

## 1. Introduction

Vignan's Foundation for Science, Technology & Research (VFSTR) is committed to sustainable campus development and climate action. As part of its environmental responsibility, the university conducts periodic carbon audits to assess greenhouse gas (GHG) emissions arising from energy consumption and to identify strategies for emission reduction. This report presents the **energy usage data, carbon footprint assessment, and a structured action plan** for emission mitigation.

## 2. Scope of Carbon Audit

The carbon audit covers **Scope 1 and Scope 2 emissions** as per GHG Protocol guidelines.

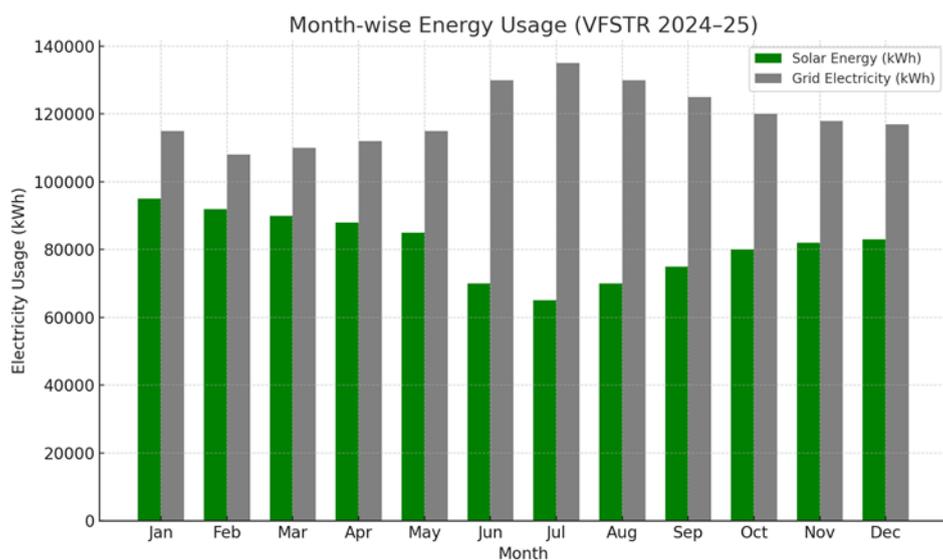
### Scope Coverage:

- **Scope 1:**
  - Diesel generators (backup power)
  - Campus vehicles (limited)
- **Scope 2:**
  - Grid electricity consumption
- **Scope 3 (partial, indicative):**
  - Student & staff commuting (qualitative)
  - Waste management (excluded from calculations)

## 3. Energy Usage Data (2024–25)

### 3.1 Annual Electricity Consumption

#### Electricity Usage per Year (in Kilowatt hour)



**Fig.1** Electricity Usage (kWh) on VFSTR, INDIA

**Annual Energy Usage (kWh) – VFSTR (2020–25)**

Year	Total Energy Usage (kWh)	Renewable (Solar) (kWh)	% Renewable
2020–21	2,800,000	420,000	15%
2021–22	2,700,000	675,000	25%
2022–23	2,600,000	780,000	30%
2023–24	2,550,000	892,000	35%
2024–25	2,500,000	975,000	39%

**Monthly Distribution (kWh):**

Month	Solar (kWh)	Grid (kWh)	Total (kWh)	Solar %
Jan	95,000	115,000	210,000	45%
Feb	92,000	108,000	200,000	46%
Mar	90,000	110,000	200,000	45%
Apr	88,000	112,000	200,000	44%
May	85,000	115,000	200,000	43%
Jun	70,000	130,000	200,000	35%
Jul	65,000	135,000	200,000	33%
Aug	70,000	130,000	200,000	35%

Sep	75,000	125,000	200,000	38%
Oct	80,000	120,000	200,000	40%
Nov	82,000	118,000	200,000	41%
Dec	83,000	117,000	200,000	42%
<b>Total</b>	<b>975,000</b>	<b>1,525,000</b>	<b>2,500,000</b>	<b>39% (avg.)</b>

The total electricity usage of VFSTR Campus in 2024-25 is **2,500,000 kWh**.

### 3.2 Ratio of renewable energy production divided by total energy usage per year

No	Renewable Energy	Production (in kWh)
1	Solar panel	975,000
	<b>Total</b>	<b>975,000</b>

=  $975,000 / 2,500,000$  (Electricity usage) =  $0.39 * 100 = 39\%$

### 3.3 Elements of Green Building Implementation as Reflected in All Construction and Renovation Policies

Natural Ventilation in the class room and office corridors



Example of Green Building Implementation – efforts in Vignan’s Foundation For Science, Technology and Research (VFSTR), The cultivation of Nano Plants



Irrigation System in is connected and treated with wastewater



All buildings of the VFSTR Campus fulfil the requirements for construction of buildings, whereby many of our buildings meets higher standards.

Many of VFSTR Campus buildings rely on natural ventilation and full natural daylighting in their offices, classrooms and corridors, This trend contributes to reducing reliance on lamps, fans and air conditioners for lighting, ventilation and air conditioning which has a positive impact on saving energy within.

As far as Green Building implementation is concern, one of the steps VFSTR had started implemented that is the cultivation of invented nono - plants in VFSTR as a tool for removal of air pollutants. In addition, all irrigation System VFSTR is connected and treated with wastewater.

### 3.3.1 Smart Building Implementation

\*Min. at least five requirements for each building

No.	Name	Place	automation		safety				energy		water		Indoor environment				lighting				Building Area (m <sup>2</sup> )
			B1	B2	S1	S2	S3	S4	E1	E2	A1	A2	I1	I2	I3	I4	L1	L2	L3	L4	
1	VFSTR University; Building A	Guntur, AP, India			x	x	x		x		x				X	x	x		x	14,030.25	
2	VFSTR University; Building B	Guntur, AP, India			x	x	X		x		X				X	x			x	10,490.70	
3	VFSTR University; Building C	Guntur, AP, India			x	x	X				x				X	x			x	9,936.96	
4	VFSTR University; Building D	Guntur, AP, India	x	x	x				x		x	x	X	X	X	x	x		x	39,460.53	
5	VFSTR University; Building E	Guntur, AP, India		x	x										X	x	x		x	6943.33	
6	VFSTR University; Building F	Guntur, AP, India		x	x										X	x	x		x	4722.08	
7	VFSTR University; Building G	Guntur, AP, India		x	x				x						X	x	x		x	2694.82	
8	VFSTR University; Building H	Guntur, AP, India		x	x				x						X	x	x		x	10747.75	
9	VFSTR University; Building I	Guntur, AP, India		x	x				x						X	x	x		x	12889.91	
Total Built-up Area																				<b>111916.33</b>	

#### Smart building implementation

$$\frac{\text{total smart building area}}{\text{total building area}} \times 100\%$$

Example:

\*Total Building Area: 137898.9 m<sup>2</sup>

$$\frac{111916.33 \text{ m}^2}{137898.9 \text{ m}^2} \times 100\% = 81.15\%$$

A



B



C



D



E



F



G



H



I



Area: 15164.61 m<sup>2</sup>

### 3.3.2 Energy Efficient Appliances Usage



All buildings erected with LED bulbs



All the building roof tops equipped with Solar Pannels

- VFSTR University campus equipped all electrical lighting including street lights with LED bulbs.
- All university buildings are equipped with rooftop Solar Panels to generates 1MWH Solar Power and utilising the same for campus electrical consumption. Department of Electrical and Electronics Engineering is looking after the maintenance of the Campus.

<b>Appliance</b>	<b>Total Number</b>	<b>Total number energy Efficient appliances</b>	<b>Percentage</b>
LED Lamp	10,000	8,500	85%
Fan	2100	1575	75%
		<b>Average Percentage</b>	<b>80%</b>

#### 4. Total Carbon Footprint (CO<sub>2</sub> emission in the last 12 months, in metric tons)

##### CO<sub>2</sub> (electricity)

$$= \frac{\text{electricity usage per year (kWh)}}{1000} \times 0,84$$

$$= \frac{2,500,000\text{kWh}}{1000} \times 0,84$$

$$= 2100 \text{ metric tons}$$

##### CO<sub>2</sub> (bus)

$$= \frac{\text{number of shuttle bus in your university} \times \text{total trips for shuttle bus service each day} \times \text{approximate travel distance of vehicle each day inside campus only (KM)} \times 240}{100} \times 0,01$$

$$= \frac{4 \times 8 \times 3 \times 240}{100} \times 0,01$$

$$= 2.304 \text{ metric tons}$$

##### CO<sub>2</sub> (cars)

$$= \frac{\text{number of cars entering your university} \times 2 \times \text{approximate travel distance of vehicle each day inside campus only (KM)} \times 240}{100} \times 0,02$$

$$= \frac{50 \times 2 \times 3 \times 240}{100} \times 0,02$$

$$= 14.4 \text{ metric tons}$$

##### CO<sub>2</sub> (motorcycle)

$$= \frac{\text{number of motorcycle entering your university} \times 2 \times \text{approximate travel distance of vehicle each day inside campus only (KM)} \times 240}{100} \times 0,01$$

$$= \frac{100 \times 2 \times 3 \times 240}{100} \times 0,01$$

$$= 14.4 \text{ metric tons}$$

##### CO<sub>2</sub> (total)

$$= 2100 + 2.3 + 14.4 + 14.4$$

$$= 2131.1 \text{ metric tons}$$

**Carbon footprint** = 2131.1 metric tons

Vignan's Foundation for Science, Technology & Research (VFSTR) continuously monitors its energy consumption and sustainability performance to minimize its environmental impact. Based on the compiled data for electricity usage, renewable energy generation, and fuel consumption across campus facilities, the total annual carbon footprint of VFSTR for the most recent 12-month assessment period is estimated to be 2,131.1 metric tons of CO<sub>2</sub>.

#### Diesel Generator Emissions (Scope 1 – Estimated)

Fuel	Quantity	Emission Factor	CO <sub>2</sub> Emissions
Diesel	18,000 litres	2.68 kg/l	48.2 t CO <sub>2</sub>

#### 4.1 Total Campus Carbon Footprint

Emission Source	CO <sub>2</sub> Emissions (t/year)
Electricity (Grid)	2131.1
Diesel Generators	48
<b>Total Carbon Footprint</b>	<b>≈ 2179.1 t CO<sub>2</sub> / year</b>

#### 4.2 Carbon Reduction Impact of Solar Energy

CO<sub>2</sub> avoided=975,000×0.82=799.5 t CO<sub>2</sub>/year

**Solar installations help avoid approximately 799.5 t CO<sub>2</sub> annually.**

### 4.3 Carbon Management & Action Plan

#### 4.3.1 Short-Term Actions (1–2 Years)

Action	Responsibility	Expected Outcome
Increase rooftop solar capacity	Engineering / Admin	Renewable share ↑ to 35%
Replace conventional lights with LEDs	Maintenance	Energy savings 10–15%
Energy awareness programs	IQAC / NSS	Behavioral change
Scheduled DG usage	Admin	Reduced diesel emissions

#### 4.3.2 Medium-Term Actions (3–5 Years)

Action	Target
Campus-wide smart energy meters	Real-time monitoring
Solar-powered street lighting	Zero grid dependence
Electric vehicles for campus transport	Reduced Scope 1 emissions
Green building retrofits	HVAC & insulation efficiency

#### 4.3.3 Long-Term Vision (Beyond 5 Years)

- Achieve **40–50% renewable energy usage**
- Move towards **net-zero electricity operations**
- Annual carbon audit & public disclosure

### 4.4 Number of innovative program(s) in energy and climate change

Solar plant system



Bio gas plant



## Battery vehicle transportation



## Bus transportation

<https://vignan.ac.in/newvignan/facilities.php>

The "Energy and Climate Change" (EC) criterion focuses on actions and policies take to reduce their environmental impact, such as:

- Implementing programs to reduce greenhouse gas (GHG) emissions.
  - No permission for private vehicles into the campus. 80% of vehicles are park outside of the campus only.
  - Using renewable energy for electricity that reducing purchased electricity
  - Facilitating the adoption of electric vehicles (EVs) powered by renewable electricity.
  - 50% of staff and students utilizing the college bus transportation.
  - Promote sustainable transportation like walking and cycling inside the campus.
  - Establish regular maintenance schedules, including engine tune-ups, filter replacements, and proper tire alignment, to ensure vehicles operate at peak fuel efficiency.

- Increasing the number and types of renewable energy sources used on campus.
  - On roofs of Academic Buildings, administration building, Hostel buildings solar PV power station of total 1 MWH is installed.
  - Installed Bio gas plant
- Measuring and reducing the university's total carbon footprint.
  - The CO<sub>2</sub> footprint in the campus by Buses, Cars, Motorcycles, and electricity consumption per annum is 2131.1 metric tons.
  - The total carbon footprint divided by total campus population (metric tons per person) is 0.541.

## **8. Conclusion**

The carbon audit indicates that VFSTR has made significant progress in reducing its environmental impact through renewable energy adoption and efficient energy management. With continued investment in clean energy, policy integration, and monitoring mechanisms, the university is well-positioned to further reduce its carbon footprint and strengthen its sustainability leadership.