Plugging into the Future:

An Exploration of Electricity Consumption Patterns

MILESTONE 1: DEFINE PROBLEM / PROBLEM UNDERSTANDING

ACTIVITY 1: SPECIFY THE BUSINESI

India is the world's third-largest producer and third-largest consumer of electricity. The national electric grid in India has an installed capacity of 370.106 GW as of 31 March 2020. Renewable power plants, which also include large hydroelectric plants, constitute 35.86% of India's total installed capacity. During the fiscal year (FY) 2019–20, the total electricity generation in the country was 1,598 TWh, of which 1,383.5 TWh generated by utilities. The gross electricity consumption per capita in FY2019 was 1,208 kWh.
In 2015-16, electric energy consumption in agriculture was recorded as being the highest (17.89%) worldwide. The per capita electricity consumption is low compared to most other countries despite India having a low electricity tariff.

the recent COVID-19 situation, when everyone has been under lockdown for the months of March to June the impacts of the lockdown on economic activities have been faced by every sector in a positive or a negative way.
The dataset is exhaustive in its demonstration of energy consumption state wise.
Analysing Electricity Consumption in India from Jan 2019 till 5
th December 2020. This
dataset contains a record of Electricity consumption in each states of India, here we are going to analyse State wise , Region wise and Overall Electricity consumption in India.

Activity 2: BUSINESS REQUIREMENTS

business requirements for analyzing analysis on electricity consumption in

IndiaIdentify the current patterns of electricity consumption in different regions and

sectors of India. This information can be used to identify areas where consumption is

high and areas where it is low. Identify opportunities for improving energy efficiency

and reducing consumption in different sectors and regions. This information can be

used to develop policies and programs to promote energy efficiency. This informationcan be used by government agencies, electricity providers, and investors to develop

policies and make investment decisions that promote sustainable energy

development and consumption in India.

Electricity

Electricity is at the heart of modern economies and it is providing a rising share of energy services. Demand for electricity is set to increase further as a result of rising household incomes, with the electrification of transport and heat, and growing demand for digital connected devices and air conditioning.

Rising electricity demand was one of the key reasons why global CO_2 emissions from the power sector reached a record high in 2018, yet the commercial availability of a diverse suite of low emissions generation technologies also puts electricity at the vanguard of efforts to combat climate change and pollution. Decarbonised electricity, in addition, could provide a platform for reducing CO_2 emissions in other sectors through electricity-based fuels such as hydrogen or synthetic liquid fuels. Renewable energy also has a major role to play in providing access to electricity for all.

The electricity generated by fuel

In the **Stated Policies Scenario**, global electricity demand grows at 2.1% per year to 2040, twice the rate of primary energy demand. This raises electricity's share in total final energy consumption from 19% in 2018 to 24% in 2040. Electricity demand growth is set to be particularly strong in developing economies. Government policies, market conditions and available technologies collectively set a course for electricity supply to shift towards low-carbon sources, with their share increasing from 36% today to 52% in 2040 in the Stated Policies Scenario.

The electricity sector

In the **Sustainable Development Scenario** electricity plays an even larger role, reaching 31% of final energy consumption. In the Sustainable Development Scenario, electricity is one of the few energy sources that sees growing consumption in 2040 – mainly due to electric vehicles – alongside the direct use of renewables, and hydrogen. The share of electricity in final consumption, less than half that of oil today, overtakes oil by 2040.

Accelerated efforts on renewables, nuclear power and carbon capture technologies rapidly decarbonise electricity supply, compensating for the sharp decline of coal-fired power generation and reducing power sector CO_2 emissions by three-quarters by 2040.

Electricity demand

Electricity demand follows two distinct regional paths. In advanced economies, future growth linked to increasing digitalisation and electrification is largely offset by energy efficiency improvements. In developing economies, rising incomes, expanding industrial output and a growing services sector push demand firmly up. Developing economies contribute nearly 90% of global electricity demand growth to 2040 in the Stated Policies Scenario, but demand per person in these economies remains 60% lower than in advanced economies.

Global electricity demand by region

Industry and buildings account for over 90% of global electricity demand today, while transport makes up less than 2%. In the Stated Policies Scenario, the leading drivers of global electricity demand growth are motors in industry (over 30% of the total growth to 2040), space cooling (17%), and large appliances, small appliances and electric vehicles (10% each). Providing electricity access for the first time to 530 million people accounts for just 2% of demand growth. In the Sustainable Development Scenario, electric vehicles become the main source of demand growth.In the Stated Policies Scenario, electricity generation from renewables increases rapidly, surpassing coal by 2026. Renewables contribute three-quarters of electricity supply growth to 2040, underpinned by policy support in nearly 170 countries and falling costs. Coal-fired output remains broadly flat, though its share declines significantly, while natural gas and nuclear power maintain their shares.

In the Sustainable Development Scenario, renewables provide two-thirds of electricity supply worldwide by 2040: solar PV and wind together provide 40%, with a further 25% from dispatchable renewables, including hydro and bioenergy. Nuclear power expands and close to 320 GW of coal and gas-fired capacity is equipped with CCUS. Unabated coal-fired power is almost completely phased ouet by 2040, addressing the largest single source of CO2 emissions, while gas-fired power remains an important source of flexibility.

ACTIVITY 3: LITERATURE SURVEY

Although many scientists worldwide accept that the global climate is being influenced by human activities it appears that public misunderstanding concerning the issue remains a barrier to effective action (Lowe et al. 2006; Lorenzoni&Hulme 2009).

In 1994, researchers at the Massachusetts Institute of Technology (MIT) concluded that public confusion about the influence of human activities on climate change results from the neglect of two basic facts: "That carbon dioxide will be primarily responsible for any global warming that does occur; and that the major source of this carbon dioxide is burning fossil fuels" (Read et al. 1994; Bulkeley 2000). Instead it has been demonstrated that the public often attributes aerosols, insecticides, nuclear power generation and ozone depletion with being potential causes of climate change (Bord et al. 2000; Lowe et al. 2006). Lately, it is likely that increased global publicity surrounding the issue has enhanced public understanding. Though as Steg (2008 p. 4449) has noted "given the complex processes involved, some confusion is still likely. Moreover, people know little about the energy use related to their behaviour". Individuals, for example, may use a 'simple heuristic' to determine the energy use of appliances, potentially assuming that consumption is based solely on size (Steg 2008). Individuals may also overlook the energy used in activities such as water heating, reinforcing their misconstruction of appliance contribution toward household energy consumption (Steg 2008).

The lack of understanding regarding climate change may be equally enhanced by the difficulty individuals face when associating the local with the global (Whitmarsh 2009a). More often than not, the social and environmental costs and benefits of an individual's action are far removed from the individual themselves (Hummel et al. 1978). The immediate personal benefit gained from turning on an air-conditioner, for instance, may override the distant, widespread costs associated with that action (Hummel et al. 1978). Individuals can have difficulty understanding the ways in which their energy consumption choices influence environmental issues (Whitmarsh 2009b). Within the OECD countries, residential greenhouse gas emissions (based on fossil fuel consumption) constitute approximately 15-20% of total emissions (Abrahamse 2007). Locally, it has been suggested that households within Alice Springs account for around 40% of the baseload electricity supply alone. In submitting their argument for the creation of a 'Solar City' within Alice Springs, the Alice Springs Town Council maintained that this level of usage provided reasonable grounds for a large and varied intervention (ASTC 2006).

In response, the Alice Springs Solar City project has been designed to explore the ways in which energy efficiency, solar technologies and energy pricing can combine to invoke changes within residential and commercial energy consumption, potentially enabling a reduction in greenhouse gas emissions. Since the residential sector is a crucial element of energy programs, the literature presented within this review has been primarily selected for its relevance to energy conservation within households. To enable an effective comparison with the academic information, this paper begins with a basic overview of the Solar City, Alice Springs. Socio-demographic correlation with energy use, methods for altering household energy consumption, the rebound effect, environmental behaviour models and potential methods for measuring participant knowledge, attitude and behaviour have likewise been summarised. It is hoped that this will provide a strong and useful knowledge base, especially within the framework of the Alice Solar City project.

2. Alice Springs, Solar City

The rural city of Alice Springs is situated within Australia's Northern Territory; Latitude: 23° 41' 60S (23.7000), longitude 133° 52' 60E (133.8833). Though a certain portion of the population comprising Alice Springs is short-term, the 2006 Australian census documented 23,893 permanent citizens within the town's local government area (LGA) (ABS 2006a). This equates to just over 9,000 occupied private residences (ABS 2006a). Consequently, community engagement has been and remains a fundamental aspect of the Alice Solar City project. By mid 2010 over 1700 households had joined the Solar City residential participant group, a sizable portion of the town's total private residences. It is also likely that characteristics of Alice Springs, such as its size, contained location and somewhat small population have increased the flow-on influence of the program to hitherto non-participating residents.

Although the arid climatic conditions experienced by the residents of Alice Springs may be seen as relatively harsh, they provide an ideal environment for the implementation and use of solar hot water systems and photovoltaic rooftop power generators. Based on a yearly average, Alice Springs receives approximately 9 hours of sunlight per day. The district also has the highest solar insolation (7.4 kWh/m2/day) in Australia. However, as shown in table 1, the mean maximum temperature is also generally high for most of the year. This may lead to elevated requirements for air-conditioning and thus potentially higher rates of appliance ownership and household energy usageresidential element of the Alice Solar City project, primary focus has been placed on achieving successful change within the following three key areas:

- Uptake of solar technologies e.g. solar hot water, rooftop PV panels
- Implementation of household energy efficiency measures
- Load reduction and time of use management through cost reflective pricing As such, a range of incentives are available to households registered with the Solar City. These incentives have been designed to motivate household energy efficiency or conservation, and currently include:
- Financial incentives for the installation or upgrade of passive heating and cooling options
  (e.g. insulation, window tinting, painting household roof white etc.)
- Financial incentives for the installation or service of solar hot water and rooftop photovoltaic systems The elective implementation of a cost reflective tariff (aimed at obtaining a shift in base energy load)

Socio-Demographic correlation with energy usage

Previous research into the area of energy consumption has shown that socio-demographic variables (outlined below) can be highly related to household energy use (Gatersleben et al. 2002; Lenzen et al. 2006; Abrahamse 2007; Abrahamse& Steg 2009). Income, for example, influences purchase decisions while age increases the need for heating or cooling, thereby raising energy consumption (Abrahamse& Steg 2009). As knowledge of household energy usage patterns will contribute to programs aiming to alter residential energy consumption, an examination of these variables is relevant to the Alice Solar City project. Additionally, socio-demographic variables may also provide deeper insight into the environmental attitudes, and knowledge of participants within the Alice Solar City project. As these factors contribute to an individual's behaviour (Steg 2008), an understanding of the demographic composition of households may add an important dimension to any attitude-knowledge-behaviouranalyses undertaken. This in turn may enhance any efforts to encourage behavioural change in participants.

ACTIVITY 4: SOCIAL OR BUSINESS IMPACT.

Social Impact:

By providing access to electricity, the analysis can help to improve the quality of life for people living in areas without access to electricity, including providingaccess to lighting, heating, and cooling, and powering essential services such ashospitals and schools..

Business Model/Impact:

By understanding consumption patterns and trends, theanalysis can help businesses identify market opportunities and develop strategies tomeet the growing demand for electricity in India**.**

World energy consumption is projected to increase almost 50% from 2020 levels by 2050.

As global energy demand increases, it is essential for us to understand energy data so we can take action to minimize the negative effects of energy production on our planet.

With the majority of global energy production reliant on non-renewable energy sources, like burning fossil fuels, climate change poses a serious threat to environmental stability. The burning of fossil fuels accounts for 83% of global energy creation and releases carbon dioxide, which increases the atmosphere's greenhouse effect, causing global warming and climate change. Today, we will explore relevant information surrounding world energy consumption. We'll look into trends and data sets of energy use worldwide, what sources energy comes from, and what solutions are available to combat excessive energy use and dirty energy production.

TOTAL WORLD ENERGY CONSUMPTION

The total world energy consumption is projected to reach 580 million terajoules in 2022. That is a significant increase from 1980 when the world used around 300 million terajoules of energy. What is more, world energy consumption is expected to increase in the coming years.

- **While the global energy demand fell by about 1% in 2020 due to the COVID-19 pandemic, it is expected to have grown around 5% in 2021, and it could increase by 4% in 2022.**
- **By 2050, global energy use could increase to around 900 million terajoules. Growing demands for energy are all the more reason to begin focusing on clean and renewable energy solutions moving forward.**

MAIN SOURCES OF WORLD ENERGY CONSUMPTION

Globally, the primary source of energy generation comes from fossil fuel combustion; burning oil, coal, and gas. The majority of global energy still depends on these fossil fuels, which make up about 83% of total energy consumption annually. With such a large proportion of energy created through the use of fossil fuels, excessive amounts of carbon dioxide and other greenhouse gas emissions can place a strain on Earth's natural carbon cycle. Out of the fuel types used for energy and industrial production, oil, coal, and gas alone were responsible for about 93% of those carbon emissions in 2020.

Other sources in the energy mix come from renewable and clean energy sources. A shift toward using sustainable energy can help minimize the effects of excessive carbon dioxide emissions on the globe. Hydropower leads in the renewable energy category, generating about 6.4% of all energy consumed in 2019. In the same year, other renewable energy sources include wind, which produced just over 2% of global energy, and solar, which accounted for just over 1%. Biofuels were responsible for about 0.7%.

ENERGY CONSUMPTION INCREASES

Increasing energy demands around the world pose a threat to the climate if we continue to rely on fossil fuels for the majority of our energy needs. Currently, too much of the global energy created uses sources that emit carbon dioxide and other greenhouse gases. As long as this practice continues, the warming effect caused by increased greenhouse gases in our atmosphere will harm ecosystems, animals, and human life on Earth. Unfortunately, global energy demand is outpacing the growth of renewable energy generation. The best bet for protecting the climate is to continue focusing on clean and renewable sources so we can provide a green solution to the increasing energy demands around the world. As soon as 2026, global renewable electricity capacity is expected to increase by 60% from its 2020 levels. These clean energy options could account for as much as 95% of all new global energy sources in 2026. Much of this energy will come in the form of solar power. As long as we continue to look for sustainable options to the increasing world energy demands, we can be sure we are moving in the right direction.

LEAD IN LOW-CARBON ENERGY CONSUMPTION

In 2019, Iceland led the way in producing the majority of its energy from renewable sources. The nation received 79% of its energy from sources responsible for minimal carbon emissions. Its primary energy consumption came from hydropower and geothermal, making up 55% and 24% of its total energy consumption, respectively.

Other nations that produced a large amount of their energy using renewable and clean sources like nuclear power were Sweden (69%), Norway (66%), France (49%), and Switzerland (49%).

Transportation is another sector that uses a good deal of energy, accounting for 26.1% of the energy used in the U.S. in 2020. If you are in the market for a new vehicle, consider switching to an electric car or hybrid. Otherwise, try to minimize the amount of time you spend driving if you are in a position to walk or ride a bike instead.

Other ways you can limit the amount of energy you consume is by reducing the amount of time using electronics like your phone, watching TV, and playing video games. Minimizing your electricity consumption positively impacts the environment and decreases your carbon footprint. Another way you can make a difference for the good of the environment is to explore renewable energy certificates that, when purchased, offset your electricity use by supporting clean energy projects like wind and solar farms.