VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

The Climate Roadmap – VIT's Path towards Carbon Neutrality by 2050

(Ver.2.0)

Summary of proposed measures for 2023 – 2050

1. Background

1.1. Global Scenario and Perspectives

1.2. India's low carbon strategy

1.3. The climate action initiatives in the Indian higher education system

2. Carbon Footprint

3. Climate Roadmap/goals for a sustainable future

Goal 1: Ecologically sustainable campus

Goal 2: Low-carbon travel

Goal 3: Promoting sustainable campus canteen meals

Goal 4: Research and education highlighting global sustainability issues

4. VIT's contribution so far to obtaining the target of net-zero

Goal 1: Green Campus

- Reducing emissions
- Waste reduction and recycling
- Enhancing campus biodiversity
- Banning the usage of plastics on campus
- Smart buildings and facilities on campus

Goal 2: Sustainable Travel

- Sustainable transport on campus
- Making business trips with careful consideration and taking into account their low carbon levels

Goal 3: Sustainable Canteen

- Emphasize more vegetarian meals
- Reduce daily food wastage
- Demonstrating sustainable catering

Goal 4: Sustainable Education System

- Educating responsible citizens and students on sustainable development
- Impactful research to address sustainable challenges through the development of new courses and study programs
- Organizing outreach programs to promote proper waste management in and around the University campus with active participation from students and staff
- Support from Management

4. Upcoming strategies yet to be undertaken by VIT

5. Responsibility and following-up

6. References

1. Background

This document outlines the Vellore Institute of Technology (VIT)'s energy conservation goals and methods. This includes projects over the next few years and a 2050 outlook. The university will keep energy conservation and sustainable energy supply in mind. The university pledges to become climate neutral by 2050. All campus energy will be made sustainable by then.

1.1. Global Scenario and Perspectives

Human emissions of greenhouse gases (GHG) have caused global warming, with global surface temperature rising continuously over the past decade (Figure-1). Over 2010–2019, global greenhouse gas emissions grew due to unsustainable energy usage, land use and land-use change, lifestyles, and consumption and production patterns across regions, governments, and individuals. Human-caused climate change is affecting numerous meteorological and climatic extremes worldwide. This has severely harmed food and water security, human health, economy, society, nature and people. Climate change disproportionately affects vulnerable groups. Emissions of GHG have increased rapidly over recent decades. These emissions have led to increases in the atmospheric concentrations of several GHGs including the three major well-mixed GHGs: CO_2, CH_4 and N_2O. Formal detection and attribution studies employ climate models and observations to estimate that humans caused all the warming mainly between 1850–1900 and 2010–2019. Since 1750, human-caused GHG emissions have increased well-mixed GHG concentrations. Over the past 60 years, land and ocean sinks have absorbed 56% of human-caused CO_2 emissions, with regional variations. In 2019, atmospheric CO_2 concentrations reached 410 parts per million (an increase of 21%), CH_4 reached 1866 ppb (an increase of 20%), and N_2O reached 332 ppb (an increase of 13%) in the past 50 years. O_3 and halogenated gases also contribute to global warming. CH_4 and N_2O concentrations have reached levels not seen in 800,000 years, while CO_2 concentrations are likely higher than at any point in the preceding two million years. It is unequivocal that human influence has warmed the atmosphere (1-2^oC increment in the earth's surface temperature in the past 50 years), ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred. In this regard, the Paris Agreement is a legally binding international treaty on climate change. On December 12, 2015, 196 Parties at the UN Climate Change Conference (COP21) in Paris adopted

it. It took effect on November 4, 2016. It aims to restrict "the increase in the global average temperature to well below 2°C above pre-industrial levels" and try harder to limit it to 1.5°C [1-4]. The key milestones in the pathway to net zero is shown in Figure-2.

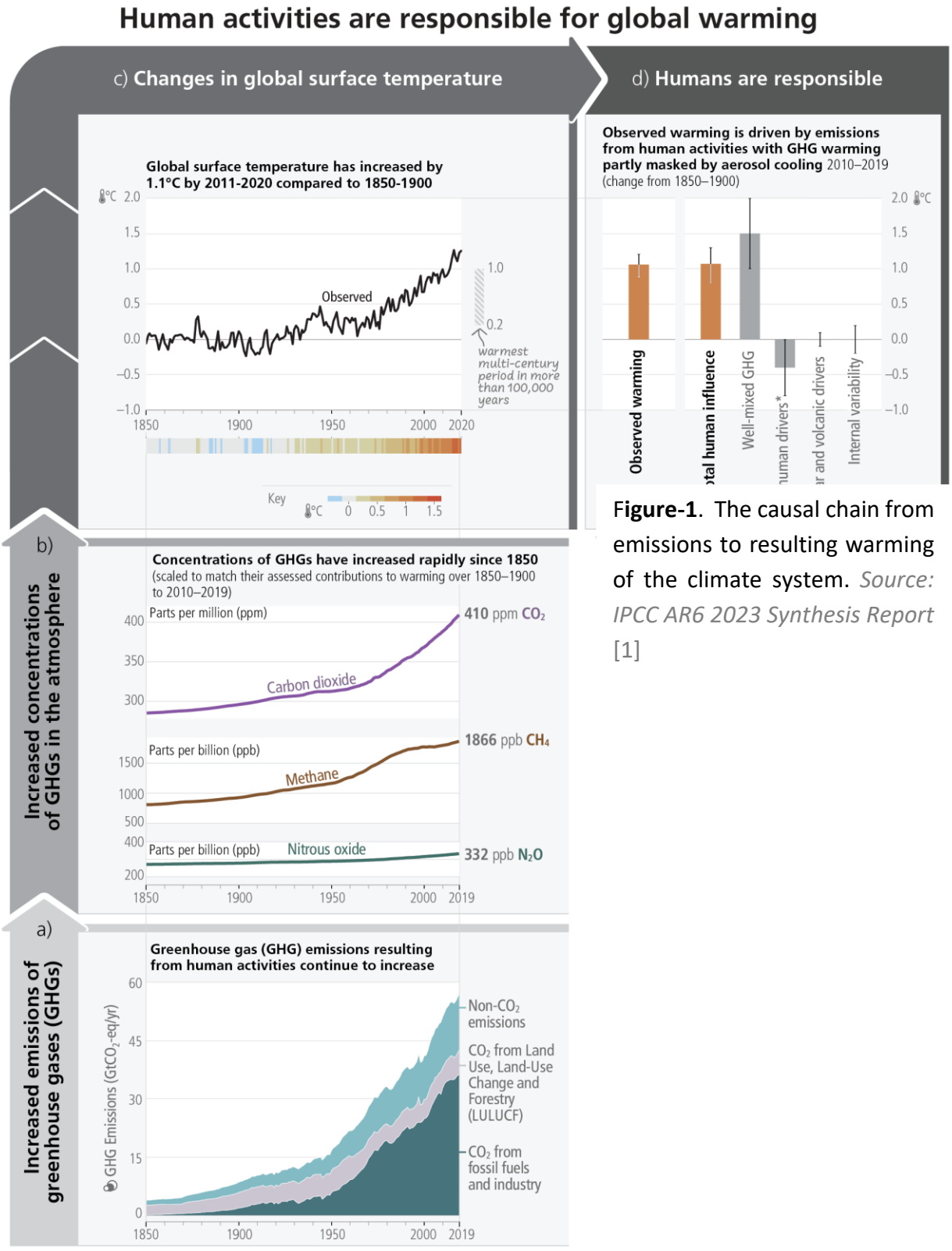


Figure-1. The causal chain from emissions to resulting warming of the climate system. *Source: IPCC AR6 2023 Synthesis Report* [1]

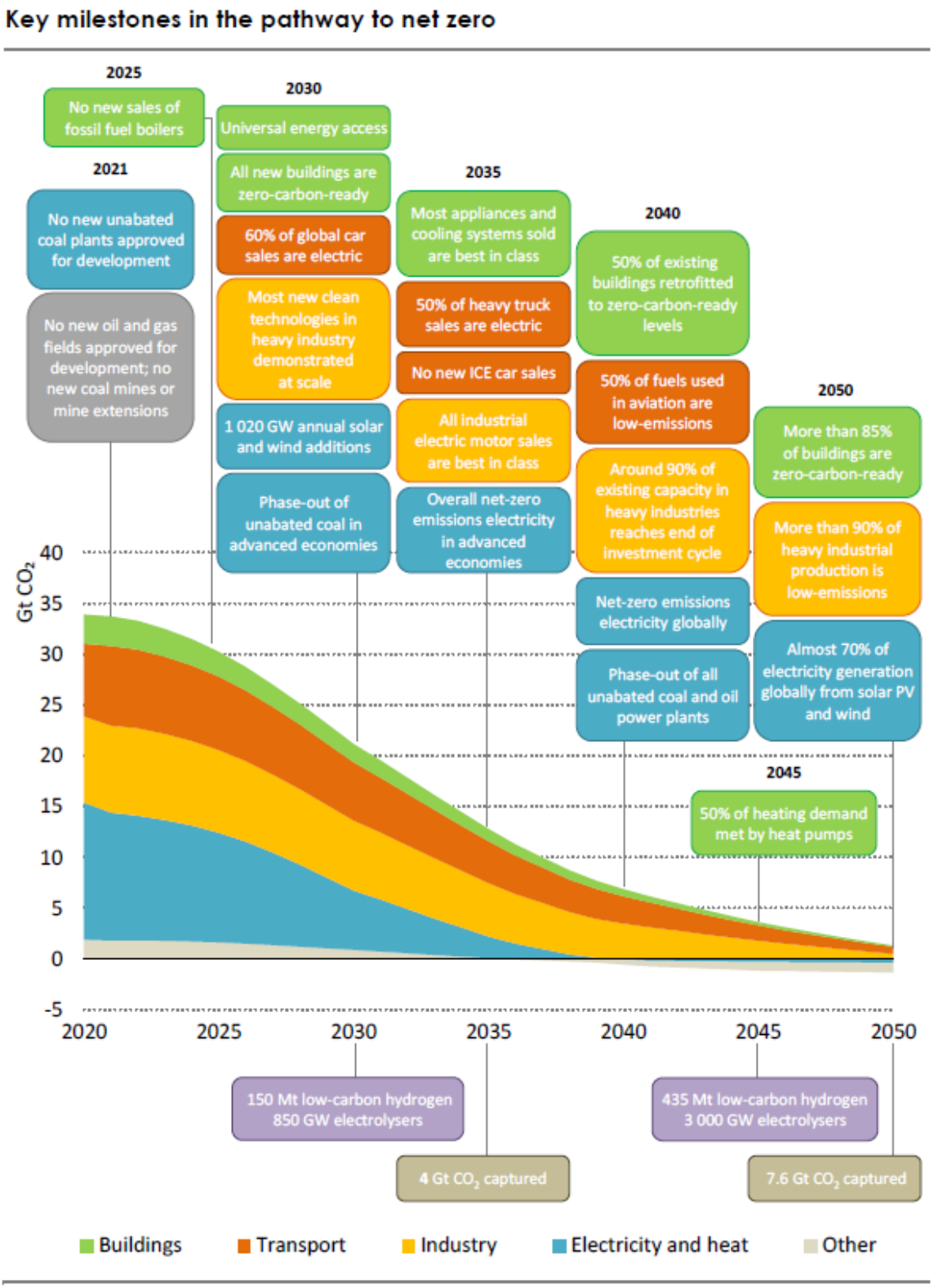


Figure-2. Key milestones in the pathway to net zero. *Source: International Energy Agency Special Report* [1]

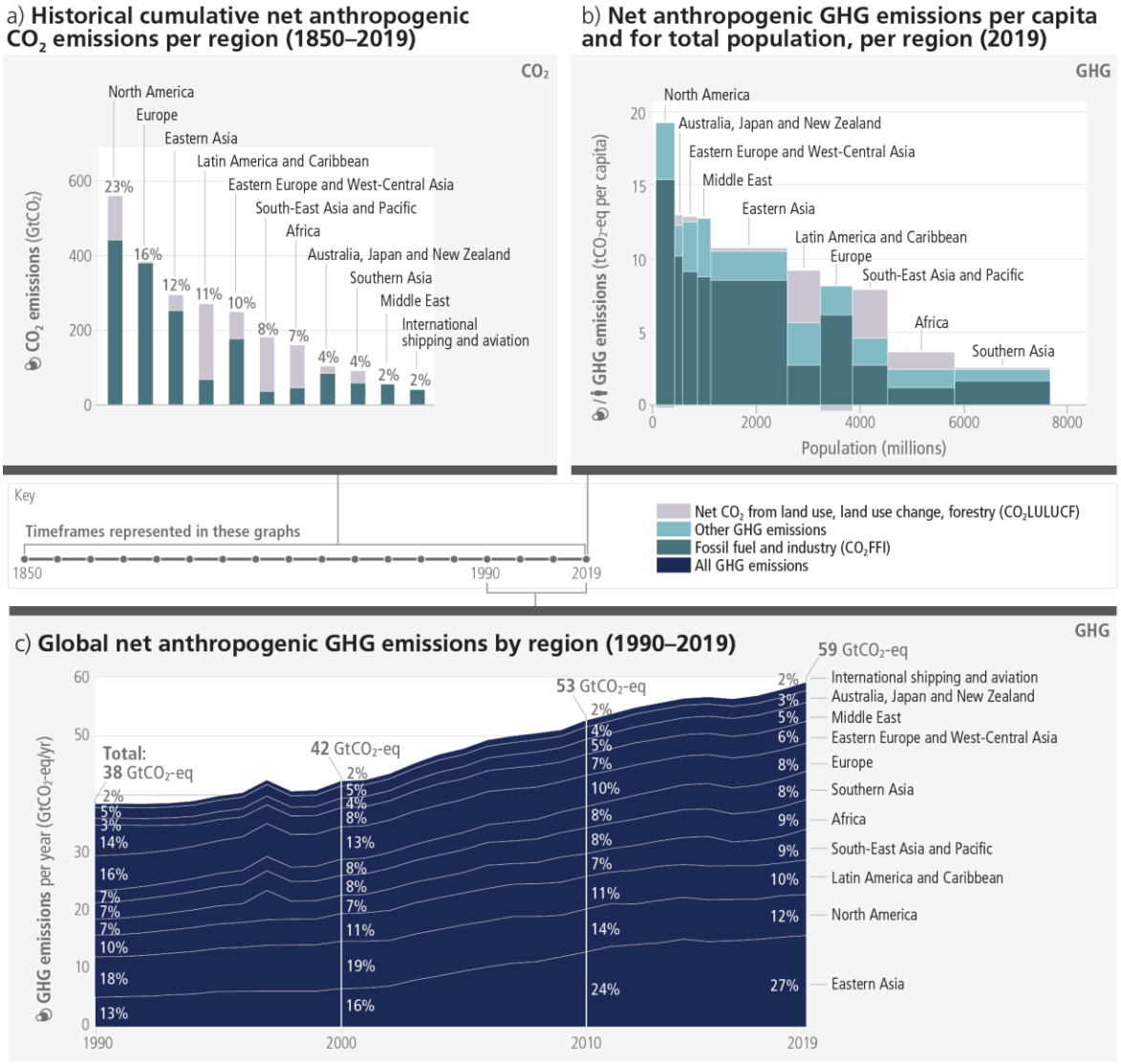
1.2. India’s low carbon strategy

India has one of the fastest-growing economies and a population of approximately one-sixth of the world population. Global and sustainable developments depend on its expansion. Climate change affects India's growth. India's global warming is modest. However, India is dedicated to addressing climate change by implementing economic choices that enable low-carbon growth and development towards net zero by 2050. India supports equity-based multilateralism and the UNFCCC's idea of common but differentiated responsibilities and distinct capabilities to address climate change. Climate science suggests reducing cumulative emissions within the global carbon budget to reduce global temperature rise. India believes this budget should be shared fairly and used responsibly for equity and climate justice. Countries should limit their cumulative emissions within this budget. Thus, India's climate policy seeks to accomplish development goals within its fair share of the global carbon budget [5].

The Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) [2023] [1] states that Southern Asia contributed only about 4% of historical cumulative net anthropogenic emissions between 1850 and 2019, even though the region has almost 24% of the global population (Figure-3). North America and Europe, with only 13% of the global population, have produced roughly 10 times more global cumulative emissions in this era. Despite possessing 17% of the world's population, India has contributed little to cumulative global GHG emissions. India's per capita annual emissions are around a third of the global average. India is correct in demanding that industrialized countries invest extensively in negative emissions and provide enough climate funding, technology transfer, and capacity development support to achieve early net-zero well before 2050.

Energy is crucial to India's development goals and deficits. India consumed 28.7 gigajoules (GJ) of primary energy per capita in 2019. Social development, demographic transition, rural and urban transition, and infrastructure development require energy. India prioritizes energy efficiency for low-carbon growth. While developed countries' decoupling of emissions from growth is still insufficient for the ambitious emissions reduction required by their historical and current responsibility, India's continued effort at increasing decoupling proceeds from a low baseline of emissions [5].

Emissions have grown in most regions but are distributed unevenly, both in the present day and cumulatively since 1850



d) **Regional indicators (2019) and regional production vs consumption accounting (2018)**

	Africa	Australia, Japan, New Zealand	Eastern Asia	Eastern Europe, West-Central Asia	Europe	Latin America and Caribbean	Middle East	North America	South-East Asia and Pacific	Southern Asia
Population (million persons, 2019)	1292	157	1471	291	620	646	252	366	674	1836
GDP per capita (USD1000$_{PPP}$ 2017 per person) [1]	5.0	43	17	20	43	15	20	61	12	6.2
Net GHG 2019 [2] (production basis)										
GHG emissions intensity (tCO_2-eq / USD1000$_{PPP}$ 2017)	0.78	0.30	0.62	0.64	0.18	0.61	0.64	0.31	0.65	0.42
GHG per capita (tCO_2-eq per person)	3.9	13	11	13	7.8	9.2	13	19	7.9	2.6
CO_2FFI, 2018, per person										
Production-based emissions (tCO_2FFI per person, based on 2018 data)	1.2	10	8.4	9.2	6.5	2.8	8.7	16	2.6	1.6
Consumption-based emissions (tCO_2FFI per person, based on 2018 data)	0.84	11	6.7	6.2	7.8	2.8	7.6	17	2.5	1.5

[1] GDP per capita in 2019 in USD2017 currency purchasing power basis.
[2] Includes CO_2FFI, CO_2LULUCF and Other GHGs, excluding international aviation and shipping.

The regional groupings used in this figure are for statistical purposes only and are described in WGIII Annex II, Part I.

Figure-3. Growth of anthropogenic CO_2 emission across the globe. *Source: IPCC AR6 2023 Synthesis Report* [1]

On June 30, 2008, India established the National Action Plan on Climate Change (NAPCC) with eight climate change missions [6]. These include:

1. National Solar Mission
2. National Mission for Enhanced Energy Efficiency
3. National Mission on Sustainable Habitat
4. National Water Mission
5. National Mission for Sustaining the Himalayan Eco-system
6. National Mission for a Green India
7. National Mission for Sustainable Agriculture
8. National Mission on Strategic Knowledge for Climate Change

1.3 The climate action initiatives in the Indian Higher Education System

Teacher training policies in India emphasize environmental education and equipping teachers to talk to students about the environment. "Emphasize the environment and its protection, living in harmony within oneself and with the natural and social environment," declares the National Curriculum Framework for Teacher Education (2009). This Framework defines environmental education research and pedagogical practices. The National Curriculum Framework (2005) recommends remote learning, courses, and outdoor camps for environmental education professional development. The Climate Project Foundation, an independent foundation, offers a Climate Change Teacher's Training Program in India since 2010. Digital training spreads climate change information in urban and rural classrooms nationwide. It teaches pupils how to adapt to climate change. The science, consequences, and climate change solutions training program promotes sustainability. 7000 teachers from 500+ schools have been educated to discuss climate change with students and communities. India has networks to help educators discuss environmental and climate change education. The 2016 university-based Green Educators' Network brought environmental educators and students together. The 500-educator Network uses newsletters and knowledge forums to improve teachers' environmental and climate awareness [7].

2. VIT'S Carbon Footprint (Tons/year of CO_2 equivalence emission)

Before getting into the action plan, it is mandatory to get information about the carbon footprint. The term "carbon footprint" is defined as the total amount of greenhouse gases (majorly CO_2, CH_4 & N_2O) that are generated by our day-to-day actions. In general, the carbon footprint is reported in terms of tons of CO_2 equivalent (CO2e; e = equivalence) emission per unit of comparison, such as per year (preferably), person, kg protein, km traveled and alike. The carbon footprint of a product includes the CO_2 emission for the entire lifecycle from production along with the supply chain to its final consumption.

The average carbon footprint for a person in the United States of America and India is about 16 (one of the highest rates in the world) and 1 tons per year respectively. Globally, the average carbon footprint is closer to 4 tons. To have the best chance of avoiding a 2^oC rise in global temperatures, the average global carbon footprint per year needs to drop to under 2 tons by 2050.

Calculations of the carbon footprints are based on the types of CO_2 emission (Figure-4):

Scope-1: Emission from direct sources like industry, transport vehicles, burning stoves and wood, etc.

Scope-2: Emission from the indirect sources, upstream (production and service) and/or downstream (usage and disposable). For example, transportation of materials and fuels is under the upstream case and emissions associated with selling the product are under the downstream case.

Scope-3: Emissions derived from the activities of an organization but from sources which they do not own or control (accounted for ~90% of business-related activities)

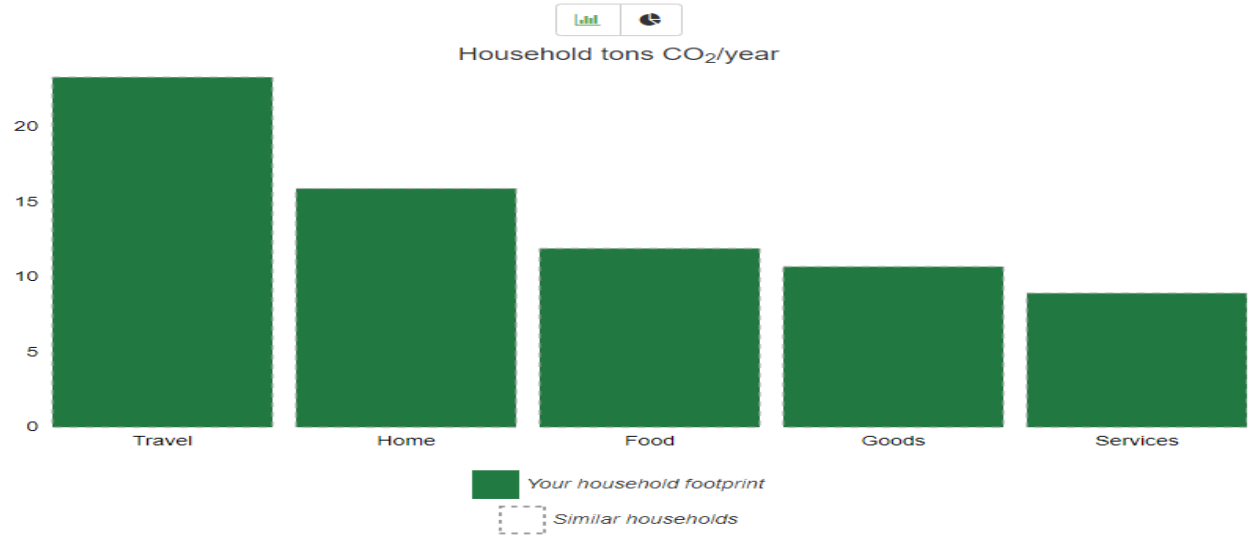


Figure-4. Bar chart for the carbon footprint data (tons of CO_2/year) of various human activities.

The calculation of the carbon footprint of a product, service or sector requires expert knowledge and careful examination of what is to be included. For example, the factors and their associated contents like Travel, Home, Food, Goods and Services are accounted for in the calculation as in Figure-5.

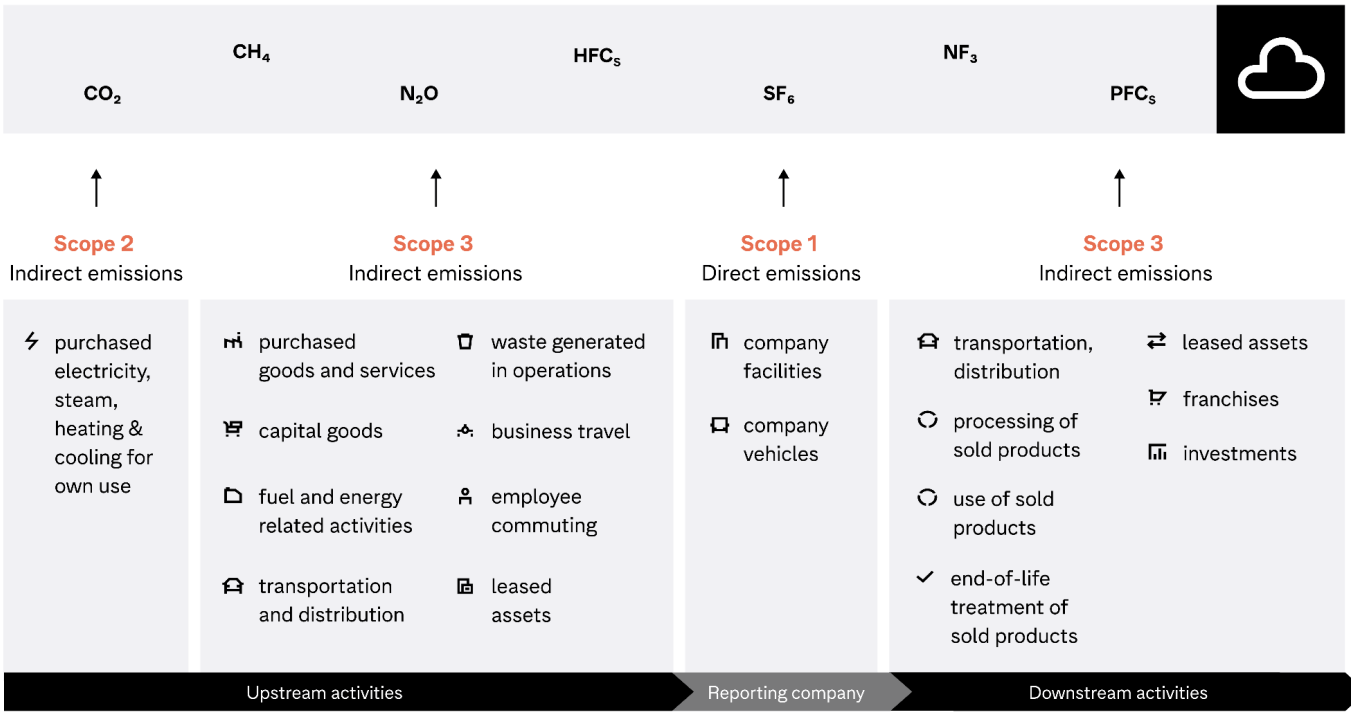


Figure-5. Chart for the footprint data for Scope 1-3 activities. *Source https://normative.io/insight/upstream-downstream-emissions/*

Note that Stockholm University's carbon footprint has remained stable, at around 37 ktonnes of carbon dioxide equivalents (CO2e) per year between 2016 and 2019, but the 2020 carbon footprint of around 26.5 ktonnes of CO2e is 28% lower (Figure 3). This is of course a consequence of the coronavirus pandemic which reflects a shift in our activities where much of the regular activities continued, while business travel was significantly reduced. On average between 2016 and 2019, the carbon footprint was 1.4 tonnes CO2e per student (full-time equivalent), or 7.7 tonnes CO2e per employee (full-time equivalent), while the 2020 carbon footprint was 0.9 tonnes CO2e per student (full-time equivalent), or 5.4 tonnes CO2e per employee (full-time equivalent). Their largest emission categories for the period 2016-2019 are (share of total average carbon footprint indicated in parentheses): Transport and travel (26 %); Buildings and facilities (25 %) & Purchase and consumption of goods (21 %) [10].

We have been working on the calculation part of the VIT CO2e. The next version will include quantitative measures of it and its associated actions.

3. Climate Roadmap/Goals For A Sustainable Future

Figure-6. UN Sustainable Development Goals relevant to sustainability [8]

Our goal of achieving net-zero emissions by the year 2050 entails striking a balance between the amount of greenhouse gases produced and those removed from the atmosphere. This should be accomplished by rapidly reducing carbon emissions, but in cases where achieving zero carbon emissions is not feasible, carbon offsets or sequestration through technical or natural means must be used. Figure-6 shows the 17 Sustainable Development Goals designed to serve as a "shared blueprint for peace and prosperity for people and the planet, now and into the future [8].

VIT's 10 point climate action plans are detailed in Figure-7:

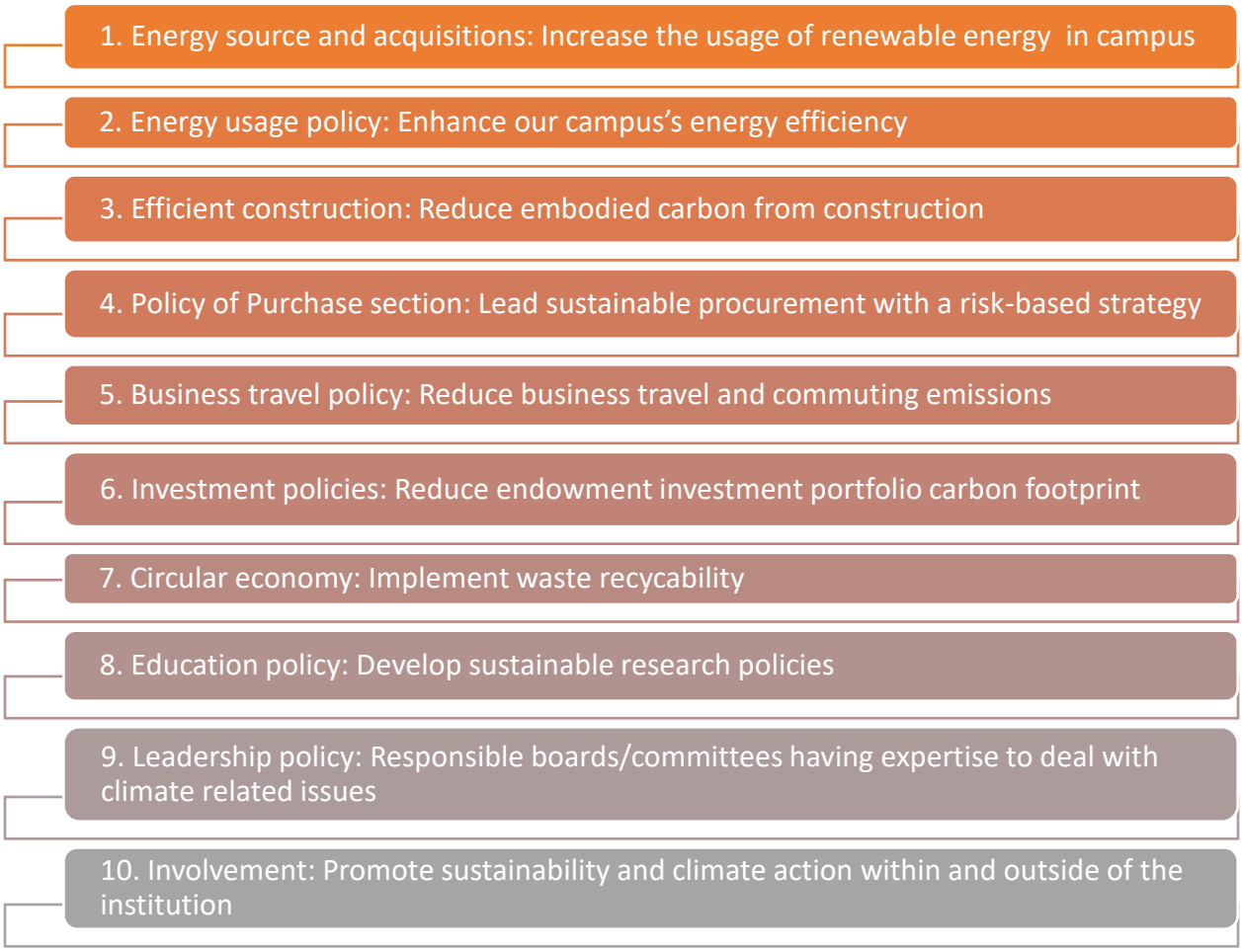


Figure-7. VIT's 10-point Climate Action Plan

4. VIT'S Contribution so far to Obtaining the Target of Net-Zero

We at VIT are aware of the threat posed by the climate catastrophe and that we must do our share to address it. This Climate Action Plan provides strategic direction for VIT University to control its greenhouse gas emissions profile and presents future scenarios, echoing the commitments made under the Paris Agreement [2]. The Plan represents VIT's commitment to precisely track, record, and control the University's emissions profile. Schools like VIT are important public institutions with buildings, infrastructure, and a sizable workforce and student body that are vulnerable to climate change. To manage the changing climate, VIT's respected management has been extremely supportive and has already over the past 10 years undertaken several strategies to mitigate these serious environmental issues as stated below:

Goal 1: Green Campus

- Reducing emissions from energy and water consumption
- Waste reduction and recycling
- Enhancing campus biodiversity
- Banning the usage of plastics on campus
- Smart buildings and facilities on campus

A significant component of VIT Vellore's activities and strategy has long been sustainable development. The 372 acres that make up the VIT campus constitute a sizable area. The cutting-edge infrastructure that VIT offers to both students and professors is one of its most impressive features. By eliminating emissions and minimizing the quantity of emissions produced, VIT seeks to become carbon neutral. The objective is to determine the most dependable method of making up for the residual emissions. The campus is modern and energy-efficient, and it makes good use of its available space. With current and new initiatives, emissions related to energy and water use will continue to be reduced. The goal is to utilize less energy and water while switching to more environmentally friendly energy sources. Reducing the requirement for energy is largely achieved through the efficient use of facilities.

- Solar panels are installed on the roof of most of the academic and hostel buildings. More than 50% of lighting power on the campus is met through LED bulbs.

- A comprehensive rainwater harvesting system is implemented and 100 % harvesting is ensured. 90% of used water is recycled and reused for secondary applications.
- Air conditioning is provided only where it is an emergency, e.g. for constructing laboratories with sophisticated instruments.
- In order to avoid the wastage of water in departments and hostels, taps with sensors have been installed.
- Waste management is taken care of properly on the whole campus with utmost importance. Waste is collected daily from various sources on the campus and is separated as dry and wet wastes.
    - Color-coded dustbins are used for different types of waste. Daily garbage is collected by housekeeping personnel and handed over to authorized Municipal personnel.
    - Efforts have been taken to produce compost manure from the canteen's solid waste and waste from other sources.
    - Manure is used for the purpose of herbal gardens as well as for planting trees.

- Chemical solid wastes are properly collected, separated and recycled.
- Almost the entire campus is full of greenery and dedicated staffs are available for Garden maintenance.
- VIT is spending about 400 Lakhs per year to maintain the green campus. A total of 431447 sqm is covered with lawns, trees, shrubs, hedges and potted plants.
- VIT campus consists of more than 90 species of plants which includes medicinal plants also.
- Green cover facilitated by efficient use of water resources improves the campus microclimate and reduces summer time shade temperature by $3^{o}C$. Use of personal motorized vehicles by resident students is prohibited and use of bicycles is encouraged on the campus.
- Different kinds of birds flock around the campus often because of its greenery. Single-use plastics are banned inside campus.
- Development of smart buildings and facilities on the campus such as the Pearl Research Block (PRB) and the Silver Jubilee Tower (SJT). In PRB, a wide green promenade that is

encircled by the building's convergent design welcomes visitors to the green civic core, which serves as the center for student interaction.

- The building offers separate spaces for not just student research activity but has independent technology parks for industry professionals to do their research activity as well.
- The Silver Jubilee Tower adds glory to the magnificent campus of VIT. Apart from enormous and spacious classrooms, brilliantly designed smart classrooms and galleries add to the list of unique features of SJT.

Goal 2: Sustainable Travel

- Sustainable transport on campus

The transportation policy at VIT is unique inside the campus. The students residing in the hostels are encouraged to use bicycles. Students are not permitted to own any vehicle that uses fossil fuel. Moreover, cabs run inside the campus to help the students commute. Those cabs are all run by batteries that have zero emissions on the campus.

Goal 3: Sustainable Canteen

- Emphasize more vegetarian meals
- Reduce daily food wastage
- Demonstrating sustainable catering

Healthy, ecologically and socially sustainable cuisine is served at the University's canteens. For instance, Fairtrade products are extensively used. Demand for vegetarian food rises due to its appeal and variety. Offering vegetarian meals at a lesser price increases its popularity. Food waste reduction reduces negative impacts. Restaurant services will continue to phase out single-use plastic products or look for replacement products produced from more sustainable materials. At the moment, plastic straws are no longer used, and products manufactured from recycled materials include takeaway mug lids and spoons. Replacement products have been found for plastic takeaway containers. Diners are aware of the problems of food waste, and use their own actions to reduce its emergence. Sustainable development and responsibility will be emphasized in university seminars, conferences, and other events that provide food or drinks. The catering serves Fairtrade, local, and organic food.

Goal 4: Sustainable Education System

- Educating responsible citizens and students on sustainable development
- Impactful research to address sustainable challenges through the development of new courses and study programs.
- Organizing outreach programs to promote proper sustainability in and around the University campus with active participation from students and staff.
- Support from Management

Graduates from VIT have a good basic knowledge of sustainable development regardless of their field of study. Sector-specific education on sustainability is also available. All new students and employees are briefed on sustainable development. Environmental Sciences and Studies are two mandatory courses provided to all first year B.Tech students irrespective of their disciplines. Overall, the course offering for sustainable development is of high quality and diverse. Sustainable development and responsibility are highlighted during the orientation phase for new students. New employees are familiarized with sustainable development and responsibility and the associated practical methods of operation. The University encourages students to develop projects on sustainability. Research funds are allocated to projects working on sustainability for undergraduate as well as research programs. Sustainability research is highlighted more boldly. The necessary resources are available for researchers to support their communication. Research and publications related to the university's sustainable development are better highlighted and communicated comprehensively in different communication channels. Making research groups and projects related to sustainability and responsibility more known and visible. Organization of annual events open to all, such as webinars, related to sustainable development and responsibility. The student chapters are encouraged to organize more outreach programs like trainings, workshops and seminars among the staff as well as residents around the campus and make them aware of sustainable living, increase awareness to conserve water and energy, create less pollution and live a healthy life. Sustainable solutions are promoted in the public and private spheres to disseminate conceptual and practical knowledge, and training materials and create awareness of sustainability.

5. Upcoming Strategies yet to be Undertaken by VIT

- Business Travel:
    - Making business trips with careful consideration and considering their low carbon levels.
    - The carbon footprint of business trips decreases as remote meetings reduce the need to travel. In case of shorter trips of one to two days, employees will only fly if absolutely necessary. Direct flights are preferred when traveling by air.
    - Land travel will be encouraged. Sustainable land transport and accommodations will be preferred [9,10].

- **Construction activities:**
    - We have to choose a benchmarked target rather than an absolute reduction because our building construction activities vary over time, making it difficult to evaluate their emissions impact.
    - Ensuring central resources for efficient and effective planning of future premises demands, with a focus on using existing premises rather than constructing new buildings.
    - Ensuring that climate considerations are a central part early in the upcoming design and construction strategies [10].

- **Procurement of goods and services:**
    - Examine methods to improve supply and material transport coordination to reduce carbon emissions, such as by requiring contract drafting during procurement and signed contracts.
    - Explore product groups with extended usable life or reuse and discover requirements/criteria that encourage lifespan extension.
    - Establish or purchase a central furniture/fixtures/equipment reuse system, including laboratory equipment [9,10].

- **Development of new courses and study programs:**
  - Develop new sustainability courses and degree packages as needed and reduce administrative impediments to developing multidisciplinary and inter-faculty educational courses.
  - Assess the demand for sustainability professional development for teachers and researchers interested in teaching multidisciplinary environmental and climate concerns.

- **Academic collaborations:**
  - Strengthen VIT's brands and reputations in sustainability and beyond. Highlight the University's sustainability-related cooperation spaces.
  - Strengthen universities' strategic knowledge contribution for timely, scientifically-based decisions needed for a sustainable society.
  - In collaboration with the Vellore Municipal Corporation, non-profit and social governance organizations, and the business community, facilitate new inter-faculty research and education.
  - Provide central resources for university collaborations on national and international climate action and sustainability research and projects.

- **Management and operational support:**
  - Ensure that the responsible boards/committees have the necessary expertise to assist University strategic decision-making.
  - Ensure that there are Human Resources within the University's administrative departments that can provide expert professional support in the implementation of the necessary activities.
  - Develop space in existing management curricula for all administrative and academic managers to learn about climate challenges and sustainability.
  - Define and set timeframes for different bodies' roles in the Climate Roadmap's measures.

- Increase communication about the University's climate action initiatives to make VIT's carbon neutrality efforts clear internally and externally. Highlight climate action efforts by individuals, academic departments, or administrative departments.
- Guarantee the Environmental Management System's development is clearly linked to the Climate Roadmap and the University's action plans. This will highlight that the Climate Roadmap is an inherent aspect of the Environmental Management System and that each School (or Center) must work on both parts within its activities.

6. Responsibility and following-up

✓ The Climate Roadmap depicts the University's plan until 2050. Any organization struggles to relate to a distant promise. This timeframe must be considered while revising and monitoring plans. Thus, the Management must examine the Climate Roadmap every two years to ensure its short and long-term efficacies. Climate action will be assessed using the Climate Roadmap. Actions may be needed to achieve goals.

✓ Senior administration at the University must guarantee carbon neutrality by 2050. The respective Schools and Centers are required to report their implemented and ongoing activities in accordance with the Climate Roadmap. Locally, each School (or Center) must examine its own operations to identify areas where budget cuts might have the most effects. Local environmental action plans should include objectives and techniques for reducing operating emissions in the short term.

✓ The two-year action plans of the administrative departments and the university administration specify who will carry out the actions. Duty emphasis is possible in action plans. Management must regularly review each measure to make sure the job is progressing.

✓ Additionally, the Climate Roadmap should be linked to the University's action and strategic goals and integrated into the Environmental Management System of the institution. The Environmental Management System will implement concrete initiatives across the campus.

7. References

1. Synthesis Report Of The IPCC Sixth Assessment Report (AR6), https://www.ipcc.ch/report/sixth-assessment-report-cycle/
2. UNFCCC (2020), What is the Paris Agreement? https://unfccc.int/process-and-meetings/the-paris-agreement
3. Net Zero by 2050: A Roadmap for the Global Energy Sector, https://www.iea.org/reports/net-zero-by-2050
4. Net Zero Strategy: Build Back Greener, https://www.gov.uk/government/publications/net-zero-strategy
5. India's Long-Term Low-Carbon Development Strategy, https://moef.gov.in/wp-content/uploads/2022/11/Indias-LT-LEDS-2.pdf
6. India's National Action Plan on Climate Change (NAPCC), https://static.pib.gov.in/WriteReadData/specificdocs/documents/2021/dec/doc202112101.pdf
7. India: Climate Change Communication And Education, https://education-profiles.org/central-and-southern-asia/india/~climate-change-communication-and-education
8. UN (2020), The 17 Goals, https://sdgs.un.org/goals
9. Eight steps into the future – Action Program for Sustainable Development and Responsibility: University of Eastern Finland 2022–2025, https://www.uef.fi/en/sustainable-development
10. The climate roadmap – universities' path towards carbon neutrality: Stockholm University, https://www.su.se/english/about-the-university/sustainable-development/the-university-s-climate-and-environment-work

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