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Digital CO_2 Footprints – An Analysis

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Abstract –

The amount of CO2 released into the atmosphere as a result of everyday human and non-human activity, such as fuel combustion, is referred to as the carbon footprint. It's a well-known phenomenon and well-understood notion. However, technology leaves a carbon imprint, which is known as the Digital Carbon Footprint. Technological improvements have made it easier to continue with routine activities. Nevertheless, the transition to a digital world has caused a harm on the environment. When digital devices are created and used, more CO2 is released into the atmosphere. Almost the entire world has been transformed by digitization. With a population of 7 billion people, 59.5 percent of the world's population has reliable internet connection. The transmission of data over the internet causes pollution, resulting in more than 4 percent of greenhouse gas emissions. Data transfer may appear to be a simple task that takes less than a second, but the process underlying it is quite complex, requiring several servers to expend tremendous amounts of energy to complete a single transfer. More than 35 percent of the world's population is exchanging data every second. The majority of the energy used for data storage, transmission, and generation originates from sources that release greenhouse gases like CO2 and methane into the environment. Every time we use a device that requires energy or the internet, we are releasing a little quantity of greenhouse gases into the atmosphere, adding to the pollution already present. Cloud computing has made it easy to store more data since technological improvements occur virtually daily. However, the cloud technology does not appear to aid in the reduction of carbon footprints. Every minute, approximately 5 million users enter into social networking sites, share data, send and receive emails, watch videos, and engage in any other internet activity, resulting in digital carbon footprints. Some techniques for reducing carbon footprints include using sustainability, employing renewable energy sources such as windmills, and only using electronics when absolutely necessary (moderate usage). The researchers intend to explore the varied effects of digital CO2 footprints as well as approaches to minimise emissions and save the environment through this study.

Index Terms – CO_2, Digital Carbon Footprints, Technology, Greenhouse Gas, Renewable Energy.

Introduction –

Technology has taken over the globe. Almost every possible transaction is using internet and related technology. Every time we search for some information, or watch a video online or send messages, etc., energy is used in the form of electricity and the demand has never stopped. People have started to live with electricity and without it seems impossible. More the demand for electricity, more is the emission of CO_2. even business transactions have completely become online, banking transactions, applications of admission processes into education institutions, every transaction uses electricity followed by internet. This requires storage of a huge amount of data using Big Data technologies. Across the globe, various countries are affected with the negative effects of such digital carbon footprints leading to pollution and climate change.

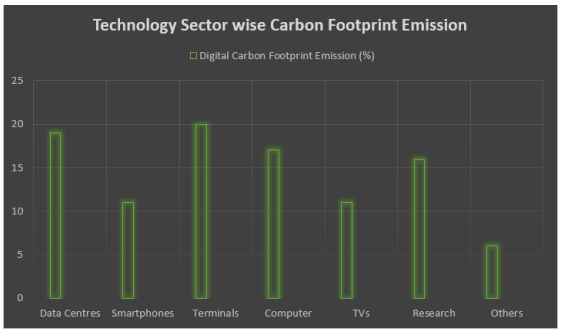

Fig. 1: Technology Sector wise Carbon Footprint Emissions

From the above graphical data, we can infer that Terminals lead to higher amount of digital carbon footprint emission. Terminals are basically conductors that use electricity. Technologies such as big data and cloud computing helps in storing huge amount of data.

Using the Internet with a mobile phone consumes the most electricity, as buildings, vegetation, and the weather weaken electromagnetic waves. This means that more transmission of power is required. But even with old copper cables, the signal must be amplified, especially over long distances. Fiber optic cables, which transmit signals using light, are definitely the most efficient form of transmission technology.

Cloud computing is another major energy consumer. Data is no longer stored locally on a computer or smartphone, but on servers that can be located anywhere in the world and therefore can be accessed anytime, anywhere. Getting your email through Gmail and backing up your photos to the cloud are just two examples of this type of service.

Most cryptocurrencies also consume large amounts of energy. An example of this is Bitcoin, possibly the best-known digital currency. According to calculations by the Bitcoin Energy Consumption Index (2018), a single Bitcoin transaction consumes around 819 kWh. With the same amount of power, a 150-watt refrigerator could run for about eight months. And the Technical University of Munich determined in a 2018 study that the entire Bitcoin

system produces around 22 megatons of carbon dioxide per year, as much as the CO2 footprint of cities like Hamburg, Vienna, or Las Vegas.

But not only the Bitcoin blockchain consumes a lot of energy. Other blockchains and distributed ledger technologies (DLT) also require huge amounts of power. In one of the recently published special RESET feature, which addresses the question of how blockchain can be used to positive effects in practice, the question of whether blockchain and sustainability can really go together is addressed.

Our digital energy consumption is not only determined by what we do, but also by how we do it; The software we use also has a great impact. For example, a less efficient word processing program takes four times as much energy to process the same document as an efficient one. At the same time, software updates often cause computers or smartphones to slow down or stop working, forcing consumers to buy new hardware. And the growing demand for electricity from digitization will surely also be driven in the future by an increase in smart technologies, as we use them more and more at home, on the Internet of Things (IoT) area, in industry and in our cities increasingly digitized.

Need for Sustainability –

The basic economic problem states that we humans have unlimited wants but limited resources. The need for sustainable development began way back, it was for the first time mentioned in the Brundtland Commission of 1984 (also known as the World Commission on Environment and Development). The results of the Commission were included in the reports submitted in the year 1987. Since then, the concept of Sustainable Development has been widely circulated amongst nations, talked about and implementation process and progress are taking place.

As sustainable development started gaining recognition, the need for its implementation began. With multiple issues related to the environment, such as pollution, global warning, ozone depletion, there are seventeen goals of sustainable development that focusses on covering almost every aspect of life and environment so that there is enough for the future generations. Carbon footprints require more attention as its contribution towards environmental pollution is higher.

To start with, the advanced business overall continues to devour increasingly more energy at run time. The greatest players that run the internet and the cloud, despite the fact that upgrading their utilization because of designing and Artificial Intelligence, continue to request more energy to coordinate with the usage of development. Regardless of whether all the computerized business entertainers (particularly China) submitted similarly to being carbon unbiased, the environmentally friendly power creation presumably could not stay aware of the energy requests until further notice. At construct time, the business continues to deliver an ever-increasing number of machines (servers,

detainers, optic strands, cell phones, PCs, and so forth) that additionally think of a tremendous carbon impression. Each of the previous realities are generally determined by the always developing made requirement for greater amusement, proficiency, and social association in the buyer's regular daily existence.

What causes digital carbon footprints –

Carbon footprints are the result of the activities and individual does on the internet. With modernization and advancements in technology, people have become tech-savvy and almost living with technology and internet every day. Mobile phones have become smart but are we humans smart enough to prevent carbon footprint emissions? Most of the smart phones today use cloud computing, artificial intelligence, cryptocurrencies, and data centres for storage of every type of data. All these consume heavy amount of electricity and storage. The electricity generated is mostly from coal using power plants and not to mention that coal is a non-renewable resource that takes many years to regenerate.

Every time we send an email, there is a carbon footprint attached thereto, an equivalent goes for our WhatsApp messages, or Instagram stories and posts, or Facebook shares, etc. Incredible because it could seem, of these actions contribute to a greater or lesser extent to extend global greenhouse emission emissions. The digital devices, computers, and networks we use for these purposes all run on electricity, and thus generate CO2 emissions.

Simultaneously, all our digital interactions with these devices define our digital footprint. This term is defined as one's unique set of traceable online digital activities. This includes the knowledge collected both passively (through 'cookies' on the online pages we visit) and actively (social media posts). This information is stored on servers, usually hosted in large data centres. The term carbon footprint, on the other hand, refers to the entire greenhouse emission emissions by a private, organization, event, or product.

Millions of transaction takes place every minute and each transaction use internet facilities and electricity. Till date most of the electricity generation for the purposes of internet facilities is generated using coal. It is one of the rare earth element. If we take global data, China is one of the world's largest producer of rare earth minerals around 70percent of global annual production. Every smart phone uses cloud for data storage and the digital traffic caused due to this very usage of cloud, it consumes lot of electricity.

The streaming services is related to energy use and carbon emissions from devices, network infrastructure, and knowledge centres. Nonetheless, contrary to a slew of recent dishonourable media coverage, the climate impacts of streaming video remain comparatively minor, especially when

compared to other activities and sectors. The carbon footprint of streaming video depends primarily on the usage of electricity and then on the carbon dioxide emissions that are associated with each unit of electricity that is generated.

Storage of data is one of the major reason contributing towards digital carbon footprint emissions. Storage houses such as data centres use and store very huge and heavy data which leads to the consumption of 3percent of the global electricity supply and leads to emission of greenhouse gases. Not only greenhouse gases but even electronic waste that are released through data centres' activities, lead to such emissions (2percent of solid waste includes e-waste as well). The entire world releases 50 million tonnes of electronic waste each year.

With advancements, artificial intelligence (AI) is globally recognized. In research in the AI field, it is released that 284 tonnes of carbon dioxide emission takes place every time new developments and training are provided to AI Models, and this results in digital carbon footprint emissions. Another issue that leads to digital carbon footprints emission is the Bitcoin and cryptocurrencies. The amount of energy required to produce a dollar's worth of bitcoins is more than double that of mining the same value of copper, gold, or platinum. Blockchain technologies (blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system. A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain.) like Bitcoin are energy inefficient and, if their potential uses are not developed in a sustainable way, they will pose a serious threat to the environment.

Reducing digital carbon footprints with simple methods –

In a 2016 data it was revealed people who stream videos streamed about 1 billion hours of YouTube videos every day leading to emission of 10 million metric tons of CO2. So, reduction of video streaming, or upgradation of some features such as turning off the video if only audio is required can be a useful method. Instead of using application for audios or music that uses internet, one can use the inbuild play music system that does not require internet. Even emails lead to digital emissions, removing subscription of emails and notifications that are not required is another method.

The green house gas emissions from the ICT (Information and Communication) sector were around 1.4 billion metric tonnes in the year 2020. One of the major reason being pandemic situation that transformed face-to-face education classes and office work to online classes and work from home respectively. By designing energy-efficient computer processors we could reduce energy consumption, and we could reduce GHG emissions in places where electricity comes from fossil fuels.

The Internet of Things (IoT), which consists of connected computing devices embedded in everyday objects, is already having a positive economic and social impact, improving our societies, the environment, and food supply chains. These devices monitor and reduce air pollution, improve water conservation, and feed the world's hungry. They are also improving the efficiency of our homes and businesses by controlling thermostats, lighting, water heaters, refrigerators, and washing machines.

With the number of connected devices expected to exceed 11 billion in 2018 (excluding computers and phones), IoT has generated massive amounts of data that necessitated massive computations. Making computation more energy efficient saves money and reduces energy consumption. It would also allow batteries that power computing systems to be smaller or run for longer periods of time. Furthermore, calculations could be performed faster, resulting in less heat generated by computing systems.

Reduction in the energy consumption of data centres can be one of the most efficient methods for lowering the emission of digital carbon footprints. Energy and electricity generation takes up lot of heat, so setting up of data centres in cooler or cold places can be one of the solutions. As is it is known that data centres produce heat due to energy generation, reusing the heat can be another method. An example of data centres located in cooler place is Sweden.

Usage of wind and solar power for generating electricity is one of the most efficient and recommended methods that can effectively reduce emission of carbon footprints. Since wind is a renewable energy, usage of windmills for electricity generation. Overall, using wind to generate energy has fewer environmental consequences than many other energy sources. Wind turbines, with rare exceptions, do not emit pollutants into the air or water, and they do not require water for cooling. Wind turbines may also reduce the amount of electricity generated from fossil fuels, resulting in lower total air pollution and CO2 emissions. Individual wind turbines have a small physical footprint. Wind farms are groups of wind turbines that are located on open land, on mountain ridges, or offshore in lakes or the ocean.

Modern wind turbines can be very large machines that have a visual impact on the landscape. A few wind turbines have caught fire, and some have leaked lubricating fluids, but these occurrences are uncommon. Some people dislike the sound made by wind turbine blades as they turn in the wind.

Most onshore wind energy projects require service roads that add physical effects to the environment. The production of metals and other materials used to make wind turbine components has an impact on the environment and fossil fuels may have been used to produce these materials.

The following graph shows how renewable energy technologies are cost effective for the reduction of digital and environmental carbon footprint emissions:

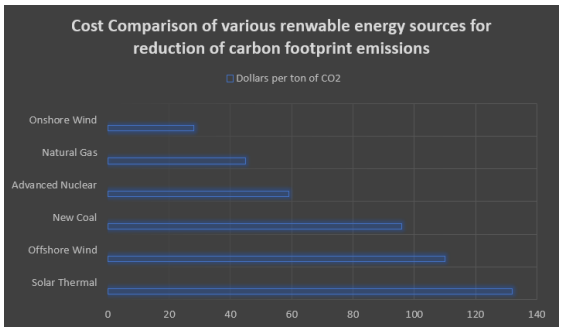

Fig. 2: Cost Comparison of various renewable energy sources for reduction of carbon footprints emissions.

Conclusion –

More the demand for electricity, more is the emission of CO_2. even business transactions have completely become online, banking transactions, applications of admission processes into education institutions, every transaction uses electricity followed by internet. And the growing demand for electricity from digitization will surely also be driven in the future by an increase in smart technologies, as we use them more and more at home, on the Internet of Things (IoT) area, in industry and in our cities increasingly digitized. Every time we search for some information, or watch a video online or send messages, etc., energy is used in the form of electricity and the demand has never stopped.

The internet, computers, and smartphones have changed our world in ways we could never have predicted, but with great power comes great responsibility. While it's encouraging to see global tech companies reducing CO2 emissions, the internet is still on track to become one of the world's largest energy consumers. However, by following the advice above and putting a little more thought into your purchasing and browsing habits, you should be able to significantly reduce your digital carbon footprint. And for the rest of your emissions, there are simple and inexpensive ways to maintain a healthy environmental balance.

Using our carbon footprint calculator; you can assess the impact of your daily activities and then use carbon offsets to reduce or eliminate your emissions. Similarly, renewable energy certificates can be purchased to support clean energy from large-scale wind farms – and to displace energy from fossil fuel sources. And, as the internet pervades more and more aspects of our lives, it is critical that we promote education, smarter browsing and purchasing decisions – as well as greener forms of energy. Fortunately, we can all help the environment by making the right choices every day – without sacrificing the productivity, enjoyment, or convenience of our digital lives.

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