Assignment – 01

Module 1 (ClimateLiteracy)

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Q1)

(a)

With 20% of Karachi's vehicle fleet converted to electric vehicles, 80% remains powered by fossil fuels. To determine the annual emissions from the remaining fleet and total emissions for all 1.5 million cars, we'll do the calculation as follows:

Annual emissions per car = Distance traveled per year × Emissions per km
= 12,000 km/year × 0.2kg CO_2/km = 2,400 kg CO_2/year
= 2.4 tons CO_2/year

Total emissions for 1.5 million cars = (1.5×10^6) x 2.4 = **3.6 million tons CO_2/year**

Fossil Fuel Cars = 80% of 1.5 million cars = 0.8 x (1.5×10^6) = 1.2×10^6 = 1.2 million

Total emissions for Fossil Fuel Cars = (1.2×10^6)× 2.4 = **2.88 million tons CO_2/year**

Reduction = 3.6 - 2.88 = 0.72 million tons CO_2/year

(b)

Since now we've to calculate emissions for EV cars first we'll have to find the number of EVs in the fleet which are as follows,

EV Cars = 20% of 1.5 million cars = 0.2 x (1.5×10^6) = 3.0×10^5 = 300, 000 cars

Annual energy per car = Distance traveled per year × Electricity consumption per km
= 12,000 km/year × 0.2 kWh/km = 2,400 kWh/year

Total energy for EV Cars = 300,000 x 2,400 kWh/year = 720,000,000 kWh/year

Total grid emissions for EV Cars = 300,000 x 720,000,000 kWh/year
= **0.3672 million tons CO_2/year**

(c)

From part (a) we got 2.88 million tons CO_2/year emissions from Fossil Fuel cars while from part (b) we got 0.3672 million tons CO_2/year emissions from EV cars.

Total Emissions of Combined Fleet = 2.88 + 0.3672 = 3.2472 million tons CO_2/year

Now to compare with all fossil fuels fleet (emissions before the conversion),

Fossil Fuel Emissions = 1.5 million cars x 2.4 tons CO_2/year = 3.6 million tons CO_2/year

Reduction in emissions = 3.6 million tons CO_2/year – 3.2472 million tons CO_2/year
= 0.3528 million tons CO_2/year
= $\frac{0.3528}{3.6}$ x 100 = **9.8%**

Converting 20% of Karachi's vehicle fleet to EVs reduces annual emissions from 3.6 million tons CO_2/year (all fossil fuel) to 3.2472 million tons CO_2/year which results in a reduction of 9.8%.

(d)

Based on the comparison, EVs in Karachi provide a modest reduction in emissions, achieving a 9.8% reduction when 20% of the vehicle fleet is converted to electric. Although EVs eliminate direct emissions from cars, Karachi's electricity grid which relies on fossil fuels and emits 0.51 kg CO_2/kWh limits the environmental benefits of EVs. As a result, EVs are only a partially viable solution under the current conditions. But to maximize the sustainability of EVs, Pakistan must transition its electricity generation to cleaner energy sources (for e.g. solar, wind, hydropower, or nuclear) which could significantly reduce emissions associated with EV charging. Other than that, can focus on energy storage systems to store excess renewable energy for EV charging during peak hours. Moreover could promote shared EV programs or electric public transport to minimise overall energy consumption. These methods reduce dependency on fossil fuels and increase the viability of EVs in the current grid environment of Karachi.

Q2)

(a)

Data provided,
Trees in Phase-I: 2 billion
Trees per hectare: 1,000 trees/hectare

Data not provided in question but found through other sources,
CO_2 sequestration per hectare per year: 22 tons CO_2/hectare/year
Pakistan's annual CO_2 emissions: ~490 million tons CO_2/year

Total hectares planted = $\frac{Total\ trees}{Trees\ per\ hectare}$ = $\frac{2{,}000{,}000{,}000}{1000}$ = 2,000,000 hectares

Total CO_2 sequestration = Total hectares × Sequestration per hectare/year
= 2,000,000 x 22 = 44 million tons CO_2/year

Now comparing it to Pakistan's annual CO_2 emissions,

$$\frac{Total\ sequestration}{Annual\ Emissions} \times 100 = \frac{44}{490} \times 100 \approx 9\%$$

Phase-I offsets approximately **9%** of Pakistan's annual CO_2 emissions.

Sources:
Terrestrial CO_2 Sequestration Rates
Pakistan's Emissions

(b)

Phase-I of the Ten Billion Tree Tsunami Programme is a practical initiative to combat climate change, enhance biodiversity, and sequester carbon. Its viability, however, depends on resolving important issues, such as obtaining sufficient money, guaranteeing access to water supplies, and preserving high tree survival rates. Furthermore, maintaining ecological equilibrium requires avoiding monoculture crops and giving preference to native species. Its implementation is made more difficult by logistical concerns, such as determining enough land and guaranteeing adequate surveillance. Although the initiative has promise, effective governance, community involvement, and open oversight procedures are essential to its success.

(c)

Scaling the program to 10 billion trees by 2023 is highly ambitious and presents several challenges. It requires a large cost for planting, maintenance, and monitoring, which could put a pressure on national budgets in the absence of outside support. Significant logistical challenges include obtaining enough land, guaranteeing water supply, and organising a sizable workforce, particularly in areas with competing land uses or water scarcity. Risks to the environment include monoculture plantings, which can degrade biodiversity, and possible ecological imbalances brought on by poorly chosen species. A phased implementation plan, multinational collaborations, and strong local governance are necessary to overcome these obstacles and guarantee the program's long-term viability and scalability.

(d)

The Ten Billion Tree Tsunami Programme offers significant socio-economic benefits. It reduces poverty by creating job possibilities in the planting, upkeep, and monitoring of trees, particularly in rural regions. By repairing ecosystems and establishing wildlife habitats, it also improves biodiversity and promotes environmental stability. The initiative also promotes agroforestry, which enhances rural livelihoods by giving people access to sustainable timber, fruits, and other resources.

However, these benefits may be limited by several barriers. The effectiveness of the program may be weakened by corruption and poor management, and large-scale execution could be hindered by a lack of money. Ecological imbalances and lower tree survival rates can result from poor planning, such as poor species selection or a lack of monitoring. The program's total impact could be reduced as well by low community involvement and public knowledge, which may have an impact on participation and long-term maintenance initiatives. To fully achieve the initiative's socioeconomic potential, these barriers must be removed.

(e)

To ensure the success of large-scale reforestation projects in Pakistan, several improvements are essential. In order to prevent mismanagement, the government should prioritise native species, set explicit land use restrictions, and implement stringent monitoring and accountability procedures. Seeking global climate finance, establishing public-private partnerships, and utilising corporate social responsibility funds are ways to increase funding.

Community involvement is also essential; through awareness campaigns, training courses, and financial incentives, local communities should be actively involved in the planning, planting, and maintenance processes.

This strategy guarantees that the advantages are shared fairly while also improving the program's sustainability. Including stakeholders and local governments in decision-making will encourage long-term dedication to the project and a sense of ownership.

Q3)

Assumptions:

Electricity Usage: 1,000 kWh/year at 0.51 kg CO_2/kWh

Transportation: 12,000 km/year with an emission factor of 200 g CO_2/km

Diet: 2 tons of CO_2/year

Waste Disposal: 0.5 tons of CO_2/year

(a)

Electricity Emissions = 1,000 × 0.51 kg CO_2/kWh = 0.51 tons CO_2/year
Transportation Emissions = 12,000 × 0.2kg CO_2/km = 2.4 tons CO_2/year
Diet emissions = 2 tons of CO_2/year

Waste emissions = 0.5 tons of CO_2/year

Total carbon footprint = 0.51 + 2.4 + 2 + 0.5 = **5.41 tons CO_2/year**

(b)

The student's carbon footprint of **5.41 tons** CO_2/year is **above** the global average of **4.7 tons/year.**

(c)

1) Switch to Public Transport:
    - Reduction: 1.9 tons CO_2/year
2) Adopt a Plant-Based Diet:
    - Reduction: 1 ton CO_2/year
3) Reduce Electricity Consumption:
    - Reduction: 0.15 tons CO_2/year

Total Reduction Potential: 1.9 + 1 + 0.15 = 3.05 tons CO_2/year

Q4)

Category	Article Links
Extreme Weather Events	• California Wildfires Intensified by Climate Change • Climate Factors Amplify LA Fires • Heat in Europe Could Kill 2.3 Million by Century's End • Wider LA Areas Becoming 'More Flammable' Due to Climate Change • Storm Eowyn Brings Tornado and 'Danger to Life' Alerts in the UK
Policy and Political Developments	• Post-Davos Corporate Sustainability Dilemma • Concerns Over U.S. Support for Amazon Rainforest Protection • US Leadership's Focus on Fossil Fuels Contradicts Global Trends
Social and Environmental Justice	• Climate Crisis Deepens Housing Inequities for Black Communities • Far-Right Engagement with Environmentalism

Renewable Energy and Sustainability Initiatives	• Corporate Climate Commitments Post-Davos • Democratic Republic of Congo's Green Corridor Initiative
Scientific Research and Findings	• Climate Change's Role in LA's Fire Vulnerability • Impact of Global Heating on Fire-Prone Conditions • Study Highlights Need for Transition to Renewable Energy

Analysis of Media Coverage

Extreme weather occurrences and political developments have dominated media coverage of climate change in recent years. The immediate and obvious effects of climate change are brought to light by reports of severe storms like the recent tornado warnings in the UK, heatwaves in Europe, and wildfires in California. The continuous political conversation around climate action is also reflected in policy conversations, such as international climate agreements, pressure on financial institutions to change their environmental positions, and corporate sustainability meetings following Davos.

Climate change is typically portrayed by the media as an urgent problem that needs to be addressed right away. They frequently highlight the need for legislative changes and scientific research that connects climate change to increasingly extreme weather. Reports usually emphasise how human activity contributes to these environmental problems, highlighting how urgent it is for businesses and governments to take action.

Nonetheless, some reporting is blatantly biassed. Narratives are frequently influenced by political connections, particularly when talking about economic effects and climate measures. While liberal-leaning media typically stress the moral and environmental imperatives of action, conservative-leaning sources might draw attention to the financial costs of climate laws. Furthermore, studies that present sustainability measures as required investments or as legislative overreach are examples of how business climate commitments are occasionally interpreted through an economic lens. These differences imply that although the climate disaster is well known, how it is portrayed varies depending on the publication's political and economic setting.