

Solar Decathlon India

Competition Guide

Version 1.0

2024-25



Solar[™]
Decathlon
India



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INDIAN INSTITUTE FOR
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1. Introduction

This is a guidance document for the participants of the Solar Decathlon India (SDI) 2024-25 Net Zero Building Challenge. It contains information about the competition divisions, ten contests, resources made available to the participating teams, requirements, and rules for this year's challenge.

SDI invites post-graduate and undergraduate students from Indian institutions to join forces to combat climate change. This is an opportunity for student teams to develop innovative and climate-resilient building solutions, contributing to solving real projects and real problems, and by partnering with industry leaders and professionals. SDI helps students stay a step ahead and introduce innovative, affordable, and market-ready solutions that enable a clean energy transition. This is the resilient and carbon-neutral way forward for sustainable buildings and communities in India. SDI is conducted by the Indian Institute for Human Settlements (IIHS) and the Alliance for an Energy Efficient Economy (AEEE) under the aegis of the Indo-US Science and Technology Forum (IUSSTF).

India is the third-largest carbon emitter, accounting for 7% of global emissions in 2020. Summer temperatures in many cities cross 40°C, and extreme weather events leave large sections of the population vulnerable to climate change risks. Urbanisation and economic growth will lead to 70% more building stock by 2050. India's Nationally Determined Contribution under the Paris Agreement for up to 2030 target a 45% reduction in carbon emissions. Climate resilient net-zero energy buildings (NZEB) are the way forward. To that end, SDI focuses on creating capacity amongst students and creating partnerships with the industry.

SDI provides the platform and resources necessary for students to learn and design net-zero buildings and contribute to a sustainable future. They get hands-on experience in developing solutions for real buildings and learning product innovation.

2. The Challenge

Teams can choose to compete in any one of the Divisions in the 2024-25 challenge. The 2024-25 Challenge includes 5 Building Divisions and 1 Product Division. The Building Divisions are challenges to design an entire building for a building owner or a developer who acts as a Project Partner. The Product Division is a challenge to design, develop, and test a working prototype as a product solution, with a product, material, or equipment manufacturer acting as an Industry Partner.



Figure 1: Competition Divisions in SDI 2024-25

2.1 Tasks

- Read this Competition Guide thoroughly.
- Form a team (Refer [Section 4.6](#) for Building Division and [Section 5.2](#) for Product Division).
- Register your team.
- Identify a Project Partner/ Industry Partner.
- Ensure that all team members complete all mandatory online learning modules.
- Study the resources provided by SDI.
- Identify additional partnerships for the areas of the competition that need collaboration.
- Check your emails for regular updates and announcements. Consult the [SDI website](#) and the [FAQ](#) page for more information.
- Design and document your work, in compliance with the requirements listed in this guide, and its subsequent updates.
- Submit all Deliverables before the deadlines.

2.2 Registration and Fees

Team Leads will register their teams on the portal which can be accessed through the SDI website. The registration fee for the 2024-25 Challenge is **INR 7,500** (inclusive all taxes) per team, which is non-refundable.

2.3 Benefits

- Alumni:** Students from teams who submit Deliverable 3 become Alumni of Solar Decathlon India. The SDI Alumni Group on LinkedIn frequently lists job openings and other opportunities.
- Career development:** As part of SDI, students gain real-world industry experience while working alongside project partners and implementing their ideas on live projects. The benefits of this are far-reaching and include developing industry connections, gaining exposure to multiple technologies, and coaching by mentors.
- Career fair:** SDI conducts a career fair at the Finals event, which gives students from finalist teams access to organisations leading the work on climate action.

- d) **Trophies, cash prizes:** The winning teams in each competition division (i.e., Divisional Winners and Runner-up) receive cash prizes, trophies, and recognition.¹ Only winners of Grand Jury, Best Movie, and People’s Choice for Movie receive cash prize, trophies and recognition.
- e) **Certificates:** Team members who complete the Self Learning Modules receive a completion certificate. Students from teams who submit Deliverable 3 will receive participation certificate.

¹ The relevant Faculty Lead is responsible for distributing any cash prizes. The competition organisers are not responsible once the funds are disbursed to the team. The competition organisers only ask for details for transferring the funds, which must be signed off by the Faculty Lead. Participation does not guarantee any compensation or award.

3. Schedule

Stage 1 of the competition formally begins on 01 September 2024. However, teams that register earlier are welcome to start working before that. Similarly, Stage 2 of the competition formally begins in January 2025. However, teams are encouraged to start working on Stage 2 in December, soon after submitting Deliverable 2.

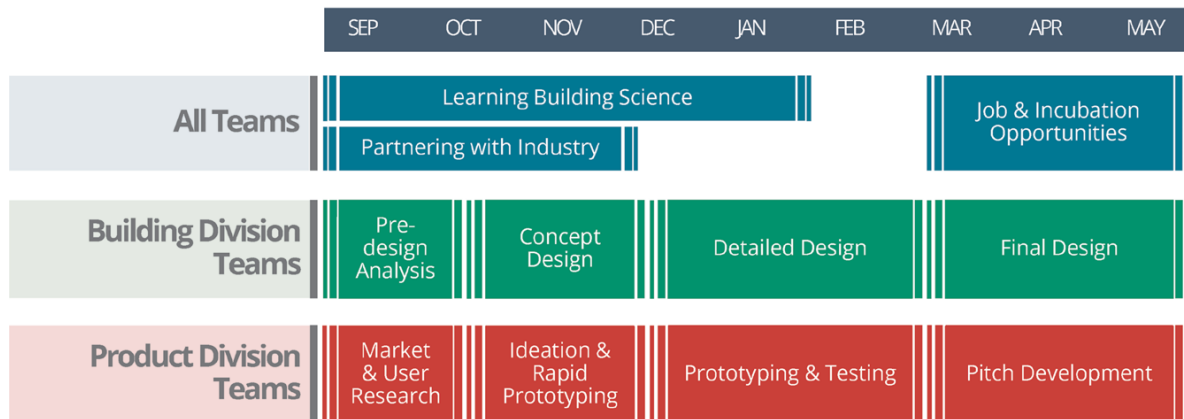


Figure 2: Solar Decathlon India 2024-25 Schedule

3.1 Deliverables and Milestones²

- Registration closes at 5 pm on 31 August 2024.
- Team name to be finalised by 16 September 2024.
- Division and Project Partner to be finalised by 16 September 2024.³
- Deliverable 1: Due by 5 pm on 8 October 2024.
- Deliverable 2: Due by 5 pm on 26 November 2024.
- Team composition finalisation (addition or removal of team member) by 5 pm on 10 January 2025.*
- Self-learning Modules to be completed by 5 pm on 10 January 2025.*
- Deliverable 3: Due by 5 pm on 25 February 2025.
- Deliverable 4: Final Design Report: Due by 5 pm on 21 April 2025.
- Movie: Due by 5 pm on 8 May 2025.
- Division Jury Presentation slides: Due by 5 pm on 19 May 2025.
- Grand Jury Presentation slides: Due by 5 pm on 19 May 2025.
- Posters: Due by 5 pm on 19 May 2025.

**Note: All team members who do not finish the SLMs before the deadline will be removed from the team. Teams with less than 5 or more than 15 members will be disqualified.*

3.2 Events and Other Milestones

- Faculty Development Programme for Faculty Leads and Faculty Advisors:** 19-21 September 2024.
- Finalists' Announcement:** The finalists' teams of the 2024-25 Challenge will be declared on 12 March 2025. Faculty Leads and Team Leads of all the Finalists' team will be informed via email.

² All times are in IST.

³ Only applicable to the Building Divisions.

- c) **SDI Finals⁴**: The selected teams (Finalists) will present their work during the SDI Finals on 23-25 May 2025. Details of the event will be shared with Faculty Leads and Team Leads closer to the event.
- d) **Grand Jury**: Division Winners will present their work in a 5-minute pitch to the Grand Jury on 24 May 2025. Division Winners will be announced on the morning of 24 May 2025.

⁴ Format and nature of these events are subject to change due to the government regulations or events beyond our control.

4. Building Divisions

There are 5 Building Divisions in the 2024-25 challenge. Teams can choose to compete in any one of the following divisions in 2024-25 challenge. Projects should comply with the byelaws, codes, and standards governing regulations such as ground coverage, setbacks, minimum room size, fire protection requirements, service locations and quantities, and other specific requirements.

4.1 Multi-Family Housing (MFY)

Multi-Family Housing is projected to experience exponential growth over the next 20 years. At 24%, housing is the second largest electricity consuming sector in India. Affordable and mid-range housing will lead demand, supported by government policy. The need for cooling and energy will rise multi-folds in next few decades. Net-zero and resilient building innovations are needed for sustainable growth of this sector. This can also contribute to the Sustainable Development Goals (SDGs). This Division can impact millions of people by giving them access to affordable homes, with clean and reliable energy, making a positive impact on their health and well-being.

Multi-Family Housing is defined as:

- ‘Residential buildings’ that are built on a plot area $\geq 500 \text{ m}^2$, OR
- The residential part of a ‘mixed land-use development project’, built on a plot area of $\geq 500 \text{ m}^2$.

Projects can range from affordable housing to high-end housing, with the following requirements:

- a) Minimum carpet area of 21 m^2 per dwelling unit.
- b) Minimum of eight attached dwelling units. No maximum plot size.
- c) For mixed-use projects, at least 70% of the occupiable area of the building must be used for dwelling units. Do not include parking areas to determine if the building programme meets the 70% threshold.
- d) The design should be able to maintain temperatures as per the thermal comfort standard and indoor air quality in all bedrooms, living rooms and kitchens during occupied hours. You must provide active cooling if passive cooling strategies are not adequate to maintain thermal comfort.
- e) If the Project Partner’s programme requires additional community services, teams may limit their energy and water performance calculations to residential dwelling units only.
- f) Disability access should be provided.

4.2 Educational Building (EDU)

Access to clean water, education, and infrastructure for children has been a challenge, where millions of children lack resources. Many classrooms in India are not able to provide the minimum level of thermal comfort, visual comfort, and clean air. When provided, the cost of construction and operation is high, resulting in high fees. Net-zero-energy-water educational buildings should ensure these at low CAPEX and OPEX and provide a resilient infrastructure for transitioning to the National Education Policy of 2020.

An educational building may range from primary schools and high schools to college buildings, with the following requirements:

- a) Total occupancy between 300 to 3,000 students; and 20 to 65 students per classroom.
- b) At least 50% of the building programme should be dedicated to teaching activities. Teaching activity areas include classrooms, labs, music/arts/crafts rooms, etc. Do not include parking areas to determine if the building programme meets the 50% threshold.
- c) Plot size: no minimum or maximum requirement.

- d) The design should maintain temperatures as per the thermal comfort standard and indoor air quality in all occupied areas during occupied hours. You must provide active cooling if passive cooling strategies are not adequate to maintain thermal comfort.
- e) Disability access should be provided.

4.3 Office Building (OFF)

Commercial buildings have been one of the fastest growing real estate sectors. During 2019, the office leasing space reached 6 million m² across eight major cities of India, registering a growth of 27% year-on-year. This building type consumed 8.4% of the total electricity in 2018-19. Accepted as an attractive destination for IT and BPO services and estimated to contribute 13% to the GDP by 2025, the sector will increase greenhouse gas emissions. Net-zero-energy office buildings can surpass the minimum requirement of the Energy Conservation Building Code (ECBC) and dramatically reduce the energy consumption and carbon footprint while contributing to country's National Action Plan for Climate Change (NAPCC).

An office building is defined as a complete commercial facility or a government and semi-government office complex with full fit and finish for the defined client(s), including support functions such as mechanical and electrical spaces, circulation, vertical transportation, and toilets. Projects can range from a single tenant/user office building to co-working offices in the building to several tenant/users' offices in the building, with the following requirements:

- a) Building footprint (built-up area): at least 1,000 m², and gross area of 10-30 m² per person.
- b) At least 70% of the building programme should be dedicated to office spaces. Do not include parking areas to determine if the building programme meets the 70% threshold.
- c) Plot size: no minimum or maximum requirement.
- d) Lobbies, conference rooms, meeting rooms, training rooms, breakout areas, reprographics/ break out areas/ cafeteria, and toilets should be included as appropriate.
- e) The design should be able to meet the thermal comfort standard and indoor air quality in all occupied areas during occupied hours. You must provide active cooling if passive cooling strategies are not adequate to maintain thermal comfort.
- f) Disability access should be provided.

If the Project Partner's programme requires additional data centres, retail/shopping facilities, teams may limit their energy and water performance calculations to the office block.

4.4 Community Resilience Shelter (CRS)

Community Resilience Shelters are used for emergency evacuation during extreme weather events like cyclones, floods, and earthquakes. They may be used to shelter disaster-affected people for short periods. Such a building should also house community service activities such as education, health training, and other income-generating social functions. Net-zero-energy-water solutions for these buildings makes them more resilient.

They could also serve as isolation centres at the community level during pandemics/ health crises such as COVID-19. We encourage teams to contact the State Disaster Management Authorities, local municipalities, or local development authorities to learn about planned and future projects.

Community Resilience Shelters are managed and owned by the communities in the long term, although they may be built by the government. These multipurpose shelters may ultimately become a 'community asset/resource' and create a broader impact on the livelihood of the community.

For this Division, teams may select projects to meet the following requirements:

- a) The shelter should be proposed after exploring the existing situation, surrounding environment, access to settlements (especially the most vulnerable), their workplaces, education facilities, health facilities, and markets.
- b) If you propose a different building use for the shelter during normal periods of operation, you must ensure that during times of extreme events, the building will function as a shelter to provide emergency response and accommodate people who have been evacuated. You are required to show how your building can be transformed, including furniture, room sizes, circulation pathways, to provide shelter services during such times.
- c) A site with sufficiently wide access that can be developed into an approach road. There is no minimum plot area required. Disability access must be considered.
- d) The approach road and the shelter should not be affected by the disaster. That is, they should also be structurally safe to survive the ensuing disaster. Teams are expected to identify disasters and extreme weather events to respond to, and design to mitigate those.
- e) The shelter should have services like lighting, ventilation, communications, food, water, and sanitation, even at the time of a disaster.
- f) Minimum amenities required are toilets, drinking water supply, storage for valuables, and emergency food and cooking supplies.
- g) Social conditions must be addressed including separate spaces for different genders (alternatively, families with young children).
- h) Barrier-free access must be considered especially for people from different religions, castes, languages backgrounds, genders, age groups, and abilities. There may also be a need to shelter pets, cattle, or other animals.
- i) The minimum built-up area should be 200 m² or the ability to provide shelter for 200 persons. If the project brief or the community needs justify a smaller built-up area or lower occupancy, teams should clearly document the rationale in their project reports.
- j) Shelter rooms should be planned for at least 1 m² per person. Note that disabled people may require more space. Provide at least 1 toilet per 40 people in the shelter, with freshwater supply and appropriate wastewater treatment.
- k) The shelter should be able to operate during a 'lockdown period' of 60 hours.
- l) The shelter should serve as a community usable space during non-disaster, extreme event times. This will require an assessment of community needs.
- m) As a net-zero-energy and net-zero-water facility, the shelter can be grid-connected during normal times and should function off-grid during disaster events.
- n) The design should maintain temperatures as per the thermal comfort standard in all the occupied areas during occupied hours. You must provide active cooling if passive cooling strategies are not adequate to maintain thermal comfort.
- o) Disability access should be provided at least for the ground/ lowest floor.

4.5 Construction Worker Housing (CWH)

Typically, construction workers are migrants and stay on site anywhere between 3 months to 3 years in poorly constructed temporary shelters, without proper hygiene or comfort. These temporary shelters do not have stable electric supply and workers burn fossil fuels for cooking and heating. Meanwhile we expect large amounts of construction to take place in the next 3 decades.

All this warrants an approach to housing for construction workers to provide hygiene and thermal comfort. This Division will focus on solutions that are modular, movable, and eliminate waste. They will be developed to be resilient, net-zero-energy and net-zero-water. Teams will develop the building program in consultation with their Project Partner and comply with the Building and Other Construction Workers (Regulation of

Employment and Conditions of Service) Act, 1996. Teams can also refer to the guidance note - “Workers’ accommodation: processes and standards” by International Finance Corporation (IFC) and European Bank for Reconstruction and Development (EBRD).

For this Division, the following requirements apply:

- a) Plot Size: no minimum or maximum requirement. However, the design should be demonstrated on an ongoing or proposed construction site with a vehicular approach road. In addition, the design should be adaptable to other sites.
- b) The entire facility, including the structure, renewable energy system, water, and waste processing, should be modular, scalable, dismantlable, transportable and reusable. The dismantling and relocation should result in zero construction waste on site. The ease and speed of assembly and disassembly should be an important consideration.
- c) The modular approach should ensure that the designs are developed to accommodate a range of sizes for the workers’ community, from as low as 30 workers to larger than 300.
- d) The modular design needs to include the possibility of small families and shared spaces for groups.
- e) All units should have adequate lighting, ventilation with minimum floor space of 5m² per occupant.
- f) Separate bathing, toilets, clothes washing areas for men and women, need to be provided. Provide at least one toilet for every ten persons, or as per the local byelaws.
- g) In addition, provide community facilities such as common kitchens with renewable fuels and childcare areas as appropriate.
- h) Social conditions must be addressed including separate spaces for single males and single females. Barrier-free access must be considered especially for people from different religions, castes, languages, gender, age, and ability.
- i) The design should be developed to maintain indoor temperatures as per the thermal comfort standard for occupied hours in sleeping areas. You must provide active cooling if passive cooling strategies are not adequate to maintain thermal comfort.

4.6 Forming a Team

4.6.1 Institution and Student Qualification

Post-graduate and undergraduate students from any Indian educational institution may form a team. Students from multiple colleges can collaborate to form a team. For better results, you are encouraged to include students from multiple disciplines such as architecture, building science, engineering (civil, mechanical, electrical), management, social sciences, marketing, communications, finance, product design, business, and others. A team can have a minimum of 5 and a maximum of 15 students. Each team must have a student Team Lead and a Faculty Lead.

4.6.2 Faculty Lead and Faculty Advisors

The Faculty Lead, along with the Team Lead, is responsible for communicating competition details from the SDI organisers to the team members. A team may have other faculty members as Faculty Advisors, but the Faculty Lead will serve as the primary contact and undertake the responsibility for students completing the online training modules. If multiple institutions are collaborating to form a team, it is recommended to have at least one Faculty Advisor from each institution. Faculty Leads and Advisors should review their team’s work before it is submitted to SDI.

4.6.3 Project Partner

Each team must partner with a building owner or real estate developer, whose project they will work on. The team should collect information about the project site, project brief, any financial and other constraints, to make the project as realistic as possible. Teams may also benefit from providing regular updates to their Project Partner and taking their feedback.

4.6.4 Industry Partners

Teams are encouraged to seek out Industry Partners to work towards market-ready solutions using the latest technologies. Industry partners can also help with factors like affordability, constructability, and innovation. Teams are also encouraged to partner with industry professionals such as architects, engineers, service providers, manufacturers, energy-efficiency experts, and local authorities, in areas like building codes, construction, material, HVAC systems, lighting systems, and financing. These partners can help with the decision-making and review the work.

4.7 Ten Contests for the Building Divisions

The ten contests of the Building Divisions cover diverse areas that embody the expectations of high performance, market-ready, climate resilient, and net-zero building projects. Teams must address all ten contests in their proposed designs.

Note: The requirements for each contest will be included in a subsequent version of this guide.

4.7.1 Architectural Design

This contest evaluates the architectural design for its creativity, integration of systems, and ability to deliver functionality and aesthetic appeal desired by the market or client. Cutting-edge energy-efficient building performance is better positioned to achieve market acceptance when integrated into architectural designs that meet the aesthetic, functional, and operational expectations of the industry and consumers. Teams are required to bring together aesthetics with sound building science, performance, comfort, affordability, and resilience.

4.7.2 Engineering and Operations

This contest evaluates the effective integration of high-performance engineering systems and understanding of building operation. Right-sizing and design of engineering systems help minimise waste of materials, equipment, and energy. Building systems, appliances, and features should be thoughtfully selected and integrated into the overall design. Structural engineering systems should be effectively integrated with architectural and other engineering systems. An intelligent approach to automation and adaptive control by occupants needs to be considered. Operations and maintenance (O&M) considerations should be developed into an O&M plan for the building.

4.7.3 Collaborative Innovation

This contest evaluates the team's collaboration and integration of innovation in design solutions. Teams should be varied and multidisciplinary, aiming for solutions that surpass typical practices. These collaborative innovations should enhance the performance of the building in the other SDI contests, or provide other benefits to the users, investors, or other stakeholders in the project. Teams will be evaluated for their multidisciplinary composition, industry partnerships, and integration of innovative industry products to enhance performance. New products, technologies, software, and methods should be researched, and appropriate ones should be integrated into the design.

4.7.4 Health and Wellbeing

This contest evaluates the building's capability to provide thermal comfort and good indoor environmental quality, essential for ensuring occupant health and wellbeing. Teams can choose an adaptive thermal comfort model appropriate for their project and design the building to maintain that level of comfort. Passive design approaches can maximise annual comfort hours without the need for air-conditioning equipment. *Teams must provide active cooling* if passive cooling strategies are not adequate to maintain thermal comfort. Teams should provide fresh air ventilation as recommended by the National Building Code of India. This will include a comprehensive approach to indoor air quality that incorporates ventilation, filtration, dilution, and material selection strategies.

4.7.5 Energy Performance

This contest evaluates net-zero building design as a super-efficient building that generates renewable energy on site. In a net-zero energy building, the total renewable energy generated annually on site should be equal to or more than the total annual energy consumption of the building. The capability of the building systems to interact with the electricity grid, with on-site or stored power is also important. A whole building approach to performance is needed, including strategies to reduce heating and cooling loads, integration of daylighting and passive systems, efficient electric lights, and appliances, as well as low-energy and efficient cooling systems. Building energy modelling and simulations should inform design decisions.

4.7.6 Water Performance

This contest evaluates a net-zero water building in terms of the design and management of on-site water resources towards a fully water-sufficient development. In a net-zero water building, the total water consumption is equal to or less than the sum of harvested rainwater used, recycled water used, and the treated wastewater returned to a source available to the public. Strategies for reducing water consumption and techniques for on-site water recycling and reuse need to be implemented. Different water end-uses require different levels of water quality, and customisation of filtration and treatment systems based on end-use should be considered. The water-cycle design should be supported by detailed water calculations.

4.7.7 Embodied Carbon

This contest evaluates the design for the use of building materials and construction technologies that reduce embodied carbon emissions, which is essential for net-zero global emissions. This contest includes embodied carbon emissions that result from the burning of fossil fuels in the mining, extraction, processing, manufacture, and transportation of building materials delivered to the building site. Teams should incorporate strategies to reduce embodied carbon in five building systems: roofs, walls, floors, structure, and fenestration. Furniture, furnishing, finishes, landscape, and sitework are not included in this contest. Research and incorporate building materials that reduce, eliminate, or trap carbon. Teams should demonstrate through calculations, the reduction of carbon emissions in their design compared to a baseline.

4.7.8 Resilience

This contest evaluates the building's ability to adapt to changing environmental conditions and the ability to maintain functionality in the face of stress or disturbance. Incorporate strategies that provide resilience against seismic, hydrometeorological as well as public health hazards. Teams should aim for reducing risks by reducing exposure to hazards, vulnerability, and increasing preparedness. These approaches should provide resilience during an event, after the event, and result in long-term resilience. Onsite energy generation, water treatment and storage, providing comfort with passive design can minimise disruption of operation. Teams should also consider food security and resilience at a community level.

4.7.9 Affordability

This contest evaluates the building's financial costs for initial investment and ongoing operations. Teams are required to demonstrate rightsizing and optimisation of systems to control the initial cost of high-performance buildings. Design strategies for obtaining economies in construction such as simplifying and integrating building assemblies and using local materials should be considered. Constructability in terms of availability of materials, technologies, and labour should be explained. Teams are encouraged to design the building to shorten the construction time and demonstrate the reduction in cost of financing. Teams are required to look at operations and maintenance for lifecycle costs of high-performance building systems. Teams are encouraged to consider green finance options available to their project.

4.7.10 Value proposition

This contest evaluates the team's ability to convey the value proposition of the proposed solution to the Project Partner and end users of the building. The value proposition must have clear and simple statements that describe and quantify the tangible benefits and describe the intangible benefits. This should enable the

Project Partner to understand why they should invest in the proposed solution, and the end users to understand why they should occupy the building.

4.8 Deliverables for the Building Divisions

This section provides detailed requirements of the Deliverables for the Building Divisions in the 2024-25 Challenge. Teams should submit all Deliverables before the deadline and time, on the online Learning Management System (LMS).

Note: The details of Deliverable 3 and 4 and their outlines for the Building Divisions will be published in the subsequent version of this guide.

Format requirements for reports

For each Deliverable, teams must follow the following format requirements.

1. Page size: Use Standard A4 size (210 mm X 297 mm).
2. Fonts and text size: Use 11-point font for body text (diagrams may have smaller fonts but must be readable). Your text should be left-aligned. You may choose your own font type, but please make sure it is easy to read. Embed the fonts in your PDF file.
3. Margins: Must be minimum of 1 inch on all four sides. However, figures, and images may bleed into the margins.
4. Tables and figures: Please number all tables and figures and provide captions for each. Do not just insert a table or figure. Introduce it in the text and refer to it by its number.
5. File type, size, and page count: See details for each deliverable.

4.8.1 Details for Deliverable 1 for Building Division

This section contains the requirements for Deliverable 1 for the Building Division. Teams must strictly follow the instructions listed in Table 1.

Table 1: Solar Decathlon India Deliverable 1 for Building Division - File Naming Conventions and Deadlines

Deliverable	Required Content	File Name	Deadline
Preliminary Report	Single Bookmarked PDF	D1_[DivisionLetterCode]_(TeamName).pdf For e.g., D1_MFY_TeamName.pdf D1_EDU_TeamName.pdf D1_OFF_TeamName.pdf D1_CRS_TeamName.pdf D1_CWH_TeamName.pdf	1-8 October 2024, 5 pm IST
Project Data Form - 1	Form (accessible through the LMS)	D1_[DivisionLetterCode]_(TeamName)_ProjectData1	1-8 October 2024, 5 pm IST

Note: MFY = Multi-Family Housing; EDU = Educational Building; OFF = Office Building; CRS = Community Resilience Shelter; CWH = Construction Worker Housing

4.8.1.1 Preliminary Report

The Preliminary Report shall have a team summary, approach, description of the project, the design approach, and some preliminary analysis. It should communicate the salient aspects of the team, its approach, and the project. We understand that for the initial submission, the project details could be tentative and may change in the future.

Teams must adhere to the page count and content outline provided below.

Page Count and File Size

1. Maximum page count: Strictly 13 pages, excluding the Cover page and Appendix. Submissions exceeding 13 pages may not be reviewed for feedback.
2. File size: Less than 15 MB.

Content Outline

Please follow this outline in terms of the content, order, and number of pages allowed.

1. **Cover Page (must have the following content at a minimum):**
 - a) Logo of Solar Decathlon India.
 - b) Name of your institution(s).
 - c) Team name.
 - d) Competition Division.
 - e) Deliverable name as 'Preliminary Report – October 2024'.
2. **Team Summary (up to 2 pages):**
 - a) Team name.
 - b) Name of your institution(s).
 - c) Competition Division.
 - d) Team members: Matrix mapping the team members, with the 10 contests, their skills and their educational programs showing a multidisciplinary diversity of the team. Use the format provided in the 'Survival Kit' on the LMS.
 - e) Approach: Description of how you plan to organise the team for working on SDI and the process you intend to follow moving forward in the competition.
 - f) Background of the lead institution, mention degree programmes and coursework relevant to the 10 contests of the Challenge (about 50 words).
 - g) Faculty Lead and Faculty Advisors – Name, designation, relevant bio (not more than 25 words each).
 - h) Names of Industry Partners (if any).
3. **Project Summary (up to 2 pages):**
 - a) Project name: This can be something you have come up with, or something from your Project Partner.
 - b) Project Partner: Name of organisation, background (50-100 words), name and designation of key individuals involved.
 - c) Brief description of project (including but not limited to location, climate zone, status of the project, profile of occupants, hours of operation).
 - d) Site area (m²), permissible built-up area (m²), permissible ground coverage, and proposed (estimated) built-up area (m²), FAR/ FSI.
 - e) Your goal for Energy Performance Index (EPI) in kWh/m² per year for your Net-Zero-energy design.
 - f) Preliminary estimate of on-site renewable energy generation potential, mentioning the amount from each renewable energy source (kWh/year).
 - g) Preliminary construction budget (INR/m²) and timeline (if any) in the format provided inside the 'Survival Kit' on the LMS
 - h) Special requirements of the Project Partner, their goals for the project or constraints (if any).
4. **Summary of Case Studies (up to 2 pages):** Learnings from case studies you think are relevant to your project.

5. **Context Analysis (up to 1 page):**
 - a) Analysis of the context your project sits in. Here you can include social and economic background of the users and the people in the region, identify technologies or materials that are regionally available, and regional environmental issues.
 - b) Analysis of the market. Here you can include your assessment of segment of the population that your solution needs to cater to.
6. **Goals (up to 1 page):** Your team’s goals for the project, including but not limited to the 10 contests. *Refer to guidance on how to write goals for your project inside the ‘Survival Kit’ on the LMS.*
7. **Building Area Programme - (up to 1 page):**
 - a) Summary of site area, landscape area, total built-up area, etc.
 - b) Provide a list of spaces with their areas in m². Classify each space as unconditioned (i.e., will have no active heating or cooling systems), or conditioned (i.e., will have an active heating or cooling system).
8. **Findings from Pre-Design Analysis (up to 4 pages):** A list of your findings from your pre-design analysis, supported by figures or tables. Present your observations and what you intend to carry forward in design.
 - a) Climate analysis.
 - b) Site analysis.
 - c) Preliminary energy and thermal analysis using simple box models.
9. **Appendix:** Letter of Confirmation from Project Partner, using the template provided to you in the LMS.

Feedback Criteria

Feedback will be provided on the following:

- Team composition
- Compliance with the requirements of the Division, and your building program, EPI goal, renewable energy estimate
- Findings from case studies
- Context analysis
- Goals for the project
- Preliminary analysis
- Correctness of calculations

4.8.2 Details for Deliverable 2 for Building Division

This section contains the requirements for **Deliverable 2** for the Building Divisions. Teams must strictly follow the instructions listed in Table 2, below.

Table 2: Solar Decathlon India Deliverable 2 for Building Divisions - File Naming Conventions and Deadlines

Deliverable	Required Content	File Name	Deadline
Pre-design Analysis and Concept Report	Single Bookmarked PDF	D2_[DivisionLetterCode]_(TeamName).pdf e.g., D2_MFY_TeamName.pdf D2_EDU_TeamName.pdf D2_OFF_TeamName.pdf D2_CRS_TeamName.pdf D2_CWH_TeamName.pdf	19-26 November 2024, 5 pm IST
Project Data Form - 2	Form (accessible through the LMS)	D2_[DivisionLetterCode]_(TeamName)_ProjectData2	19-26 November 2024, 5 pm IST

Note: MFY = Multi-Family Housing; EDU = Educational Building; OFF = Office Building; CRS = Community Resilience Shelter; CWH = Construction Worker Housing

4.8.2.1 Predesign Analysis and Concept Report

This is an interim submission to demonstrate the team's progress towards completing the project. Teams must adhere to the page count and content outline provided below.

Page Count and File Size

1. Maximum page count: Strictly 24 pages, excluding the cover page, response to reviewers' comments and appendix. Submissions exceeding 24 pages may not be reviewed for feedback.
2. File size: Less than 30 MB.

Content Outline

Please follow this outline in terms of the content, order, and number of pages allowed.

1. **Cover Page**, which must have the following content at least:
 - a) Logo of Solar Decathlon India.
 - b) Name of your institution(s).
 - c) Team name.
 - d) Competition Division.
 - e) Deliverable name as 'Predesign Analysis and Concept Report – November 2024'.
2. **Table of Contents**
3. **List of Tables**
4. **List of Figures**
5. **Response to reviewers' comments⁵**
 - a) Provide reviewers' comments to your Deliverable 1 and your response to each comment mentioning any actions you have taken.

Note: Teams that do not submit the response to reviewers' comments will not get review comments for ANY subsequent Deliverables. Refer to the template and example for "Response to reviewers' comments" inside the 'Survival Kit' in 'Resources and Forums' on the LMS.

6. **Team Summary (up to 2 pages, revised from Deliverable 1 as needed):**
 - a) Team name.
 - b) Name of your institution(s).
 - c) Competition Division.
 - d) Team members: Matrix mapping the team members, with the 10 contests, their skills and their educational programs showing a multidisciplinary diversity of the team. Use the format provided in the 'Survival Kit' on the LMS.
 - e) Approach: Description of how you plan to organise the team for working on SDI and the process you intend to follow moving forward in the competition.
 - f) Background of the lead institution, mention degree programmes and coursework relevant to the 10 contests of the Challenge (about 50 words).
 - g) Faculty Lead and Faculty Advisors – Name, designation, relevant bio (not more than 25 words each).
 - h) Names of Industry Partners (if any).
7. **Project Summary (up to 2 pages, revised from Deliverable 1 as needed):**
 - a) Project name.
 - b) Project Partner: Name of organisation, background (50-100 words), name and designation of key individuals involved.

⁵ Teams should refer to "Template for responding to the reviewers' comments" under the Survival Kit on the LMS.

- c) Brief description of project (including but not limited to location, climate zone, stage of the project, profile of occupants, hours of operation).
 - d) Estimated total built-up area (m²).
 - e) Energy Performance Index (EPI) Goal in kWh/m² per year for your net-zero-energy design.
 - f) Preliminary estimate of on-site renewable energy generation potential, mentioning the amount from each renewable energy source (kWh/year).
 - g) Preliminary construction budget (INR/m²) and timeline (if any) in the format provided inside the 'Survival Kit' in 'Resources and Forums' on the LMS. (Revised from D1 as needed).
 - h) Special requirements of the Project Partner (if any).
- 8. Summary of Case Studies (up to 2 pages, revised from Deliverable 1):** Learnings from case studies you think are relevant to your project.
- 9. Context Analysis (up to 1 page, revised from Deliverable 1):**
- a) Analysis of the context your project sits in. Here you can include social and economic background of the users and the people in the region, identify technologies or materials that are regionally available, and regional environmental issues.
 - b) Analysis of the market. Here you can include your assessment of segment of the population that your solution needs to cater to.
- 10. Goals – (up to 3 pages, revised and expanded from Deliverable 1):**
- a) Your team's goals for the project, including but not limited to the 10 contests.
 - b) Your strategies for addressing each goal you have identified.
- Note: Refer to the guidance on how to write goals and strategies for your project inside the 'Survival Kit' in 'Resources and Forums' on the LMS.*
- 11. Building Area Programme - (up to 2 pages, revised and expanded from Deliverable 1):**
- a) Summary of site area, landscape area, total built-up area, etc.
 - b) Provide a list of spaces with their areas in m². Classify each space as unconditioned (i.e., will have no active heating or cooling systems, also termed as free running), or conditioned (i.e., will have an active heating or cooling system).
- 12. Findings from pre-design analysis - (up to 2 pages, revised from Deliverable 1 as needed):** A list of your findings from your pre-design analysis, supported by figures or tables.
- a) Climate analysis.
 - b) Site analysis.
 - c) Preliminary energy and thermal analysis of simple box models.
- 13. Resilience (up to 1 page):** List and describe potential risks resulting from climate change, public health hazards and other disasters for the project and community. Identify and explain the stress and disruptions to services such as energy, water, food security, and waste disposal.
- 14. Energy and Water consumption– (up to 2 pages):**
- a) Energy and Water consumption baseline estimates of all end-uses.
 - b) Preliminary water cycle diagram identifying uses and sources of water along with reuse pathways.
 - c) Preliminary analysis identifying strategies and approaches for energy demand reduction.
- 15. Design Ideas with Pros and Cons (up to 7 pages):** Include ideas and design concepts that show approaches for architecture, structure, passive/active cooling/heating, building materials and provide preliminary energy and thermal comfort analysis of those design ideas. Provide a summary of 'Pros and Cons' that compare those design ideas and identify the direction you are likely to take moving forward.
- 16. Appendix:** Letter of Confirmation from Project Partner (revised from Deliverable 1 if needed)

Feedback Criteria

Feedback will be provided on the following:

- Your responses to Deliverable 1 comments
- Building area programme and classification of spaces for conditioning
- Resilience risk analysis
- Energy and water calculations
- Design Ideas and their Pros and Cons

5. Product Division

There is one Product Division in the 2024-25 challenge. Teams are required to develop a tested prototype for their product solution.

5.1 Residential Cooling Retrofit (RCR)

All new construction that is not built as climate resilient or net-zero presents a huge challenge for India's climate goals and needs to be addressed through retrofit of existing buildings. About 80% of India's existing building stock is made up of residential buildings, where thermal comfort needs attention because of the potential exposure to heat stress, and growth in space cooling energy and related carbon emissions.

The Residential Cooling Retrofit is a challenge to 'make' solutions that improve thermal comfort and cooling performance in existing residential buildings, where the solution could be implemented by the resident with minimal assistance from a technician, such as an electrician or a carpenter. Teams can develop solutions in a range of domains, including building envelope, dynamic shading, passive cooling techniques, active cooling, etc. This can be in the form of materials, components, assemblies, appliances, controls, and beyond. Solutions can also overlap across these domains. Solutions are expected to be original, unique, creative, innovative, feasible, functional, and of good quality.

For this Division, the following requirements apply:

- a) The solution should demonstrate reduction in cooling (thermal) load, or reduction in energy consumption for cooling.
- b) The solution should apply to an existing residential space. There is no restriction on the size and typology of the residence.
- c) The solution should be developed towards a product that a resident may be able to buy-off-the-shelf.
- d) The solution should be easy to install with minimal assistance from a technician.
- e) The result should be a tested prototype.

5.2 Forming a Team

5.2.1 Institution and Student Qualification

Post-graduate and undergraduate students from any Indian educational institution may form a team. Students from multiple colleges can collaborate to form a team. It is recommended that teams include a range of disciplines such as engineering, architecture, product design, industrial design, management, UX design, computer science, robotics, marketing and sales, business, and others depending on the proposed solution. Students from multiple colleges can collaborate to form a team. A team can have a minimum of 5 and a maximum of 15 students. Each team must have a student Team Lead and a Faculty Lead.

5.2.2 Faculty Lead and Faculty Advisors

The Faculty Lead, along with the Team Lead, is responsible for communicating competition details from the SDI organisers to the team members. A team may have other faculty members as Faculty Advisors, but the Faculty Lead will serve as the primary contact and undertake the responsibility for students completing the online training modules. If multiple institutions are collaborating to form a team, you are recommended to have at least one Faculty Advisor from each institution. Faculty Leads and Advisors should review their team's work before it is submitted to SDI.

5.2.3 Industry Partner

Each team must have at least one committed Industry Partner. Industry Partners can provide support for materials, equipment, know-how, and facilities for making or testing, and they should be interested or invested in the outcome of the team.

5.2.4 Equipment

All teams need to have access to tools and equipment through workshops or labs within their institution, or through locally available maker spaces, fab-labs, or tinkering labs. Teams are encouraged to explore equipment and facilities for making and testing that could be provided by their Industry Partner.

Note: SDI organisers will not provide any equipment or facilities for making or testing.

5.3 Ten Contests for the Product Division

The ten contests of the Product Division cover diverse areas that embody the expectations of a successful product. Teams must address all ten contests in their product solution.

Note: The requirements for each contest will be included in a subsequent version of this guide.

5.3.1 Value Proposition

This contest evaluates the team's ability to convey a compelling value proposition to both investors and end users. The value proposition should estimate the total environmental impact, such as the emissions resulting from adoption of the solution by the target market. A value proposition goes beyond a simple ROI calculation, to summarise select achievements in the other nine contests. It should be clear and succinct, including tangible and intangible benefits to the end users, to convince them to choose the product. It should build a strong narrative that enables an investor to see the potential success of the solution.

5.3.2 Novelty

This contest evaluates the novelty of the solution in its ability to bring new materials, techniques, technologies, algorithms, methods, etc. to address the problem. Novelty is likely to result in intellectual property created within the solution. New products will be considered novel, but a new way of using existing products may not be considered novel, unless teams are able to show significant value-add through techniques, algorithms, and methods while using existing products.

5.3.3 Target Market

This contest evaluates the identification and quantification of the potential market for the product. A larger market size typically translates into potential for wider adoption, increased accessibility and affordability, and potential for a larger impact. Teams should evaluate and quantify the market size for their product for a wider target of users, peripheral use-cases, national or international regions with similar climatic conditions. Teams should also identify their beachhead market.

5.3.4 User Desirability

This contest evaluates the desirability of the product from the perspective of end-users. A great product or solution will not be adopted by the users unless the product is also desired by them. Factors such as user-friendliness, aesthetic appeal, and user satisfaction count towards user desirability. Team should corroborate these through primary research techniques (such as surveys, interviews, focus groups, and observations).

5.3.5 Cooling Performance

This contest evaluates the solution's effectiveness for cooling performance. Solutions that aim to only reduce cooling energy through equipment should demonstrate the amount of energy reduced compared to a baseline case. Solutions that aim to reduce discomfort hours and heat stress should demonstrate the reduction in cooling (thermal) load compared to a baseline case. Performance should be demonstrated through measurements during the testing of a prototype.

5.3.6 Co-benefits

This contest evaluates the solution's ability to provide other benefits to the users. Co-benefits add value to the product or solution by going beyond the core performance-related issue, often solving other problems

experienced by the users. Teams should conduct user research and identify problems to address them into the proposed solution, thus providing co-benefits beyond the core performance-related issue. Co-benefits can include but are not limited to, improved health, well-being, flexibility of use, integration with other building components, and product lifecycle. Teams should conduct user surveys, studies, or measurements, to corroborate that the solution is able to provide the expected co-benefits.

5.3.7 Ease of Installation

This contest evaluates the simplicity and convenience of installing the proposed solution. Users should be able to install and operate the product or solution with minimal assistance, or as a completely DIY installation. Teams should prepare an installation and operation guide that shows the ease of installation.

5.3.8 Technical Feasibility

This contest evaluates the use of materials, components, and their availability, along with the potential for scalability of the processes involved to make the product. Sound engineering of the product for robust performance in the conditions of use is needed. If appropriate, teams should demonstrate the compatibility of the product with the infrastructure available in existing buildings.

5.3.9 Financial Feasibility

This contest evaluates the financial feasibility of the solution. Appropriate pricing makes the production and sales of the product a viable business, and attractive to potential investors. It is important to understand the price that users are willing to pay for the product using a value based-pricing approach, and to build a cost-plus pricing model that includes the manufacturing and sales costs, and the profit. Teams should use these two approaches to demonstrate the financial feasibility of the solution and identify challenges such as the need for more efficient manufacturing, government rebates, etc. if the cost-plus price exceeds the value-based price, or opportunities for adding features, increased R&D, increased profitability if the value-based price exceeds the cost-plus price.

5.3.10 Go-to Market Strategy

This contest evaluates the team's approach to developing a business. It includes the marketing plan, the team, and the Industry Partners' commitment. A strong marketing plan is an important aspect of a larger business plan, and explains the competitors, the beachhead market, a pricing strategy, and marketing channels. A diverse team in terms of skills and knowledge, is likely to generate better solutions for a robust business, thereby giving confidence to investors. Committed Industry Partner/s provide support for materials, equipment, know-how, and facilities for making or testing, along with an interest in the outcome, to help the team achieve its potential. Teams should include ideas or arrangements for protecting or sharing intellectual property or licensing products and services. The go-to-market strategy should be written for a potential investor.

5.4 Deliverables for Product Division

This section provides detailed requirements of the Deliverables for the 2024-25 Challenge of the Product Division. The four deliverables are expected to be the outcome of the four stages of work as shown below in Figure 3.

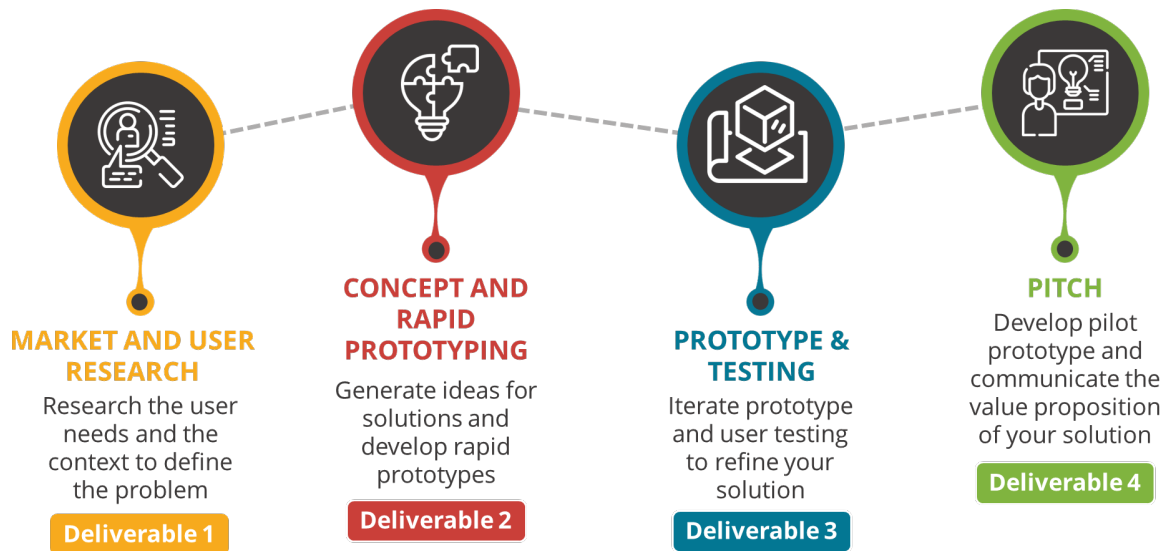


Figure 3: Four-stage deliverable topics within the Product Division

Note: The details of Deliverable 3 and 4 and their outlines for this Division will be published in the subsequent version of this guide.

Format requirements for reports

For each Deliverable, teams must follow the following format requirements.

1. Page size: Use Standard A4 size (210 mm X 297 mm)
2. Fonts and text size: Use 11-point font for body text (diagrams may have smaller fonts but must be readable). Your text should be left-aligned. You may choose your own font type, but please make sure it is easy to read. Embed the fonts in your PDF file.
3. Margins: Must be minimum of 1 inch on all four sides. However, figures, and images may bleed into the margins.
4. Tables and figures: Please number all tables and figures and provide captions for each. Do not just insert a table or figure. Introduce it in the text and refer to it by its number.
5. File type, size, and page count: See details for each Deliverable.

5.4.1 Details for Deliverable 1 for Product Division

This section contains the requirements for **Deliverable 1** for the Product Division. Teams must strictly follow the instructions listed in Table 5, below.

Table 3: Solar Decathlon India Deliverable 1 for Product Division - File Naming Conventions and Deadlines

Deliverable	Required Content	File Name	Deadline
Market and User Research Report	Single Bookmarked PDF	D1_[DivisionLetterCode]_(TeamName).pdf for e.g., D1_RCR_TeamName.pdf	1-8 October 2024, 5 pm IST

Note: RCR = Residential Cooling Retrofit

5.4.1.1 Market and User Research Report

The Market and User Research Report shall describe the context, user research, description of the people you are designing the product for, problem definition, objectives, and success metrics, as well as a project summary and a team summary.

We understand that for the initial submission, the project details could be tentative and may change in the future. Teams must adhere to the page count and content outline provided below.

Page count and file size

1. Maximum page count: Not more than 13 pages, excluding the Cover page and Appendix. Submissions exceeding 13 pages may not be reviewed for feedback.
2. File size: Less than 15 MB.

Content Outline

Please follow this outline in terms of the content, order, and number of pages allowed.

1. **Cover page (must have the following content at a minimum):**
 - a) Logo of Solar Decathlon India.
 - b) Name of your institution(s).
 - c) Team name.
 - d) Competition Division.
 - e) Deliverable name as 'Market and User Research Report – October 2024'.
2. **Context of the problem (up to 1 page):**
 - a) Brief description of the context of your problem (including but not limited to location, climate zone, description of residential spaces and demographics of the people considered for the retrofit solution).
3. **Market and User Research (up to 3 pages):**
 - a) List and analyse a range (at least 3) of existing products/ solutions that could be potential solutions to the problem. Describe both the successful and unsuccessful features and approaches employed by these products/ solutions.
 - b) List the questions asked to understand the users' concerns related to cooling and thermal comfort. Also list the questions asked to understand how users think, feel, and behave related to the context of this problem. Include any additional questions asked to guide your project design.
 - c) Describe your research methods such as interviews, surveys, observations, secondary data, usability testing, etc.
 - d) Add photographs and links to videos showing your user research.
4. **Insights (up to 2 pages):**
 - a) Describe insights and inspiration that you gained from the market analysis to inform your own ideas.
 - b) Summarise the key findings from your research, emphasising the sample size, target audience profile, and users' current approach to cooling. Highlight the needs, problems, motivations, and aspirations of the users that you discovered. Present any patterns or trends that you found in the data in a clear and understandable way.
 - c) Describe the opportunity areas that were identified based on your research.
5. **Project Summary (up to 5 pages):**
 - a) Problem definition: Describe the opportunity that you have selected to solve with your cooling retrofit product. Outline the challenges that you have identified and why are they important.
 - b) Objectives and Metrics: List the objectives of your project. Define specific metrics that will help assess how your solution meets the objectives.
 - c) Scope of your project: Describe the building systems, components, etc, that your solution will be composed of. Also, mention any limitations or restrictions that your solution may have and list the situations where it may not work effectively.
 - d) Users: Describe the specific target audience for your product. Provide detailed information about their characteristics.
 - e) Stakeholders: Identify other stakeholders who are important to consider and explain why they matter to make your project successful.
6. **Team Summary (up to 2 pages):**
 - a) Team name.

- b) Institution(s) name.
- c) Competition Division.
- d) Team members: Matrix mapping the team members, with the 10 contests, their skills and their educational programs showing a multidisciplinary diversity of the team. Use the format provided in the 'Survival Kit' on the LMS.
- e) Background of the lead institution, mention degree programmes and coursework relevant to the 10 contests of the Challenge (about 50 words) .
- f) Resources: Discuss your team's access to labs, equipment, makerspaces, fab-labs etc.
- g) Faculty Lead and Faculty Advisors – Name, designation, relevant bio (not more than 25 words each).
- h) Names of Industry Partners and their expected support to your team.

7. Appendix: Letter of Confirmation from Industry Partner(s), using the template provided to you in the LMS.

Feedback Criteria

Feedback will be provided on the following:

- Compliance with Division and the context of the problem
- Market and User research
- Insights from research
- Project summary
- Team composition

5.4.2 Details for Deliverable 2 for Product Division

This section contains the requirements for **Deliverable 2** for the Product Division. Teams must strictly follow the instructions listed in Table 6, below.

Table 4: Solar Decathlon India Deliverable 2 for Product Division - File Naming Conventions and Deadlines

Deliverable	Required Content	File Name	Deadline
Concept and Rapid Prototyping Report	Single Bookmarked PDF	D2_[DivisionLetterCode]_(TeamName).pdf e.g., D2_RCR_TeamName.pdf	19-26 November 2024, 5 pm IST

Note: RCR = Residential Cooling Retrofit

5.4.2.1 Concept and Rapid Prototyping Report

This is an interim submission to demonstrate the team's progress towards completing the project. Teams and must adhere to the page count and content outline provided below.

Page count and file size

- a) Maximum page count: Strictly 24 pages, excluding the cover page, response to reviewers' comments and appendix. Submissions exceeding 24 pages may not be reviewed for feedback.
- b) File size: Less than 30 MB.

Content Outline

Please follow this outline in terms of the content, order, and number of pages allowed.

- 1. Cover page** (must have the following content at a minimum)
 - a) Logo of Solar Decathlon India
 - b) Name of your institution(s)
 - c) Team name
 - d) Competition Division
 - e) Deliverable name as 'Concept and Early Prototyping Report – November 2024'

2. Table of Contents**3. List of Tables****4. List of Figures****5. Response to reviewers' comments⁶**

- a) Provide reviewers' comments to your Deliverable 1 and your response to each comment mentioning any actions you have taken.

Note: Teams that do not submit the response to reviewers' comments will not get review comments for ANY subsequent deliverables. Refer to the template and example for "Response to reviewers' comments" inside the 'Survival Kit' in 'Resources and Forums' on the LMS.

6. Team Summary (up to 2 pages, revised from Deliverable 1 as needed):

- a) Team name.
- b) Institution(s) name.
- c) Division.
- d) Team members: Matrix mapping the team members, with the 10 contests, their skills and their educational programs showing a multidisciplinary diversity of the team. Use the format provided in the 'Survival Kit' on the LMS.
- e) Background of the lead institution, mention degree programmes and coursework relevant to the 10 contests of the Challenge (about 50 words).
- f) Resources: Discuss your team's access to labs, equipment, makerspaces, fab-labs etc.
- g) Faculty Lead and Faculty Advisors – Name, designation, relevant bio (not more than 25 words each).
- h) Names of Industry Partners and their expected support to your team.

7. Context of the problem (up to 1 page, revised from Deliverable 1 as needed): Brief description of the context of your problem (including but not limited to location, climate zone, description of residential spaces and demographics of the people considered for the retrofit solution).**8. Project Summary (up to 3 pages, revised from Deliverable 1 as needed):**

- a) Problem definition: Describe the opportunity that you have selected. Talk about the challenges you have identified and why they are important.
- b) Objectives and Metrics: List the objectives of your project. Define specific metrics that will help assess how your solution meets the objectives.
- c) Scope of your project: Describe the building systems, components, etc, that your solution will be composed of. Also, mention any limitations or restrictions that your solution may have and list the situations where it may not work effectively.
- d) Users: Describe the specific target audience for your product. Provide detailed information about their characteristics.
- e) Stakeholders: Identify other stakeholders who are important to consider and explain why they matter to make your project successful.
- f) Product name: This can be something you have come up with, or something from your Industry Partner. This can be modified in the subsequent stages.

9. Ideation (up to 6 pages): Document 10-15 alternative ideas that emerged during your ideation stage.**10. Design Concepts (up to 7 pages):** Document three design concepts which are distinct from each other based on the chosen opportunity. For each design concept, provide the following information:

- a) Salient features of the product.
- b) Explain who needs this solution the most, the market gap it fills, the unmet needs it serves, and how it benefits the users/stakeholders.
- c) Outline the process and materials required for prototyping the design concept.

⁶ Teams should refer to "Template for responding to the reviewers' comments" under the Survival Kit on the LMS.

- d) Document the following for the three low-fidelity prototypes that are developed for the five-design concepts.
- Provide drawings, photos, links to videos, etc. that document your prototypes.
 - Describe how you tested your models or low-fidelity prototypes.
 - Document the results and findings of your testing.

Note: Low-fidelity prototyping is a step within the product development process that quickly iterates upon an initial design concept. The primary focus is to test form, fit, and function of the product or its components. They can be a combination of drawings, storyboards, computer simulations, or physical models made of paper or other quick-to-model materials. Low-fidelity prototypes enable the designers to test certain aspects of the product or solution and can be discarded or modified quickly as the designers continue to iterate the solution. A low-fidelity prototype is not same as your Deliverable 3 prototype.

11. Shortlisted concept (up to 2 pages): Evaluate your test results and provide a comparative analysis of your design concepts. Shortlist one concept you intend to move forward with.

12. Contest areas (up to 3 pages): For your shortlisted concept, describe your expectations for the following contest areas.

- a) **Cooling Performance:** Describe the scientific principles that will contribute to improve cooling or thermal comfort.
- b) **User desirability:** Describe the user-friendliness of your solution and explain why it will be accepted by the target audience, ensuring their satisfaction with the retrofit product.
- c) **Technical Feasibility:** Mention the materials used, components, and their availability, along with the potential for scalability of the processes involved to make the product. Demonstrate the compatibility of the cooling retrofit solution with the infrastructure available in existing residential buildings.
- d) **Novelty:** Identify the uniqueness and novelty in your solution, particularly in terms of introducing new/innovative materials, techniques, technologies, algorithms, methods, or other relevant aspects to address the problem at hand.

Note: In Deliverable 2, the requirements of the contest areas are meant to be expectations and not the results of any testing.

13. Appendix: Letter of Confirmation from Industry Partner(s) (revised from Deliverable 1 if needed)

Feedback Criteria

Feedback will be provided on the following:

- Your responses to Deliverable 1 comments
- Design concepts, rapid prototypes, and testing
- Expectations described for the contest areas

6. Judging

Teams are assessed based on the Deliverables they submit and their presentations in the finals. The Deliverables should meet the requirements mentioned in the Deliverable outline. The jurors evaluate the team's work for the ten contests based on the criteria and process described below.

6.1 Judging Criteria

All 10 contests have equal weightage, and each contest will be judged based on the scale below:

Scale	Judging criteria
Excellent	Work exceeds expectations
Very Good	Work meets expectations and is of good quality
Good	Work meets minimum expectations
Fair	Work can meet minimum expectations with some improvement
Poor	Unacceptable and below expectations

6.2 Judging Process

The judging process is described below:

- Deliverables 1 and 2 are not elimination rounds. These Deliverables are milestones and convergence points for the teams to define their design problem and initial approach. A panel of reviewers provides feedback on Deliverables 1 and 2.
- Deliverable 3 is an elimination round, which is judged by a panel of experts as per the 'Judging Criteria'. Teams should meet the contest requirements and follow the Deliverable outline. Up to six teams per Division will be selected as Finalists. The Finalists will submit Deliverable 4 and present their work to the jury at the SDI Finals event.
- For Deliverable 4, a panel of three jurors will assess each Competition Division based on the judging criteria and select a winner and runner-up for each Division.
- For the SDI Finals Division Presentations, the panel of three jurors assesses the quality of the presentation, the information presented, and how the team has incorporated comments given to them for Deliverable 4. Based on this assessment, the Jurors may decide to revise their scores that they had given earlier for Deliverable 4.
- For the SDI Finals Grand Jury, the Grand Jury members will assess the 5-minute pitches of the Division winners and award the Grand Prize to the project that is deemed to be the most investment-worthy.
- Best Movie award is judged based on how well the movie a) tells an inspiring story, b) explains whom the solution serves and how and, 3) explains the problem and the solution.
- People's choice award for movie is selected based on the number of 'Likes' on YouTube by the cut-off time. The cut-off time will be shared with you after the Deliverable 4 submission.

Note: Each team must include a 'Response to Reviewer comments' in Deliverables 2, 3, and 4. Teams who fail to include this will not receive any feedback. Failure to adhere to the prescribed length and structure (outline) of Deliverables shall be penalised during the review. Any additional pages beyond prescribed length may not be reviewed and no feedback shall be provided.

6.3 Disqualification Criteria

Teams may be disqualified from the competition if:

1. They fail to submit deliverables before the respective deadlines.
2. Their projects fail to comply with division requirements for the respective Divisions.
3. Less than 5 members of a team fail to complete SLMs by the deadline of 10 January 2025.

4. They fail to provide a letter of confirmation from an authorised person representing the Project Partner
5. With Deliverable 3, they fail to provide a letter signed by the Faculty Lead (or Faculty Advisors for Partner institutions stating that all team members are bona fide students. In case a team is composed of students from multiple institutions, they may provide letters signed by a Faculty Advisor from each institution.
6. If the size of a team exceeds 15 or is less than 5.
7. Any instance of plagiarism is found in the work submitted by the team.

7. Resources available to teams

7.1 Technical Resource Group

The teams can reach out to a group of people with specific technical expertise areas. The Technical Resource Group (TRG) members provide high-level guidance, point-out resources, and provide explanations to the teams. However, they do not solve problems for the teams. Each team will be assigned one TRG member as a mentor, who will be the first point-of-contact for the teams on technical issues related to their project. The assigned TRG member may point the team towards any other TRG members based on the nature of query of the team. The teams can schedule meetings with their assigned TRG member at a mutually agreed time. The list of TRG members is posted on the [SDI website](#), and their contact information is available on the Learning Management System (LMS). Teams can initiate contact with the TRG members through email. After receiving inputs from the TRG, teams are responsible for the design decisions taken by them. Neither the competition organisers nor the TRG members will be held responsible for those decisions.

7.2 Online Learning Modules

The teams are provided with online Self Learning Modules in technical topic areas related to building science, energy efficiency, renewable energy, water sufficiency, cost estimation, etc. The teams will also be provided access to recorded webinars by experts that describe case studies and best practices.

7.3 Webinars

SDI conducts a series of webinars to support participants throughout the competition. These webinars fall into three categories: general, division-specific, and simulation-focused. The webinars are also recorded and made available on the LMS.

7.4 Software

Select members of a team will be provided a license to DesignBuilder™ software for the duration of the challenge to carry out building performance simulations and test their design ideas. The SDI organisers provide the contact information of the participating students, Faculty Leads, and Faculty Advisors for teams to get access to the software licenses. The respective teams at their own risk and responsibility, will enter into relevant agreement(s) with DesignBuilder™ for use of the DesignBuilder™ software.

Each member of a team is also provided a license to ClimateStudio software for the duration of the challenge to carry out building performance simulations and test their design ideas.

Note: Although the organisers are providing access to DesignBuilder™ and ClimateStudio, teams are free to use any dynamic simulation modelling software of their choice.

7.5 Guidance for Pitching

The SDI organisers provide a handout to the participating teams to explain to Project Partners (relevant for teams competing in Building Division) and Industry Partners (relevant to teams competing in Product Division) the benefits they get and clarify their role and commitment. Teams should also refer to guidance documents on how to approach Partners in the survival kit.

7.6 Faculty Guide

The SDI organisers provide a [‘Faculty Guide’](#) document. This document explains the benefits to participating institutions and students. Faculty mentors are encouraged to refer to this document to encourage student participation and seek alignment with their curriculum.

7.7 Survival Kit

Teams should refer to the various resources provided by the organisers under the ‘Survival Kit’ in the LMS. These include guidance documents, best practices, templates, and lists of past partners.

7.8 Past Submissions

Work submitted by finalist teams who have participated in the past are posted on the SDI website. The teams are encouraged to refer to this work by clicking on the links below.

- [2023-24 Challenge](#)
- [2022-23 Challenge](#)
- [2021-22 Challenge](#)
- [2020-21 Challenge](#)

8. Terms and Conditions

1. Participants agree that they abide by the rules and conditions stated in the Solar Decathlon India Competition Guide, and any updates/revisions specified by the organisers from time to time.
2. Solar Decathlon India logo shall only be used by the participants with the prior written permission in accordance with the Terms of Use provided on the website.
3. Participants agree that personal data submitted by them may be collected, processed, stored, and otherwise used for the purposes of conducting and administering the competition. By entering the competition, participants agree to the transmission, processing, disclosing and storage of the personal data for the requirements of the competition related activities.
4. Participants agree to participate in any media or promotional activity resulting from the competition as reasonably requested by the competition organisers at its expense. The project submissions may also be used for promotional, marketing, press, and media purposes including on the competition website. Participants acknowledge that they are not paid for use of the same and hereby relinquish any monetary or other claims against Solar Decathlon India for this use.
5. Subject to fair dealing requirements under Indian laws, wherein the competition organisers have the right to use the competition material and results for teaching, instruction, and research (including publication/putting up material in the public domain, further preparation of material etc.), the IP for the material produced by the teams shall vest with the respective teams. Such rights of the team may also be subject to any agreement as applicable entered into with their respective Project/Industry partners as long as fair dealing rights of the competition organisers as specified above are retained.
6. Teams must cite sources for other referenced works. If the teams are using work done by the team members for any other competition, they must ensure that they have the complete ownership of the work (no disputes), and such work must not be submitted directly, and shall adhere to competition submission requirements.
7. All work submitted shall be original and the teams must ensure that they have the complete ownership of the work (i.e., no disputes or any restrictive covenants from third parties prohibit such use).
8. The work submitted by the teams must not contain content, material, or any element that is unlawful, or otherwise in violation of or contrary to all applicable national or state specific laws and regulations.
9. The work submitted by the teams must not contain any content, material, or element that displays any third-party advertising, slogan, logo, trademark or otherwise indicates a sponsorship or endorsement by a third party, that is not within the spirit of the competition.
10. Teams are responsible for the terms determined with their Industry Partner's policies, subject to fair dealing rights to the competition organisers as mentioned above.
11. The final decision is of the Jury; no arguments or challenges on the same is allowed.
12. Each team is financially responsible for any damage it causes during the competition events.
13. Teams are liable to be disqualified for violating any of these terms and based on the disqualification criteria stated in Section 5.3.
14. Participants from each team represent that they have carefully read and fully understood the terms and conditions of participating in Solar Decathlon India and hereby accept the same. They also acknowledge that the organisers reserve the right to amend relevant provisions governing the competition keeping in mind the interests of the participants and the competition organisers, in accordance with relevant government directives from time to time. The participants further acknowledge that all the information submitted by them is true and they have not misrepresented or falsified any information provided. In the event that any representation made, or documents duly submitted herein are untrue or materially inaccurate amounting to misrepresentation, the

organisers shall at its discretion and without prejudice to any other right that may be available to the organisers, shall take suitable action in this regard, including cancellation of participation and other relevant action.

15. The competition organisers reserve the right to withdraw or amend the competition and these Terms and Conditions in the event of any unforeseen circumstances.

9. Version Control

#	Date of publishing	Version	Summary of changes/ updates
1	8 July 2024	1.0	<ul style="list-style-type: none">• Not applicable

Organisers*



Gov Support



Knowledge Partner†



Programme Support



Affiliates‡



* The roles and responsibilities of AEEE and IIHS are separate and distinct, with independent budgets, financial resources and execution.

† AEEE and COA have signed a Memorandum of Understanding for knowledge collaboration on net-zero buildings in India.

‡ The American Council for an Energy Efficiency Economy (ACEEE) has funded AEEE for activities relating to SDI.

§ ISHRAE (India) and IEEE SA (India) are acting as outreach partners to SDI. Solemma provides free software licenses to all student participants and faculty mentors for the SDI competition. There is no financial implication. The respective teams at their own risk and responsibility, may enter into relevant agreement(s) with Solemma for use of the Solemma software. Teams are however free to use any dynamic simulation modelling software of their choice. Climate Launch Pad India to provide incubation to finalist team(s) of SDI.



For more information, visit

SolarDecathlonIndia.in

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