# INDIAN INSTITUTE OF TECHNOLOGY JODHPUR

Managing Carbon Footprint 2023-2024

# Indian Institute of Technology Jodhpur

## Scope 1 and Scope 2 emission, 2023-2024

## Our approach towards Sustainability

The unique master plan of Indian Institute of Technology (IIT) Jodhpur conceptualizes the workings of all parts of the campus as an interlocking, integral network of complex dynamic systems, like the metabolism of a living organism. This meta-system shall be actively studied and monitored (partly to generate intelligent control instructions and partly to mine data) and in that sense is a settlement evolving through trials and tests, a "Living Laboratory". The ideas for this "Smart Intelligent Eco-campus" encompass the ideals of social, economic and environmental sustainability, and integrate aspects of landscape and biodiversity, food, water and waste, solid waste, mobility, energy and ICT to create an intricate life-like system of campus metabolism. Berms in IIT Jodhpur act as signature bounding elements containing compact desert settlements. They mitigate noise, dust, heat, and are part of the de-desertification strategy along with green buffer zones, green infrastructure, compact settlement pattern, and east-west streets. IIT Jodhpur campus is a sustainable oasis in a challenging desert context, providing a protected habitat for flora and fauna (including humans). It rejuvenates the site by providing biodiversity corridors to allow native species to have contiguous habitat and passage across the site and within the region than be isolated in island sanctuaries in a human settlement.

The landscape plan aims at minimizing its water requirement uses recycled water. The campus uses hardy native species of plants, conserving water and improving soil moisture, while requiring little upkeep and easy disease management. The landscape is designed to absorb storm water even during extreme rainfall incidents and prevent erosion or flooding. The landscape provides open space for interaction between students, faculty, local communities, artists, etc. and for art installations and public spaces, and also suitable green cover for parked vehicles.

Sustainable Development Efforts by IIT Jodhpur Through Use of Emerging Technologies

Overarching Goal: Mobilize academic, fund generated, research and laboratory capabilities, student and personnel skill, and social scientific responsibility capacities of IIT Jodhpur to advance emerging technologies for knowledge preservation of adapted communities, adopt sustainable climate resilient systems, water conservation measures, natural resource management, and achieve net-zero greenhouse gas emissions by 2050.

Snapshot IIT Jodhpur students and administration have unique understanding of their relationship with the environment they live in. Here on the eastern edge of the Thar Desert, they know intimately the importance of co-existing communities and their adaptations while living with resilience to extreme heat, water management, soils and the flora and fauna. While IIT Jodhpur is young, IIT Jodhpur look with bold vision toward the sustainability. (*IITJ-Indian Institute of Technology Jodhpur). Evolution of the Sustainability Center From 2019 IIT Jodhpur declared its commitment to making Western Rajasthan the most sustainable desert institution in India by setting up the Center for Emerging Technologies for Sustainable Development (CETSD). In the meantime, IIT Jodhpur outlines its climate action plan and also role of CETSD to affirm its resolve to put climate resilient technologies in the service of the location.

CETSD Action Strategy The Climate Action Plan outlined here, puts forward the necessary steps to achieve this vision, charting the path to preserving adaptation knowledge of societies, its related technologies, carbon neutrality, climate resilient agriculture, zero waste, water and soil conservation to preserve Thar desert ecosystem. It is a data-driven strategy which follows a "DECLARE model" proposed by CETSD towards achieving the objectives of the plan. • Develop a network with industries and NGO networks for knowledge sharing and working in partnerships for applying emerging technologies for achieving SDGs • Enable a strong internal structure and sustainability studies (technology, policy, social aspects, management, legal and financial) expertise base within the centre • Close connected with the other entities in IITJ, for actualizing the emerging technology work , along with strong capacity building, and undertake projects. • Link with government to enable applying emerging technologies for helping governmental to carry out its activities. • Actionable focus on small partnership viable funding with industry and NGO to put technologies on the ground within minimal time to put CETSD on the global map • Responsibility: scientific social responsibility aspects. • Engage: Students take concerted action for generating awareness amongst themselves by involve them through campus sustainability projects and academic projects.

## Carbon Emission

The Greenhouse Gas (GHG) Protocol of the World Resources Institute (WRI) and the Business Council for Sustainable Development (WBCSD), published in 2011, gives requirements for quantifying GHG emissions within organizations under the Kyoto Protocol. It gives the stakeholders a step-by-step guide to finding out the carbon emissions. A carbon footprint measures the emission of greenhouse gases. The protocol is organized to account for emissions in a bottom-up method calculating emissions from each segment of the business individually. The GHG protocol divides emissions into three categories: scope one, scope two, and scope three. Scope 1 emission is a facility's direct emissions, such as greenhouse gas emissions from fossil fuel combustion or coolant leakage from refrigerators. Scope 2 emissions are those related to purchasing power and include those involved with generating electricity from a variety of fossil fuel sources. Scope 3 emissions include all greenhouse gas emissions, including those that occur upstream and downstream in the supply chain, employee commuting, and various other categories. The amount of carbon dioxide generated from on-site natural gas heating in your building is an example of a direct emission you'd measure and report. Because the combustion of natural gas on-site provides the heat, all emissions created on-site are considered explicit and are registered under the scope-1 category.

For finding the GHG emissions, we will be following these steps:

1. We will first measure the energy consumption for each category, like the electrical consumption in kWh and Liters for the LPG consumption.

2. After that, we will find the GHG emissions factor associated with each category, i.e., for example, LPG, the emission factor is 1.61 Kg Co2/unit. And if we get the LPG consumption as x amount, we will get the GHG emissions as 1.61 x. 3. We will calculate the amount of CO2e for each category by the consumption with the emission factor.

$$CF(tCO_2e) = \sum_{i=1}^{n} (X_i * F_i)$$

Here $X_i$ is the amount of energy (diesel, and electricity), and $F_i$ is the GHG emission factor per type of energy.

## Analysis:

The below table provides the carbon emissions of the Institute for 2023-2024

**Table 1.** Carbon emissions of Institute for 2023-2024

<table>
<tr><th>Type</th><th colspan="2">Data</th><th>Amount</th><th>Unit</th><th>Emission (tones of $CO_2$ e)</th></tr>
<tr><td rowspan="2">Scope 1</td><td rowspan="2">Fuel for Institute Vehicle & Generator</td><td>Diesel</td><td>30802</td><td>L</td><td>82</td></tr>
<tr><td>LPG</td><td>131498</td><td>Kg</td><td>392</td></tr>
<tr><td rowspan="2">Scope 2</td><td colspan="2">Electricity Purchased</td><td>137687672</td><td>KWh</td><td>108773</td></tr>
<tr><td colspan="2">On-site solar production (Solar panels installed from 2022)</td><td>962332.6</td><td>KWh</td><td></td></tr>
<tr><td rowspan="9">Scope 3</td><td rowspan="5">Procurements</td><td>Computers & Peripherals</td><td colspan="3" rowspan="9">Collecting Data for next year and planning to calculate associated Carbon Emissions</td></tr>
<tr><td>UPS batteries</td></tr>
<tr><td>Laboratory equipment’s</td></tr>
<tr><td>Washer & Washing machines</td></tr>
<tr><td>Chemicals</td></tr>
<tr><td rowspan="2">Travel</td><td>Land Travel</td></tr>
<tr><td>Air Travel</td></tr>
<tr><td rowspan="2">Waste</td><td>Kitchen</td></tr>
<tr><td>Horticulture</td></tr>
</table>

The total carbon emissions for Scope 1 and Scope 2 are estimated at 474 and 108773 tonnes, respectively. Scope 3 emissions are still under assessment. A significant source of emissions stems from electricity purchases. As depicted in Figure 1, the highest electricity consumption was observed in academic buildings and refrigerator usage, likely due to the arid climate of IITJ and the heavy machinery used in academic labs, which demands substantial energy.

The second highest electricity consumption was identified in hostels. Upon comparing our electricity consumption data with that of other institutes, it became apparent that our hostels consume significantly more electricity. This could be attributed to the fact that each student at our college is provided with a single room equipped with air conditioning units. In contrast, most other colleges either lack air conditioning altogether or do not offer single-room accommodations to students.

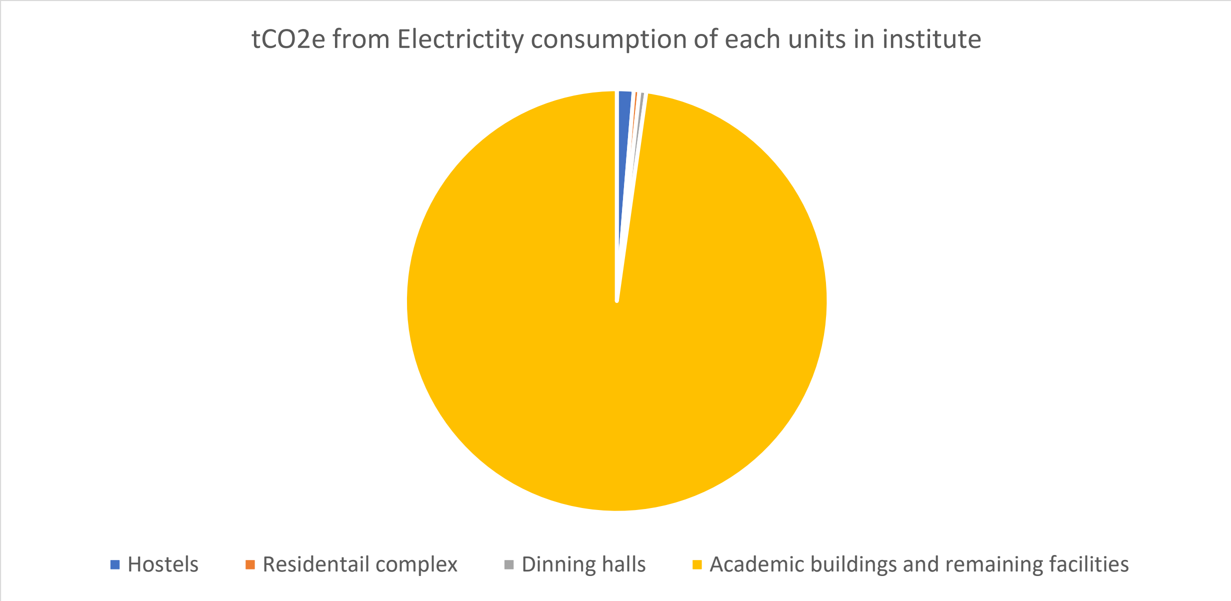


**Figure 1.** $tCO_2e$ from electricity consumption of each unit in institute

To reduce Scope 2 emissions, our institute has initiated the production of electricity in-house, as illustrated in Table 1, using solar renewable energy. Additionally, the institute has expanded its green plantation coverage to 106,334 square feet by planting 2,460 plants, 6,963 shrubs, and hedges. This initiative contributes significantly to carbon reduction in arid regions like Rajasthan.

Previously Current

**Figure 2**. Green cover improvement of our institute

Similarly, as shown in figure 3, in scope 1 emissions, LPG consumption has the major contributor. This is mainly from the kitchens of dinning's available for students, to overcome this institute is planning to reduce the LPG demand by converting kitchens into solar kitchens.

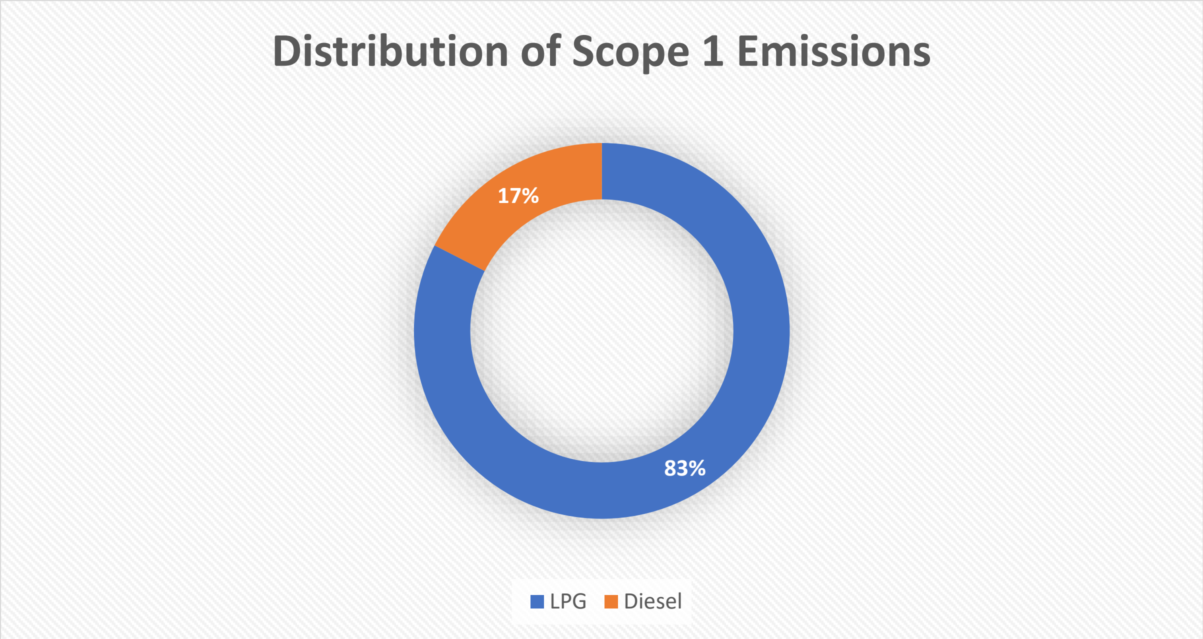

Figure 3. Distribution of Scope 1 Emissions

## Way Forward

Rooftop solar panels (grid-connected) are planned to be installed of 1 MW capacity for admin buildings. It will be zero-export electricity generation. In scope 1, LPG consumption has the major contributor. This is mainly from the kitchens of dinning's available for students, to overcome this institute is planning to reduce the LPG demand by converting kitchens into solar kitchens.

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## Annexure 1

## Scope 1 Calculations

| GHG EMISSION DUE TO DIRECT ENERGY CONSUMPTION (SCOPE I EMISSION) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sources of Emission** | Units | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 | Jan-24 | Feb-24 | Mar-24 | Total (2023-24) | Kg CO2/unit | Total $tCO_2e$ |
| **Total LPG consumption** | Kg | 10804 | 11174 | 10804 | 11174 | 11174 | 10804 | 11174 | 10804 | 11174 | 11174 | 10064 | 11174 | 131498 | 2.98 | 391.864 |
| **Diesel usage in Labs** | L | 0 | 3889.03 | 2957.26 | 2969.67 | 100 | 2041.76 | 3208.25 | 3052.28 | 2240.338 | 4030.33 | 3200.96 | 3112.98 | 30802.86 | 2.67 | 82.24363 |
| | | | | | | | | | | | | | | | **Total Scope 1 $tCO_2e$** | 474 |

## Annexure II

## Scope 2 calculation

| GHG EMISSION DUE TO INDIRECT ENERGY CONSUMPTION (SCOPE II EMISSION) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sources of Emission** | Units | Apr-23 | May-23 | Jun-23 | Jul-23 | Aug-23 | Sep-23 | Oct-23 | Nov-23 | Dec-23 | Jan-24 | Feb-24 | Mar-24 | Total (2023-24) | Kg CO2/ unit | Total $tCO_2$ |
| **Electricity usage of hostels** | KWh | 91044.10 | 175237.08 | 104755.72 | 159918.56 | 110374.18 | 149932.40 | 217753.32 | 187885.96 | 140012.23 | 175473.87 | 127615.61 | 118544.65 | 1758547.662 | 0.79 | 1389 |
| **Electricity consumption from Housing Complex** | KWh | 33473.00 | 39185.00 | 58894.00 | 55034.00 | 65600.00 | 62434.00 | 61343.00 | 42365.00 | 35989.00 | 38103.00 | 55182.00 | 42763.00 | 590365 | 0.79 | 466 |
| **Electrictity consumption from Dining hall** | KWh | 23784.00 | 118428.00 | 26975.00 | 106163.00 | 87187.00 | 69679.00 | 80025.00 | 45762.00 | 27186.00 | 48633.00 | 31963.00 | 54817.00 | 720602 | 0.79 | 569 |
| **Academic buildings and remaining** | KWh | 8655710.904 | 10355407.92 | 15397148.28 | 9066165.444 | 10258313.82 | 23919685.6 | 17506497.68 | 8363827.039 | 8213996.774 | 7472916.134 | 7857769.389 | 7550718.351 | 134618157.3 | 0.79 | 106348 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **facilities** | | | | | | | | | | | | | | | | |
| **Electricity produced from solar panel** | KWh | 0 | 0 | 0 | 71078.40 | 93654.56 | 124932.00 | 120311.70 | 97942.00 | 113862.20 | 110935.20 | 113068.80 | 116547.70 | 962332.56 | | |
| **Total Scope 2 $tCO_2e$** | | | | | | | | | | | | | | | | 108 773 |