



ICT Oriented Customary Methods for Minimizing Carbon Emission in the Environment

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Abstract: *The social scientists, researchers and world leaders are too much concerned about the unpredictable climate change occurring in the different part of the world. According to Voltaire, “Men argue. Nature acts”. In year 2019, carbon dioxide comprises 411 ppm of earth’s atmosphere. There is a strong correlation between climate and amount of co2 in in the atmosphere ; more carbon dioxide means too hotter the earth. Human activities including burning of fossil fuels and deforestation are the main cause of increase of CO2. According to EPA.gov, the main emitters of CO2 are transportation (29%), electricity production (28%), industry (22%) , commercial including residential (12%) and agricultural (9%). Both Internet of Things (IoT) and Artificial Intelligence (AI) present opportunities to lower carbon emission maximize energy efficiency and store the renewable energy efficiently. IoT enabled public and green transportation, Mobility-as-a-Service(MaaS),and Carbon capture(CarbFix) are new suitable methods to minimize the influence of CO2 in the atmosphere. Researchers found that Information communication technology ,including IoT could help reduce greenhouse gas emission by upto 63.5 gigatons or 15%,across all industrial sectors by 2030 and also predict that by 2050 ,two-thirds of the world’s population will live in cities , so that cites should be smart with IoT. Using the Big Data analysis, scientists know what’s coming and how can act accordingly. This paper points out the role of Information Communication Technologies and normal methods for the reduction of carbon emission. Wipe out pollution before it wipes you out.*

Key Words: CO₂, ICTs, IoTs, GHG, e-LCVs, Big Data.

1. INTRODUCTION :

World is too much concern on more frequent and intense drought ,storms, rising sea levels, flood , heat waves, melting glaciers and warming oceans , which directly harm living being on the earth. Behind the phenomena of global warming and climate change lies the increase in greenhouse gases in our atmosphere which is capable of absorbing infrared radiation, thereby increase heat in the atmosphere.

Natural sources of carbon dioxide emission include decomposition, ocean release and respiration. Human sources carbon dioxide emission come from activities like cement production, deforestation as well as the burning of fossil fuels like coal, oil and natural gas.

Due to human activities, the atmospheric concentration of carbon dioxide has been rising extensively since the Industrial Revolution and has now reached dangerous levels not seen in the last 3 million years. Human activities are responsible for almost all of the increase in greenhouse gases in the atmosphere over the last 150 years. The largest source of greenhouse gas emissions from human activities is from burning fossil fuels for electricity, heat, and transportation. Burning of oil, gas and coal, as well as deforestation are the primary cause of increase in CO₂ concentration in the atmosphere. Eighty seven percentage from burning oil, gas and coal, and nine percentages from the clearing of forest and other land use changes, remaining four percentage from other sources. Females, adults ,with higher income and educational level have amore positive attitude towards carbon footprint labels[1]. Human activities that lead to carbon dioxide emissions come primarily from energy production, including burring oil, natural gas, coal and more.



Today, there are over 41,700 airports all over the world according to central Intelligence Agency. The United States has the highest number of airports in the world, with 13,513 in total. In 2022, despite the corona virus outbreak, the global aircraft fleet is expected to have **25,578 aircraft** in service worldwide

One way to help lessen the effect of climate change is to reduce our carbon emissions

Country	Cumulative Co ₂ emission from fossil fuel combustion worldwide from 1750 to 2020 in Billion Metric tons	Number of Airports
United States	416.72	13,513
China	235.56	507
Russia	115.34	1,218
Germany	92.64	539
UK	78.16	460
Japan	65.63	175
India	54.42	346
France	38.73	464
Canada	33.58	1,467
Ukraine	30.56	187
Poland	27.86	126
Italy	24.74	129

Table 1 – Cumulative CO₂ emission Vs No. of Airports

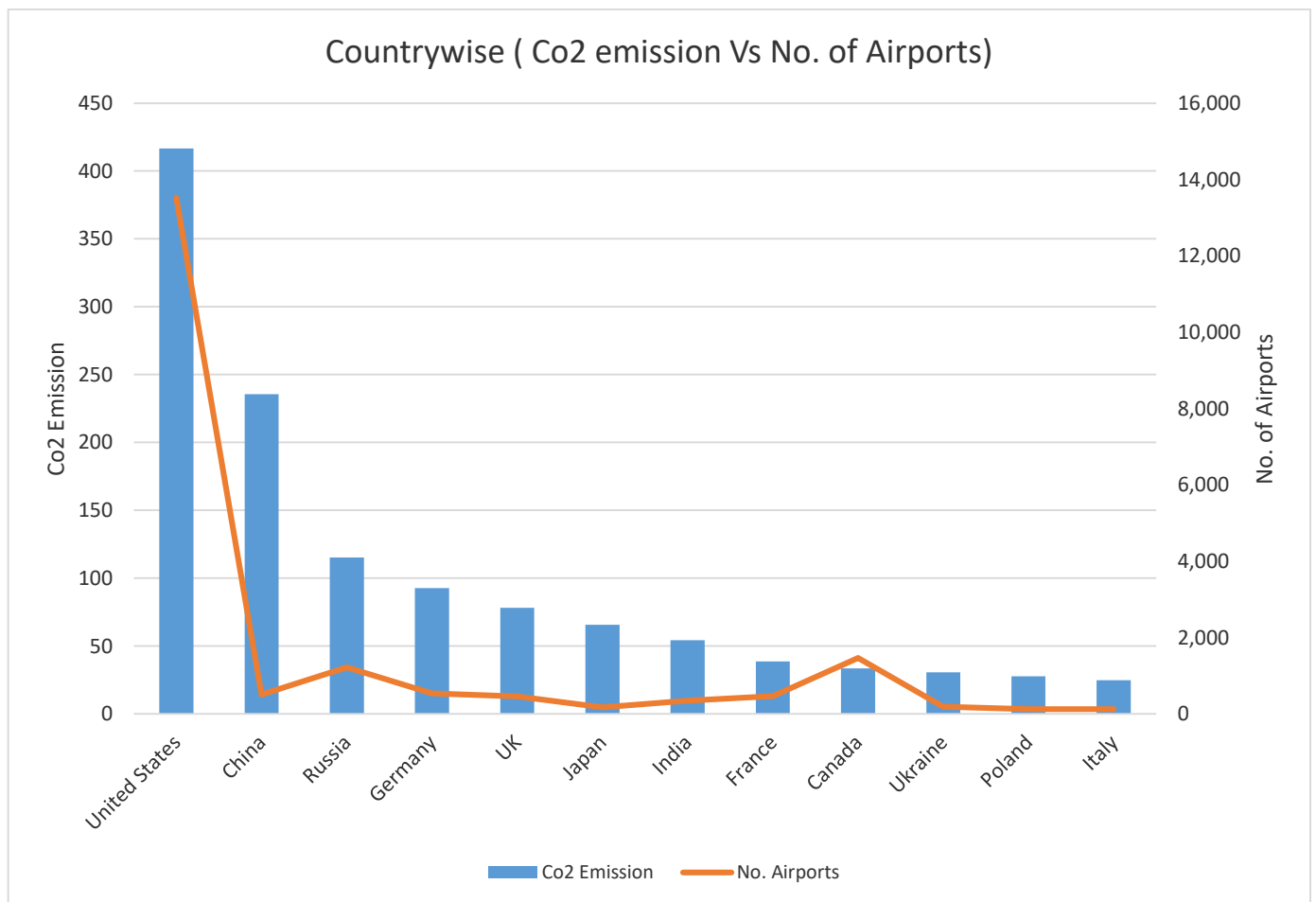


Figure 1 – Country wise details (CO₂ emission Vs No. of Airports)



2. CARBON EMISSION & CAUSES :

The amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organization, or community. Carbon emissions refer to the release of carbon dioxide, a type of greenhouse gas (GHG) that filters into the atmosphere both naturally and from human activities like electricity consumption, deforestation and industrial manufacturing. While plants and animals also emit carbon, human activity like the burning of fossil fuels, manufacturing, and transportation has been a leading cause of the sharp increase in CO₂ emissions, at levels that are impossible for nature to balance on its own.

A carbon footprint is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions. The simplified carbon footprint definition for kids is: The amount of CO₂ released into the atmosphere because of one's own energy needs. This is called your "carbon footprint."

There are a few main industries that create the majority of the greenhouse gasses we produce. Accounting for the huge volume of carbon consumption, the steel industry needs to reduce generated carbon dioxide[2]. Global data from 2016 shows the main culprits:

- **Energy** (the burning of fossil fuels) produced 36013.52 million tonnes of CO₂e.
- **Agriculture** produced 5795.51 million tonnes of CO₂e.
- **Land-use change and forestry** (altering or converting land) produced 3217.07 million tonnes of CO₂e.
- **Industrial processes** produced 2771.08 million tonnes of CO₂e.
- **Waste** produced 1560.85 million tonnes of CO₂e.

There was the bidirectional granger causality relationship between global per capita carbon emissions and economic growth, and between global per capita carbon emission and economic structure[3]. Carbon can emit through inevitable logistic activities in the chains (eg. lighting, air-conditioning, product deterioration, heating) [4]. To have the best chance of avoiding a 2°C rise in global temperatures, the average global carbon footprint per year needs to drop to under 2 tons by 2050.

For example, the carbon footprint of **a bottle of water** includes the CO₂ or CO₂ equivalent emitted during the manufacture of the bottle itself plus the amount emitted during the transportation of the bottle to the consumer.

How does technology increase carbon footprint?

Digital technologies are responsible for 4% of greenhouse gas emissions (GHG), and its energy consumption is increasing by 9% a year. The internet emits 1.6 billion annual tons of greenhouse gas emissions. The communications industry will represent 20% of the world's electricity consumption by 2025

Reducing carbon emissions can

- **Save lives.** Poor air quality due to carbon emissions can lead to severe health issues like heart attacks, strokes, lung disease, high blood pressure, and even diabetes. According to scientists, reducing carbon emissions will positively impact air quality and prevent thousands of premature deaths.
- **Reduce wildfires.** Wildfires and carbon emissions are part of a harmful cycle. Wildfires emit dangerous amounts of carbon emissions and rising carbon emissions cause extreme weather conditions like heat waves, which often contribute to wildfires. Reducing our emissions can relieve some of the burdens from forest and land management, emergency responders, and fire departments worldwide.

3. CARBON EMISSION REDUCTION METHODS :

There are many ways humankind can pitch in to help reduce carbon emissions:

- **Reduce air travel.** As of 2017, the amount of transportation-related carbon dioxide emissions eclipsed the amount of electricity generation emissions. Transportation is now the number-one source of greenhouse gases. Eliminating just one roundtrip transatlantic flight will save you 1.6 metric tons of carbon dioxide equivalents per year. Also promote eco-friendly commuting[5].
- **Encourage to work on digital skill.** To reduce our energy waste and emission through travelling, share documents using cloud storage or video conferencing
- **Make your driving more efficient.** While living a car-free lifestyle may not be possible for everybody, try substituting car trips with bike rides, bus trips, train rides, or other forms of public transportation. When you drive, cut back on fossil fuel emissions by accelerating slowly and using the air conditioning sparingly. Check your tire pressure for better fuel economy, carpool when possible, and consider purchasing a hybrid



or electric vehicle if you want a new car. Other factors to reduce CO₂ emission are driving style, unnecessary acceleration reduce mileage by up to 33%, properly insulated tires improves mileage by up to 3%, and more..

- **Plant trees.** Deforestation is one of the significant causes of carbon emissions. Trees absorb and store the carbon dioxide in the atmosphere, but they can no longer absorb carbon once they are cut down. Planting trees is among the most inexpensive, natural ways to take climate action and reduce our negative environmental impact.
- **Switch to clean energy.** Clean energy is another way to help reduce carbon emissions. Solar panels, wind turbines, and geothermal energy are all energy sources with a higher level of sustainability, produce low carbon emissions, and lower our dependence on natural gas and resource harvesting.
- **Eat less red meat.** Over 220 grams of carbon dioxide are produced for every gram of beef produced, resulting in almost four percent of the total GHG emissions. Eating vegetarian more often or consuming less beef can lower the amount of carbon present in our atmosphere.
- **Make our home more energy-efficient.** All of them try to use renewable energy sources which reduce energy use in our everyday life. Choosing appliances with a high energy star rating buy energy-saving light bulbs and install automatic & movement sensing lights.
- **Efficient water usage.** Installing drip irrigation so that plants receive only what they need, which reduce energy used to pump the water. Control unnecessary flow of water in the home using electronically monitoring system.
- **Change the diet :** Choose a plant based diet and shop for locally sourced food.
- **Reduce ,Reuse, Recycle.** By buying used products and recycling or reselling items no longer use dramatically reduce CO₂ emission. Reuse Information Technology equipment. Reduce single-use plastics as possible as needed.
- **Awareness programme.** Conduct awareness programme in education institutions especially in middle schools such as walking and cycling more, sharing and reusing things, chose plant alternatives to meat sometimes, buying local products if possible, use both sides of paper, not waste food, plant trees, limit the practice of use & throw and more.
- **Ecobricks projects.** Ecobricks are used to make many things such as **furniture, walls and buildings**. It allows communities and companies to get control of their plastic waste to create modular furniture, garden spaces, walls and even full-scale buildings.

4. MESHERING CARBON EMISSION :

So, what is the average carbon footprint? In reality, this question is a little tricky to answer. It really depends on which averages you're talking about, whether for a person, a business, or a country. Even then, there are many different factors that contribute to an entity's carbon footprint.

There are plenty of studies and evidence out there that show average levels of carbon emissions. However, a lot of the data published by governments focuses on *territorial* emissions. Essentially, this refers to the greenhouse gases produced **within a nation**. In the UK, for example, 2018 data shows annual emissions of 448.5 million tonnes of CO₂e, down 43% since 1990.

This data seems encouraging. However, when it comes to the total carbon footprint, there are other factors to consider. *Consumption* emission data takes into account that is responsible for the emissions, no matter where they're produced.

Again, using the UK as an example, greenhouse gas emissions related to imports have actually increased. In 2017, for example, they were 18% higher than in 1997.

So, the latter example takes into account the story behind the emissions. For example, if a person in the UK buys a device produced in China, the emissions involved in producing, shipping, and using the device are attributed to the UK. Obviously, this is harder to measure but is perhaps a better indicator overall.

Use this method for the calculation: Max. controlled mass emissions [tons/year] = Maximum Controlled Mass Emissions (tons/year) x (100 – Pollution control efficiency) ÷ 100. The Greenhouse Gas Equivalencies calculator allows you to **convert emissions or energy data to the equivalent amount of carbon dioxide (CO₂) emissions from using that amount**. The calculator helps you translate abstract measurements into concrete terms you can understand, such as the annual emissions from cars, households, or power plants.



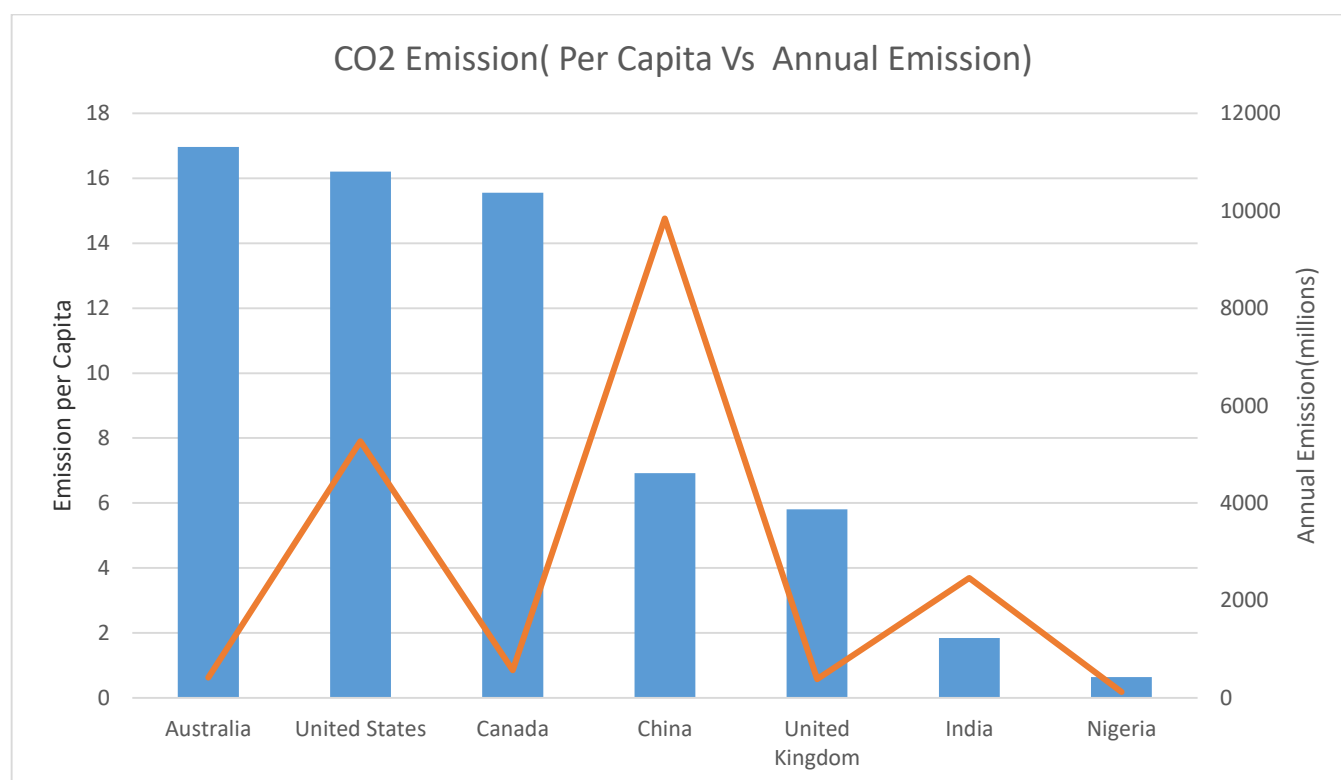
Global averages

If you're wondering how much CO2 the average person emits, there are figures out there. One source is our world data, which allows you to look at per-capita CO2 emissions. We've outlined data from just a few countries as an example.

It's worth noting that this 2017 data focuses on territorial emissions, so it doesn't account for traded goods. And, of course, you'll also need to take into account the difference in population size across these countries.

Country	Emissions per capita (tonnes of CO2)	Total annual emissions (tonnes of CO2)	Total annual emissions (tonnes of CO2) million
Australia	16.96	417.04 million	417.04
United States	16.21	5.27 billion	5270
Canada	15.55	571.14 million	571.14
China	6.92	9.84 billion	9840
United Kingdom	5.81	387.39 million	387.39
India	1.84	2.46 billion	2460
Nigeria	0.64	122.78 million	122.87

Table 2 – CO2 emission per Capita of leading countries



The annual carbon dioxide (CO2) emission in Kochi, Kerala due to vehicular movement is about 7.65 million tone. The studies of CDIA (cities Development Initiative for Asia) has assessed that around 25 percent of the emission can be avoided in the city with improved traffic conditions. Carbon monoxide(CO) emitted by the vehicles contributes 90%of the total emissions followed by hydrocarbons. Like other Indian cities, two and three-wheelers occupy a significant share in total vehicular stock. Main fact that the vehicles were used for extended lifetime without proper maintenance .According to the report , improper inspection and maintenance, use of poor quality fuel, poor road conditions are main cause of the CO2 emission.

Globally, urban freight transport represents up to twenty five percentage of urban vehicles, takes up to 40 % of road space, and contributes to up to forty percentage of carbon emission. Thirty eight percentage of vehicles operated in the Kochi city carried freight, of which forty two percentage were diesel run LCVs.



5. RECOMMENDATION FOR CARBON EMISSION REDUCTION :

- To introduce e-LCVs (Electric –Light Commercial Vehicles) and e-LPVs (Electric –Light Passenger Vehicles) to deliver goods and to carry passengers within the city ,which would be monitored over a particular period with attributes like life cycle cost, carbon footprint and operational expense.
- Provide 30% subsidy for electric vehicles.
- Provide many charging centers in the city.
- Motivate and educate people to use mobile based apps for identifying the charging centers with help of GIS and electric charging procedures.
- 24 X 7 help line with best navigation apps like Google Maps , apple Maps, Waze, MapQuest, Maps.Me and more for break down service of electric vehicle.
- ICT enabled carbon emission checking centers are implemented in urban and rural areas
- ICT enabled instant checking for air pollution made by vehicles with the help of Motor vehicle department and fined accordingly.
- An IoT enabled traffic system can dynamically adjust the timing of traffic signals.
- Implement smart home technology.
- Widen the public roads for the smooth flow of vehicles. It should reduce traffic jam, results in the reduction of the carbon emission.

Educate our children to reduce carbon footprint as follows

- Walking and Cycling more
- Sharing and Reusing things
- Choosing plant alternative to meat
- Not wasting food
- Buying local products as possible as
- Use both side of paper maximum.
- Calculate our own carbon footprint.
- Discuss with family and friends how they can help.

Provide computers, laptops with internet connection to pre-primary , primary schools with free of cost. Educate them through ICT based power point presentation, display videos to motivate them for the above mentioned activities.

Educate the layman to reduce carbon footprint as follows :

Planting trees. As trees grow, they help stop climate change by removing carbon dioxide from the air, storing carbon in the trees and soil, and releasing oxygen into the atmosphere. Trees provide many benefits to us, every day. Government or concerned authorizes should provide fertilizers free of cost and monitor the progress though ICT tools. Agriculture department of the state should take the initiative with the help of Information Communication Technological tools.

- Install solar panels. Solar power reduces CO₂ emissions by providing a clean and renewable source of energy. The panels that are installed on our home collect energy from the sun and convert it into usable electricity.
- Implement wind turbines. Converting the kinetic energy of wind directly into electricity will not result in any form of pollution or carbon emissions, but if the whole life cycle of wind farm is taken into account, wind turbine manufacturing, transportation and recovery and disposal do have quantitative environmental effects.

6. CONCLUSION :

One of the main causes of climate change is Carbon Emission. It can be reduced by the conventional methods which are described in details. Since we are living in a digital world, Information Communication technology with IoTs can play major role in minimization of carbon emission that will protect our environment are mentioned in detail in this paper.

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