools:** Scissors, craft knives, hot glue guns, screwdrivers, pliers (with appropriate safety supervision).

C. Local Challenge Day Event Resources

Resources needed by the school to host the science fair-style event.

- **1. Venue & Setup:**
    - A large room (gymnasium, auditorium, or several connected classrooms).

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    - Tables and chairs for each team's booth/station.
    - Access to electrical outlets for teams displaying digital presentations on laptops or tablets.
    - Extension cords and power strips.
- **2. Presentation Equipment:**
    - A projector and screen for the opening/closing remarks.
    - A sound system or portable microphone for announcements.
    - A designated area for the jury to deliberate privately.
- **3. Judging Materials:**
    - Multiple copies of the **official evaluation rubric** (see Section 6).
    - Clipboards, pens, and scorecards for each jury member.
    - Calculators for tallying final scores.

D. Virtual Final Event Resources

Resources needed by the winning team and the host for the international online event.

- **1. For the Participating Team:**
    - A reliable, high-speed internet connection.
    - A computer with a webcam and microphone.
    - Presentation software (e.g., PowerPoint, Google Slides) screen-sharing capabilities.
    - A quiet, well-lit room for the presentation.
- **2. For the Host Organisation (IDDA):**
    - A licensed video conferencing platform (e.g., Zoom, Microsoft Teams) capable of hosting all participants and attendees.
    - A dedicated technical host to manage breakout rooms, audio, and screen-sharing.
    - A digital presentation timer to keep presentations on schedule.
    - A virtual background or branded slides for the event.

4. Roles: Responsibilities of Teachers, Students, and Community Members

The successful execution of the Solar Energy Challenge hinges on a clear and collaborative division of labor. Each participant—from the student teams to the teachers and community members—plays a distinct and vital role. The following table outlines the specific responsibilities for each group, ensuring structured guidance, authentic student-led innovation, and valuable real-world engagement throughout the project.

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Role	Primary Function	Key Responsibilities
Student Team Member	Primary Actor & Innovator	• Commit: Actively participate in all team meetings and work sessions. • Specialize: Fully embrace one dedicated STEAM role (Scientist, Technologist, Engineer, Artist, Mathematician). • Collaborate: Work cooperatively, delegate tasks, and integrate ideas from all team members. • Execute: Conduct research, perform calculations, create designs, and build prototypes. • Meet Deadlines: Adhere to all submission deadlines.
Student Presenter	Communicator & Advocate	• Develop: Craft and rehearse a clear, compelling 5-minute presentation. • Prepare: Create professional visuals (posters, slides, prototypes). • Articulate: Clearly explain and defend the project to judges and audience. • Engage: Answer questions knowledgeably and accept feedback gracefully.
School Coordinator (Lead Teacher)	Project Manager & Liaison	• Administer: Act as the main liaison between the school and the project leader (RTU). • Manage Timeline: Oversee the entire 14-week schedule within the school. • Secure Resources: Manage logistics, materials, and technology for the challenge. • Plan Event: Organize the Local Challenge Day (venue, schedule, ceremony). • Coordinate Jury: Identify, invite, and brief the external jury member.
Teacher-Mentor	Facilitator & Guide	• Facilitate Learning: Ask probing questions to stimulate critical thinking without giving direct answers. • Provide Feedback: Offer constructive critique on draft proposals and presentations. • Monitor Progress: Check in with teams to ensure they are on track and working well together. • Ensure Safety: Supervise all practical work and enforce school safety protocols.
External Jury Member	Expert Evaluator	• Evaluate Objectively: Assess proposals and presentations based on the official rubric.

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Role	Primary Function	Key Responsibilities
		• Provide Insight: Offer professional perspective on feasibility, innovation, and real-world application during Q&A. • Deliberate Fairly: Collaborate with other jurors to select the winning team based on merit. • Inspire: Serve as a role model for STEAM careers.
Community Audience	Stakeholder & Supporter	• Attend: Be present at the Local Challenge Day to validate student work and show community support. • Engage: Listen to presentations, visit team booths, and ask questions. • Support (Optional): Local businesses may sponsor prizes or donate materials.

5. Data Collection: How to Gather and Analyze Energy Data

Welcome, Energy Detectives! Your mission is to investigate how much energy a device uses and prove how your brilliant solar solution will make things better. The best part? You'll use the same simple detective steps for any project you choose!

A. Your Detective Mission: Gather the Clues

Every great investigation starts with clues. Your first two clues are the most important.

Clue #1: Find the Power Number (The "Wattage")

- **What to do:** Become a detective! Look for a sticker or stamp on the device you want to power (like a light bulb, fan, or phone charger). Find the number followed by a **"W"**. This is its **Wattage** – how much power it uses every second it's on.

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- **Case File Examples:**
    - **Case: The Old Light Bulb.** Evidence: 60W
    - **Case: The Phone Charger.** Evidence: 5W
    - **Case: The Desk Fan.** Evidence: 20W

Clue #2: Time How Long It's Used (The "Hours")

- **What to do:** For one typical day, become a spy! Notice or guess how many **HOURS** the device is turned on. A timer or a simple logbook can help.
- **Case File Examples:**
    - **Case: The Garden Light.** On from 8pm to 6am = 10 hours
    - **Case: The Phone.** Takes 2 hours to get a full charge
    - **Case: The Fan.** Runs for 4 hours on a hot afternoon

Do the Detective Math: Find the Energy (The "Watt-hours")

- **The Magic Formula:** Wattage (W) x Hours (h) = Watt-hours (Wh)
- **This is your case-breaking number!** It tells you the total energy the device uses in one day.
- **Crack the Case:** A 10W garden light on for 10 hours uses 10W x 10h =100 Watt-hours of energy.

B. Become a Data Scientist: Analyze Your Clues

Now, let's discover what your clues mean for your school and the planet!

1. Calculate Money Saved

- **Find the Cost:** Ask your teacher for the school's cost of electricity. It will look like €0.20 per kWh. *(Remember: 1 kiloWatt-hour (kWh) = 1000 Watt-hours (Wh). It's just a bigger unit, like kilometers and meters!)*
- **Do the Math:**
    1. **Convert to kWh:** Turn your **Daily Watt-hours** into **kWh** by dividing by 1000.
        - 100 Wh / 1000 = 0.1 kWh
    2. **Find Daily Savings:** Multiply your daily kWh by the cost.
        - 0.1 kWh x €0.20 = €0.02 (That's 2 cents saved per day!)
    3. **Find Yearly Savings:** Multiply by 365 days!
        - €0.02 x 365 =€7.30 saved **per year** for just one light!

2. Calculate CO2 Saved (Become a Climate Hero!)

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- **Find the Magic Number:** Ask your teacher for your country's **"CO2 emission factor."** This tells you how much pollution is created to make 1 kWh of electricity. (A great estimate is 0.300 kg of CO2 per kWh).
- **Do the Math:**
  1. Use your daily energy in **kWh** (from above: 0.1 kWh).
  2. **Find Daily Pollution Saved:** Multiply by the magic number.
     - 0.1 kWh x 0.300 kg = 0.03 kg of CO2 saved per day.
  3. **Find Yearly Impact:** Multiply by 365 days!
     - 0.03 kg x 365 =10.95 kg of CO2 saved **per year**!
- **What does that mean?** Saving 11 kg of CO2 is like **planting a tree**! · Your project makes a real difference!

C. The Big Comparison: Prove Your Solution Rocks!

This is where you present your evidence. Create a simple "Before and After" table to show your amazing results.

SUMMARY: Follow these steps to become an Energy Detective! This guide works for any project you choose.

Step	What to Do (Your Mission)	How to Do It (Detective Work)	Example for a 10W Light
1	Find the Wattage	Look for a number followed by **"W"** on the device. This is its power.	10W
2	Time the Hours	Figure out how many **hours per day** the device is used.	**10 hours** (8pm – 6am)
3	Calculate Daily Energy	**Multiply:** Wattage x Hours **Formula:** `W x h = Wh`	`10W x 10h = 100 Wh`
4	Convert to kWh	**Divide** your Watt-hours by 1000. (1 kWh = 1000 Wh)	`100 Wh / 1000 = 0.1 kWh`
5	Find Electricity Cost	Ask your teacher for the cost. It looks like **€0.20 per kWh**.	**€0.20 / kWh**
6	Calculate Yearly Cost	**Multiply:** Daily kWh x Cost x 365 days `Step 4 x Step 5 x 365`	`0.1 kWh x €0.20 x 365 = €7.30`

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Step	What to Do (Your Mission)	How to Do It (Detective Work)	Example for a 10W Light
7	Find CO2 Factor	Ask your teacher for this number. A good guess is **0.300 kg CO2/kWh**.	**0.300 kg CO2 / kWh**
8	Calculate Yearly CO2	**Multiply:** Daily kWh x CO2 Factor x 365 days `Step 4 x Step 7 x 365`	`0.1 kWh x 0.300 kg x 365 = 10.95 kg`
9	Show Your Results!	Make a table to compare the **Old Way** vs. **Your Solar Solution**.	See table below

The Big Comparison: Your Results!

The Old Way	Our Solar Solution	Why It's Awesome
Energy Used per Day	100 Watt-hours	0 Watt-hours
Cost per Year	€7.30	€0
CO2 Pollution per Year	10.95 kg	0 kg

Your Detective's Notebook: Remember, the process is always the same! Just change the device you are investigating. Your solar solution will always turn those big, scary numbers for cost and pollution into powerful, beautiful **ZEROS**.

6. Evaluation: Criteria for Measuring Success

The evaluation of project proposals will be conducted by a jury against a standardized rubric. The purpose of this assessment is to ensure a fair, transparent, and objective selection process based on predefined criteria of excellence.

Proposals will be scored on five key criteria, which are designed to assess the project's innovation, academic rigor, analytical depth, practical potential, and quality of communication.

6.1 Official Evaluation Rubric

The following rubric outlines the specific benchmarks for performance at each scoring level across the five core criteria.

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Criteria	4 Points (Excellent!)	3 Points (Good)	2 Points (Getting There)	1 Point (Not Yet)	Your Score
1. Creativity & Innovation (The "Wow!" Factor)	The solution is highly original and solves the problem in a surprising, clever, or brand-new way.	The solution is a smart improvement on an existing idea and shows creative thinking.	The solution is a simple copy of a common idea but is applied correctly.	The solution is unclear or does not address the problem in a new way.	/4
2. STEAM Integration (The "Teamwork" Factor)	All 5 STEAM roles are clearly used. The proposal explains each member's specific contribution perfectly.	4–5 STEAM roles are used well, but the connection for 1–2 roles is a little weak.	Only 2–3 STEAM subjects are clearly used in the solution.	It is unclear how STEAM was used. The project seems to use only one subject.	/4
3. Data & Analysis (The "Detective" Factor)	All calculations (Energy, Cost, CO_2) are correct, easy to follow, and clearly presented in a table.	Calculations are mostly correct but may have one small error. The presentation is good.	Calculations were attempted but contain several errors. The results are hard to understand.	Data is missing, incorrect, or not used to support the solution.	/4
4. Feasibility & Impact (The "Can It Work?" Factor)	The solution is realistic, affordable, and would make a big positive impact on the school/community.	The solution is realistic and would make a good impact, but the cost might be a little high.	The solution is creative but may be too expensive, complex, or would only make a small impact.	The solution is not realistic or would not work in the real world.	/4
5. Clarity & Presentation (The "Storytelling" Factor)	The 5-minute pitch is engaging, confident, and easy to understand. Posters/models are professional and helpful.	The pitch is clear and covers all main points. The visuals are good but could be neater.	The presentation is unclear or rushed. The visuals are messy or don't help explain the idea.	It is very difficult to understand the solution from the pitch and visuals.	/4
Total Score:					**/20**

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What Your Total Score Means:

- **18-20 Points: Solar Superstar!** Your project is outstanding in every way. You are ready to compete internationally!
- **14-17 Points: Bright Innovator!** Your project is strong and well-thought-out. You have a great solution.
- **10-13 Points: Rising Sun!** You have a good foundation. With a little more work, your project could shine even brighter.
- **<10 Points: Future Engineer!** You've started your journey! Use the feedback from the judges to learn and improve your idea for next time.

Remember: The goal is to learn and have fun! Even if you don't get a perfect score, you've already succeeded by becoming an Energy Detective and creating a solution for a better planet.

8. Collaboration: Opportunities to Work with Local Organizations

Forging partnerships with local organizations is a cornerstone of this challenge, designed to bridge the gap between theoretical learning and real-world application. These collaborations provide students with authentic contexts, expert guidance, and a broader perspective on the impact of their work.

8.1. Proposed Partner Organizations and Their Roles:

Organization Type	Potential Role in the Challenge	Benefits to Students
Local Energy Companies & Utilities	• Provide expert jurors for the Local Challenge Day. • Offer site visits to solar farms or energy facilities. • Share real-world data on energy costs and grid emission factors. • Potentially donate or loan equipment for prototyping.	Access to professional expertise, authentic data, and an understanding of the energy sector.
Environmental NGOs & Advocacy Groups	• Act as guest speakers on topics of climate change and sustainability. • Help publicize the	Connects project work to broader environmental goals and civic engagement.

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Organization Type	Potential Role in the Challenge	Benefits to Students
	challenge and its outcomes within the community. • Provide context on the local environmental impact of energy choices.	
Local Government (Municipality / City Council)	• Provide endorsements and official support. • Offer experts from urban planning or sustainability departments as jurors or mentors. • Identify community energy needs that students could address.	Demonstrates the role of public policy in sustainability and provides a pathway for student ideas to be heard by decision-makers.
University Engineering & Science Departments	• Provide student or professor mentors for teams. • Offer access to labs or specialized equipment for advanced testing. • Host the Local Challenge Day on a university campus.	Inspires students toward STEM higher education and provides access to advanced academic resources.
Local Businesses (Hardware Stores, Tech Companies)	• Provide in-kind donations of materials for prototypes (wiring, sensors, tools). • Offer sponsorships for small prizes or event refreshments.	Connects learning to the local economy and demonstrates community support for education.

8.2. Guidelines for Collaboration

Successful collaboration with local organizations requires a structured and professional approach. The School Coordinator holds primary responsibility for initiating and managing these partnerships. This process should begin with a formal letter of invitation addressed to the potential partner organization, which clearly outlines the vision of the Solar Energy Challenge, the specific role being proposed for them, and the anticipated benefits of participation. It is critical to establish a clear memorandum of understanding, whether verbal or written, that mutually defines the roles, responsibilities, and expected time commitment from the outset. This ensures alignment and prevents misunderstandings. Schools are encouraged to leverage existing networks, including those of parents and teachers, to identify and connect with relevant local entities. Finally, to foster long-term relationships, all partner organizations must be formally recognized and thanked in all challenge-related communications, presentations, and materials, acknowledging their valuable contribution to the educational experience.

9. Feedback: Methods for Gathering Feedback and Improving the Challenge

A structured feedback mechanism is essential for the continuous improvement and sustainability of the Solar Energy Challenge. The following multi-tiered approach ensures insights are gathered from all participants and stakeholders.

9.1. Feedback Collection Methods

Method	Target Group	Timing	Purpose
Post-Challenge Survey	All participating students and teachers.	Immediately following the Local Challenge Day.	To gather quantitative and qualitative data on the overall experience, perceived learning outcomes, and enjoyment.
Structured Debrief Meeting	School Coordinators, Teacher-Mentors, and Local Jury members.	Within one week of the Local Challenge Day.	To conduct a qualitative review of the process, logistics, evaluation rubric, and identify strengths and areas for improvement.

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Method	Target Group	Timing	Purpose
Focus Group	A select, representative sample of student participants.	Within two weeks of the Local Challenge Day.	To gain in-depth insights into the student experience, team dynamics, and motivational factors.
Partner Feedback Form	All external partners and jurors.	Sent via email after the event.	To gauge the partner's experience and gather suggestions for enhancing future collaboration.

9.2. Key Areas for Feedback Inquiry

Surveys and discussions should be designed to gather feedback on the following specific areas:

- **Clarity of Guidelines:** Were the instructions and timeline clear?
- **Adequacy of Resources:** Did teams have access to the necessary information and materials?
- **Fairness of Evaluation:** Was the judging rubric perceived as fair and understandable?
- **Quality of Support:** Was the mentorship from teachers adequate and effective?
- **Logistics of Event:** Was the Local Challenge Day well-organized and engaging?
- **Overall Impact:** What was the most valuable thing learned? What was the biggest challenge?

9.3. Feedback Implementation Process

1. **Analysis:** The School Coordinator, in conjunction with project leadership (RTU/IDDA), will compile and analyze all feedback data after the conclusion of the challenge cycle.
2. **Reporting:** A brief internal report will be generated summarizing key findings, successes, and recommended actions for improvement.
3. **Iteration:** The report will be used to formally revise and update the challenge guidelines, schedule, and rubric for the following year's iteration.
4. **Communication:** A summary of changes made based on feedback will be shared with all participating schools and partners to demonstrate a commitment to continuous improvement.

Conclusion

The #Solar4Future+ Solar Energy Challenge provides a comprehensive and structured framework for empowering students to become the innovative problem-solvers and sustainability leaders of tomorrow. This guideline has been designed to transform theoretical knowledge into tangible action, guiding participants through every critical phase—from initial research and data analysis to collaboration, presentation, and evaluation.

By adhering to this process, students will not only develop a deep, practical understanding of renewable energy and STEAM principles but also gain invaluable skills in critical thinking, teamwork, and communication. The challenge is more than a competition; it is an authentic learning journey that connects classroom learning to real-world community impact.

We encourage all participants—students, teachers, and community partners—to embrace this opportunity with creativity and enthusiasm. The ultimate success of this initiative lies in the collaboration, curiosity, and commitment of everyone involved. Together, we can ignite a passion for sustainability, demonstrate the power of clean energy, and take meaningful steps toward a brighter, greener future for all.

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