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**Faculty of Economics and Administration**

Implementation of EU Renewable Energy Policy - case study of the  
Kingdom of Sweden and The Czech Republic.

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### Zásady pro vypracování

The aim of the work is to carry out an analysis of the European Union Legislation on Renewable Energy and its implementation in Sweden and the Czech Republic. The level of achieving the policy goals – i.e. to lower EU dependence on imported fossil fuels, make its energy production more sustainable, and create a stable legal environment for businesses – is to be studied through comparison of promotion instruments used in two Member states that have met the 2020 national targets, however with much different share of renewable energy sources of the total energy consumption. Additionally, within the clean energy concept, the progress of Carbon Decrease legislation and its impact is to be analysed.

- Renewable energy policy in the EU' goals an main features of the EU legislation on Renewable Energy.
- Clean energy concept in the EU: the goals and impact of Carbon Decrease legislation.
- The effect of EU Renewable Energy Legislationon Sustainable Energy production.
- Comparative Case Study Methology.
- Analysis of the implementation of EU renewable energy in the Czech Republic and the Kongdom of Sweden.
- The analysis of implementation of the Carbon Decrease legislation, the Czech Republic and the Kongdom of Sweden.

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In Pardubice on (31<sup>st</sup> May 2020)

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## **ABSTRACT**

*Analysis of the European Union legislation on renewable energy and its implementation in the Kingdom of Sweden and the Czech Republic. The level of achieving the policy goals – i.e. to lower EU dependence on imported fossil fuels, make its energy production more sustainable, and create a stable legal environment for businesses – is to be studied through comparison of promotion instruments used in two Member states that have met the 2020 national targets, however with much different share of renewable energy sources of the total energy consumption. Additionally, within the clean energy concept, the progress of carbon decrease legislation and its impact is to be analyzed.*

## **KEY WORDS**

*European Union, the Czech Republic, the Kingdom of Sweden, Renewable Energy, legislation, Sustainable Development, Implementation, EU Policies, Carbon Dioxide, Emissions.*

## **NÁZEV**

*Provádění politiky EU v oblasti obnovitelné energie-případové studie Švédského království a České republiky*

## **ANOTACE**

*Analýza právních předpisů Evropské unie o obnovitelné energii a jejím provádění ve švédském království a České republice. Úroveň dosahování politických cílů – tedy snížení závislosti EU na dovážených fosilních palivech, zvýšení udržitelnosti výroby energie a vytvoření stabilního právního prostředí pro podniky – musí být prozkoumán porovnáním propagačních nástrojů používaných ve dvou členských státech, které splňují národní cíle 2020, nicméně s mnohem odlišným podílem obnovitelných zdrojů energie na celkové spotřebě energie. Navíc v rámci koncepce čistých energií je třeba analyzovat pokrok v legislativě na snížení uhlíkových emisí a jeho dopad.*

## **KLÍČOVÁ SLOVÁ**

*Evropská unie, Česká republika, Švédské království, obnovitelná energie, právní předpisy, udržitelný rozvoj, oxid uhličitý.*

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## **LIST OF THE ABBREVIATIONS**

CO<sub>2</sub> – Carbon Dioxide

EC – European Commission

ECSC – European Coal and Steel Community

EEA – European Environmental Agency

EEC – European Economic Community

ETS – Emissions Trading System

EU – European Union

GDP – Gross Domestic Product

GHG – Green House Gas

GW – Giga Watts

IEA – International Energy Agency

MDG - Millennium Development Goals

MDS - Most Different Systems Design

MEP – Member of European Parliament

MFC - Microbial Fuel Cells

MSSD – Most Similar Systems Design

Mtoe - Millions of tonnes of oil equivalent

MW – Mega Watts

OECD - Organization for Economic Co-operation and Development

PV – Photovoltaic

RED – Renewable Energy Directive

SDS – Sustainable Development Strategy

SEA -Strategic Environment Assessment

TEU – Treaty on European Union

TFEU – Treaty on the Functioning on the European Union

UK – United Kingdom

UN – United Nations

USSR – Union of Soviet Socialist Republics

WCED - World Commission on Environment and Development

## **Introductions**

The earth is currently facing a rare phenomenon of rising temperatures in the Arctic, twice as fast as the rest of the world. This rise in temperature undoubtedly is due to global warming with corresponding climate changes. The population of the earth has more than tripled in the last 200 years. What was a fair use of resources by an optimum community is now at an extreme depletion. The issue of sustainability has been a matter of urgency for sometime now, according to Our Common Future (Brundtland, 1987), Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The rate of energy usage, depletion of natural reserves and pollution from fossil fuels does not show our concern as a generation for the future. This is why the choice of energy resource is a huge factor, as byproducts of fossil fuels contribute to one of the most substantial emissions of CO<sub>2</sub>. CO<sub>2</sub> emissions are a significant contributor to Global warming, leading to the extinction of various plant and animal species. The destruction is now progressing from plants and animals to all living organisms, mostly because of the actions and inactions of human beings. World leaders, international organizations, collective groups, and individuals from various parts of the world have a role to play in making a quick turnaround or a speedy crash to the end of the planet's existence.

This thesis is intending to study Renewable Energy and its usage to curb the overuse of fossil fuels. Fossil fuels have a limited supply, which means we cannot rely on them for an unlimited time seeing the unlimited demand with the increase in population. The byproduct of fossil fuels, however, is the CO<sub>2</sub> emission, which has a deadly impact on the earth, with its effect on climate change. Ultimately there is a need for a sustainable approach, and renewable energy is what has passed the litmus to be an alternative energy source, seeing the merits attributable. Renewable energy is simply energy harvested from sources that keep replenishing itself and for the most, have close to no emissions in their byproducts. Switching to renewable energy resources does not only provide the world with sustainable energy but protects the earth from the over-arching consequences of CO<sub>2</sub> emissions. Ultimately the EU is considering a Carbon Tax for member states to use in the curbing of CO<sub>2</sub> emissions as one of the ways to combat the current crisis. There two effects to be realized from the Carbon Tax; it will primarily offer incentive for fuel substitution, which will consequently cut down the CO<sub>2</sub> emissions from reduced usage. Another reward from establishing the Carbon Tax will be energy conservation which will reduce to cut out the amount of emissions. These are helpful alternatives that if realized will see a better, greener future for the sustainability of the planet. (Pearson et al, 1991).

This research is being conducted to investigate the alternative use of Renewable energy as a sustainable energy resource. In doing so, the renewable energy policy by the EU will be analyzed comparing the Czech Republic to the Kingdom of Sweden. The above countries are both in the EU and have been selected given their various infrastructure and progress made or pitfalls encountered in implementing the Renewable energy legislation. These countries, therefore, have a target set in the Renewable Energy policy to be met. The kingdom of Sweden currently tops the EU member states as the country with the most Renewable Energy usage, with 54% of its energy sources being renewable. The Czech Republic now fall below the EU average of 16.4% and stands at 13.6% as of 2018. This vast disparity is of interest to the researcher. Besides, the recent Carbon Decrease legislation leaves more to be asked if these countries are on their way and in line with how much emissions can be contained within the set limits.

The study aims to analyze the European Union Legislation on Renewable Energy and to reveal its implementation in the Czech Republic and the Kingdom of Sweden. The level of achieving the policy goals – i.e. to lower EU dependence on imported fossil fuels, make its energy production more sustainable, and create a stable legal environment for businesses – is to be studied through comparison of promotion instruments used in two Member states that have met the 2020 national targets, however with much different share of renewable energy sources of the total energy consumption. Additionally, within the clean energy concept, the progress of carbon decrease legislation, and its impact is to be analyzed.

The study will be divided into the following chapters. Chapter One: We will look at Renewable energy policy in the EU: goals and leading features of the EU legislation on Renewable Energy. Chapter Two will focus on the Clean energy concept in the EU: the goals and impact of Carbon Decrease legislation. Chapter three will aim at the effects of EU Renewable Energy Legislation on Sustainable Energy production. The fourth chapter will be based on the Comparative Case Study Methodology. The fifth chapter will be based on the Analysis of the implementation of EU renewable energy in the Czech Republic and the Kingdom of Sweden. The sixth chapter will be based on the Analysis of the implementation of the Carbon Decrease legislation, the Czech Republic, and the Kingdom of Sweden and finally, the analysis of Nuclear energy as a potential renewable energy source is outlined by the last chapter.

# **1. Renewable Energy Policy in The EU: Goals and Leading Features of The EU Legislation on Renewable Energy.**

## **The European Union**

The intention to set up a union that will bind the countries of Europe had been conceived and was in the offing long before the actual start date. The idea of a union manifested after two bitter world wars that tore the continent apart. The need for political and economic cooperation in Europe could not be over-emphasized after the ruins left by the second world war. The harshness of the times, the cold winters, and the limited movement of resources between the countries were devastating.

Most contemporary accounts of European integration begin with the aftermath of the second world war and the desire for peace in Europe. After the destruction of the war years, was the climate of nationalism. However, many had hoped for a new model of political cooperation in Europe. This critical point in the story of modern European integration was to be considered in a much longer time frame. Ideas of European Unity were articulated long before the arrival of the twentieth century, including the call of 1693 by a prominent English Quaker, William Penn, for a European parliament, and the end of the state mosaic in Europe.

A cooperative effort, including the pooling of resources, was needed for Europe to recover from the war and cope with economic problems of the post-war years. Another reason was that these individual countries in Europe were too small to compete economically or militarily with either the United States, the then USSR, or now China. Despite the cogent reasons for a European Union, its formation was delayed for over a decade after the war, the EEC treaty, which ultimately led to the formation of the EU was not signed until 1957.

In 1951, Belgium, the Netherlands, and Luxembourg (sometimes known as the Benelux countries) together with France, Italy and Germany signed the Treaty of Paris establishing the European Coal and Steel Community. The ECSC expired in 2002, but by then, there had been successful removing Trade restrictions between 15 member states of the ECSC on coal and steel creating a supernational authority. Today the European Union has 27 member states that form a supernational body to coordinate various issues in the Union. The current membership is short of the UK in a historic Brexit that took place on 31st January, 2020. The significant areas such as Customs, Trade, and Free movement people, goods, and capital are paramount to the functioning of the EU. The individual

countries still hold their sovereignty and operate as such while submitting to agreed areas for the functioning of the various EU bodies and institutions. The EU cannot be discussed without the historic Maastricht Treaty. The EU does not have a constitution, instead the legal documents that binds the union together is called the Treaties. The treaties thus serve as the fundamental provisions for governing the union and the member states. Treaties does not mean that the member states gave up their sovereignty but rather give up some powers to form a greater power to represent them and be in charge of particular sectors of the economy. (Craig et al, 2011)

## **The Maastricht Treaty**

The aim of a treaty is to correctly identify the rights and obligations of parties involved. The importance is that each party must uphold it above their individual sentiments and agree to abide by it. The treaty once signed by any two countries is above the national law in a case of conflict of interests. (Gardiner, R. K. 2015). The formation of EU cannot be talked about without singling out the one most important event leading up to this; The Maastricht Treaty. This treaty is also commonly referred to as the Treaty on European Union (1992). The key elements of this treaty came into force on 1 November 1993.

The Maastricht treaty introduced the name European Union to replace the European Economic Community. The change of name has more significance to the new phase of the organization to be limited to only the economic aspects of the member states. The new phase was concerned about the culture, consumer protection, security, education and in general a more wholistic approach to viewing the EU.

The Maastricht treaty also brought about the principle of subsidiarity. This principle allowed for issues to be dealt with at the most local level possible. Thus further strengthening the decentralization process. For example if an issue can be dealt with at the city council, it should not have to go to the national level for a resolve.

Introduction of a new legislative procedure. The new procedure gave more powers to the European Parliament in decision making process to enable joint decision making with the council. The new legislative procedure enhanced environmental protection by way of co-decision making processes speeding up the rate of change in member states whose elected leaders tend to be the ones making these proposals. (Berry et al, 2019)

## **1.1. The Aims of the EU**

The aims of the EU (Article 3 TEU) are necessary to serve as a focus for the needs of the Union and the countries. Without the aims, the organization will be reduced to a "white elephant," thus an expensive useless entity. Each aim has been carefully articulated in the treaties and as such the Union has a high commitment to ensure the delivery. (Berry et al, 2019)

- I. The Union's aim is to promote peace, its values and the wellbeing of its peoples.
- II. The Union shall offer its citizens an area of freedom, security and justice without internal frontiers, in which movement of persons is ensured in conjunction with appropriate measures with respect to external border controls, asylum, immigration and the prevention and combating crime.
- III. The Union shall establish an internal market. It shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress and a high level of protection and improvement in the quality of the environment.
- IV. The Union shall establish an economic and monetary union whose currency is the euro.
- V. In its relations with the broader world, the Union shall uphold its values and interests and contribute to the protection of its citizens. It shall contribute to peace, security and the sustainable development of the earth.
- VI. The Union shall pursue its objectives by appropriate means commensurate with the competencies which are conferred upon it in the treaties.

## **1.2. Powers of the EU**

The law-making powers of the European Union are limited to what the treaties make room for. The EU, as a super-national body, is commissioned by sovereign nations to have complete control of various sections of the countries under it. There are however some reservations as the EU shares some powers and others are exclusively left to the country to be in total control. Free movement of goods and things like product standards, labelling of products and composition as well as rights of movements and residence of EU citizens are all enshrined in the environment protection policies to be obeyed by the countries. Security however is a shared responsibility or power between the union and the member states. The EU doesn't have an army of its own but the borders are very much in synch especially in sharing intelligence of immigrants, third country nationals crossing and the free movement of labour.

The powers of the EU can not be deliberated upon without mentioning the institutions that exist to uphold these powers and ensure their enforcement without fear or favour. Five institutions run the EU: the European Council, the Council of the European Union, the European Parliament, the European Commission and the Court of Justice. The meeting place for Heads of State or Government is the European Council. The European Council prepares the overall policy agenda and priorities. They meet at least four times a year. There is usually a confusion with the name and role from the Council of Europe, which is different. The Council of Europe is usually represented by ministers of member states. It is hence referred to as "the Council" or "Council of Ministers." (Craig, 2019)

The member states of the EU are committed to follow the agreements which are drafted by the Commission and approved by the Council and European Parliament. The Court of Justice is also important in the running of the EU. Laws enacted by the EU can be challenged in court for a variety of reasons. The European Parliament is made up of directly elected representatives from national constituencies. They are usually referred to as MEPs, members of the European Parliament. The MEPs are organized into political groups rather than nationality. There are seven political affiliations in the European parliament, at least 25 Members of the European parliament are needed to form a political group, with a quarter representation of each member state. Members may not belong to more than one political group and members can also choose not to be in any political group. (Craig, 2019)

The researcher decided to focus more on the Commission which has been mandated with several roles to be discussed below. The researcher takes into consideration, the relevance of the Commission's work which directly impacts the environmental policy and the EU Renewable Energy policies. The primary reason for including the European Commission is because law enforcement powers are retained to the commission. Therefore there is the need to know about the impact it has in holding each member state responsible for the directives, legislations and treaties signed.

### **1.3. The European Commission**

The European Commission shortened to be "The Commission" is undoubtedly a principal institution of the European Union. It may be that the Commission's representation of the Union to the outside world has gained it this relevance. It may be of interest to know that the Commission is very powerful even within the other institutions of the Union. (Lenaerts, K. 2017) The Commission is made up of commissioners from all member states, including the president of the commission and the High Representative of the Union of Foreign Affairs and Security Policy (who acts as the vice president of the Commission). Law enforcement powers in the EU is retained in the Commission. It can take to Court a member country for breaking the EU law. Failure by member countries to comply with judgements can result in the imposition of fines by the Commission.

#### **1.4. The Functions and Powers of the Commission**

The Powers of the Commission are set out in (Article 17 TEU):

1. The Commission shall promote the general interest of the Union and take appropriate initiatives to that end. It shall ensure the application of the treaties and the measures adopted by the institutions according to them. It shall oversee the application of the union law under the control of the Court of Justice of the European Union. It shall execute the budget and manage the program. It shall exercise coordinating, executive and management functions, as laid down in the treaties. Except for standard foreign and security policy and other cases provided in the treaties, it shall ensure the Union's external representation. It shall ensure the Union's annual and multiannual programming to achieve interinstitutional agreements.
2. Union legislative acts may only be adopted based on a Commission proposal, except where the treaties provide otherwise. Other acts shall be adopted on the basis of a Commission proposal where the treaties so provide. (Berry et al, 2019)

All policies taken under the European Union are directly under the watch for the Commission to execute and ensure member states follow to the latter. In this regard, we shall start to look at some policies that have a crucial interest in our study. The EU Environmental Policy shall be a subject of focus to inform what the various needs and aspects of this policy has on the subject of Renewable Energy.

#### **1.5. EU Environmental Policy**

The European Union has undoubtedly been noted for holding one of the highest standards for environmental protection. (European Union, 2019) This principle holds dear to the commitment of combating if not reducing the barest minimum concerning water pollution, air pollution and waste management. (Ambec, S et al, 2014). The general principle has always been the polluter pays for the consequence of the pollution. These policies are immersed in other international policies and agreements, particularly the UN Sustainable Development Goals.

The importance of EU's Environmental Policies can not be over-emphasized because it gives member states a roadmap for what is allowed and what can be managed. The legal basis for this policy can be found in Articles 11, 191 to 193 of the Treaty on the Functioning of the European Union (TFEU). The articles mainly represent the agreed upon stipulations bound by the treaty. The main articles regarding environmental protection will be reviewed for the purpose of our study. Article 11 of the Treaty on the Functioning of the European Union requires that environmental protection be integrated into the implementation of the union's policies and activities for sustainable development.



Article 191 of the Treaty on the Functioning of the European Union stipulates policies on the environment shall be with the following objectives:

- Preserving, protecting and improving the quality of the environment.
- Protecting human health.
- Prudent and rational utilization of natural resources.
- Promoting measures at the international level to deal with regional and worldwide environmental problems and in particular combating climate change.

The environmental policy also takes into consideration the protection of the diverse plants, animals and other living organisms within the member states. Preventive principle should be the aim of the member states. Destruction should be contained and resolved at the source. The polluter pays principle must be adhered to at all times.

In preparing for the union policy on the environment, the union shall consider:

- Available scientific and technical data.
- Environmental conditions in the various states of the union.
- The potential cost and benefits of the lack of action or action.
- The economic and social development of the union as a whole and balanced development of the regions.

The union shall cooperate with member states, third countries and international organizations within their areas of competence. The arrangements will be a subject of agreement between the union and third countries or international organizations.

It is clear from the above, how important the safety of the environment and the management of the natural resources is important to the EU. The researcher is keen on going further to discover the origins and development of environmental policies which goes back to the European Council meeting of heads of state and government in 1972.

### **1.5.1. Origins and Development**

In 1972, Heads of State and Governments met in Paris for the European Council, and this was the birth of European Environmental policy. It must be noted though that this was after the first UN Conference on the environment. The moment set forth by the UN had created the right atmosphere for the European leaders to make the vital step of safeguarding the environment. The Single European Act of 1987 introduced a new 'Environment Title', which provided the first legal basis for a common environment policy with the aims of preserving the quality of the environment, protecting human health, and ensuring rational use of natural resources.

The Maastricht Treaty (1993) decided to include the environment as an official Policy Area for the EU. The Treaty of Amsterdam (1999) incorporated into all EU sectoral policies environmental protection to promote sustainable development.

### **1.5.2. General Principles of the Environmental Liability Directive**

The environmental policy principles are based on precaution, prevention, and rectifying pollution at source, as well as the polluter pays principle. This means that the first commandment of the policy is to take precautionary measures to first prevent pollution from happening, and if that should fail, rectifying the issue at source to stop the spread of the pollutants. If all else fails, the responsibility of cleaning up the mess falls on the polluter to pay for the damages caused. (Ambec, S et al, 2014). The precautionary is a risk alert tool where is scientific uncertainty about suspected pollutants to human health, risking animal life or threatening plants and other living organisms. These are non-discriminatory measures and are reviewed with the availability of new scientific studies.

The Environmental Liability Directive (Directive 2004/35/EC) Issued on 30th April, 2004 from the European Parliament and Council, it is expected that member states will draft it into their national laws by 30th April, 2007. The directive is in regard to the prevention and remedying of environmental damage. The Environmental Liability Directive has implemented the “polluter pays” principle to guard against the possibility of future pollutants affecting the environment or making amends to affected areas by responsible parties. The environmental damage includes damages caused by airborne elements as far as they damage water, land, endangered species and natural habitat. The directive can be said to be a legal act that requires the member state to incorporate into their national laws by way of working with the relevant ministries or state institutions involved. It must also be stated that the directive aims at preventing and remedying environmental damage, this however should not affect the right of compensation to traditional damage done under any relevant international agreement regarding civil liability. There are many things that could account for environmental damage, however the directive is clear on what merits a damage and what does not. The liability mechanism states that the damage should be more concrete and quantifiable. Secondly, there must be an established causal link between the damage and the identified polluters. The directive does not apply cases of personal injury or loss to private property or damages. Operators of large-scale industries and transport must be responsible for the pollution they create, they must have an inclusive plan to treating the waste in a way that the harmful effects are reduced or eliminated. There are three main areas of this directive which are; management of extractive waste, the operation of geological storage sites and safety of offshore oil and gas operations respectively. Operators are any natural or legal private or public

institution with occupational capacity. The member states are responsible for ensuring the accountability of persons or operators in default. The procedure for this to be done is by, assessing the imminent threat of the damage caused. Member states may provide administrative, legal, enforcement and other general costs to be recovered. Operators should not be made to bare the cost in cases where situations beyond the operator's control led to the eminent threat of pollution. However, in situations where operator was in charge of making sure the right measures could have been taken to prevent the danger of pollution, operators are to be fully responsible for the damages caused and preventive costs against future occurrences.

### **1.5.3. Basic Framework**

Environment Action Programs has since 1973 issued multiannual programs through the commission in setting forthcoming legislative goals for the EU Environmental Policy. The Council and Parliament adopted in 2013 the 7<sup>th</sup> EAP for a duration up to 2020, under the auspices 'Living well, within the limits of our planets.'

Several strategic initiatives were proposed, among them were nine priority objectives, including the protection of nature; stronger ecological resilience; sustainable, resource-efficient and low-carbon growth; and the fight against environmental-related threats to health. Overall, the implementation of Environmental law is a significant focus. There is an investment in science and environmental concerns into other policies. The EU also introduced its Sustainable Development Strategy (SDS) in 2001, in addition to the Lisbon Strategy for increasing awareness and job creation in the environmental sector. The SDS was renewed in 2006 to include internal and international aspects of sustainable development. Revising the EU SDS aimed at constant advancement of the quality of life.

The EU is prominent in playing critical roles for environmental negotiations through international environmental cooperation. The EU has agreements with numerous international and regional, as well as sub-regional organizations. Varied issues are ranging from protection of nature and biodiversity, air and water pollution to climate change. (Laky, 2019)

The European Union helped modify numerous significant international agreements enforced in 2015 at UN levels. One of such was the 2030 Agenda for Sustainable Development (which includes the 17 global Sustainable Development Goals (SDGs) and their 169 associated targets), the Paris Agreement on Climate Change and the Sendai Framework for Disaster Risk Reduction. (United Nations, 2015)

The need to be some form of accountability and evaluation as to the progress of the Environment Policies leading to the creation of Strategic Environment Assessment (SEA). In the SEA, environmental considerations are projected into the planning phase, and the foreseeable consequences are taken into account before approval is given to any project. This is ultimate to ensure a high level of environmental protection. (Mai, 2014)

### **1.6. EU legislation on Renewable Energy (Directive and Goals)**

The (Renewable energy directive (2009/28/EC) establishes a common framework for the promotion of energy from renewable sources. It sets mandatory national targets for the overall share of energy from renewable sources in gross final consumption of energy and for the share of energy from renewable sources in transport. It lays down rules relating to statistical transfers between Member States, joint projects between Member States and with third countries, guarantees of origin, administrative procedures, information and training, and access to the electricity grid for energy from renewable sources. Renewable Energy policy in the EU, was brought about by the need to have a way out of the crisis of fossil fuel's by-product. The discussion and need for an alternative fuel is not one of a recent subject, however with the ever changing climate owing to global warming and the adverse consequences, it was necessary for the Commission to role out a directive. The Directive specifies what is required of each member state and the period for them to transition these into national laws and reporting system that serves as a follow up. Each country irrespective of the success in renewable energy production and usage was supposed to still make it a point to adjust upwardly.

The EU's original Renewable energy directive (2009/28/EC) sets a binding target of 20% final energy consumption from renewable sources by 2020. For EU countries to achieve this, a commitment to reaching their own national renewables targets for 2020 ranging from 10% in Malta to 49% in Sweden. They are also each required to have at least 10% of their transport fuels come from renewable sources by 2020.

All EU countries have adopted national renewable energy action plans showing what actions are foreseen to meet their 2020 renewables targets. These plans include sectorial targets for electricity, heating and cooling, and transport; planned policy measures; the different mix of renewables technologies they expect to employ; and the planned use of cooperation mechanisms.

1. The EU Renewable Energy Legislation was primarily brought about concerning:
2. To increase the energy used from Renewable Sources.
3. To create energy-efficient sources to reduce greenhouse gases.

4. To reduce the dependence on imported foreign fuels.
5. Improving local renewable energy production to reduce energy loss in transit and emissions.

The Renewable energy directive comes at a very essential state in the century where, the green house emissions is at its all time high giving the consequences of global warming and climate change. The core of this directive is aimed at reducing green house gas emissions within the communities at local levels. It also has at the core of its mandate to reduce imports of fossil fuels that have direct linkage to these CO<sub>2</sub> emissions. Energy efficiency is to be closely associated with the decentralization of renewable energies. The importance of decentralization of renewable energy production cannot be underestimated and has the following benefits: utilization of local resources. There are many ways of adopting a local resource that is in abundance for the production of renewable energy. While it is a known fact that not all localities have abundance of resources needed for the production, there are chances that these communities have one area or perhaps can cooperate with another community or even a third country for the production of renewable energy. Another significance of the locally produced energy is the job creation aspect and the expansion it brings to the local economy. Installation plants, new roads, several construction work aides the local unemployed as well as skilled populace to be given means of earning a living. These projects take several months to complete and as well as need constant maintenance. Decentralizing the production therefore boosts the local economy and creates jobs, as well as enable people acquire new skills that are transferrable or can be sold as a service for other communities starting up such projects.

The RED obliges the Member States to achieve a general target of 20% renewables in all energy used by 2020 and a sub-target of 10% renewables in the transport sector. The EU Member States are required to meet a minimum binding target of 10% renewable energy share in the transport sector by 2020. All types of renewable energy used in all transport modes are included in the target setting. Some renewable energy sources are counted differently. For example, the contribution of advanced biofuels towards achieving the 10% target is counted twice, whereas electricity from renewable energy sources for road transport counts five times. These are the fundamental factors which have been updated as discussed later in the report.

According to the Official Journal of the European Union (2009), every Member State is to adopt a national renewable energy action plan. The national renewable energy action plans shall set out Member States' national targets for the share of energy from renewable sources consumed in transport,

electricity and heating and cooling in 2020, taking into account the effects of other policy measures relating to energy efficiency on final consumption of energy, and adequate measures to be taken to achieve those national overall targets, including cooperation between local, regional and national authorities, planned statistical transfers or joint projects, national policies. Apart from the national targets required by the Commission, the member states have the liberty to achieve the set objectives by varying means. For instance, two or more member states may cooperate on several projects to produce electricity, heating or cooling for renewable energy sources. Private operators are allowed to share in such projects. The proportion of energy produced from such collaboration is supposed to be reported to the Commission.

One or more member states may enter into joint cooperations with third countries for the production of renewable energy. This kind of production may also involve private operators. Electricity produced in a third country shall only be taken into account where: the electricity is consumed in the member state for which it is produced. Another requirement is that the electricity is produced by a new installation that came to function after 25th June 2009 or was refurbished by the increase capacity of installation after 25th June 2009. Finally, the energy produced in the third country should not be receiving support from a support scheme in the third country other than investment aid granted to the installation.

**Table 1: EU National Renewable Energy Target for 2020***National overall targets*

	Share of energy from renewable sources in gross final consumption of energy, 2005 ( $S_{2005}$ )	Target for share of energy from renewable sources in gross final consumption of energy, 2020 ( $S_{2020}$ )
Belgium	2,2 %	13 %
Bulgaria	9,4 %	16 %
Czech Republic	6,1 %	13 %
Denmark	17,0 %	30 %
Germany	5,8 %	18 %
Estonia	18,0 %	25 %
Ireland	3,1 %	16 %
Greece	6,9 %	18 %
Spain	8,7 %	20 %
France	10,3 %	23 %
Italy	5,2 %	17 %
Cyprus	2,9 %	13 %
Latvia	32,6 %	40 %
Lithuania	15,0 %	23 %
Luxembourg	0,9 %	11 %
Hungary	4,3 %	13 %
Malta	0,0 %	10 %
Netherlands	2,4 %	14 %
Austria	23,3 %	34 %
Poland	7,2 %	15 %
Portugal	20,5 %	31 %
Romania	17,8 %	24 %
Slovenia	16,0 %	25 %
Slovak Republic	6,7 %	14 %
Finland	28,5 %	38 %
Sweden	39,8 %	49 %

Source: Office Journal of the European Union, 2009

In the table 1 above depicts the National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2020.

The year 2005 was selected as the starting point due to the reliability of data for the latest national shares of energy from renewable sources are available. It can be seen that the targets are varying from country to country. No two countries or member states are expected to have the same targets archived by 2020. This is largely because each member state is unique in diverse ways. Apart from the population factor, several member states have diverse capacity for energy production and usage owing to the discrepancies in the numbers. Sweden by far has the largest share percentage-wise of 49% to be achieved by 2020. The reason being that they have as of 2005 achieved 39%, a record amount which no other member state is yet to achieve. Despite their high achievement, they are not left out of the future targets. Different member states also have different development levels and practices that make them either more sustainable in using more renewable energy or less of it. It cannot be overemphasized the availability of renewable energy resources. There are several renewable energy sources but each member state has a limited option as to how to make use of the resource. It is not usually just the availability of the resources but the extraction as well. The right machines, technical know-how and infrastructure is necessary for the successful tapping into the renewable energy sources. The directive has made it possible for the trade of renewable energy to be counted as part of the national targets regarding these challenges which may equally serve as opportunities for developed countries.

To ensure that the mandatory national overall targets are achieved, Member States are to work towards tracing a path towards the achievement of their expected mandatory targets. National renewable energy plans must be established including information on sectoral targets. In addition, Member States should set out measures to achieve those targets. Each Member State should assess, when evaluating its expected gross final consumption of energy in its national renewable energy action plan, the contribution which energy efficiency and energy saving measures can make to achieving its national targets. Member States should take into account the optimal combination of energy efficiency technologies with energy from renewable source. (Renewable energy directive (2009/28/EC))

### **1.6.1. Features of the Renewable Energy Directive**

There are several features that have the RED spells out, and these are of crucial interest to the researcher in conducting further assessment of this study. Below are some features listed as of the directive:

1. National overall targets must be consistent with a target of at least a 20 % share of energy from renewable sources in the Community's gross final consumption of energy in 2020. In order to



achieve the targets laid down in this Article more easily, each Member State shall promote and encourage energy efficiency and energy saving.

2. Each Member State shall ensure that the share of energy from renewable sources in all forms of transport in 2020 is at least 10 % of the final consumption of energy in transport in that Member State.
3. Member States are likely to meet their target by ensuring energy-saving mechanisms. That is energy efficiency and energy-saving policies that will harness the overall usage to the barest optimum.
4. The primary purpose of mandatory national targets is to provide certainty for investors and to encourage continuous development of technologies which generate energy from all types of renewable sources.
5. Member States may encourage local and regional authorities to set targets above national targets and to involve local and regional authorities in drawing up national renewable energy action plans and in raising awareness of the benefits of energy from renewable sources.
6. Passive energy systems use building design to harness energy. This is saved energy. To avoid double-counting, energy harnessed in this way should not be considered for the purposes of this Directive.

### **1.6.2. The current EU policy framework and what has been achieved.**

The success of any long-term project is reliant upon the evaluation of previous and current achievements to ensure succession and accountability pact of stakeholders.

Central to the current policy framework are the three headline targets to be achieved by 2020:

1. An EU based target for GHG emission reductions of 20% relative to emissions in 1990;

The 20% GHG reduction target and implementing measures. The 20% GHG reduction target for 2020 compared to 1990 is implemented through the EU Emissions Trading System (EU ETS) and the Effort Sharing Decision which defines reduction targets for the non-ETS sectors, and its achievement is supported through EU and national policies to reduce emissions. In 2011 GHG emissions as covered by the climate and energy package were estimated at 16% below 1990 levels. (European Commission, 2013)

2. A 20% share for renewable energy sources in the energy consumed in the EU with specific target for the Member States;

The renewable energy target and implementing measures. The EU is making progress towards meeting the 2020 target of 20% renewable energy in gross final energy consumption. In 2010, the renewables share in the EU was 12.7% compared to 8.5% in 2005. In the period 1995-2000 when there was no regulatory framework, the share of renewable energy grew by 1.9% a year. (European Commission, 2013)

3. 20% savings in energy consumption compared to projections. In addition, there are specific 2020 targets for renewable energy for the transport sector (10%) and decarbonization of transport fuels (6%). The framework also recognizes Member States' different energy mixes, economic wealth and capacity to act, and therefore includes mechanisms to ensure a fair distribution of effort between them. It includes measures to address the risk of carbon leakage and its impacts on energy-intensive industry sectors. (European Commission, 2013)

The energy savings target and implementing measures. The 2020 target of saving 20% of the EU's primary energy consumption (compared to projections made in 2007) is not legally binding for Member States, but significant progress has nevertheless been made. After years of growth, primary energy consumption peaked in 2005/2006 (around 1825 Mtoe) and has been slightly decreasing since 2007 (to reach 1730 Mtoe in 2011). This trend is partly due to the economic crisis and partly due to the effectiveness of existing policies. It is also due to reduced energy intensity of EU industry which was 149 toe per million euro in 2010, down from 174 in 2000 and 167 in 2005. (European Commission, 2013).

### **1.6.3. Renewable Energy Roadmap.**

The control of European energy consumption and the increased use of energy from renewable sources, together with energy savings and increased energy efficiency, constitute essential parts of the package of measures needed to reduce greenhouse gas emissions.

The Commission communication of 10 January 2007 entitled 'Renewable Energy Roadmap — Renewable energies in the 21st century: building a more sustainable future' demonstrated that a 20 % target for the overall share of energy from renewable sources. A 10 % target for energy from renewable sources in transport would be appropriate and achievable objectives, and that a framework that includes mandatory targets should provide the business community with long-term stability. It needs to make rational, sustainable investments in the renewable energy sector which are capable of reducing dependence on imported fossil fuels and boosting the use of new energy technologies. Those targets

exist in the context of the 20 % improvement in energy efficiency by 2020 set out in the Commission communication of 19 October 2006 entitled 'Action Plan for Energy Efficiency: Realizing the Potential', which was endorsed by the European Council of March 2007, and by the European Parliament in its resolution of 31 January 2008 on that Action Plan.

## **1.7. Analysis of the European Union framework for Climate and Energy Policies (The Green Paper and Paris Agreement)**

### **The Green Paper and how it relates to the EU Energy Policies**

The energy saving objective of the EU is of paramount importance to the environment. In light of the current high reliance on fossil fuels with its respective emissions suggests that another way to protect the environment is to reduce the consumption as well as diversify the sources of energy. The strategy however is to ensure that the relevant stakeholders are together to meet the set objectives by the year 2030. The Green Paper is a EU Strategy for Sustainable, Competitive and Secure Energy. The Green paper's aim is to consult relevant partners of the climate change and green house sustainability to secure evidence to support the development of the 2030 framework. It starts with comprehension of the current measures and achievements to present the issues where stakeholder input is concerned. (European Commission, 2013)

### **1.7.1. Key issues for this consultation of the 2030 framework for climate and energy policies.**

The framework for the 2030 climate and energy policies will be based on the importance steps achieved in this regard. The framework shall draw on current learnings and see to it that there is growth from the previous work done. Experience and advice from partners and relevant parties will be incorporated to reviewing strategies, process and tools to achieve the expected results. There are four broad essentials to be considered; policy instruments; competitiveness; and the different capacity of Member States to act.

### **1.7.2. Targets for the Green Paper.**

The Green paper is supposed to see a reduction in the current climate and energy targets for the GHG, the sources of renewable energy and savings are to be observed by the member states as well as have a control of sources for the procurement of fossil fuels. An on-going interaction will be set up between relevant stakeholders to measure the progress and share experience to towards a greener future.

Fundamental issues for a new 2030 framework for climate and energy policies relate to the types, nature and level of targets and how they interact. Should the targets be at EU, national or sectoral level

and be legally binding? There are diverging views on the need for targets and types of targets. There is a broad consensus that interim targets for GHG emissions reductions will be necessary to reach the aspiration of an 80-95% reduction by 2050. The key issue is deciding on the most appropriate level for such an intermediate target. The 2050 Low carbon Economy Roadmap suggests that a 40% reduction in emissions by 2030 compared to 1990 would be cost-effective. A reduction of less than 40% would increase the costs of decarbonizing the economy over the longer term. While the roadmaps suggest that GHG reductions of 40% by 2030 can be achieved without unduly increasing the costs for our energy system, mobilizing the funds necessary to cover the capital costs for significant up-front investments will, however, be a challenge. (European Commission, 2013).

The 2030 policy framework should, therefore, strike a balance between concrete implementing measures at EU level and Member States' flexibility to meet targets in ways which are most appropriate to national circumstances, while being consistent with the internal market. The current balance of the approach between EU level instruments and Member States targets/national instruments will have to be assessed in more detail, including the impacts of fossil fuels subsidies. As before, the distribution of efforts will need to be considered as well. (European Commission, 2013).

### **1.7.3. Summary for the Green Paper.**

The Member States have different capabilities in differing terms of wealth, industrial structure, energy mix, building stocks, carbon and energy intensity, exploitable renewable resources, and social structure. This diversity must be considered in reviewing the policy framework to help achieve respective outputs. The Climate and energy targets impacts each member state differently and must be further given the chance to contribute in a proportional manner.

## **1.8. The Paris Agreement**

The Paris Climate Change Conference is a momentous event that seeks to change the future of our planet regarding the effects of climate change and GRG emissions. The Conference was climaxed on December 12, 2015, in Paris, with a new climate treaty signed by various heads of states and governments. France. The Paris Agreement aims to give a stronger voice to the global response to the consequences of climate change in maintaining a global temperature below 2 degrees Celsius above the pre-industrial levels. The Agreement further seeks to reduce temperature increase down to 1.5 degree Celsius. The agreement also seeks to empower countries in their quest to fight the impact of climate change and at making the requisite budget allocation for the consistent reduction of GHG emissions. (Unfccc.int, 2019).

This ambitious goal can be reached by a combination of factors; appropriate financial resources allocated to the fight for a greener earth space and reduction of GHG emission, innovative ways of doing things with the appropriate technology applied, together with capacity building. Transparency and support for action are prioritized for all countries willing to participate. (Savaresi, A. 2016) In May of 2019, there were 194 states and the European Union signed onto this agreement; this represents 97% of global greenhouse emissions.

According to (Spash, C. L. 2016), has argued that the Paris agreement changes nothing, in his publication, he emphasized the reality behind continues exploitation of fossil fuels with no real change and in total defiance towards reducing the industrial temperature. The result is a denial that tackling GHG emissions is incompatible with sustained economic growth. The reality is that the Nation States and international corporations are engaged in an unremitting and ongoing expansion of fossil fuel energy exploration, extraction and combustion, and the construction of related infrastructure for production and consumption. The targets and promises of the Paris Agreement bear no relationship to biophysical or social and economic reality.

The sad reality is that not much has been done in the sense of the word, but another undeniable fact is the level of conscientization raised among the public. Individual and groups have been collating towards what has now become weekly strikes and demonstrations to have governments sit up and put in more action towards the sustainability of the earth. A lot of corporations are now looking into investing their corporate social responsibility towards the environment. These are in various forms such as tree planting, research and development into recyclable waste and being energy efficient to save the world in their small ways.

### **1.9. Overview of Renewable Energy and the Types.**

Renewable energy is energy that is obtained from sources that can replenish themselves over time (Owusu & Asumadu-Sarkodie, 2016). The main take of renewable energy is their unlimited supply as compared to fossil fuels. The production of renewable energy can be obtained from varied sources such as wind, solar, hydro, tidal, geothermal, and biomass. The usage of Renewable Energy to meet the needs of EU is significant to the lowering of imported fossil fuels, which in turn makes its energy usage sustainable

There are several kinds of renewable energy types available with each of them being unique its sources and availability depending on geographical areas as well as the climatic conditions. Knowing the differences and kinds of these energy sources is imperative to know what is available in each region

and a necessary tool in making the most of it for the purpose of sustainability. Below, we consider the various types of renewable energy sources.

## Hydropower

One of the oldest electricity technologies is obtained from Hydropower, and early plants have been attributed to some time as far back as the 1800s. The complexity involved includes a host of different sizes, parts and function with differing longevity. The civil structures usually can last about a century old, that is the dams, water canals and powerhouses. However, the mechanical parts such as the batteries, generators and turbines can last for about 20 years with servicing and required changes afterwards to upgraded versions or ones that can weather the harsh climatic conditions. The ageing parts can affect the output and much more expenditure if not serviced or replaced in time. The routine maintenance for preventing an eventual breakdown and equipment repairs as well as replacement of significant parts are performed in some cases to increase output for increased market demands. The other needs for the maintenance and replacement are to also introduce some modernization into the operation with viable market trends to complement the technological improvements. (Okot, D. K. 2013) Hydropower as a renewable energy source can be a huge capital investment to fund, but the numerous advantages presented with close to no emissions in the production process makes it very important to the sustainability agenda.

## Wind Energy

The power in the wind can be harnessed in the form of running turbines that can generate electricity. The power and force depending on the geographic and climatic factors vary. However, one undeniable truth is that wind is in abundance, more in some places than others, and with the right tools, we can harvest renewable energy with it. Wind turbines have an economic lifespan of around 2 decades. In their final approach to the end of their service years, there are usually three considerations made. 1) Decommissioning: Bringing their respective service to an end and discontinuing their function since their expected purpose given their lifespan has been fulfilled. 2) Extending the lifespan of the existing turbine is another option. This is done by reinstalling specific aspects that can boost the life of the turbine for another 20 years. 3) Complete repowering the plant by disentangling the old turbine and replacing it with a new one. (Kwon, S. D. 2010).

Today, only 5 GW (1%) of the global wind fleet is 20 or more years old, but this proportion will increase more than sevenfold by 2024. According to estimates by the Global Wind Energy Council (GWEC), at the end of 2018, there were 568.4 gigawatts (GW) of operating onshore wind capacity spread across the world, with China accounting for the majority at 206.8 GW (36.4%), Europe at 171.3 GW (30.1%), the United States at 96.6 GW (17.0%), and the remaining countries representing 93.7 GW (16.5%) (Knutson, 2019). To maintain the capacity and performance of the ageing fleet, refurbishments and repowering are required. Fortunately, given recent technology improvements, refurbishing and repowering onshore wind projects may be valid alternatives to decommissioning.

## Solar Energy

Solar energy is one of the cleanest energy resources that does not compromise or add to global warming. (Solangi et al., 2011) The sun radiates more energy in one second than people have used since the beginning of time. Solar energy is often referred to as alternative energy to fossil fuel energy sources such as oil and coal. Availability of cheap and abundant energy with minimum environmental and ecological hazards associated with its production and use is one of the factors for desired improvements in the quality of life of people. Growing scarcity in fossil fuels has raised global interest in the harnessing of solar energy. Solar power is a type of energy with great future potential, even though at present it covers merely a minor portion of global energy demands (0.05% of the total primary energy supply). Solar power also known as photovoltaic (PV) power generates less than 1% of total electricity supply. This is due to solar power still being considered the most expensive type of renewable energies. However, in remote regions of the earth, it may very well constitute today's best solution for decentralized energy supply. (Solangi et al., 2011).

Solar photovoltaic technology could harness the sun's energy to provide large scale, domestically secure, and environmentally friendly electricity. Solar energy is obviously advantageous relative to other energy sources, and the linchpin of any serious sustainable development program. It does not deplete natural resources, does not cause CO<sub>2</sub> or other gaseous emissions into the air or generate liquid or solid waste products. Concerning sustainability development, the main direct or indirectly derived advantages of solar energy are the following:

- ✚ No emissions of greenhouse or toxic gases.
- ✚ Reclamation of degraded land.
- ✚ Reduction of transmission lines from electricity grids
- ✚ Improvement of quality of water resources.

- ✚ Increase of regional and national energy independence.

Solar energy is one of the most promising renewable energies. It is very consistent and is not significantly vulnerable to changes in seasonal weather patterns. Solar energy can be exploited through the solar thermal and solar photovoltaic (PV) routes for various applications. The power generated by Solar energy is not just relatively simpler but is also much more environmentally friendly compared to power generation using non-renewable sources like fossil fuels and coals. Considering that energy usage worldwide has been increasing throughout the years, switching to solar energy can be a viable move. (Solangi et al., 2011).

## Biomass

Biomass is the first-ever used fuel by humankind and is also the fuel which was the mainstay for the global economy until the middle of the 18<sup>th</sup> century. Then fossil fuels took over because fossil fuels were not only more abundant and denser in their energy content, but also generated less pollution when burnt in comparison to biomass. In recent years, there is the resurgence of interest in biomass energy because of biomass in perceived as a carbon-neutral source of energy, unlike net carbon-emitting fossil fuels of which copious use has led to global warming. (Abbasi et al., 2010)

If solar energy is the mother of all other forms of renewable energy, the primary source of food energy for all multi-cellular organism is biomass. (Abbasi et al., 2010) Biomass is the general term which includes phytomass or plant biomass and zoomass or animal mass. Sun's energy, when intercepted by plants and converted by the process of photosynthesis into chemical energy, is fixed or stored in terrestrial or aquatic vegetation. The vegetation when grazed or used as food by animals get converted into zoomas and excreta. The excreta from terrestrial animals, especially dairy animals, can be used as a source of energy.

Any and every type of biomass can be used to either burn it for energy or to deride one or other form of fuel from it. But some species provide a better quality of fuel at lesser costs than other species. There are certain types of food crops that can be used to create energy when burnt to produce biofuels such as (ethanol, biodiesel or petrol additives).

- Woodchps
- Sugarcane



- Corn or maize
- Soybean
- Wheat
- Sugar beet
- Vegetable oil

When seen from the limited perspective of standing crop, theoretical replenish ability, and carbon-neutral character as a fuel, biomass appears to be a desirable source of renewable energy. Biomass energy is indeed a sustainable option and has proven to be so for thousands of years, but only if it is used to a minimal extent. The quantity of fossil fuels saved in the course of the production and the utilization of biofuels is not always more significant than the number of fossil fuels used. These factors, besides the environmental degradation and ecological disruptions, cause in the course of large-scale biomass cultivation, but serious question marks on the sustainability of the existing biomass-to-energy programs.

## Geothermal

Several kinds of fluids exist below the crust of the earth. Under excessive pressure, the heat from these fluids can be utilized as an energy source. One such energy is what has come to be known as Geothermal energy. Two Greek words make up the meaning of Geothermal, "geo" means earth and "therme" means heat. The most usual way in extracting geothermal energy is by constructing boreholes into the earth and pumping out hot water to the surface, in the process turbines are used to generate electricity.

The exploitation of Geothermal energy as natural steam and hot water has been for decades used to generate electricity. This primarily has been used in heating and industrial processes. In the last two decades, worldwide electricity production of energy from geothermal sources has increased significantly. The process of geothermal heat production is the conversion of energy contained in the hot rock into electricity by placing water on the surface and transported outside the crust of the earth where turbines convert these into electricity. This production system is not deprived of its own challenges such as the cost of geothermal well drilling, corrosion and scaling problem. The cost of drilling can be as high as 50% of the total cost of the geothermal process. Over 200,000 oil/gas wells have been abandoned by Petroleum China. If these abandoned wells can be used for producing

geothermal energy, the initial capital or drilling costs can be significantly reduced, while acquiring renewable energy at the same time. (Bu, X et al., 2012).

### **1.9.1. Advantages and Disadvantages of Renewable Energy.**

The choice for a more sustainable energy source is more than a preference by any one state, organization or individual. Instead, it's more about the advantages of an option that is viable and far outweighs the disadvantages. The researcher has expounded further the advantages and disadvantages of a renewable energy option.

#### **Advantages of Renewable Energy**

##### **1. Renewable energy exists in abundance.**

The technologies used to extract renewable energies are taken from the environment to provide power. The sources of energy are wind, tides, sunshine and biomass to name but a few. These are always in abundance and will not run out which cannot be said concerning fossil fuels. The limited nature of fossil fuels, in the long run, means it is bound to run out and relying on it may not be sustainable for future generations.

##### **2. Lower cost of maintenance.**

The technologies involved in renewable energies do require lower maintenance in a sense than traditional sources of fuel. Unlike fossil fuel energy extraction, most renewable energy sources do not require burning and combustion to generate energy. Solar panels, hydro and wind plants require few maintenances. Hence more time and money are saved.

##### **3. Renewables save money.**

Still, on savings for renewable energy, money can be significantly saved on operating costs for energies obtained from the sun, wind and hydro processes. They do not usually require payments for refuelling, and a specific technology adaptable may last for a longer period. Even though the initial cost of starting may be high, the lower operational costs will save more money in the long term.

##### **4. Renewable energy has numerous health and environmental benefits**

The emissions from renewable energy sources are little to nothing, which is very helpful to the environment. Fossil fuels have primarily contributed to greenhouse gas emissions which have become very harmful to the environment. Fossil fuels give off a high amount of CO<sub>2</sub> during combustion process for both extraction and usage. The little to no emissions by renewable energies is of great advantage to reduce significantly and help maintain a healthy environment. The CO<sub>2</sub> is not the only emission that fossil fuels give, but other gases are also given off, which may lead to respiratory issues.

## 5. Renewables lower reliance on foreign energy sources.

Renewable energy can be produced locally. This of course on the availability of technology to extract and transport energies to the relevant parts of the region. By locally taking advantage of the provisions available, various countries and regions of the world can afford to produce what is needed. This will avoid the overwhelming costs of importing foreign fuels to power the economy.

### Disadvantages of Renewable Energy

Renewable energy has many merits associated. However, a balanced perspective will be realized once we know the demerits of renewables as compared to traditional fuel sources.

#### 1. Higher upfront cost

Renewable energies undoubtedly save money in the long run, but the initial cost to get started is in most cases higher than the cost for generators in traditional generator sets. However, it is worth mentioning that governments are moving to support the renewables initiative by offering tax credits and rebates to cut down the initial startup cost. The costs for a utility scale wind turbine range from about \$1.3 million to \$2.2 million per MW of nameplate capacity installed. Most of the commercial-scale turbines installed today are 2 MW in size and cost roughly \$3-\$4 million installed.

#### 2. Intermittency

The availability of renewable energy sources in almost every part of the world is a great incentive. However, the supply is not guaranteed all year round. The sun shines only a fraction of the day and not all days of the year, and there are more windy days than others, and when drought sets in the production of hydro energy may be affected. This intermittency does not apply to fossil fuels which can be accessed all year round.

#### 3. Storage capabilities

Due to the intermittency of some renewable energy sources, storage is of the essence in making this harvested energy reserved for future usage. Storage technologies are quite expensive, especially for storage in commercial quantities. The progress in technologies means in the future battery for storage will be cheaper.

#### 4. Geographic limitations

Irrespective of the fact that renewable energy is available through various regions of the world, the geographic and climatic factors may very much limit the options available. An area with large farms and windy climate can make use of either wind or solar harvesting technologies in large quantities. However, townhouses or urban areas with a cluster may be limited to just solar panel, which very much may be limited in the harvesting process.

## **2. Clean Energy Concept in the EU: Goals and Impact of Carbon Decrease Legislation.**

Clean energy may also be referred to as green energy. These are energies that are produced from natural sources, and these sources replenish itself, without leaving any environmental debt or carbon footprints to the society. A lot of natural energy is clean and replenishes itself. However, not all-natural sources of energy are clean or replenish itself. Examples of natural energy sources that are not clean are fossil fuel and coal. These two forms of energy release CO<sub>2</sub>, that is Carbon Dioxide into the atmosphere as by-product mostly during their usage and sometimes also in the extraction process. Carbon dioxide, which is part of greenhouse gases, does destroy the ozone layer, which protects direct sunlight from harming living organisms on the planet as well as causing drastic climate changes. The necessity of clean energy is long overdue and has a two-way benefit: the first being reduction in pollution of the environment. The second reason is the reliance on a more sustainable alternative fuel, since the over-reliance on fossil fuel which is limited in supply hence making it not viable. Fossil fuels are dominant in the eastern terrain of the world. The limited presence of fossil fuels allows diplomacy to favour countries that have access to it in large quantities. The world is at the mercy of oil-rich countries, as they monopolise this scare resource, and in some cases go against world conventions or even human right abuses but end up with lighter to no sanctions owing to the valuable commodity produced in these regions of the world. Clean energy suggests "a greater focus on modern and sustainable forms of renewable energy which have relatively less effect on the environment and society." (Erbil, 2011).

### **2.1. Clean energy, and it's social acceptance.**

The clean energy discussion on the social level is significant on two levels: the first being the dangerous condition of non-renewable energy such as fossil fuel being infinite quantities and the climate change consequence. The significance of clean energy then becomes a solution to two major world problems. The debate on clean energy is not that it solves all of humankind's needs relating to the energy crisis and its consequential dealings. The issue at hand is that clean energy saves more lives in the long run and makes the planet cleaner comparatively and on a large scale compared to fossil fuels. It will be incorrect to claim that clean energy does not have any negative consequences. There are concerns at the rate at which bird strikes have been discovered around windmills generating electricity, which is a negative consequence of clean energy. It is indeed a problem as some species stand a chance to be endangered, especially around ecological sites. It must be noted that these birds may as well develop respiratory problems in the long run from the pollution from carbon dioxide. The

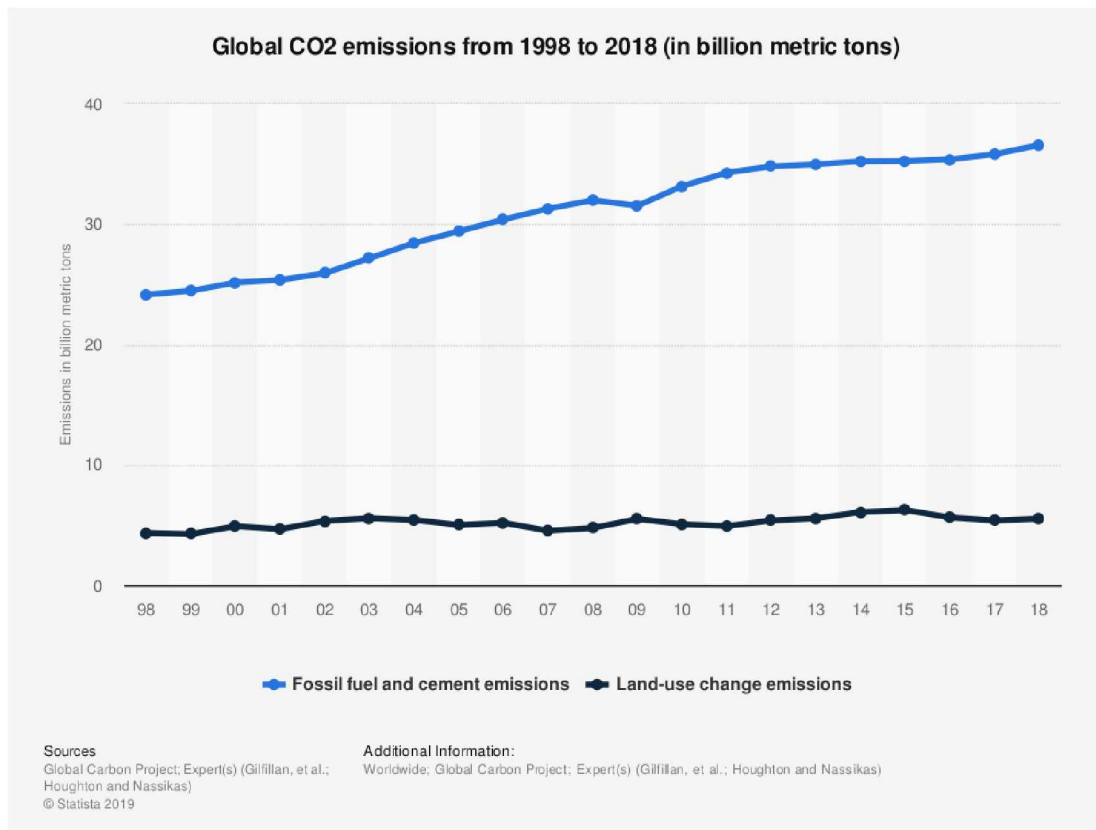
number of birds, then that may be killed cannot be compared with the number of livestock and humans that will be affected by the long-term catastrophe from unchecked fossil fuel usage. (Erbil, 2011).

## **2.2. The Impact of Carbon Dioxide**

One of the significant concerns of fossil fuel usage can be traced down to one gas, CO<sub>2</sub> or carbon dioxide. Carbon dioxide is a by-product that is produced from burning fossil fuels. Carbon dioxide is a chemical compound consisting of one carbon and two oxygen atoms. (ScienceDaily, 2020) The formula represented by it is CO<sub>2</sub>. The CO<sub>2</sub> gas is already present in the earth's atmosphere and is a greenhouse gas. It forms a significant component of the carbon cycle. Atmospheric carbon dioxide derives from multiple natural sources, including volcanic outgassing, the combustion of organic matter, and the respiration processes of living aerobic organisms. The atmospheric carbon dioxide is not much of a challenge because of its low concentration and content. Plants use a process called photosynthesis to convert carbon dioxide to oxygen, which is very vital to living organisms for respiration, forming a cycle. It may seem that planting more trees and reducing deforestation can balance the equation of carbon dioxide with oxygen. However, the opposite is happening, and that adds to the climate crisis. First, there are more people that a living currently in history than a few decades ago or in the last century. The rise in population with its apparent need for urbanisation and other necessities has caused more clearing of vital green zones than replenishing them. Other factors have reduced the number of forests that might have tended to reduce the number of greenhouse gases. For example, during bush fires which are usually caused by humans, the amount of carbon dioxide released from the combustion is enormous. Bush fires and forest fires situation hence takes away oxygen-producing, carbon dioxide sucking intervention from the trees and instead adds more gas into the atmosphere.

Carbon dioxide produced from human-made sources come also is generated from burning fossil fuels for power generation and transport use. Various microorganisms also build it from fermentation and cellular respiration. The levels of carbon dioxide released in the atmosphere are at its all-time high, which has direct consequences on the climate. (ScienceDaily, 2020).

Carbon dioxide is the most significant long-lived greenhouse gas in the earth's atmosphere. Since the Industrial Revolution anthropogenic emissions – primarily from the use of fossil fuels and deforestation – have rapidly increased its concentration in the atmosphere, leading to global warming. Carbon dioxide also causes ocean acidification because it dissolves in water to form carbonic acid. To better understand the level of emissions in the atmosphere, the researcher has provided a chart below to illustrate the emissions over the last two decades.



Source: Global Carbon Project, 2018

Figure 1: Global CO2 emissions from 1998 to 2018 (in billion metric tons)

The graph represents global carbon dioxide emissions between 1998 and 2018, broken down by fossil fuel and cement emissions and land-use emissions. Globally, more than 36.6 billion metric tons of carbon dioxide were emitted in 2018 through fossil fuel and cement use. The blue dotted line on the graph in (Figure 1) depicts the fossil fuel and cement emissions. Cement emissions are a considerable component of carbon dioxide emissions. Producers of cement generate greenhouse gases directly through the manufacture of carbon dioxide when calcium carbonate decomposes, it produces lime and carbon dioxide, and through energy usage, particularly from the combustion of fossil fuels. We can see the vast disparity from 24 billion metric tons to 37 billion metric tons in 20 years. Land-use change emission, which is mainly attributable to other activities of humans such as deforestation has lower emissions, but that is not to be overlooked. In the last 20 years, according to the graph in (Figure 1), the CO2 from those have increased from 5 billion metric tons to 6.5 billion metric tons. Reforestation must be practised on a large scale to enable more photosynthesis to take place to suck up the CO2. Reforestation is not, however, the best way to reduce the amount of CO2 released seeing that it takes time for trees to grow and our activities as humans continue to increase the release of CO2 gas into the atmosphere.

Climate change, being the long-term shift of the earth's weather patterns and temperatures, is a considerable challenge and global crisis to humanity. *Since the Industrial Revolution, carbon dioxide (CO<sub>2</sub>) emissions have increased dramatically, increasing global temperatures by over 1 degree Celsius in comparison to pre-industrial times. Greenhouse gas emissions are gases that trap heat within the earth's atmosphere by absorbing energy and preventing heat from escaping into space. There are various types of gases, including carbon dioxide, methane, nitrous oxide, and fluorinated gases that each impact climate change at varying levels – known as global warming potential. The effect of each gas depends on the concentration of the gas in the air, length of time the gas remains in the atmosphere, and the strength of its effects on the atmosphere* (Wang, 2020).

Regarding the global trend of climate change, the emissions also known as the greenhouse gas emitted in large volumes by a few countries. The United States, China and India are among the largest in the discharge of CO<sub>2</sub> as of 2018. The highest emissions per capita, however, are the United States and Australia. It is an alarming reality that on the global stage one of the largest emitters per capita, the United States has withdrawn from the Paris Agreement in reducing the industrial level of CO<sub>2</sub> release. The unequal emissions across the board are, in fact, consequential as well. Whereas developing countries are among the least emitters of the greenhouse gases, they turn to suffer more and are most vulnerable to the impact of climate change. There are several attempts to limit the emissions on a global scale with the overall strategy being to limit the global temperature increase to 2 degrees Celsius. Several climate policies are being rolled out to combat this fight against climate change, and key amongst them is the Carbon Decrease legislation.

### **2.3. Carbon Decrease Regulation.**

One of the most convenient sources of carbon emissions is through vehicles. Over the years, industrialisation has mastered the art of mega-production of cars and other cars, which means, their demand for them is met with the intended supply. To add to this, acquiring a vehicle has been made easier with loan facilities and hire purchase. This means that most people with decent-paying jobs can easily buy a car without going through much stress. Also, with the current individualistic lifestyle and culture of gains, people are more likely to acquire vehicles as a means to show off, instead of a real need of commute. Others also for the convenience of not travelling on public platforms. However, you look at it, there are more vehicles than there is every year with most of it relying on fossil fuel creates a CO<sub>2</sub> emissions issue.

According to the European Automobile Manufacturers Association, there were 19.2 million cars produced in the EU in 2018, which is only 20% of the world's production. The majority of these cars

are built to run on fossil fuel with the consequences of CO<sub>2</sub> emissions, that add up to the already existing cars out there. The EU has a commitment towards the environment, and the reducing greenhouse gases are paramount among these. The vehicular emissions of CO<sub>2</sub> which includes private cars, buses, light to heavy-duty trucks all come under the regulation rolled out to check the emissions and help reduce the rate of escalation of the climate change from the greenhouse gases.

The EU is committed to drastically reducing dangerous greenhouse gas emissions. To avoid a catastrophic climate change, the EU has committed to lower its greenhouse gas emissions by at least 40% below 1990 levels by 2030 under the Paris Agreement and to set out a way forward towards carbon neutrality by 2050. In the fall of 2018, the European Commission set out a working schedule to work towards carbon neutrality that will help reduce the emissions and fight climate change by 2050. (European Commission, 2018).

The emissions challenge can be tackled from different phases, in as much as the push for alternative fuels with lesser emissions are the subject of the day, there is a need to look at the emissions that have yet to happen from newer vehicles. In this regard, the European Parliament and Council have adopted a regulation in setting emission performance standards in modern passenger cars as part of a community-integrated approach to reduce CO<sub>2</sub> emissions. This regulation can be found in (EC) No 443/2009 Of The European Parliament and of the Council. The objective of this regulation is to set emission performance standards in new passenger cars registered in the community. The approach is part of the new community integrated measures to reduce CO<sub>2</sub> emissions. The implication of this regulation is to ensure that all sectors of the economy work at reducing the emissions, primarily from road transport, which is the second-largest emissions contributing to greenhouse gas emissions.

The new targets for passenger cars will enable the community to ensure its national policies are moving towards car manufacturers to meet with the standard emissions that will go a long way to reduce the overall emissions. The regulation builds on an established measurement and monitoring of CO<sub>2</sub> emissions from new productions following *Decision No 1753/2000/EC* of the European Parliament and of the Council of 22 June 2000 establishing a scheme to monitor the average specific emissions of CO<sub>2</sub> from new passenger cars. Planning community restrictions for new vehicles must make available the needed information for predictability and measuring just about how much more release of CO<sub>2</sub> is getting out there. In 1995, the Commission adopted a strategy for CO<sub>2</sub> emissions in cars. This required voluntary commitments from the car industry to cut down emissions, improve customer information to help them decide on a range of choices and promotion of fuel-efficient cars. The main challenge of this strategy was the obligation for the car manufacturers were more of a voluntary nature. That means they could opt out and just race for higher profit margins and by all means, strike their competitive



advantage than protect the environment. The aftermath of the strategy was not helpful, in making matters worse, there instead has been emission scandals, and deception from some car producing giants in tricking the public into buying products that emit more than is supposed to.

The current regulation is supposed to have national policies hold local car manufacturers accountable for the emission standards. The incentives to this new regulation are supposed to enable car manufacturers to resolve to eco-innovative ways of the new cars to be manufactured. Thus, in mass producing the cars, there should be eco-friendly technologies to cut down the emissions and also invest more in research and development towards significantly reducing the emissions of new vehicles produced. The measurement of emissions from new passenger cars is according to a harmonised basis according to community methodology in Regulation (EC) No 715/2007. In minimising administrative burden, the measurement must be on the data from registrations of the new cars according to the member states and reported to the Commission. In ensuring consistency, rules of the data collection must be harmonised as much as possible.

According to the Regulation (EC) No 715/2007 in Article 4, there are some manufacturers obligations, requirements and tests to ensure that the cars are meeting the community standards. The manufacturers were obliged to do the following:

- I. Manufacturers shall demonstrate that all new vehicles sold, registered or put in service in the community are type-approved following the regulations and implementing measures. Manufacturers shall also prove that all new replacement pollution control devices requiring type approval which are sold or put into service in the community are type-approved following the regulation and implementing measures.
- II. Manufacturers shall ensure that type-approval procedures for verifying the conformity of production, the durability of pollution control devices and in-service conformity are achieved. In addition to the technical measures taken by the manufacturers must be such as to ensure that the tailpipe and evaporative emissions are effectively limited, according to this regulation, through the normal life of vehicles under normal conditions of use. Therefore, in-service conformity measures shall be checked for a period of up to 5 years or 100 000km, whichever is taken sooner.
- III. Manufacturers shall set out carbon dioxide emissions and fuel consumption figures in a document given to the purchaser of the vehicle at the time of purchase. The paper will serve as a guide for owners to make informed decisions about the longevity of the car. In a more recent attempt to reduce carbon emissions, some manufacturers are willing to swap older vehicles for newer versions with better emission offsets.

Car manufacturers have to abide by Article 5 of the Regulation (EC) No 715/2007, which stipulates the requirements and tests as part of the manufacture's obligations in the following ways:

- The manufacturer shall equip the vehicles so that the components likely to affect the emissions are designed, constructed and assembled, to enable the car in regular use, to comply with this regulation, and it was implementing measures.
- The use of defeat devices that reduce the effectiveness of the emission control system shall be prohibited. The prohibition will have an exception where:
  - ✓ The need for the device is justified in terms of protecting the engine against damage or accidents and for the safe operation of the vehicles.
  - ✓ The device does not function beyond the requirements of the engine starting.
- The specific procedures, tests and requirements for the type approval set out as well the requirements for implementation are designed to amend the non-essential elements of this regulation.

The manufacturers' obligations also is required to cover the access to vehicle repair and maintenance information in accordance with the Regulation (EC) No 715/2007 under Article 6.

- The manufacturer shall provide unrestricted and standardised access to vehicle repair and maintenance information to independent operators through websites using the standardised format in a readable accessible and prompt manner. How is done should be none discriminatory compared to the provision given or access granted to authorised dealers and repairers. In order to facilitate the achievement of this objective, the information shall be submitted consistently following the technical requirements. Manufacturers shall also make information on training materials to independent operators, authorised dealers and repairers.
- The information on repair and maintenance shall comprise of unequivocal vehicle identification, service handbooks, technical manuals, components of diagnosis information, wiring diagrams, diagnostic trouble codes, software calibration identification number applicable to vehicle type and data record information.
- Authorised dealers or repairers within the distribution system of a vehicle manufacturer shall be regarded as independent operators for this regulation.

### **2.3.1. Carbon Emission through Transport (Cars).**

Transport plays a very significant role in the life of people; we are always reliant on some form of transportation that facilitates our movements from one place to the other. We commute every day for work, school, to participate in leisure activities, to visit friends and family and for all manner o reasons.

Transport, however, is one of the significant contributors to greenhouse gases. There are several transport options, but they are mostly divided into these three categories: Road, Rail, Aviation and Maritime. The majority of these mediums rely on fossil fuel for energy to move, and the by-product being CO<sub>2</sub> is undoubtedly released into the atmosphere, increasing our carbon footprint. More so, emissions from air pollution harm our health and will need to be reduced drastically without delay.

- a. The challenge for the EU now is to move to an irreversible shift to low-emission mobility. The European Strategy for low-emission mobility will benefit European citizens by delivering clean air, reduce noise pollution, lower congestion levels and increase safety. The Commission and the EEA have prioritised the following in achieving this strategy:
- b. Increased efficiency in the Transport System by making the most of digital technologies. Efficiently moving people from one point to the other can be done through smart pricing to ensure people travel less and make use of alternative means of transportation. For instance, various capitals in Europe such as London are now charging congesting fees for cars that go some principal street of the cities. Commuters are left with fewer choices than to make use of public transport or walk. Another efficient move has been the introduction of city-wide cycles, that can be rented for less. These cycles have no emissions and can move people for relatively short taxi commutes, also adding to the overall reduction.
- c. The development of alternative fuel for transport must be sped up. Over-reliance of fossil fuels has been the main issue with the ongoing climate disaster. A shift of this heavily relied on fuel to alternative energy to power the transport sector will mean fewer emissions. The introduction of electric cars and hybrid cars has been one step ahead, although the percentage of these don't match their carbon-emitting counterparts. Mass and public transportations need to redirect their energies to rely on alternative fuels solely. The advantage hence will be more reduction in the emissions, this comes at a high cost but very necessary in the fight to reduce emissions. It is thus moving towards zero-emission vehicles.

The car emissions target for 2015 was achieved by 2013, according to the report according to the EEA (European Environmental Agency). There were several changes after 2015, a target of 130 grams of CO<sub>2</sub> per kilometre is applied to EU fleet for average passenger cars. Emissions of 130g CO<sub>2</sub>/km correspond to fuel consumption of about 5.6l per 100km of petrol. The early achievement has impacted future targets, and as a result, as of 2018, new cars registered in the EU were 120.4g CO<sub>2</sub>/km. Car manufacturers are going to have penalties for excess emissions. If the average CO<sub>2</sub> discharge is exceeded, the manufacturer would have to pay for an excess emissions premium for each registered car. Beginning 2019, the penalty of 95 euros will be incurred for each g/km exceedance of target. The

prospect for a greener future may be possible if the objectives and expectations of the strategy is upheld.

### **2.3.2. Carbon Neutrality**

Carbon neutrality is having a balance between the carbon emitted and carbon absorption from the atmosphere in the form of carbon sinks. Carbon sinks are hence the area of more intake than the release of carbons, especially in typical rainforests. In order to achieve net-zero emission, we will have to balance out the carbon emission with the relative absorption. Forests, Oceans and the soil, are some ways to make the carbon sink naturally. However, a scientist is working to introduce other effective ways to include technology in the carbon absorption process. No artificial carbon sinks have yet been invented to remove enough carbon from the atmosphere and the scale to fight the climate change. Carbon sinks, therefore, take in more carbon from the environment than they emit. "According to estimates, natural sinks remove between 9.5 and 11 Gt of CO<sub>2</sub> per year. Annual global CO<sub>2</sub> emissions reached 37.1 Gt in 2017." (Europarl.europa.eu, 2020).

### **2.3.3. Goals of the Carbon Decrease Legislation.**

The European Union, in its quest to address the root causes of climate change and a bid to strengthening the global response, has rolled out a long-term strategy for the reduction of greenhouse gas emissions. The European Council in March 2018 confirms this lead on climate action. The position of the union is to achieve climate neutrality by 2050 through incorporating all sectors of the economy and all member states involvement. The following are the steps to be taken or in other sense, goals to be achieved by the midcentury.

#### **The Road to Climate Neutral Economy: Strategic Priorities (European Commission, 2018)**

1. Fully decarbonising Europe's energy supply: Large scale electrification of the energy system coupled with deployment of renewables will decarbonise the energy supply and significantly reduce our dependency on third country suppliers.
2. Embracing clean, safe and connected mobility: Decarbonising the transport sector by using alternative means of transport, connected and automated driving combined with the roll-out of electric vehicles and enhanced use of alternative fuels.
3. Maximising benefits from energy efficiency: Reducing energy consumption by close to half between 2005 and 2050.

4. Putting industrial modernisation at the centre of a fully circular economy reaping first-mover benefits by modernising existing installations and investing in new carbon neutral and circular economy compatible technologies and systems.
5. Developing smart network infrastructure and interconnections a modern and intelligent infrastructure, ensuring optimal sector coupling and enhancing regional cooperation, is the cornerstone of the energy transmission and distribution landscape of tomorrow.
6. Reaping the full benefits of bioeconomy and creating essential carbon sinks creating natural sinks by developing more sustainable land-use and agriculture.
7. Tackling remaining CO<sub>2</sub> emissions with carbon capture and storage compensating for remaining greenhouse gas emissions in our economy and creating harmful emissions.

#### **2.3.4. Impact of the Carbon Decrease legislation.**

The Carbon decrease is one of many steps in tackling the climate crisis. There have been many reformations to make way for what is to clean up the emissions out there and introduce a sustainable way for future generations. Here are some of the measure being taken by member states which are impacts of the carbon decrease.

**EU Emissions Trading Scheme:** The EU emissions trading scheme is a policy to fight against climate change by enabling cost-effective greenhouse gas reduction. There is a set cap for greenhouse gas that can be produced by organisations. Organisations can purchase their allowance cap and trade it between other organisations based on demands.

**Home Smart Meters:** In the UK, the government is introducing smart meters, that shows how much carbon is being produced or release through the day to day activities. These are measures to ensure that people conserve energy. Recycling and reducing waste are of paramount in making sure that the necessary efforts needed to save energy is achieved.

**Industry:** Organisations around Europe are not only making it a point to conserve the energy used but more importantly to find alternative energy sources that have and leave low carbon imprints. Investment into research and general practices by corporations to divert spending into a sustainable future is moving more and more industries to take a second look at the energy crisis and how they can help.

**Transport:** Greenhouse gases produced by the transport sector is one of the largest. Transport is responsible for nearly 30% of the EU's total CO<sub>2</sub> emissions, of which 72% comes from road transportation. As part of efforts to reduce CO<sub>2</sub> emissions, the EU has set a goal of reducing emissions

from transport by 60% by 2050 compared to 1990 levels. CO<sub>2</sub> emissions from passenger transport vary significantly depending on the transport mode. Passenger cars are a significant polluter, accounting for 60.7% of total CO<sub>2</sub> emissions from road transport in Europe. The production and disposal of electric vehicles are less environmentally friendly than a car with an internal combustion engine, and the level of emissions from electric cars varies depending on how the electricity is produced. The transport sector's paradigm shift to electricity instead of fossil fuel will go a long way to affect the emissions of CO<sub>2</sub>. (Europarl.europa.eu, 2020).

**Forest:** The forest is a major player in reducing greenhouse gases. Trees can absorb the CO<sub>2</sub> and in return, give our oxygen. The more forests that are planted, the more absorption can take place to offset the CO<sub>2</sub> gas in the atmosphere. This also calls for improved agriculture habits and the reduction of bush fires that tends to send out huge volumes of CO<sub>2</sub> into the atmosphere.

There is still a long way to go in reaching the overall targets set. However, member states need to observe measures put in place, as part of the roadmap to change. The impact of CO<sub>2</sub> emission is real, and the dangers ahead are non-negotiable. It is incumbent upon individuals, industries and governments to take the necessary actions to reduce energy usage while making every effort to go green in creating a sustainable world for the generations unborn.

### **3. The effects of EU Renewable Energy Legislation on Sustainable Energy production.**

#### **3.1. Sustainability and Sustainable Energy.**

Sustainability is the ability to exist for the foreseeable future. Being sustainable in the 21st century, therefore, depicts the survival of humans without a complete depletion of the biosphere. The theme of sustainability is about maintaining balance in nature. Development, industrialisation and urbanisation have therefore by their very nature contributed to the degradation of forests and pollution of the environment. These actions of humans threaten the next generation's survival should there be no adequate way of managing the use of resources without total depletion. Sustainability is a very new subject that was expounded by the Brundtland Commission in 1987. The World Commission on Environment and Development (WCED) which was set up by the United Nations in 1983, was given the mandate to investigate the protection of the environment regarding the accelerated development and growing cities which was enabling pollution at an alarming rate. A commission was established in 1987 headed by Gro Harlem Brundtland; the commission had a comprehensive study of environmental issues and sustainable development. A report was put together in 1987 known as "Our common future". The impact of this report got the United Nations to be more involving and refocus on the environment as a priority as much as world peace. The Brundtland Commission's report became an essential tool in shaping several global environmental policies.

The Brundtland Commission came up with the most inclusive definition of Sustainable development "the ability to make development sustainable to ensure that it meets the needs of the present, without compromising the ability of future generations to meet their own needs." (Brundtland Commission, 1987). The concept of sustainable development seeks to introduce limits, but not absolute limits. The limitations are the ones placed over us by the state of technology with its consequential effects on the environment, and more importantly, how we can overcome these limits for the benefit of future generations. The race to save the planet has not yielded the needed results so far as, in rich and developing nations alike, there are overdrawn resources. The current generation has borrowed into the future's generation environmental resources and left a deficit without any intention of paying back. The real harm is also that we are continually taking because of the need for survival, making us deeply indebted to unborn generations. International decision making is necessary to make sustainability not only in favour of the wealthy and privileged but to ensure that the poor in the society have their fair share as well. Sustainability, therefore, requires that those who have more affluent lifestyles and

access, adopt lifestyles that are within the planet's ecological means, especially in the area of energy usage. Also, the rise in population with a limited resource can lead to a decreased standard of living if people in power, countries with resources and the influential do not make the decisions and changes required to affect the rest of the world positively. In the end, sustainable development is not a complete state that can be achieved but rather a process of continuous decision making and adaptation to limit the exploitation of resources, guarding against wastage and moving towards alternative energy sources, as well as recycling used materials to preserve more of what is left of the world.

There exists an institutional gap as to who is responsible for checks and balances in the state of depletion and eminent deteriorating environment. Firms, governments and international bodies are all culprits of the mass depletion. The profitability to firms, the politics in governments and the loose control of international organisations have all led to the difficulty that we currently face to switching up a better approach. A starting place is, however, necessary, and that is mass conscientization, a public understanding and education is crucial to making the first step to hold each other accountable. According to the Brundtland report, a major institutional flaw is governments' failure to make entities whose policies and actions destroy the environment responsibly, to ensure that their systems are in line with making the environment safer during and after their operations or suffer the consequences. The mandate of central government ministries is often too shallow, for instance in most governments, there are ministries of energy and power with large budgets to ensure the production of electricity and to make continuous growth in production without any mandate to clean the mess afterwards. Smaller environmental agencies with more modest budgets or lesser power, influence and control must deal with the responsibility of cleaning up after the energy sectors. The hypocrisy of this does not present the checks and balances needed.

The change needed puts international bodies in a place of leadership and shaping foreign policies, treaties and agreements towards establishing partnerships and developmental goals to maintain a balance and ensure sustainability in the long run. International bodies must now anticipate environmental degradation and prevent them from happening through trade regulation, agricultural development and industrialisation. These policies must carry the weight and importance of national priorities and even more, as there would be no governments or businesses without the environment being sustainable to continue. Significant developmental reforms may be hindered by struggling countries that are already deprived, and as a result, may be lacking in ways to get ahead without any aid. International agencies may be helpful in alleviating the challenges of these developing regions through financial and technical assistance, as well as through training to overcome depletion of



resources, scaling up recycling plants or introducing them, as well as establishing national commissions on civic education to conscientize the masses that are usually not very literate. Population growth and natural resource are now at an inversely related. Many regions of the world with increasing populations have limited resources to meet the need. The available environmental funds are therefore insufficient for healthcare, housing, food security and the supply of energy. The issue is not just the numbers but how the resources available match up the numbers needing it to survive. One proven way of making this adequate distribution is through education. Thus, training will improve human potential to manage scarce resources. The population increase can be addressed by governments in several ways through policies as well as empowering people to make choices with lasting impact. In recent decades, some regional systems placed a limit to the number of children; a family may have. One such example was China's one-child policy in the 1970s; the policy achieved the intended aim but not without infringing on human rights violations for families that could not follow through. It was very harsh more so if a family lost their child after childbearing age, that meant no way to reproduce or have an heir. A more humane policy later introduced by some governments in the west was to give smaller families financial incentives if they had a limited number of children within the first few years of marriage. People were empowered to make decisions that positively affected their livelihood and were in charge of when and how to procreate. Under-developed countries were mostly with colossal population growth with an attributable factor to low and mostly no usage of contraceptives. Family planning was not a part of developing countries and marginalised groups. Women were not in control of their bodies and some cultures placed value on large families than trained and efficient human resources. Government policies in such countries were then to establish family planning centres and posts in such communities and hospitals. The aim was to educate on family planning and ensure that women oversaw their birth control since men in most instances culturally resisted the responsibility of controlled birth but rather took pride in large families. Population control is an effective measure to reduce the overexploitation of natural resources and raise the living standards of people — however, the way the population is controlled matters. Education and empowering families as well as giving them access to birth control options is not only necessary but helpful to achieve an optimum community which may also reduce the rate of exploitation. The success of the above measures may contribute significantly to sustainable development.

### **3.2. The Three Pillars of Sustainability.**

In 2005, the World Summit on Sustainable Development concluded on three significant areas that are key to the science of sustainable development. In many National Standards and schemes, the pillars form the backbone of addressing the issues that the world now faces. The Brundtland Commission's

report suggests, therefore that the development in these areas to meet the needs of the present is essential to seek not to compromise the future generation's ability to meet their own needs. Future generations ought to be considered in making decisions today in the following pillars.

**Economic Development:** Economic development continues to be a problem with regards to sustainability due to the disagreement in political ideologies. The political ideologies are mostly regarding what is sound and what is not sound economics. The preoccupation of businesses is to make a profit and seek growth, regardless of whether they are adhering to sustainability guidelines and the standard legislative requirements. Economic development is more about giving people a good life or what they want without compromising the quality of life, especially in less impoverished countries and region. One region should not suffer unduly to make another area comfortable; there must be a balance in meeting business growth at the same time ensuring fairness and equity. Most businesses do not look into giving back to the societies they operate in, especially if there is no direct benefit from the businesses to such communities.

**Social Development:** There are many phases of social development as a pillar to sustainability. The more important aspect, however, is awareness and protection of the health of people from pollution. In North America, Europe and most developed parts of the world, strong policies exist to protect the social fabric of doing business. Legislations and program checks exist to make the realisation of balancing development and growth in the social infrastructure sustainable. Health and wellness of people are very much protected. Industries must inform what ingredients used for what products under the consumer protection policies in these places. One of the most important topics in social development is the subject of sustainable housing. Thus, building that does not negatively affect the environment as well as makes recyclable materials a part of the fabric and reduction of wastage. Developing countries and countries without much structurally planned communities have often been affected more by flooding because buildings have been allowed in what should have been waterways, and there is no proper drainage system for the clustered societies.

**Environmental Development:** Protecting the environment is at the centre of sustainable development. We cannot assume everyone thinks about protecting the environment and in fact, many people scarcely think about the impact of their actions on the environment. Whether it is recycling, reducing power consumption or walking shorter journeys instead of driving. Business and households are now being granted incentives in some parts of the world for reducing consumption of energy or reducing the emission of CO<sub>2</sub>. Installing renewable power resources is gaining more recognition in an attempt to save the environment. Technologies that drive towards a greener future have more chances of government support than traditional means of energy sources to contribute towards a sustainable future.

### **3.3. Sustainable Energy**

The practice of using energy in a way that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (Lemaire, 2004). A major challenge of the 21<sup>st</sup> century has been managing the energy crisis facing the world. It is a crisis where over-reliance on some sectors of production has led to the exploitation of natural resources due to the increase in population. Over-reliance on renewable resource is not a problem due to their ability to replenish themselves. Still, over-reliance in fossil fuel which is limited in supply presents a risk for future generations’ access to these resources, not counting the cost of pollution from the CO<sub>2</sub> by-products. To have sustainable energy reforms, we must have a reliable alternative source that is renewable. The merits of sustainable energy are limitless in reducing the risk of depleting natural resources and reduced pollution due to their clean nature.

Sustainable energy includes all renewable energy sources such as solar, biomass, wind, geothermal, wave and tidal energies. Nuclear power was once described as sustainable energy but has not met more new requirements, in that nuclear relies on uranium to function, which is a limited resource (Petrescu et al., 2016). Sustainable energy is, therefore, the energy that will never be used up or depleted, any energy source or accessory to that source that has the potential to be exhausted or run out is not sustainable. Sustainable energy can also be achieved through energy conservation, conserving existing energy and reducing waste is an effective way to sustain energy. The benefit of sustainable energy production far outweighs the cost involved. There are apparent capital factors that are not readily available, especially for developing countries and low-income households who seek to diversify their energy sources. Governments are now looking into putting more funds into the research of sustainable energy alternatives and granting firms some incentives to divert their energy sources to renewable. The current status may be defined as a transition period, moving from fossil to sustainable will take time. Still, with dedication and the allocation of resources coupled with the needed policy framework, it is possible to achieve a higher percentage of energy production sustainably.

#### **3.3.1. Sustainable Energy Production**

The production of sustainable energy is vital for the planet and saving resources for the future generation. There are many traditional ways through which energy has been produced and preserved in a way that does not harm the environment or leave any carbon footprints. Windmill technology uses energy from the wind span on a blade to generate electricity, solar panels convert UV rays into solar energy and geothermal plants help absorb heat from the earth to produce electricity through generators and other refined technology. One recent sustainable energy production that is gaining roots in the

sustainable revolution is the microbial fuel cells. The microbial fuel cells (MFC's) can convert organic waste, including low strength wastewaters and biomass into electricity. The MFC's has the potential to be significant bioenergy in the future, offering the opportunity to convert little soluble waste into electricity. (Pant. D et al., 2010) The only disadvantage with the MFC's is that the power yield is currently low, more research and development is needed to work at its optimum usage in delivering high power voltages.

Nevertheless, MFC's may be used locally or in domestic ways for appliances that require minimum power to work. The revolution of MFC's has several advantages in that using the wastewater substrates, provides electricity and simultaneously deals with wastewater treatment at the same time. It solves sanitation and an energy problem with one stroke of intervention. The objective of major waste treatment centres has been safely removing pollutants from the wastewater before discharging them to the environment. MFC's response now brings an added step into the waste treatment, making them potential powerhouses at the same time due to energy-producing abilities.

Several substances may qualify for an MFC in their usage in sustainable energy production. The researcher has limited these to three significant sources of wastewater, that may serve as components to produce electricity. The first component is known as lignocellulosic biomass. The abundance of this substance can be found in agriculture residue that renders an alternative way for cost-effective energy production. The chemicals from these cannot be used directly; however, they may be converted into a low molecular weight. (Huang et al., 2008). Dye wastewater is another source of MFC for sustainable energy production. The textile industry is a huge one that uses many materials significant amongst them is the dye. Azo dye is known to be the most substantial form of synthetic dye used extensively in dye manufacturers and textile industries. The removal of this dye from dye wastewater is paramount to protecting the environment. Recent studies have proven this dye to be very useful in making the MFC substances reactive enough for electricity production. (Pant et al., 2008).

The ultimate source of MFC for sustainable energy production is landfill leachates. Landfill leachates are heavily polluted areas with very toxic substances that destroy almost anything in its part. They consist of dissolved organic matter, inorganic macro-components and heavy metals. In recent research, (Greenman et al., 2009) has demonstrated the possibility of simultaneously generating electricity and treating landfill leachates at the same time. The growing research into MFC's usage in bioenergy production is a source of hope for sustainable energy production. Critical insight into MFC energy production is that it is possible to use solar energy to aid the process of bioenergy for sustainable energy production. Through this intervention, there is no need for fossil burn fuel or add more carbon

dioxide to the environment. It only gets cleaner by the day with more research and studies to make MFC's a significant alternative source of energy. Some school of thoughts have argued nuclear energy as a sustainable energy source, however that leads a lot to be resolved due to the nature of nuclear production. The Kyoto Protocol places obligation on signatories to reduce their emissions significantly from the 1990 emissions rates. The possible avenues for reducing the emissions has been championed by switch to nuclear energy production. This is in hope to reduce the greenhouse gas emissions among bringing about some energy security. (Menyah, K et al, 2010) The major environmental problem is the safe storage of radioactive waste through their immobilization. Although a possible approach in the means of transmutation of radioactive elements, the approach only reduces the risk but does not eliminate the problem. Transmutation converts the chemical component to a less radioactive vector but remains harmful to the environment. Nuclear fusion technology seems to be an ultimate breakthrough to renewable energy if development advances beyond the current flaws such as seen in Chernobyl (1986) and Fukushima (2011). While nuclear energy at this point is free from carbon emissions, the main challenge remains in the safe disposal of nuclear waste over a long period of time. (Nowotny, J et al, 20016). The final school of thought on nuclear energy is about the sustainability of an important element, Uranium. Uranium is an exhaustible element used in nuclear energy production. It is mined beneath the surface of the earth's crust and like oil it is in limited reserves. Since a primary source of energy from the earth crust is involved in nuclear production, it has been challenged as being wholly renewable. Nuclear energy may be said to be a viable option needing more research and development to be completely cleared as a green source of energy. (Mayumi, K., 2012 Nuclear power has been with us for more than half a century, early record date back to 1940 during the second world war during the production of bombs. Nuclear power works basically by energy being produced by splitting atoms and other elements. According to the (World Nuclear Association), 10% of the world's electricity is generated through nuclear energy by 440 nuclear reactors. The WNA also associates the first commercial production to Nuclear energy in the 1950's.

The largest producer of nuclear energy in 2018 was the United States, followed by France, China and Russia. The Czech Republic is the world's 15<sup>th</sup> largest producer of Nuclear Energy. There are 6 Nuclear reactors generating about a third of the country's electricity, thus 35%. The first Nuclear Power begun in 1985 and the government is committed to making the future of nuclear energy reliable. Sweden has seven operating Nuclear reactors enabling the production of up to 40% of nuclear energy of the country's total share of electricity production. Despite the growing number of nuclear reactors in the countries above, nuclear energy production has had to deal with an unfortunate amount of radioactive wastes which is harmful to the environment. In addition to that, the main element used in nuclear

energy uranium is not a renewable resource. Therefore, the continuous reliance on it to create another form of energy leave nuclear energy widely contested as a renewable resource.

Nuclear Energy is more acceptable than some other forms of energy production because of its low carbon impact. However, it is not entirely devoid of leaving carbon imprints. Nuclear Energy in replacing fossil fuel and coal will significantly reduce emissions and save the planet. In our desperate attempt to reduce the damage by fossil fuel, it hasn't affected its dominance by being 65% of world's energy production. Some scientist and energy stakeholders are of the view that nuclear may be a bridge between High carbon-emitting energy production and renewable energies. An essential factor for generating nuclear energy is an essential element called Uranium used in production. Uranium is mined from below the earth's crust and as with every other form of mining activity, the environment is severely damaged with its impact of vegetation, aqua-culture, air pollution with consequences on human health. Irrespective of the dilemma of nuclear energy, there are at least 30 countries with active nuclear energy production. The production wavelength varies according to the resources available and the population, which translates to need and usage.

### **3.3.2. Goals of Sustainable Energy production**

The goals of sustainable energy production may be categorised in threefold:

**Managing Climate Change:** Climate change is at its all-time peak with over-reliance on fossil fuel. There are no two ways about the impact of CO<sub>2</sub> gases and the necessity of re-working our way back to a sustainable future. The move towards sustainable energy production and its numerous advantages adds significantly to the cutting back of CO<sub>2</sub> gases hence managing climate change.

**Reducing urban-industrial Air Pollution:** Governments are responsible for ensuring the reduction of urban-industrial air pollution, it, however, cannot achieve this without switching primary energy sources into sustainable production. Apart from the usage of fossil fuel causing infection, the mining and sourcing them adds to the industrial deficit of pollution, since most homes depend on heat which is produced on an industrial level through fossil or coal. The need for a change is crucial, as well as measures to ensure individuals and households have a part to play.

**Reducing Transport Air-pollution:** The sustainable energy plan implies that we not only switch to cost-effective energy production that saves the environment but more so protect the energy already produced to be used over a more extended period. Transportation may be a significant consumer of the energy produced but not if we switch to alternative means. Biking short distances, cab-sharing and carpooling, are all goals of sustainable energy production. We can save more fuel by attempting to limit transport usage or share a ride.

### **3.4. The UN Sustainable Development Goals. (Affordable and Clean Energy and Climate Action)**

In 2015, the United Nations adopted 17 sustainable development goals for all member states. The 2030 Agenda for Sustainable Development is a blueprint for prosperity and peaceful living for the planet and people all over the world. At the core of these 17 sustainable development goals remains an urgent call for countries (both developing and developed) to enter into a global partnership to strategise and ensure the improvement in health and education, reduced inequality, climate action and decent work and economic growth, clean and affordable energy. The SDG's are a build-up from decades of work by countries and the UN looking at the various needs and challenges of people as well as the environment. The UN Department of Economic and Social Affairs has been prominent in making these goals come to light from the following works and partnerships:

- In June 1992, at the Earth Summit in Rio de Janeiro, Brazil, over 178 countries signed Agenda 21, a comprehensive plan of action to build a global partnership for sustainable development to enhance human lives and safeguard the environment.
- Member States decided the Millennium Declaration at the Millennium Summit in September 2000 at UN Headquarters in New York. The Summit led to the elaboration of eight Millennium Development Goals (MDGs) to reduce extreme poverty by 2015.
- The Johannesburg Declaration on Sustainable Development and the Plan of Implementation, adopted at the World Summit on Sustainable Development in South Africa in 2002, reaffirmed the global community's commitments to poverty eradication and the environment and built on Agenda 21 and the Millennium Declaration by including more emphasis on multilateral partnerships.
- At the United Nations Conference on Sustainable Development (Rio+20) in Rio de Janeiro, Brazil, in June 2012, Member States adopted the outcome document "The Future We Want" in which they decided, inter alia, to launch a process to develop a set of SDGs to build upon the MDGs and to establish the UN High-level Political Forum on Sustainable Development. The Rio +20 outcome also contained other measures for implementing sustainable development, including mandates for future programs of work in development financing, small island developing states and more.
- In 2013, the General Assembly set up a 30-member Open Working Group to develop a proposal on the SDGs.
- In January 2015, the General Assembly began the negotiation process on the post-2015 development agenda. The process culminated in the subsequent adoption of the 2030 Agenda

for Sustainable Development, with 17 SDGs at its core, at the UN Sustainable Development Summit in September 2015.

Every one of the 17 SDG's is essential; however, Sustainable Development Goals 7 and 13 are more relevant to this study. The following have been outlined as such:

**Sustainable Development Goal 7:** seeks to ensure access to reliable, affordable, sustainable and modern energy for all. Access to power is increasing especially in emerging countries, the need for renewable energy is vital in bridging the gap between these poorer countries. Poorer or developing countries have a long way to go in enjoying the benefits of power. However, more practical help will be starting them off on a sustainable energy source that does not require limited fossil fuel.

According to the progress of goal 7 in 2019:

- The global electrification rate rose from 83 per cent in 2010 to 87 per cent in 2015, with the increase accelerating to reach 89 per cent in 2017. However, some 840 million people around the world are still without access to electricity.
- The global share of the population with access to clean cooking fuels and technologies reached 61 per cent in 2017, up from 57 per cent in 2010. Despite this progress, close to 3 billion people still rely primarily on inefficient and polluting cooking systems.
- The renewable energy share of total final energy consumption gradually increased from 16.6 per cent in 2010 to 17.5 per cent in 2016, though much faster change is required to meet climate goals. Even though the absolute level of renewable energy consumption has grown by more than 18 per cent since 2010, only since 2012 has the growth of renewables outpaced the growth of total energy consumption.
- Global primary energy intensity (ratio of energy used per unit of GDP) improved from 5.9 in 2010 to 5.1 in 2016, a rate of improvement of 2.3 per cent, which is still short of the 2.7 per cent annual rate needed to reach target 3 of Sustainable Development Goal 7.
- International financial flows to developing countries in support of clean and renewable energy reached \$18.6 billion in 2016, almost doubling from \$9.9 billion in 2010

**Sustainable Development Goal 13:** inspires urgent action to combat climate change and its impacts. With rising greenhouse gas emissions, climate change is occurring at rates much faster than anticipated, and its effects are clearly felt worldwide. While there are positive steps in terms of the climate finance flows and the development of nationally determined contributions, far more ambitious plans and accelerated action are needed on mitigation and adaptation. Access to finance and strengthened capacities need to be scaled up at a much faster rate, particularly for least developed countries and small island developing States.



- Increasing greenhouse gas emissions are driving climate change. In 2017, greenhouse gas concentrations reached new highs, with globally averaged mole fractions of CO<sub>2</sub> at 405.5 parts per million (ppm), up from 400.1 ppm in 2015, and at 146 per cent of pre-industrial levels. Moving towards 2030 emission objectives compatible with the 2°C and 1.5°C pathways requires a peak to be achieved as soon as possible, followed by rapid reductions.
- As indicated under Sustainable Development Goal 1 (see para. 22 above), during the period 1998–2017, direct economic losses from disasters were estimated at almost \$3 trillion. Climate-related and geophysical hazards claimed an estimated 1.3 million lives.
- As of April 2019, 185 parties had ratified the Paris Agreement. Parties to the Paris Agreement are expected to prepare, communicate and maintain successive nationally determined contributions, and 183 parties had demonstrated their first nationally determined contributions to the secretariat of the United Nations Framework Convention on Climate Change. In contrast, one party had expressed its second. Under the Agreement, all parties are required to submit new nationally determined contributions, containing revised and much more ambitious targets, by 2020.
- Global climate finance flows increased by 17 per cent in the period 2015–2016 compared with the period 2013–2014.
- As of 20 May 2019, 28 countries had accessed Green Climate Fund grant financing for the formulation of national adaptation plans and other adaptation planning processes, with a value of \$75 million. Of these, 67 per cent were for least developed countries, small island developing States and the African States. Proposals from an additional seven countries, with a value of \$17 million, are in the final stage of approval. In total, 75 states are seeking support from the Green Climate Fund for national adaptation plans and other adaptation planning processes, with a combined value of \$191 million.

## 4. Research Methodology.

The Research methodology depicts the main aspects of the thesis design and the ways used in carrying out the research. The selected approach, the system used in the collection of data and conclusions drawn from the analysis, has been outlined. Focus is given to the explanation for the chosen policy documents and sampling technique. As with every approach to research, there are limitations to the method selected outlined in this chapter.

### 4.1. Research Design

The thesis aims to comparatively examine the EU renewable energy policies implementation, the shortcomings and potential challenges with ensuring national legislations match up with the administrative practices. The Carbon Decrease policy in the EU is reviewed to assess its impacts on the environment. The research will mainly focus on the Czech Republic and the Kingdom of Sweden, comparing how both countries have managed to achieve or reason for failing to achieve the EU renewable energy policies in the respective countries. The research seeks to provide answers to the main research questions as to *what the goals and main features of the EU legislation on Renewable Energy are, what role Sustainable Development plays in the system of EU Renewable Energy Legislation, what the main features of Renewable Energy Legislation are, how does Sweden and the Czech Republic implement the EU Renewable Energy Legislation, Analysis of Nuclear energy as a potential renewable energy source, what the strengths and weaknesses of both countries' Renewable Energy practices are and how can lessons from these countries contribute to a Sustainable Development future.*

The research design for the study undertaken is that of qualitative method, secondary sources of data will be consulted, and desktop research will be maximised in the analysis of various policy documents and reports. The documents collected from various sources will be reviewed and analysed, making up the secondary data. Information and expert knowledge gathered from the EU policy documents, books, internet sources and journal articles has been used for the study. According to (Silverman, 2016) qualitative research is more than an in-depth study of secondary sources of data. In qualitative research, derived insights from data do not depend on proximity to the first-hand collection of the data but on judiciously balancing with close observation with analytical distance. Qualitative research then has more to do with how reliable the descriptions of the secondary data are and their relevance to the research questions being asked. Qualitative research is beneficial when the aim of the research is also to observe and gain meaning of perspectives and exploring the phenomenon of activities, events or

results after that. In this instance, the research aims to analyse the European Union Legislation on Renewable Energy and to reveal its implementation in Sweden and the Czech Republic. The study also seeks to analyse the legislation on Carbon Decrease in the European Union and the progress made. Qualitative research is inductive, researchers develop concepts, insights and understanding from the patterns of data, rather than collecting data to prove preconceived models, theories and beliefs. Glesne (2016). The inductive nature takes a form of emerging analysis and which makes the process creative and intuitive than mechanical. In qualitative studies, researchers follow a flexible research design, sometimes starting from vague research questions. However, the motion and vision move from the unknown to the known through systematic analysis of data and gathering of knowledge (Marshall & Rossman, 2011).

#### **4.2. Method for Selecting Relevant Policy Documents**

Qualitative research may be on either swing of the spectrum in the analysis. There are two main kinds of selecting cases of study. These have been consistently termed as the "most similar" and "most different" systems design, also known as MDSD and MSSD. According to (Plümper et al., 2010), most qualitative comparative researchers prefer most similar technique to its main rival "most different" design. The most similar systems design compares very similar cases that differ in the dependent variable. The most different systems design, however, uses the approach of quasi-experiments to compare cases that are significantly different in every way except for the variable of interest. The believe that the dominance of the MSSD over MDSD has been justified. There are specific criticisms leveraged over this justification, amongst which is that: the chosen cases never represent the entire population, the lack of variation makes it impossible to eliminate the possibility of casual effect, and the elimination of rival hypothesis is impossible (Gerring et al., 2016).

The MDSD was used in the selection of case for this study. The MDSD research design was selected by the author because both countries selected have the same variable interest being renewable energy in generating electricity. Apart from that, both countries are members of the EU and have similar population sizes of just about ten million inhabitants. Now following the requirements of MDSD for subjects being maximally different, the Czech Republic and Kingdom of Sweden have a lot of differences. The surface area of the Czech Republic is 78 867 sq. km, Sweden is approximately 450 295 sq km. While this staggering number means Sweden is more than 400% bigger than Czech Republic, it does make more meaning that Sweden has more natural resources including large number of moving waters to foster hydro power and other renewable energy sources. The economic variable (GDP per capita) for 2020 indicates that the Czech Republic has \$42 165, whiles Sweden has \$54 834.

Now this can also indicate the amount of disposable wealth the country has available for investing into the environment and energy sector. The final difference to be talked about is the emissions level. The emissions level of both member states has also been of significant interest and according to the current OECD data, the Czech Republic has CO<sub>2</sub> emissions of 9.5 tons per capita, while that of Sweden is 3.6 tons per capita. The Czech Republic has 3 times more CO<sub>2</sub> emissions than Sweden, the differences above are the subject of interest to the researcher and compliments the choice of MDSD.

The policy fields analysed required that relevant parties pursue significant coordination and the selected design by the researcher inspires excellent insight into the cases. It elaborates more on the similarities and differing methods chosen by the respective countries in the implementation of the EU renewable energy policy.

### **4.3. Population and Sampling**

The EU renewable energy policies are taking a stand a more comprehensive approach in making the member states responsible for their overall output and contribution to the environment. The EU, by far, has a more dedicated approach to environmental protection and sustainability, compared with other supranational bodies and unions. A comparative case study will be used by this research owing to the similarities and diverse nature of the research subjects. The case studies undertaken often involve an in-depth examination of policies, programs and interventions, comparing two or more cases in a way that produces general knowledge about why particular policies work or fail to work (Goodrick, D. 2014). The Czech Republic and the Kingdom of Sweden as selected cases will be used to evaluate the implementation of EU renewable energy policies. The reasons for selecting the Czech Republic and the Kingdom of Sweden for this study are: the selected member states are active participants of the EU with differing membership years and active participation and cooperation. The Kingdom of Sweden joined the EU in 1995, while the Czech Republic joined in 2004. The Kingdom of Sweden has emerged as a member state with the most renewable energy sources in the EU, second in the world to Iceland according to the EU renewable energy report of 2018. Sweden's population was 9.6million people as of 2019 with a growth rate of 0.9%. CO<sub>2</sub> emissions currently stand at 3.6 tonnes per capita according to the OECD reports. Sweden is noted for its active environmental protection compliance and investment in recycling as well as environmental conservation. The Czech Republic, on the other hand, has a population of 10.5million people and a growth rate of 0.1% as of 2019. CO<sub>2</sub> emissions currently stand at 9.5 tonnes per capita according to the OECD reports, about three times of Sweden's emissions.

Renewable energy supply is of significant interest to this study, and according to the 2017 OECD data (IEA World Energy Statistics and Balances: Sweden's renewable energy production was 18,426 thousand toes, while in the Czech Republic renewable energy accounted for 4,466.1 thousand toes. The vast discrepancy is of great importance to this research. Establishing what accounts for this margin will be of great importance to positively shaping the renewable energy policy implementation for a sustainable future. The Kingdom of Sweden and The Czech Republic portray distinctive characteristics as well as a sort of similarities propelled by the implementation of EU renewable energy policies.

#### **4.4. Data Collection**

The researcher made use of secondary data in the study of the implementation of policies, the EU legislation and reports on renewable energy, the environment and carbon decrease has been gathered and analysed. Collection of journals and relevant articles together with published documents from the EU official websites has been examined for the thesis. The study of reports from the EU environmental agencies enables the usage of a wide array of data. Multiple sources of data have been used to pass the validity test. For the reliability of data collected, data triangulation was used to ensure that there was correspondence with the analytical and theoretical framework. The secondary data relied on the reports and policy documents from the EU, International Environment Agency, Eurostat and various publications from scholarly books, articles and peer-reviewed journals that were essential to the purpose of the study.

#### **4.5. Data Analysis**

A comparative research study, according to Kolb (2012), implies that the researcher uses the strategies of making constant comparisons and applying theoretical sampling to ascertain or justify the validity of an observed phenomenon. Glense (2016) shares that the significant contribution to comparative qualitative study is the selection rules for the highest reliability to make casual inferences under a range of conditions regarding the underlying data generating processes. The analytical tool employed seeks to find out the implementation of the EU renewable energy policies in the selected member states and to outline the success achieved or failures encountered with the implementation process. It will be worthwhile gaining some more background information about both countries and the level of individual participation in government policies. The kind of government practised is very crucial to the success of policy implementation. The amount of time, the member state has been in the EU also may help determine the relative amount of assistance and help in pushing through specific policy requirements. Finally, the expression of independence, level of development and infrastructure and general cultural expression do have a stake in various dimensions with regards to the success or failure of the policies implemented.

#### **4.6. Research Limitations**

Regardless of the inputs from various resources and policy documents and analysis of the report, as well as peer-review journals, limitations are a vital part of every research. The level of development in the respective member states has far-reaching consequences on the level of policy implementation. The Kingdom of Sweden was founded in 1523 when it declared independence from the Kalmar Union, even though Sweden has survived other conflicts, it stands proud and has enjoyed the freedom to develop and re-invent itself as a European superpower for all these centuries. The Czech Republic on the other hand since becoming a sovereign state in 1918 as the then Czechoslovakia has had many divisions, significant conflicts and oppression under the Soviet Union and the Nazis until 17 November, 1989 during the Velvet revolution. On January 1, 1993 the Czech Republic and Slovakia became independent countries. The development, access to resources and renewed ways of doing things including power production, including renewable energy, maybe significantly hampered due to competing priorities of a younger nation.

In order to limit the forecasted weakness of the thesis with regards to secondary data collection, triangulation of data was optimised to ensure the reliability and credibility of the information gathered. Multiple checks from diverse and certified EU agencies or networks for reporting have been consulted for analysis.

## **5. Analysis of the implementation of the EU Renewable Energy in the Czech Republic and the Kingdom of Sweden.**

### **5.1. Implementation of renewable energy policies in the Czech Republic.**

The coming into force of the Directive EU 2018/2001 for the promotion of renewable resources is a framework for the Union's binding target of 32% renewable energy in gross energy consumption by 2030. The Directive is to ensure that member states take on their obligation to meeting the 2020 targets to set the trajectory for the future. At the heart of EU's priorities is renewable energy and the Directive 2009/28/EC on the promotion and use of the renewable resource is a crucial policy for ensuring a sustainable Europe and a better world to save the planet.

The Czech Republic is a central European country which is landlocked between Poland, Germany, Austria and Slovakia. The current GDP of the Czech Republic is \$40,403 and a projected growth rate of 2.3% (OECD, 2020). The Czech Republic has been an active member of the EU since 1 May 2004 and has committed in the time frame since joining the EU to be an active participant in the EU policies and frame of work. As a result, the EU renewable energy policies are of no exception. The Czech Republic has multiple energy sources with coal being the most used, that has now been largely contested due to the CO<sub>2</sub> release and the harm they leave. Renewable energy is a more recent energy source that seeks to be a sustainable option. Hence more focus is being given in recent years. According to Eurostat, renewable energy usage as of 2009 was just 5% of the various sources of energy and 6% of the overall electricity. In that same year, 40% of energy consumption came from coal, and petroleum accounted for 21%, gas accounted for 15% and 16% from nuclear energy. The most electricity produced was with coal at 55%.

The table 2 sourced from the progress report of the implementation of renewable energy, outlines the various energy sources (renewables), and their respective outputs towards the 2020 targets. The table presents the total actual contribution (installed capacity and gross electricity generation) from each renewable energy technology in the Czech Republic. The primary sources outlined were hydropower, wind, solar and biomass. The overall capacity installed and produced was an upward shift, though not a significant one. In 2015, the total energy produced from renewable sources was GWh 4689, compared to the total production in 2016 of GWh 4692. According to the *Directive 2009/28/EC* of the European and of the Council of 23 April 2009 on the promotion and use of renewable sources with the subsequent amending and repealing of *Directive 2001/77/EC* and *2003/30/EC* in line with the Commission's Decision on 30 June 2009, pumped hydropower plants are not considered a renewable energy source (Progress Report, Commission, 2016).

**Table 2: Renewable Energy share in the Czech Republic for 2015 and 2016.**

	2015		2016	
	MW	GWh	MW	GWh
Hydropower <sup>11</sup> :	1 088	2 291	1 090	2 279
non pumped				
<1 MW	154	485	156	473
1 MW-10 MW	181	658	181	647
>10 MW	753	1 235	753	1 217
pumped <sup>11</sup>				
mixed <sup>12</sup>				
Geothermal	0	0	0	0
Solar:	2 075	2 264	2 068	2 131
<i>photovoltaic</i>	2 075	2 264	2 068	2 131
<i>concentrated solar power</i>				
Tide, wave, ocean				
Wind:	281	521	282	519
<i>onshore</i>	281	521	282	519
<i>offshore</i>				
Biomass <sup>13</sup> :	368	4 702	369	4 657
<i>solid biomass</i>		2 091		2 068
<i>biogas</i>	368	2 611	369	2 589
<i>bioliquids</i>				
<b>TOTAL</b>	<b>3 812</b>	<b>9 778</b>	<b>3 809</b>	<b>9 586</b>
<i>of which in CHP</i>	-	4 689		4 692

Source: (The Progress Report, European Commission, 2016)

## 5.2. Policies for the promotion of Renewable Energy Sources in the Czech Republic.

The overall EU target for the share of RES to total energy consumption for the 2030 target, is set for 32%, towards the 2020 targets, respective member states are to set their national targets in line with the Directive 2009/28/EC. The Czech Republic, in alignment with the National Action Plan, set its RES target for 2020 at 13% and present has achieved 14.89%. However, comparing the current achievement with the National Action plan, which set the 2020 RES target for 13% means that the Czech Republic has met this target. There is still more to go in making the Czech Republic achieve the RES targets on the 2030 RES agenda for the EU. The following proposals have been put across in supporting and approaching the achievement of RES targets. The Draft National Energy and Climate Plan (2018), gives a comprehensive insight into the progress of the Czech Republic. The table below is a summary of existing policies that aim towards the promotion and use of renewable energy in the Czech Republic. Each policy or measure has a feature making it easier for a framework to be outlined in the achievement of the 2030 renewable energy targets.



**Table 3 Renewable Energy Policy Framework in the Czech Republic**

Policy/Measure	Characteristics
Indirect support (reduction of administrative requirements)	Reducing administration requirements for connection and operation for sources of up to 10kW.
Indirect support (mandatory assessment of installation)	Mandatory assessment of installation of alternative systems as part of the compliance with the energy requirements of buildings.
Indirect support (guarantee of origin of energy)	Issue of guarantees of origin.
Indirect support (overview of official heat supply systems)	Overview of heat supply systems according to Section 25(5) of Act no 165/2012 on supported energy and amending individual acts.
Operation of support for electricity	Operating support for electricity in the Czech Republic is provided in Act No 165/2012, on supported energy sources which implemented Directive 2009/28/EC on promotion and use of renewable energy resources. Operating support is possible for the electricity sector utilizing feed-in tariff or green bonus.
Operation for heat	Operating support for heat (Biomass including Biogas and Geothermal energy)
Investment support - electricity (state programs)	State Programme for the Promotion of Energy Savings and the Use of Renewable Energy Sources (Ministry of Industry and Trade); Green Savings and New Green Savings (Ministry of the Environment); Boiler Replacement Scheme from the Operational Programme Environment 2014–2020, SO 2.1 (Ministry of the Environment and selected regions)

Investment support – electricity (operational programmes)	Operational Programme Enterprise and Innovation for Competitiveness (Ministry of Industry and Trade) 2014–2020; Investment support – electricity (operational programmes)
Investment support – electricity (European Agricultural Fund for Rural Development)	European Agricultural Fund for Rural Development – Rural Development Programme (Ministry of Agriculture) – this type of support has already been terminated.
Investment support – heat (European Agricultural Fund for Rural Development).	European Agricultural Fund for Rural Development – Rural Development Programme (Ministry of Agriculture) – this type of support has already been terminated.
Tax instrument (tax exemption, reduction or refund)	Exemption from electricity tax for electricity from renewable sources
Tax instrument (tax exemption, reduction or refund)	Exemption from immovable property tax
Promoting the use of biofuels through the mandatory reduction of greenhouse-gas emissions from fuels	Promoting the use of biofuels through the mandatory reduction of greenhouse-gas emissions from fuels laid down in Section 20(1) of Act No 201/2012, on-air protection, as amended.
Aid for biofuels (mandatory blending)	The mandatory blending of biofuels into automotive petrol and diesel fuels
Aid for biofuels (high-percentage and pure biofuels)	Support for high-percentage and pure biofuels, support for advanced biofuels.

*Source: Prepared by MIT for National Planning.*

The Czech Republic is one of the least dependent European countries to import fuels due to the vast quantities of coal. The potential for renewable energy has yet to be tapped into mainly because of the abundance of coal. Aside from coal, nuclear energy has been the second source of energy in the Czech Republic, and this leaves renewable energy to be in the third area of energy focus or production. The country's national instrument for laying down policies for the promotion of the use of renewable energy is known as The Act on the Promotion of Use of Renewable Sources ("Zákon o podpoře využívání

obnovitelných zdrojů"). However, with the respective RES targets for 2020 and 2030, there is the opportunity for the Czech Republic not only significantly put RES as part of the energy mix but prioritize on it owing to the many advantages on the climate level. The existing RES does have great potential and may be expanded significantly towards expanding the infrastructure and consequently being less reliant on coal. The drive to boost the RES sector in the Czech Republic also does mean that more jobs will be created for the locals and enhancement of the economy. The willingness of the Czech government to open doors of investment and to make it easier for willing parties to participate gives a bright future towards a more sustainable future.

### **5.3. Implementation of renewable energy policies in the Kingdom of Sweden.**

Sweden is a Scandinavian country in northern Europe, it shares borders with Norway, Finland and connected to Denmark by a bridge. The population of Sweden is 10.3 million people, and the GDP currently stands at \$53,808 per capita. Sweden has emerged as the leading member state in the EU with the most RES. The country is blessed with an abundance of moving water and an abundant supply of biomass which makes up most of its renewable energy supply. Hydropower mostly for electricity production and biomass for heating. The government of Sweden has taken advantage of the abundance of the hydro and biomass stock in rolling out policies that have consistently encouraged renewable energy production and usage. The Kingdom of Sweden, like many countries, has a National Climate Policy Framework responsible for steering the country towards a more sustainable future based solely of renewable energy. The following policies are highlights of the continuous strides taken in achieving a 49% renewable energy solution by 2020 in line with the 2020 RED targets.

**Green electricity certification:** The government's policies in line with renewables maintains that energy retailers are required to buy a portion of green electricity in line with their standard supply. Power producers receive a certificate for the renewable energy produced. The criteria for green electricity are that it must have come from the following wind, solar, geothermal, wave power and small-scale hydroelectric plants.

**Body heat:** The usage of heat given off by house occupants and other electrical appliances comes to be used as a source of energy for non-conventional houses built as such. These building styles are called passive houses and have been used since 2001 when the ground-breaking innovation hit the Swedish energy industry. A wooden frame single-family residence built according to the passive house standard provides a clear and consistent reduction of cumulative energy demand by 24 – 38%. (Dahlström et al., 2012).

**Energy Tax:** Sweden has long implemented the energy tax as early as 1924 and 1937 on petrol and diesel. The aim of this tax was initially fiscal to have the public internalize some of the external cost. In more recent years the aim has been to steer people towards Sweden's energy and renewable targets.

**Climate Change Communication:** The overall aim of the communication was to give useful public knowledge on climate mitigation and adaptation to enhance and equip ordinary citizens with tools for climate policy instruments and measures. The Swedish government's aim of making Sweden the first fossil-free member state requires that the mobilizations of citizens from cities to business and industries. In addition to dialogues and discussions with stakeholders.

**Renewable Fuels at filling stations:** The national climate and energy policies have required that the availability of renewable fuels at filling stations. Filling stations with annual sales of at least 1500m cube of fuel must have a renewable fuel option.

**Charge at home grant:** The Swedish government allocates SEK 90 million annually to support homes that have installations for charging their electric vehicles. Individuals receive a rebate of 50% for installing car charging devices at home. The goal is to make it less stressful for individuals to switch to more sustainable energy options.

**Urban Environment Agreements:** As part of shaping the Kingdom of Sweden towards a sustainable future, the scheme for urban transport and infrastructure was enforced in 2015. The scheme aims to increase accessibility through local transport, ensuring adequate cycle lanes and walkways for pedestrians and cyclists respectively.

**Extended Producer Responsibility:** Mandates that requires producers to be responsible for their products have ensured more sorting, collection and recycling in Sweden. Eight product groups in Sweden are to ensure that they have producer responsibility. The legislation, which is part of the national targets aims to reduce the amount of waste and incentivize producers to produce a more resource-efficient product, easier to recycle.

**Support for Solar Panel:** A subsidy for photovoltaic systems has been introduced. The subsidy covers all actors who are willing to transform their energy usage from other sources into solar. The government has a 30% subsidy to ensure this switch for a more sustainable future.

#### **5.4. Achievement of the RED 2020 targets.**

The target for Sweden for the RED 2020 renewable energy usage was 49%. That target has been achieved and exceeded standing now at 54.5%. Many factors are contributing to the achievement. First, the Kingdom of Sweden has an abundance of moving water that ensured the hydropower generation was a key element in energy production. Also, as has been elaborated above, the policy tools adopted by Sweden was one that ensured more rapid change and diversity in the scale of usage.

The national policies have consistently rewarded the Swedes from individual homes to businesses and industries.

The Czech Republic, in alignment with the National Action Plan, set its RES target for 2020 at 13% and present has achieved 14.89%. In comparison to Sweden, the Czech Republic has coal as a resource in abundance for energy production. It makes economic sense that each member state would for a long time making use of the energy source available, and that is what the two countries have done respectively. They maximized the potential of abundant resource for a long time, Sweden has been favoured to be in the lead for using most renewable energy sources not just by choice but as a matter of necessity. The Czech Republic now, however, is making steady steps to divert some substantial energy usage from a renewable source in line with the RED for 2020 targets and beyond.

### **5.5. Nuclear Energy in the Czech Republic and the Kingdom of Sweden.**

In the Czech Republic, the government has agreed to invest in a new nuclear plant. Currently, nuclear energy makes up about 35% of the energy mix, while energy from coal makes up at least 50%. The new plants are projected for 2035 and will substantially reduce the energy derived from coal, increasing nuclear energy in the process. The Czech government is yet to make this proposal into an Act by voting on it in the parliament, Bill No. 165/2020 Coll, on Supported Energy Sources and amending Act No. 458/2000. Once voted upon in parliament, the Bill No. 165/2020, will then move to become an Act and binding. At the moment there are four VVER-440 reactors in operation in Vysocina region. The new proposal yet to be approved by parliament replace two units at the Dukovany nuclear plant. The current proposal would substantially increase the nuclear energy contribution to the energy mix. The long-term plan for the Czech Republic is to get away from coal which has far more reaching climate implications.

Sweden has a much older nuclear infrastructure dating back to 1947. About 40% of electricity in Sweden comes from the nuclear production. There are currently 7 reactors in operation and 6 reactors shut down. Sweden has had very little need in increasing the number of reactors or even shutting down unused reactors due to the multiple sources of renewable energy production. Apart from the multiple sources to provide Energy, Sweden felt a tremendous amount of pressure from the Chernobyl Disaster of 1986. Even though the disaster happened outside the borders of Sweden, the nuclear station at Chernobyl was that of Sweden's. The parliament was forced to retreat on decommissioning reactors outside the country and started looking more at other areas of possibility for energy production.

### **Nuclear Energy: A Potential Sustainable Energy or A Looming Disaster.**

The current contribution of nuclear energy has risen to about 14% of the world energy mix. The current production cannot be decreased in a way that would compensate for the reduction of fossil fuels or to bridge the CO<sub>2</sub> emissions. The current production of nuclear energy globally requires at least 680000 tons of natural Uranium, a very damaging blow for the environment and a considerable price to be paid indeed. (Dittmar, 2012)

The reactor used in nuclear production has an average age of 25 years. In the next 10 to 15 years most nuclear reactors would see a decline mostly in Western Europe, North American and Japan. China, Russia and India are now at the expansion phase of various nuclear programs, leaving the OECD with less control if they cannot immediately manage the situation globally.

There is still such a little knowledge on the safest ways to decommission or safely ensure used nuclear reactors are safely kept away. Their considerable radioactive powers poses a threat to the environment. The problem now lingers from using a limited uranium element to now inability to safely ensure the safe transitioning of used nuclear reactors.

The hard truths about the looming disaster of nuclear energy from its required element to the final phase of decommissioning makes us aware of the need for contingent plans. In as much nuclear energy may seem like a bridge between fossil fuels and renewable energy, we are yet to experience the overall impact. It cannot be said that nuclear energy production is sustainable, however, it remains a difficult subject to decode. By using up the essential Uranium from the earth and by not having a safe passageway to ensure the aftereffects of the reactors, nuclear energy makes little to no provision for future generations. Secondly, the adverse effects of radioactive waste is more damaging not for immediate generations but also is carried in the DNA and other cellular matter of living organisms. The impact may be seen from either cancerous skin mutations, to deformation of unborn living organisms to making the surface of the earth and water bodies extremely poisonous. There may be more options for renewable energy production with little harm to the environment in comparison to nuclear energy.

## **6. The analysis of the implementation of the Carbon Decrease legislation, the Czech Republic and the Kingdom of Sweden.**

The EU is committed to reducing carbon emissions as part of the Climate and Environmental protection towards a sustainable future. CO<sub>2</sub> emissions are harmful gases that are emitted from everyday activities carried out by nature and distinct human factors. The CO<sub>2</sub> gases released by nature is self-absorbed in a cycle whereby the trees replace these with oxygen in a process called photosynthesis. Human causes of CO<sub>2</sub> emissions, however, are more detrimental to life because of the scale at which the release occurs. The increasing release of CO<sub>2</sub> has led the EU to be more upfront in confronting member states to limit their emissions, to prevent dangerous climate change, greenhouse gas emissions are being cut by 40% by 2030 below 1990 levels. In the attainment of its climate goal, the EU has come up with legislation regarding the limitation of emissions of CO<sub>2</sub>.

### **6.1. Comparative analysis of Greenhouse gas emissions of the Czech Republic and the Kingdom of Sweden.**

The table below sourced from Eurostat provides 10 years of emissions from both the Czech Republic and the Kingdom of Sweden. These are greenhouse gas emissions showing the number of emissions released by both countries each year and over the period. The numbers look more favourable for Sweden, which uses more renewable energy sources as compared to the Czech Republic. It can further be stated that the more Renewable Energy is used, the fewer emissions are given off and vice versa. The total emissions from both member states for the period were **8691.29 g/euro**, out of which the Czech Republic was **7228.88 g/euro**, and that of Sweden was **1462.41g/euro**. The scale of measurement g/euro is measurement of how many grams measured in financial terms of a ton in table 4 below. In the emissions table, the g/euro depicts how much is lost in financial units from emissions.

**Table 4: Air Emissions Intensities by Eurostat**

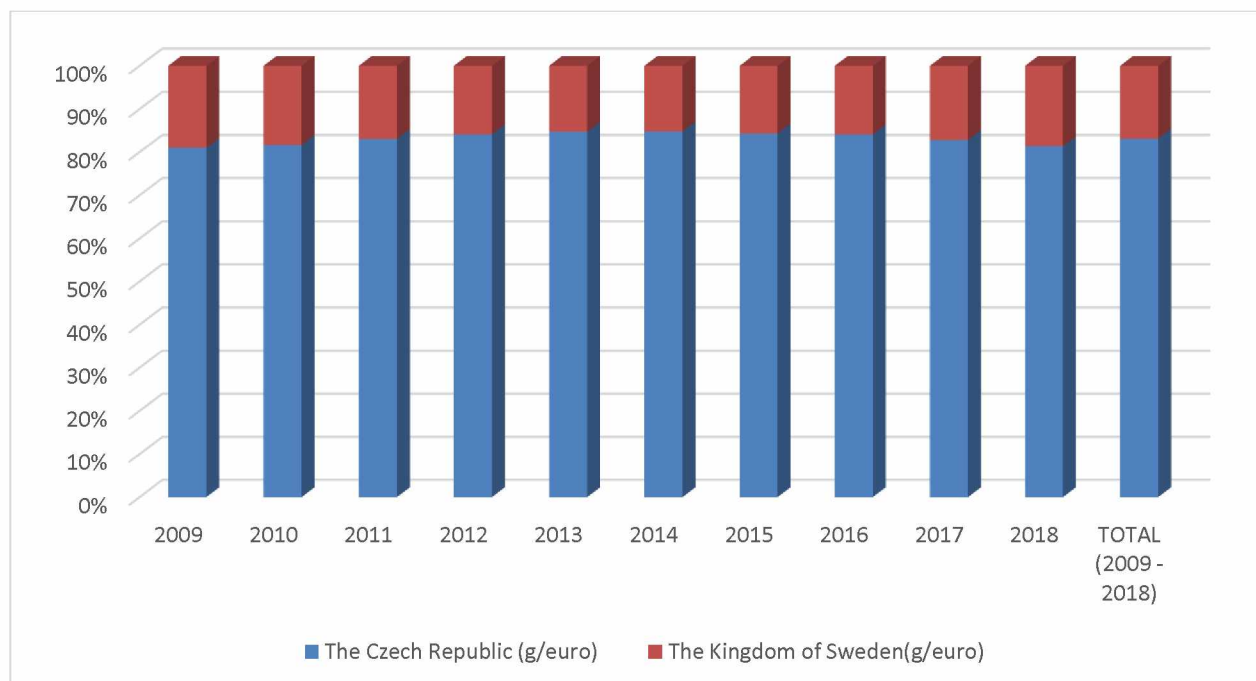
<b>AIR EMISSIONS INTENSITIES BY EUROSTAT, NACE.</b>		
<b>(Greenhouse Gases: CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, HFC, PFC)</b>		
<b>Years</b>	<b>The Czech Republic (g/euro)</b>	<b>The Kingdom of Sweden(g/euro)</b>
2009	855.97	200.97
2010	827.78	185.71
2011	775.11	157.76
2012	759.95	143.11
2013	746.66	134.38
2014	741.42	132.91
2015	685.01	127.37
2016	669.91	126.16
2017	605.71	125.3
2018	561.36	128.74
<b>TOTAL (2009 - 2018)</b>	<b>7228.88</b>	<b>1462.41</b>

*Source: Eurostat (NACE), prepared by the author.*

The chart below provides a further visual presentation of the emissions from both the Czech Republic and the Kingdom of Sweden. The overall emission given percentage for both countries indicate that Sweden in the period emitted 20% of combined emissions, while the Czech Republic emitted 80% of the combined emissions. The Air Emissions chart below shows significant emissions by the two countries, the Czech Republic and Sweden. The chart is essential due to the following: it informs that the two countries involved are not emissions-free or none have reached negative or zero-emissions yet. This further implies that no matter how low or high amount of emissions are being released, it must be controlled. Secondly, it gives an insight into the degree of emissions out there, causing the greenhouse catastrophe. It also becomes clear from the chart that several gases are making up the greenhouse gas, even though the CO<sub>2</sub> is significant amongst them. We learn from the combined emissions that, the Czech Republic emits more emissions on average than Sweden. The average over the last ten years of combined emissions from both countries gives a staggering figure of 80% emissions from the Czech



Republic and 20% emissions from Sweden. The main component of greenhouse gases is the CO<sub>2</sub>, Carbon Dioxide, and there are other harmful gases that form a part of the greenhouse gases which were tracked in the emissions. They are N<sub>2</sub>O, Nitrous oxide. According to the EPA, N<sub>2</sub>O contains the capacity to absorb radiation and trap heat in the atmosphere. The lifespan of N<sub>2</sub>O exceeds a century, and the process of removing it destroys the ozone, making it an ozone destroyer. CH<sub>4</sub>, also known as methane, is a part of the greenhouse gases and can capture heat from the atmosphere and re-emit it back to inducing warmer climates and consequently global warming. HFC or hydrofluorocarbons even though considered as weak ozone-depleting gases, they tend to be potent greenhouse gases due to their ability to trap and re-emit heat in the atmosphere. The final greenhouse gas is the PFC, also known as the Perfluorocarbon, this greenhouse gas is usually used as cleaning agents dry-edging. PFC's are also an essential part in the production of semi-conductors. The ability of PFC's to trap heat and re-emit it into the atmosphere makes it dangerous in large emissions and must be controlled.



Source: Prepared by the author, data from Eurostat

Figure 2: Air Emissions Intensities by Eurostat, NACE.

## 6.2. EU's standard guidelines for reducing the amount of CO<sub>2</sub> emissions.

**Emissions Trading System for Industry:** The trading system aims to reduce industrial carbon emissions by obliging companies to hold a permit for each tonne of carbon emitted. These permits are to be procured through auctions and offers some incentives to the companies. The Carbon Emissions Trading Scheme is the world's first and largest and regulates up to 45% of emissions in Europe. The consequences of climate change and global warming has spurred different actions and reactions from the European Union; one such notable acts has been the European Trading Scheme (ETS). The

European Union Emission Trading Scheme (EU ETS) is governed by Directive No. 2003/87/EC, as amended. In 2008, the European registries were integrated into the global registry system under the Kyoto Protocol. According to the Commission Regulation (EU) 389/2013, as amended, each Member State is obligated to use the standardised Union Registry that also functions as the registry under the Kyoto Protocol. The ETS governs about 40% of the total EU greenhouse gas emissions, in pursuing this, a cap is set for greenhouse gas that industries within member states can release into the atmosphere within a period. Examples of industrial activities that are considered in these member states are cement production, iron production, oil refinery, and heat production to mention but a few. The ETS from stationary installations from 2017 to 2018 declined by 4.1%. The Czech Republic and the Kingdom of Sweden both have made use of the ETS in varying degrees.

The ETS Directive, Article 10(1) gave 88% of allowances auctioned from 2013 to 2020 to be distributed to the member states on verified emissions from installations. The next decade from 2021 to 2030, will see 90% of allowances auctioned to member states based on their verified emissions. The remaining 10% will be allocated to less wealthy EU member states for solidarity.

**Tackling Emissions from other sectors:** There are some sectors not covered in the emissions trading system. These are mainly agriculture, building, waste management and transport, 60% of emissions are through these sectors. The EU intends to reduce these emissions through national emission targets agreed upon based on the country's gross domestic product per capita.

**Managing Forest Climate Change:** Through the process of photosynthesis, EU forests absorb up to 10.9% of greenhouse gas emissions each year. There are new legislations to prevent deforestation in member states, and each EU country is to compensate for land use which leads to CO<sub>2</sub> emissions. The promotion of re-forestation is widely encouraged to fight the adverse effect on the climate from deforestation.

**Reduction in car emissions:** CO<sub>2</sub> emissions from cars and vans amount to 15% in the EU. The Parliament has introduced regulations to cut down the emissions from new cars by 37.5% and for new vans a reduction by 31% by 2030. New trucks are also being targeted for a reduction of up to 30%. The main push for vehicles is to facilitate a shift to electric and smart vehicles.

### **6.3. Implementation of Carbon decrease legislation in the Czech Republic.**

The health risks associated with the combustion of polycyclic aromatic hydrocarbons, benzo(a) pyrene and ground-level ozone which are found in coal with its associated release of CO<sub>2</sub> is detrimental to health and lives. Under Article 7 of Regulation (EU) 2018/842 of the European Parliament, the Czech Republic has adopted a 2020 emissions target. By 2020, the Czech Republic is set to reduce emissions

by at least 32 Mt. CO<sub>2</sub> eq. A reduction of 20% by comparison to 2005. The health and life expectancy for the people of the Czech Republic is significantly affected the large volumes of emissions and cost the state millions of Czech korunas each year. The seriousness of this issue has led the Czech government to take actions to reduce emissions from combustions in areas such as the household furnace, old petrol and diesel engines which has been rolled out in the following implementation measures.

**Transport Sector:** The transport policy in the Czech Republic is giving rise to the alternative use of fuel instead of conventional fossil fuel. Electrification of railways and urban public transport is a measure that will give way to cutting down some emissions otherwise. Act No. 16/1993 has given several measures being implemented to ensure that vehicles using alternative fuels have lower road tax and exempt from excise rate. The exemption is for vehicles for passengers and freight transport with a maximum permissible weight of fewer than 12 tonnes using alternative fuel.

**Agriculture and forestry sector:** The alternative use of methane in the agricultural residue is significant to producing biomass. A vital tool implemented to promote the utilization of biogas was the introduction of feed-in tariffs and green bonuses linked to the amount of energy produced. The Rural Development Program in the Czech Republic supported the construction of Biogas stations. The operational program enterprise and innovation for competitiveness also provides support of heat from exiting biogas stations for efficient use.

**Carbon sequestration:** The prolonged storage of carbon dioxide and other forms of carbon to defend the planet against global warming is a measure that has passed the implementation procedures of reducing CO<sub>2</sub> in the Czech Republic.. In the Czech Republic, the Government Decree No 48/2017 facilitates mandatory compliance with the standards on goods and agriculture. It has laid down specific requirements for the agriculture sector to comply with in order to access government grants for their business. Paying support to farmers is now conditional on meeting the requirements to foster the sequestration of carbon as a measure to reduce the impact of CO<sub>2</sub> emissions in the Czech Republic. One particular tool for expanding forest areas is increasing local support for afforestation under agriculture land provided under the Rural Development Program, enshrined in Government Decree 185/2015.

**Waste Management Sector:** The main objective of the waste management sector is reducing the amount of waste which consequently reducing the processing of waste. Thus, processing waster reduces the number of greenhouse gases produced. The Czech Republic's legal waste regulation plan can be found in Act No 185/2001; the Act is in line with Directive 2008/98/EC of the European Parliament and Council. The obligation of the Act ensures that waste packaging and recycling are observed at the highest levels, thus sorting out waste in the right labelling will lead to effective and

efficient recycling reducing the need to process large volumes of waste unsorted, reducing emissions in the process.

**Household Sector:** Greening the heating source in households is one of the best ways to cut down on conventional energy usage from coal. Where possible, biomass boilers and heat pumps must replace the mainstream heating source cutting down on the use of energy. The New Green Savings Program in the Czech Republic supports the transition from older building heating measures to greener sources of heating in and in the process limiting emissions. The grants from the NGS are purposed to replace environmentally damaging solid fuel boilers with low modern emission boilers. Efficient and cleaner heating in buildings is supported by the Boiler Replacement Scheme from the Operational Programme Environment 2014 – 2020.

**Industry Sector:** Reducing the greenhouse-gas emissions in the industry sector means enforcing significant measures based on EU legislation. Prevention and control of pollution through an integrated approach may be realized in Act No 76/2002. The main aim is to reduce CO<sub>2</sub> emissions by controlling ozone-depleting substance from the offset of gases from production sites.

#### **6.4. Implementation of Carbon decrease in legislation in the Kingdom of Sweden.**

Sweden is gearing towards to zero net emissions by 2045 in line with the Paris Agreement for the curbing of CO<sub>2</sub> emissions. The Swedish Parliament has passed a Climate Act to strengthen their commitment to controlling and preventing the release of greenhouse gases. Swedish ambitious aim is not just to land at zero emissions but eventually move to negative carbon emissions. Thus, greenhouse gas emissions are less than the amount of carbon absorbed by nature. The new Climate Policy Act is part of the framework which contains goals and plans for business and society to transition into a long-term reduction in emissions. Sweden's emissions targets started as far as 1988 when the Parliament adopted their first climate policy aimed to stabilize CO<sub>2</sub> emissions at current levels. The climate policy of Sweden has evolved into the current 2017 framework to have net-zero emissions by 2045. Implementation measures are as follows with regards to the emission reduction strategy:

**Carbon Dioxide Tax:** A tax levied on CO<sub>2</sub> content in fossil fuel was introduced in Sweden since 1991 that aims at reducing emissions of CO<sub>2</sub>. The tax has been increased since its introduction consistently from SEK 0.25/kg carbon dioxide (1991) to SEK 1.15/kg (2018). A yearly index of the tax level is applied the CO<sub>2</sub> emissions proportionately based on fossil fuel carbon content. Sustainable biofuels are not subject to the carbon tax; this means an increased usage leading to an overall low level of emissions. The carbon dioxide tax has been the primary tool for reducing emission in Sweden and

implemented in the following sectors of the economy: heat production, electricity production, industrial sector and agriculture sector.

**Local Climate Investment program:** Sweden introduced a Climate Leap in 2015 for local investors to access grants based on an estimated greenhouse gas reduction of each investment. All kinds of organization are eligible to apply for this grant, which has a budget of SEK 1.5 million as of 2018.

**Environmental Code and Planning Legislation:** The Swedish Government, in an attempt to minimize pollution, introduced an environmental code in January 1999. The code requires a permit to be obtained for significantly hazardous activities to take place in the environment. Part of the requirement is assessing the CO<sub>2</sub> emissions and ensuring compliance with the limits thereof or risk facing a fine.

**Climate Change Communication:** The communication aims to make available essential communication to mitigate the climate challenge provide people with the tools necessary for making changes in their ways. Sweden's attempt to become the world's fossil-free state requires the mobilization of entire societies, municipalities and businesses. The government launched a fossil-free Sweden initiative that brings out a dialogue between key actors and the government agencies to provide partnership programs and resources needed to reduce emissions actively.

**Emission Reduction Obligation:** The obligation falls on fuel suppliers and large consumers to ensure the blend of biofuels to reduce the amount of CO<sub>2</sub> emissions. The emissions obligation is part of the Fuel Change Reform scheme passed on 1 July 2018 in Sweden. The fuel change makes an essential contribution in reducing fossil fuel used for transport. The indicative target of emissions reduction by 40% by 2030, has a significant significance towards this obligation which introduces 50% of biofuels usage.

**Electrical Vehicle Premium:** In 2018, the Swedish government increased possibilities of commuting and transportation with electric bicycles and scooters at a premium for long distances. This measure aims to make people less dependent on cars and subsequently reduce emissions.

**Charge at home-grant:** An allocation of SEK 90 million has been made annually between 2018-2020 by the government to support installations as charging points for cars. Private individuals receive a rebate of 50% for either purchasing or installing these charging points in their homes. The aim of this measure is making it cheaper for households to transition to more sustainable modes of transportation.

**Extended producer responsibility:** A legislation enforcing producers to be more responsible for the afterlife of their products is underway to make significant reduction in the level of waste. The challenge that this measure seeks to meet is reducing the amount of waste to be processed by ensuring adequate sorting, collection and recycling of products.

## 7. Conclusions and Recommendations.

The research started with a goal of analyzing the implementation of EU renewable energy in the Czech Republic and Sweden. The carbon decrease legislation was also an important area of consideration seeing that, it had a direct impact on renewable energy usage as compared to fossil fuel. The midpoint between the two energy producing giants Nuclear Energy production is discussed. The following research questions have been analyzed to provide an overview of the research findings:

**Question No.1:** What are the goals and main features of the EU legislation on Renewable Energy?

**Question No.2:** What role Sustainable Development plays in the system of EU Renewable Energy Legislation?

**Question No.3:** How does Sweden and the Czech Republic implement the EU Renewable Energy Legislation?

**Question No.4:** Why is Nuclear energy a potential renewable energy source?

**Question No.5:** What are the strengths and weaknesses of both countries' Renewable Energy practices and how can lessons from these countries contribute to a Sustainable Development future?

Now, the following paragraphs are great answers to the questions posed by the researcher above in chronological sequence.

### 7.1 Answers to the Research Questions.

#### **Question No. 1: The Goals and Features of the EU legislation on Renewable Energy.**

The EU had set a target of 20% renewable energy usage across board for all member states for final consumption of energy. This was set in the Renewable Energy Directive of (2009/28/EC) All countries must abide by channeling its energy usage to include an overall renewable targeted mandate. The directive was brought about for the following reasons:

- ✚ To increase the energy used from Renewable Sources.
- ✚ To create energy-efficient sources to reduce greenhouse gases.
- ✚ To reduce the dependence on imported foreign fuels.
- ✚ Improving local renewable energy production to reduce energy loss in transit and emissions.

The EU achieved these targets by employing member states to employ the instruments listed below:

- a) Member States are likely to meet their target by ensuring energy-saving mechanisms. That is energy efficiency and energy-saving policies that will harness the overall usage to the barest optimum.
- b) The primary purpose of mandatory national targets is to provide certainty for investors and to encourage continuous development of technologies which generate energy from all types of renewable sources.
- c) Member States may encourage local and regional authorities to set targets above national targets and to involve local and regional authorities in drawing up national renewable energy action plans and in raising awareness of the benefits of energy from renewable sources.
- d) Other means of achieving the targets were ensuring passive energy systems in building design to harness energy. New Buildings were designed to utilize modern techniques of reusing heat already generated than from energy sources, hence reducing consumption.

The strategies above were employed by both the Czech Republic and the Kingdom of Sweden as expanded on in the implementation phase in chapters 5 and 6. In (a) above, both member states are employing diverse energy saving mechanisms to ensure the achievement. Whereas Sweden is rolling out on its charge at home grants to encourage a switch from fossil fuel to electric cars, the Czech Republic is ensuring building heating systems have individual heat adjusted for specific parts of the building, rather than heating the whole building, saving energy in the process. Another recent innovation has been insulation, which requires thicker walls with heat absorption capacity to warm buildings from their storage. In (b) above, both member states have their larger shares of investment from the government grants, with some amount of support from local investors who benefit from tax exemption mostly. Tax exemption enables investors to have security in their first few years by saving on taxes and expanding the capacity to generate more energy. In (c) above of the EU strategies, both countries set national targets as well as regional targets for achieving set goals. Every region has different needs and inputs for energy generation. The spotlight for emission was however on the capital and industrial regions due to their emissions and energy usage. Finally, in (d) above, harnessing energy from newer building designs is very much in force. Building permits in both countries require for a clear plan of energy consumption and modern installations of heating systems that have capacity to save more energy. The EU's liberal approach to the member states in enforcing the strategies is helpful to bring about innovation and create momentum for member states already achieving targets with their working strategies and tools. The member states also went beyond the laid-out strategies to employ a varying degree of implementation methods. Table 5 further gives a comparative analysis of strategies

employed in instrument (a) and (b) above. These were chosen from the national plan employed by both member states and their importance in achieving the targets are outlined below:

**Table 5: Instruments of Renewable Energy Compliance.**

Instrument	The Czech Republic	Sweden
Instrument (a)	Mandatory assessment of installation of alternative systems as part of the compliance with the energy requirements of buildings. This is to ensure that buildings are moving from centralized heating systems to individual heating which saves about 40% of energy.	Charge at home grant was implemented by the Swedish government to support homes that have installations for charging their electric vehicles. Individuals receive a rebate of 50% for installing car charging devices at home.
Instrument (b) & (c)	Operating support for heat (Biomass including Biogas and Geothermal energy) Energy producers are being granted support from government to enhance the production of biomass and geothermal energy to contribute to the renewable energy share.	Extended Producer Responsibility mandates that requires producers to be responsible for their products have ensured more sorting, collection and recycling in Sweden. Eight product groups in Sweden are to ensure that they have producer responsibility. The legislation, which is part of the national targets aims to reduce the amount of waste and incentivize producers to produce a more resource-efficient product, easier to recycle.



Instrument (a) & (b)	Green Savings and New Green Savings (Ministry of the Environment); Boiler Replacement Scheme from the Operational Program Environment 2014–2020. The scheme ensures that boilers use biomass and heat pumps making them sustainable and energy efficient.	Urban Environment Agreements, as part of shaping the Kingdom of Sweden towards a sustainable future, the scheme for urban transport and infrastructure was enforced in 2015. The scheme aims to increase accessibility through local transport, ensuring adequate cycle lanes and walkways for pedestrians and cyclists respectively.
Instrument (c)	Tax instrument (tax exemption, reduction or refund). Exemption from electricity tax for electricity from renewable sources	Tax instrument (tax exemption, reduction or refund). Exemption from electricity tax for electricity from renewable sources
Instrument (d)	Promoting the use of biofuels through the mandatory reduction of greenhouse-gas emissions from fuels. The mandatory blending of biofuels into automotive petrol and diesel fuels.	Promoting the use of biofuels through the mandatory reduction of greenhouse-gas emissions from fuels. The mandatory blending of biofuels into automotive petrol and diesel fuels.

*Source: Prepared by the author*

### **Question No. 2: The Role Sustainable Development plays in the system of EU Renewable Energy Legislation.**

In order to understand the role Sustainable Development plays in the system of EU Renewable Energy Legislation, a look at the Brundtland report is essential. From the Brundtland (1987) we understand that Sustainable development is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. In view of this, the two

member states have national acts which is keen on not only reshaping the future of energy choice to preserve the planet, but to reduce the emission rates. In Sweden, the (Integrated Climate and Energy Policy is outlined in Government Bills 2008/09:162 and 2008/09: 163). In the Czech Republic, Act No. 165/2012 Sb., on (Promoted Energy Sources and Amendment to some laws) is the main legal instrument to enforce the implementation of EU's RED. Other legislations correspond to the renewable energy directive was for the carbon decrease legislation that aims at member states reducing the amount of emissions with specific targets. The European Parliament and Council have adopted a regulation in setting emission performance standards in modern passenger cars as part of a community-integrated approach to reduce CO2 emissions (EC) No 443/2009 Of the European Parliament and of the Council. The objective of this regulation is to set emission performance standards in new passenger cars registered in the community. The approach is part of the new community integrated measures to reduce CO2 emissions. Emissions from cars and automobiles are the second largest CO2 emissions affecting climate change. The first is industries which also called for the Emissions Trading Scheme, this however has been deemed to be a failure. The ETS has been deemed ineffective in significantly reducing the amount of GHG's. There has been little evidence that the reduction of emissions is attributable to the trading schemes, instead the redirection of various power generating facilities from coal and fossil to renewable and nuclear stands the chance of time in bringing forth some amount of emission reduction. The EU ETS has not equally been effective in that it has subsidized polluters at taxpayers' expense. Businesses have passed carbon costs to consumers that were never in reality accrued in the first place. The ETS further has been prone to fraud and gaming, carbon unlike oil or corn being intangible product has been allowed to be traded by proxy instead of measured. The ETS is basically a permission to pollute the environment in the future without adequate or accurate controls. The lack of cooperation between the Commission and National Financial Regulators leaves an unresolved believe in the certainty of records.

### **Question No. 3: Implementation of the EU Renewable Energy Legislation in Sweden and the Czech Republic.**

Implementation of EU Renewable Energy directive in Sweden and the Czech Republic took different ways to accomplish. As seen above, the EU did not restrict states to achieve the set targets by any means, the member states were at liberty to use the resources they had in abundance to ensure achievement of targets. It must be noted that both member states are in different territorial regions and varying access to resources as well as land size and other nature reserves. The surface area of the Czech Republic is 78 867 sq. km, Sweden is approximately 450 295 sq. km. While this staggering number means Sweden is more than 400% bigger than Czech Republic, it does make more meaning that

Sweden has more natural resources including large number of moving waters to foster hydro power and other renewable energy sources. There are varying degrees of methods used by both countries in addressing the renewable energy production. There are some methods employed by both member states which are solar, biomass and geothermal, Sweden however was privileged due to the large area mass and scale of waters to generate more energy through hydropower plants as well as windmills. In addition to the above, Sweden introduced green electrification which ensures that energy suppliers in the country have a percentage of green energy and obtain certification as such. The government also introduced the charge at home grant which gave homeowners the opportunity to install home charging mechanisms for their cars and vehicles, thereby receiving 50% of the installation cost. Sweden also employed extended producer responsibility, this mandate requires producers to be responsible for their products and have ensured more sorting, collection and recycling in Sweden.

The findings made by this research has exposed that not only have the countries in the study: The Czech Republic and the Kingdom of Sweden have been able to achieve the 2020 set target of Renewable Energy usage, but compliance has been to the decrease of carbon dioxide. The considerable disparity seen in the usage of renewable energy in Sweden compared to the Czech Republic is attributable to many moving waters in Sweden and the abundance of biomass in the country. The Czech Republic, however, has been very much inclined to the usage of coal to produce electricity due to its abundance. In retrospect, the researcher discovered that each member state has, for the most made the most use of the resource that was in abundance for meeting the energy needs of the country. Sweden, therefore, has gain wide praise and recognition for going with a sustainable choice at a point where they did not have many alternatives to energy production. The classification fast-forwards three decades from the '90s with a renewed understanding of our energy needs placed Sweden as a forerunner.

#### **Question No. 4: Nuclear energy, a potential renewable energy source.**

The Czech Republic has Nuclear energy as its second-largest contributor to the country's energy sources. It may be mentioned again that the subject of Nuclear energy has been controversial over its classification as renewable energy. Nuclear energy is enabled using Uranium, which is a mineral mined from below the surface of the earth. In the Czech Republic, a total of 6 nuclear power units in the Temelín power plant and the Dukovany power plant are currently in operation. The key national strategy documents clearly state that the maintenance of the current share of nuclear energy in the energy mix and its further development is crucial for achieving the long-term low-emission commitments of the Czech Republic. The current Czech Republic's State Energy Policy envisages increasing the share of nuclear energy in primary energy sources to 25–33 % (from the current level

of about 15 %) and increasing its share in gross electricity production to 46–58 % (from the current level of about 29 %). Following the approval of the State Energy Policy in the Czech Republic in May 2015, the National Action Plan for the Development of Nuclear Energy in the Czech Republic was approved in June 2015, which specifically elaborates on the requirement of the Czech Republic's State Energy Policy to strengthen the role of nuclear energy. From the above policy documents with regards to nuclear energy in the Czech Republic, it may take a relatively long time to see the amount of mainstream renewable energy taking large percentages, as seen in Sweden where the nuclear energy is not counted as part of the renewable energy mix. The main lesson learnt from Sweden's high and continuous increase in the usage of renewable energy has been the government's involvement in households. The government's commitment to assist households has seen a more radical approach to Swedes being more conscientious in dealing with household implementation measures to reduce the emissions, as well as switch to renewable options, from heating to transport.

The strength of Sweden in achieving a high amount of renewable energy production can be attributed to the availability of abundance resources, which is possible due to the area or territory inhabited. The large surface area of Sweden offers it multiple running water sources such as the Baltic sea and Gulf of Bothnia. The above makes hydropower, windmill generators and biomass production of energy flourish. The case is very much different in the Czech Republic where, the country is landlocked and there are limited sources of running water for hydropower generation. The surface area of the Czech Republic compared to Sweden is relatively small and offers limited options for alternative renewable sources causing the Czech Republic to rely on coal for most of its energy generation.

**Question No. 5: Lessons from member states from Implementation of the Renewable Energy Directive.**

The two member states have lessons that can be maximized by the other in increasing efficiency of cutting down the fossil fuel usage, hence consequently reducing emissions. One of the main tools in Sweden has been the charge at home grants to install charging stations for vehicles. The success of this program seeks to eventually switch users of fossil fuel to electric cars, hence phasing out the need for fossil fuel usage. This instrument would be a key initiator to reducing the emissions in the Czech Republic when employed. Now, there are no charge at home grants in the Czech Republic, which means that people are hesitant to move from fossil to electric vehicles. The hesitation can also be attributed to the fact that electric vehicles are very expensive for the average Czech employee. The largeness of Sweden's economy with its accompanying share of income may be another reason for which the Swedes have been more accommodating to the concept of buying more electric vehicles.

Sweden has also championed the incorporation of cycle lanes on all city roads enabling road users to ride to work and many places within riding distance. This is helpful in reducing the energy that would have been used or fumes that might have been released into the atmosphere. If this instrument is incorporated in the Czech Republic, emissions would be cut down as well as savings on energy. The Czech Republic is currently employing technologies to move from central heating in buildings to individual heating. The advantage of individual heating is that only the portion of the building being used would be heated at a time instead of the whole building. A review from (Conbiz Consultancy) states that at least 40% energy is saved with the innovation of individualized heating. This is an instrument lacking in Sweden and may be of great improvement to further saving energy. The Czech government currently rolls out grants to ensure new buildings have access to this facility and old buildings have support to make the switch.

## **7.2 Recommendations**

The success of the implementation of EU's renewable energy policies lies not only in the industrial scale of emissions and energy usage but in the combined efforts of industries and public transportation. Stricter rules and adherence must be given to emissions limits from industries. The cap given not be exceeded concerning emissions targets. More rewards and support must be given to industries that either include renewable energy in their energy mix or switch to primarily use renewable energy. Governments must include the ordinary citizen in employing basic energy-saving techniques and rewards for choices made in lower-emitting vehicles. Public transportation must constantly move towards green energy that ultimately have lower to no emissions. Industries may be contributing a considerable chunk of CO<sub>2</sub> emissions, as well as using more energy sources that are non-renewable. The scale of regulation for industries are well controlled by the government and therefore, can be addressed more efficiently. The more important measure, however, is the ways the ordinary citizen can make a daily decision in what mode of transportation to take, what kind of heating installation to use, the level of recycling to be incorporated in reducing the amount of waste to be processed goes a long way to reduce the emissions and energy usage.

One interesting pointer for the research has been how nuclear energy seems to be a bridge between fossil energy and renewable energy. The Czech Republic may take advantage of its lack of abundance renewable sources to increase substantial production of nuclear energy. The additional plants being built and the aim of the government to reduce the reliance of coal is a step in the right direction. Another approach in reducing the emissions as seen in Sweden may be the introduction of charge at home installations with support from the government. The new wave of electric and hybrid cars mean

that people can make effective and efficient switch to contributing to less pollution from driving cars with emissions.

The important aspect of the renewable energy case in Europe is that it is leading the way for the rest of the world. The more significant aspect is consistency and employing all the necessary tools to ensure that we do not have a situation where returning to the use of fossil fuel becomes an option. The aim is to outdo the usage of fossil fuels within the century if possible, and this is achievable if we make consistent choices that are in line with saving the planet and maximizing renewable energy options. In the wake of global warming and climate change, no sacrifice is too big or too small to make in stopping what will otherwise be the end of our existence. Nature will always find a way to heal itself if overstepped, we (humans) must act right in making daily decisions to help nature recover. In defiance of saving the world from being at an existential threat, we become threatened and eventually would not survive the extinction if nature decides to purge itself. Now is the time to act, there is no planet B, we owe ourselves and the next generation a sustainable future. The collective action of all stakeholders from political figures, to businesses and ordinary citizens is very much needed for the success of saving the planet from further destruction. Individual choices, however small it may be such as recycling, choice of transport and energy saving techniques all contribute to a greater achievement of a safer planet.

### **Specific Recommendations to the EU.**

**Rural Energy Development:** There is a need for a boost in the rural energy development. Decentralizing the production of renewable energy is very key way to boost the economies of smaller towns that have potential for energy production. It must be however be from the standpoint finding a renewable source that can harness the expansion of the energy production and usage

**Household Energy Generation:** There are a number of ways that households can and will be able to generate energy for usage. Biogas energy generation has been perfected and improved to small scale production of energy for household. There are new innovations that have the ability to recycle household waste into gas that can further be used for heating. Household energy generation through the use of biogas would go a long way to reduce amount of waste to be treated as well as save energy from national grid lines.

**Ozone Protection:** The ozone layer has proven to be replenished given time and therefore more must be done in saving the future of the planet. The EU must do more to curb the production of gases that readily destroys the ozone. Alternative means must be ensured to replace chemicals or industrial activities that offset these gases. In the past, CFC's have been replaced in the manufacture of

refrigerating systems. More research must be encouraged and supported to continuously find other means to reduce the usage of such harmful gases.

**Nuclear Energy:** The nuclear energy continues to be controversial on many fronts. The information available now suggests that there are no CO<sub>2</sub> emissions from the usage of nuclear energy. There however exist two challenges, the first one being the usage of Uranium, which is an element mined from the earth. The second challenge is the safe disposal of nuclear plants considering its radioactive powers and potential harm to life. The EU must invest into finding a renewable element to replace Uranium and also perfect the safe disposal of nuclear waste.

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