**Committee:** International Energy Agency (IEA)

**Issue:** Redesigning the power planning systems to support the energy transition process

**Student Officer:** Panagiotis Bouloutas

**Position:** Deputy President

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## PERSONAL INTRODUCTION

Dear Delegates,

My name is Panagiotis Bouloutas, I am 16 years old, and I am currently in my penultimate year of school at the American College of Greece. For this conference, I will serve as your Deputy President of the International Energy Agency.

Personally, I view MUN as an opportunity. An opportunity to meet new people, to learn new things in various areas, to perfect some useful skills, and to improve personally. I started MUN one and a half years ago and, since then, it has become my passion, having attended 8 MUN conferences, either as a delegate, a judge in the ICJ, or a Student Officer, and always looking forward to the next one.

In the following Study Guide, you will be given the chance to take a look at useful information regarding the current power planning systems, the ways that energy takes different forms, and how the current power planning system should be reformed in order to meet the new standards, so we prevent climate change. However, I urge you to do further research on this topic on your own and use this guide as just one of your sources. Also, I advise you to know your country's policy, for organized and functional committee work.

I cannot wait to meet you all at the conference. I hope you find the following information helpful, so you get a general idea of the issue and some ways it can be resolved. Should you have any questions, do not hesitate to contact me via e-mail. I wish you all an entertaining and unforgettable experience at the conference!

Best wishes,

Panagiotis Bouloutas

p.bouloutas@acg.edu

## INTRODUCTION

The main issues the world faces in the 21st century and that will concern future generations are undoubtedly global warming and climate change. The greenhouse gases produced mainly by industrial production and the widespread use of petrol-powered vehicles have already made tackling the aforementioned problem a difficult mission to accomplish. Nevertheless, it is still feasible, and one powerful way to prevent bigger effects is the energy transition.

The energy transition is a plan to change the basis of the global energy sector from petrol to carbon-free (i.e., mainly renewable energy) by 2050. This plan, also known as decarbonization, will be mainly achieved using information technology, proper governmental policies and smart technologies, such as the internet of things. Data will be collected and the proper change in each case will be made (for example, if the data shows that wind energy is the best form of energy to produce electricity, instead of factories, electricity providers will gather and distribute electrical power from wind generators).

However, the solution is not that simple. The infrastructure must exist, which would efficiently support the transition targeted. Thus, there must be a reformation in the power systems planning, for the power coming from renewable energy sources to be distributed to the various businesses, households, etc. And, as climate change is a problem of great importance, it has to be faced soon. Hence, the redesigning of the power systems planning as well has to be done soon.

In conclusion, the power systems must be redesigned, in order to achieve energy transition and, hence, combat global warming and climate issues to a great degree. In the rest of the guide, you'll be provided with some information, which will help you understand the issue further.

## DEFINITION OF KEY TERMS

### Greenhouse effect

"The greenhouse effect is a process that occurs when gases in Earth's atmosphere trap the Sun's heat. This process makes Earth much warmer than it would be without an

atmosphere. The greenhouse effect is one of the things that makes Earth a comfortable place to live."[1]

## Greenhouse gases

"Gases that trap heat in the atmosphere are called greenhouse gases."[2] The main gases which assist the greenhouse effect are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and other fluorinated gases.

## Renewable energy

"Renewable energy is energy derived from natural sources that are replenished at a higher rate than they are consumed. Sunlight and wind, for example, are such sources that are constantly being replenished. Renewable energy sources are plentiful and all around us."[3]

## Roadmaps

"A roadmap is a strategic plan that defines a goal or desired outcome and includes the major steps or milestones needed to reach it. It also serves as a communication tool, a high-level document that helps articulate strategic thinking—the why—behind both the goal and the plan for getting there."[4]

## Energy transition

"The energy transition is a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. At its heart is the need to reduce energy-related CO2 emissions to limit climate change."[5]

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[1] "What Is the Greenhouse Effect?" *NASA*, NASA, climatekids.nasa.gov/greenhouse-effect/.

[2] *EPA*, Environmental Protection Agency, www.epa.gov/ghgemissions/overview-greenhouse-gases.

[3] "What Is Renewable Energy?" *United Nations*, United Nations, www.un.org/en/climatechange/what-is-renewable-energy.

[4] Kirsch, Maddy. "Roadmap Basics." *ProductPlan*, 9 Sept. 2021, www.productplan.com/learn/roadmap-basics/.

[5] *Energy Transition*, www.irena.org/energytransition.

## Smart technologies

"'Smart' originally comes from the acronym 'Self-Monitoring, Analysis and Reporting Technology' but became widely known as "smart" because of the notion of allowing previously inanimate objects to talk back to us and even guide our behavior."[6]

## Energy Scenarios Simulation Tool (ESST)

"The Energy Scenarios Simulation Tool (ESST) is a simple tool for exploring energy system development that allows the assessment of future simplified energy balances and provides a first screening of alternative scenarios in terms of capacity expansion, investment and greenhouse gases emissions."[7]

## Conference of the Parties (COP)

"The Conference of the Parties (COP) is the supreme decision-making body of the United Nations Framework Convention on Climate Change. All States that are Parties to the Convention are represented at the COP, at which they review the implementation of the Convention and any other legal instruments that the COP adopts and take decisions necessary to promote the effective implementation of the Convention, including institutional and administrative arrangements."[8]

## Power Systems

"A power system is a network of components deployed to supply, transfer and use power."[9] Power systems are used for the aforementioned reasons in industries, offices, houses, etc.

[6] "What Is Smart Technology?" *Wholesale Distributor | Petra Industries*, 6 Apr. 2022, www.petra.com/blog/what-is-smart-technology/.

[7] *IAEA Methodologies and Models for Sustainable Energy Planning*. www.iaea.org/sites/default/files/19/02/iaea-methodologies-and-models-for-sustainable-energy-planning.pdf.

[8] *Unfccc.int*, unfccc.int/process/bodies/supreme-bodies/conference-of-the-parties-cop.

[9] "Electric Power System." *Wikipedia*, Wikimedia Foundation, 28 July 2022, en.wikipedia.org/wiki/Electric_power_system.

### Direct Current (DC)

"Direct current (DC) is electrical current which flows consistently in one direction. The current that flows in a flashlight or another appliance running on batteries is direct current."[10]

### Alternating Current (AC)

"Alternating Current (AC) is a type of electrical current, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles. Current flowing in power lines and normal household electricity that comes from a wall outlet is alternating current."[11]

### Reactive Power

"Reactive power is the power that flows back from a destination toward the grid in an alternating current scenario. […] Reactive power is the dissipated power resulting from inductive and capacitive loads."[12]

## BACKGROUND INFORMATION

### The Main Problem-Climate Change

#### History

In the late 18th and early 19th century, one of the most important revolutions in human history took place in Europe, the industrial revolution. The revolutionary discovery was the use of coal for the movement of vehicles and generally as a source of energy. In the 1820's, French scientist Joseph Fourier discovered the greenhouse effect, claiming that, while energy arriving on earth should be equal to energy leaving earth, an amount of energy is withheld by the atmosphere, as it happens with a

[10] *Glossary: Alternating Current & Direct Current*, ec.europa.eu/health/scientific_committees/opinions_layman/en/electromagnetic-fields/glossary/abc/alternating-current.htm.

[11] *Glossary: Alternating Current & Direct Current*, ec.europa.eu/health/scientific_committees/opinions_layman/en/electromagnetic-fields/glossary/abc/alternating-current.htm.

[12] Techopedia. "What Is Reactive Power? - Definition from Techopedia." *Techopedia.com*, Techopedia, 26 Jan. 2021, www.techopedia.com/definition/15008/reactive-power.

greenhouse. No one would then think, however, that the two discoveries above were connected.

A couple decades forward, in the 1850's and the 1860's, the work of important scientists, namely Eunice Foote, from the US, and John Tyndall, from Ireland, proved the connection mentioned above. Specifically, in her experiments, the former one observed that the heat is mostly increased in a glass full of carbon dioxide, from which coal is made of. As Foote's work was not recognized during her lifetime, the latter scientist, Tyndall, repeated Foote's experiments and concluded in the same result, but he also found other gases which can increase heat, as they absorb heat and keep it within the atmosphere. Those gases, as they strengthen the impact of the greenhouse effect, are known as greenhouse gases.

In the 1890's, though, the idea of a warmer climate was viewed positively by people, as it would allow for more livable climates, easier transportation and trading, as well as a bigger variety of agricultural products cultivated. Later, in the 1930's, Guy Callendar from the UK claimed that global warming would have a negative impact on the world in the long term, if CO2 continued to be emitted at such rates and quantities. Today, climate change is the main issue that concerns the future of the world.

## Causes

Climate change is a long-term crisis. Crises are divided into categories depending on their causes. There are natural causes (e.g. an earthquake), artificial/man-made causes (e.g. pollution) and complex ones, which occur from a combination of natural and artificial circumstances. Climate Change is a complex crisis, since it is caused by pollution, but ultimately it causes a vicious cycle. Deforestation, extensive industrial production and petrol-powered transportation are just some of the various human causes to the problem discussed.

Firstly, extensive industrial production is one of the main human activities, which enlarges the issue of global warming. As technology continues to develop, more and more new products are required to satisfy today's needs, but humanity is not ready to leave behind past habits, so there is an increasingly large number of products needed, thus there is an increase in the greenhouse gases emitted to the atmosphere.

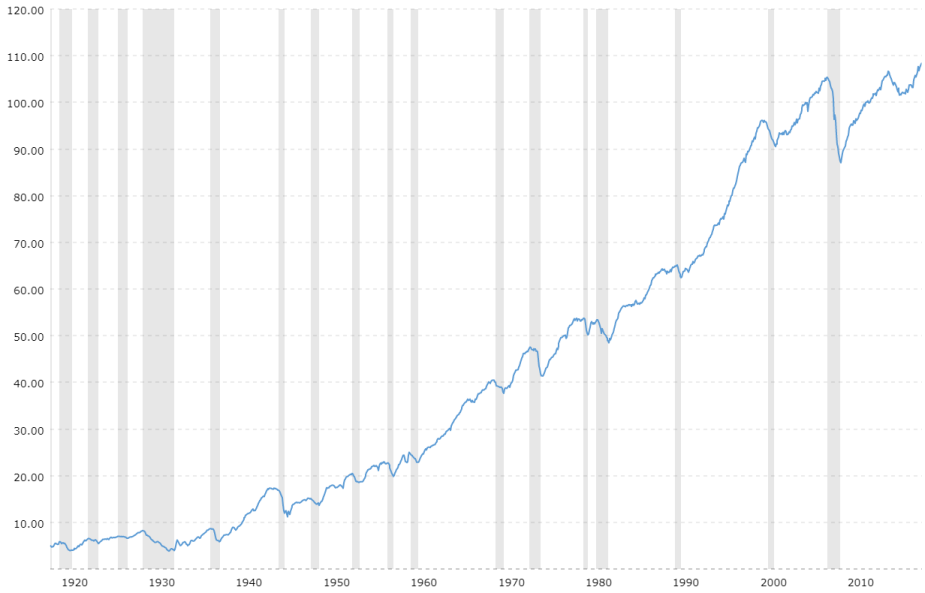
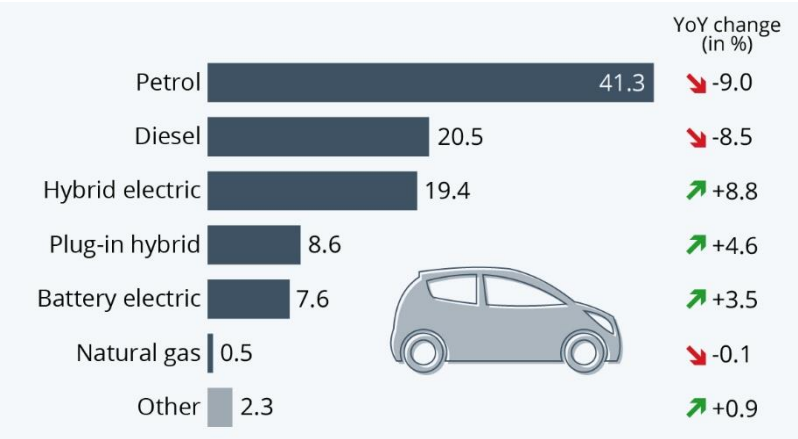



*Figure 1: Industrial production over the last century*[13]

Furthermore, over the 20th and the 21st century, petrol powered vehicles became popular and currently are the main kind of vehicles used for personal and public transportation. As petrol, diesel, kerosene and ship fuel are all oil products, meaning they produce large amounts of CO2, when they get burnt in the vehicle's engine, all of this carbon dioxide is emitted to the atmosphere, along with methane and other greenhouse gases. Although public awareness has been raised over the past few years and many people seek alternative methods of transport, like bikes, electric, hybrid or alternatively fueled vehicles, electric public means etc., the majority of the people are still using carbon-based vehicles to move around.




[13] "Industrial Production - 100 Year Historical Chart." *MacroTrends*, www.macrotrends.net/2583/industrial-production-historical-chart.

*Figure 2: Year-to-date market share of cars registered in the EU by fuel type (in %)*[14]

Moreover, human interference on nature is also quite an important cause of climate change. Deforestation, for example, which is either done for wood processing or urban expansion, increases the amount of CO2 in the atmosphere. That is because trees "inhale" carbon dioxide and "exhale" oxygen. Thus, if there are fewer trees in the world, there will be more carbon dioxide, meaning an increase in the temperature. Also, overfishing makes the climate crisis even tougher to face. Fish and sea life in general help in a process called "carbon sequestration", or carbon isolation, making the oceans the largest storage of carbon in the whole world. Hence, if there is overfishing, more and more carbon is emitted in the air.

### Effects

Climate change affects the environment as whole, but human life as well. Effects on weather phenomena create further problems in human activities like transportation or agriculture, which gradually reduce the quality of life in various parts of the planet.

First, warm weather creates more hurricanes. That happens because oceans get warmer, thus more water gets evaporated and more intense hurricanes and tornadoes occur. Additionally, weather phenomena like the aforementioned pick up a large percentage of their energy from the oceans, meaning that if the sea is warmer, it contains more energy (heat), and the intensity of those phenomena is increased, which causes further damage to human communities.

Furthermore, because of global warming, ice from the Arctic and Antarctic circle is melting, having an important impact on sea life and human societies. As ice melts, sea level increases, causing more floods and setting residential areas in danger. Also, as levels increase, many cities and countries are in great danger of drowning (e.g., Venice). However, because of global warming, water from lakes and rivers also evaporates, raising concerns regarding the available water deposits in the future.

[14] Zandt, Florian, and Felix Richter. "Infographic: Diesel and Petrol Cars Losing Ground in the EU." *Statista Infographics*, 22 Oct. 2021, www.statista.com/chart/26037/market-share-of-cars-registered-in-the-eu-by-fuel-type/.

## Energy Transition

As already mentioned, energy transition aims at zero carbon use in the future, in order to reduce the impact climate change. Changes in transportation, energy production and industry need to be made for the whole energy system to get decarbonized.

Its significance on the climate change issue is vital. Firstly, everything that emits carbon dioxide and other greenhouse gases in the atmosphere would use sustainable energy forms, resulting in a decreased amount of carbon dioxide and other greenhouse gases emitted to the atmosphere. Then, as less greenhouse gases would be emitted into the atmosphere, the concentration of such gases would be smaller, meaning that the effect of global warming would be reduced. As a result, oceans, for example, would get cooler and, thus, as mentioned above, the intensity of catastrophic weather phenomena would be reduced as well and would not set sea life and human life in danger. Additionally, if everything regarding energy is decarbonized, the public would get sensible regarding the issue and would willingly follow the regulations provided to sustain decarbonization.

However, energy transition cannot be achieved at the moment. Our communities are not constructed for non-carbon energy use. Thus, changes need to be made for achieving energy transition in the future. Firstly, infrastructure must exist. This means that, in energy production factories, equipment to collect, process, move, store and distribute decarbonized energy. Also, there should be alternative types for heating and cooling, for example, which, on the one hand, would use non-carbon energy to serve their purposes, while on the other hand they would not emit greenhouse gases back into the air, mainly carbon dioxide which is the most usual and the main to eliminate. In simpler words, a change in the power systems' planning must be done.

## Power Systems Planning

The use of power systems has made today's way of living easier and has helped for the overall development of technology. Power systems are mainly used to transfer electrical power, as most of the devices used in households, businesses, etc. are powered by electricity. The main components of a power system are the supplies, the loads, the conductors, the capacitors, the reactors, the power electronics, the protective devices and the supervisory control and data acquisition (SCADA) systems.

The supplies are the components from which a power system takes the energy at first. They can be part of the power system, for example a solar panel, or external bodies, such as a power production factory. There are different supplies for DC and AC. For DC, a common

power supply is a battery, which forces power to move to a certain direction. For AC, usually a rotor is used which moves in an electromagnetic field an distributes power where it is needed. Usually, for this rotor, fossil fuels are used in the post-industrial era.

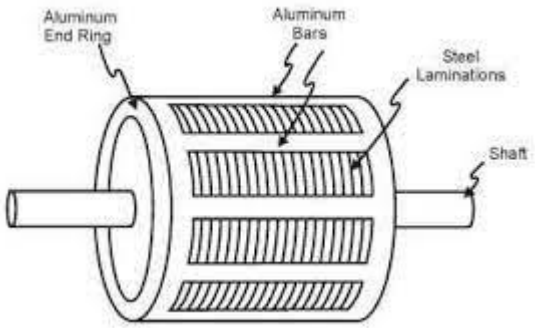



*Figure 3: A rotor used in AC power systems as supply*[15]

The loads are the components which use the power of the systems to perform a certain action. In most cases, a load is the end of a power system, the device which performs the action targeted. Loads in a power system are made to function properly at a specific voltage. In the case of an AC power system, the loads must get a specific frequency of power supply too to function properly.

The conductors are the parts of the power systems which carry the power from the supplies to the loads. The conductors also distribute the power to different loads. They are used to carry the maximum amount of energy and sustain it under rough external conditions, such as high heat. There are conductors made from different metals, like copper, aluminum and others, which are used respectively for lower resistance or lower cost.


*Figure 4: Examples of conductors*[16]

[15] "AC Motors: General Principles of Operation (Motors and Drives)." *Whatwhenhow RSS*, what-when-how.com/motors-and-drives/ac-motors-general-principles-of-operation-motors-and-drives/.
[16] Electrical, Wat. "Electrical Conductors : Properties, Principle, Types and Conductivity." *WatElectrical.com*, 10 May 2022, www.watelectrical.com/what-are-electrical-conductors-types-and-their-properties/.

*Figure 5: Conductor devices*[17]

The capacitors are devices used in power systems to provide the reactive power cheaper than directly by the power generators. They are usually placed near electricity stations to reduce the demand of current in the system. The reactors are devices which are used to consume the reactive power; hence they manage the voltage load in the power system. This means that using reactors the efficiency of the power is increased.

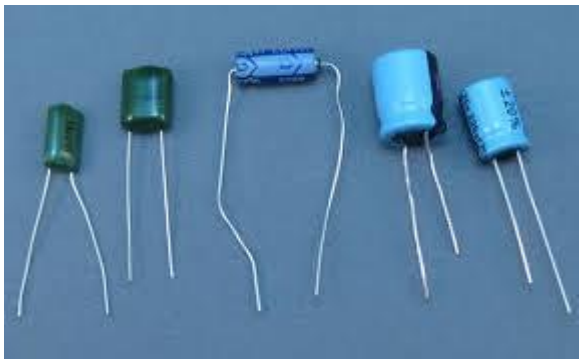


*Figure 6: Different capacitors*[18]

[17] "Electric Power System." *Wikipedia*, Wikimedia Foundation, 28 July 2022, en.wikipedia.org/wiki/Electric_power_system.

[18] By: Cathleen Shamieh and Updated: 08-29-2016 From The Book: Electronics For Kids For Dummies, et al. "What Is a Capacitor? Article." *Dummies*, www.dummies.com/article/technology/electronics/general-electronics/what-is-a-capacitor-223693/.

*Figure 7: The reactor of a power system*[19]

Power electronics are devices which are used in the power systems to regulate the quantities of power transmitted to the loads and other destinations, being able to make drastic changes in these quantities. The initial use and still one of the main uses of power electronics is to switch the type of current (i.e., from AC to DC and vise versa). Today, power electronics are used in power systems and devices to increase their efficiency.

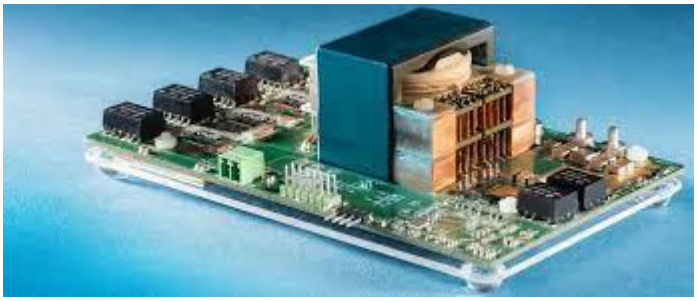


*Figure 8: A computer CPU is an example of a power electronics device*[20]

Protective devices are used in power systems to prevent damage caused by a possible failure in the transfer of the energy within the system. The main problems the protective devices prevent is the unavoidable replacement of fuses after use and the inadequacy of fuses as the only safety device in a power system. For the former problem, circuit breakers are used. Circuit breakers are devices like fuses, which shut the electrical supply to a device in the case of an overvoltage, like fuses, but are able to be reset after they function. Protective relays are also used in larger systems, which prevent overflows of electricity within the system. For the latter problem, residual-current devices (RCDs) are used, which detect leaks of power in the system and ground the supply to prevent electrocutions, electric fires, etc.

[19] Electrical4U. "Electrical Reactor: What Are They? (Line Reactors)." *Electrical4U*, 27 Oct. 2020, www.electrical4u.com/types-of-electrical-reactor/.

[20] "Efficient and High-Frequency Power Electronics - Fraunhofer Ise." *Fraunhofer Institute for Solar Energy Systems ISE*, 15 Feb. 2022, www.ise.fraunhofer.de/en/business-areas/power-electronics-grids-and-smart-systems/power-electronics-and-grid-integration/efficient-and-high-frequency-power-electronics.html.


*Figure 9: A protective relay*[21]

The SCADA systems are used in modern power systems, usually of larger scale, which allow for automation of the system. The main components of the SCADA systems are computers and sensors. The sensor sends data regarding a device to the central computer, which processes the data and returns a solution (e.g., the sensor detects an increase of a lamp's temperature, the computer processes this message and decreases the electricity flow to the lamp).

## MAJOR COUNTRIES AND ORGANISATIONS INVOLVED

### USA

The USA has been one of the most important countries in the energy market for the past century, especially in the recent energy crisis. Although it is the largest producer of oil worldwide[22], in the past decade, it has made large steps in the energy transition. Firstly, 38% of the US' energy comes from natural gas, while the use of coal has been reduced by more than a billion tons for the time period of 2005-2019. World leaders hope they have influence over other nations to follow their path. Furthermore, the US government has called for accelerated energy transition action.

[21] Ashlin. "What Is a Protective Relay and How Do Protective Relays Work." *Instrumentation and Control Engineering*, 24 May 2020, automationforum.co/what-is-a-protective-relay-and-how-do-protective-relays-work/.
[22] "Oil Production by Country." *Worldometer*, www.worldometers.info/oil/oil-production-by-country/.

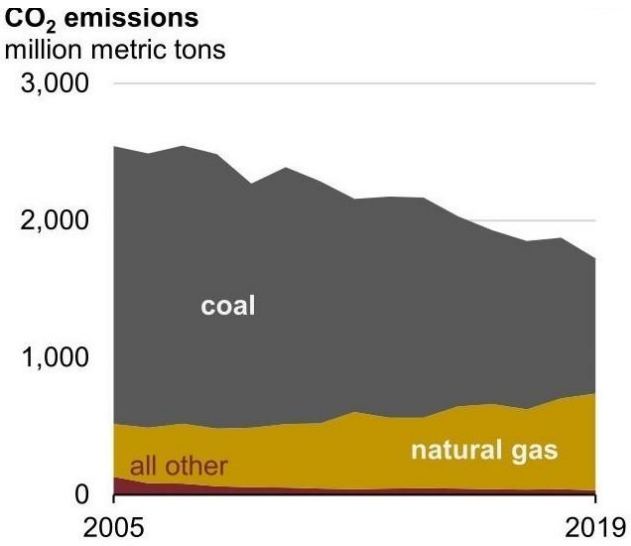



*Figure 10: US CO2 emissions in million tons (2005-2019)*[23]

## Australia

Along with the US, Australia has also asked for rapid energy transition actions. According to the Energy Transitions Commission, Australia has one of the biggest potentials of solar and wind energy[24]. As a result, and as it is already one of the biggest exporters, could possibly help for a quicker decarbonization process worldwide. Furthermore, the Australian minister of energy Chris Bowen says that renewable sources are safer than fossil fuels[25].

## Uruguay

Uruguay's role in the decarbonization is quite different than expected. While it does not help directly other countries or organizations, 100% of electricity in Uruguay comes from renewable sources[26]. Uruguay's example has been used in many IEA reports as a base for the agency's studies and find possible results which could rapid up the decarbonization process.

## Denmark

Denmark's 43% of electricity production was from solar and wind power in 2017[27]. While an active member of the UNFCCC, Denmark followed the convention's proposed for the future regulations in the present and is set to have no fossil fuels use by 2050.

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[23] "This Is How the US Energy Market Is Shifting." *World Economic Forum*, www.weforum.org/agenda/2021/06/energy-us-market-shift/.
[24] "Australia." *Energy Transitions Commission*, 17 Mar. 2022, www.energy-transitions.org/region/australia/.
[25] Mercer, Daniel. "'Greatest Peace Plan of All': US, Australia Say Renewable Energy Cannot Be 'Weaponised'." *ABC News*, ABC News, 12 July 2022, www.abc.net.au/news/2022-07-12/renewable-energy-transition-a-security-boost-us-australia-say/101231130.
[26] "The Global Top Ten Countries Driving the Energy Transition." *Veolia Planet*, 5 Feb. 2020, www.planet.veolia.com/en/energy-transition-global-countries-players-top-ten.
[27] "The Global Top Ten Countries Driving the Energy Transition." *Veolia Planet*, 5 Feb. 2020, www.planet.veolia.com/en/energy-transition-global-countries-players-top-ten.

### International Energy Agency (IEA)

The International Energy Agency (IEA) is an intergovernmental organization formed in 1974. Today, it is constituted by 31 member countries, with its latest addition being Lithuania this year. One of the IEA's main goals is energy efficiency, thus it analyzes data, statistics and different policies in order to promote renewable energy and achieve energy transition, so energy becomes efficient, clean and affordable for countries, businesses and households. The IEA has already launched some projects in order to meet its goal, with the main one being the "NetZero by 2050" program.

### International Renewable Energy Agency (IRENA)

The International Renewable Energy Agency (IRENA) is an international organization officially formed in 2008 consisting of 168 members, which aims to promote renewable energy from various sources for everyday use. The agency has suggested means that can be used to achieve energy transition. Also, it has raised awareness regarding climate change and aims with various plans to decarbonize the power systems and combat global warming.

### International Atomic Energy Agency (IAEA)

The International Atomic Energy Agency (IAEA) is an independent organization within the United Nations which focuses on safe use of nuclear energy for global security and to complete the 2030 Agenda for Sustainable Development. In the worldwide attempts to eliminate global warming, the IAEA has provided some plans for a redesign in the power systems, but also ways to manage the new behavior of the market that would emerge when decarbonization is achieved.

### United Nations Framework Convention on Climate Change (UNFCCC)

The United Nations Framework Convention on Climate Change (UNFCCC) is a commission of the United Nations which focuses on the fight against climate change. It was created in 1992 and today has 197 members. The UNFCCC signed the Paris Agreement in 2015, on which every country, agency and organization involved with energy transition has based its researches, studies, simulations and reports. The UNFCCC also provides financial aid to organizations who research on how to combat climate issues and ask for it.

### Organization of American States (OAS)

The Organization of American States (OAS) is an intergovernmental organization formed in 1889 and is consisted of 35 states, the independent nations of the whole American continent. The OAS's General Assembly has drafted a handful of resolutions and its members have made some declarations which propose measures in order to achieve sustainable

development. Among these measures, energy transition is proposed so energy efficiency is met. Although these propositions are suggested to American nations, organizations like the IEA have been inspired by them and have gone on with further scientific work on the issue.

### Intergovernmental Panel on Climate Change (IPCC)

" The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing science related to climate change"[28]. Regarding energy transition and power systems planning, the IPCC in the reports it has released has mentioned a plentiful of times plans to decarbonize the energy power systems. To this day, the IPCC continues its research and advises other agencies working on the issue for general working lines, in order for quicker results.

## TIMELINE OF EVENTS

| Date | Description of Event |
|---|---|
| 1780-1820 | Peak of Industrial Revolution |
| 1820's | Greenhouse effect discovered |
| 1850's-1860's | Global warming discovered |
| 1930's | First climate change concerns |
| 18/11/1974 | The IEA is created |
| 21/03/1994 | The creation of the UNFCC is ratified by the UN Secretary |
| 19/12/1997 | The Kyoto Protocol is signed |
| 16/02/2005 | The Kyoto Protocol is put into action |
| 26/01/2009 | The IRENA is created |
| 08/12/2012 | The Doha Amendment is adopted |
| 25/09/2015 | The 2030 Agenda for Sustainable Development is adopted |
| 12/12/2015 | The Paris Agreement is signed |
| 2020 | Uruguay achieves 100% electricity use from renewable sources |
| 24/09/2021 | Global Roadmap for Accelerated SDG7 Action is adopted |

[28] "About the IPCC." *IPCC*, www.ipcc.ch/about/.

# UN INVOLVEMENT: RELEVANT RESOLUTIONS, TREATIES AND EVENTS

## The Paris Agreement

The Paris Agreement is an international treaty signed on December 12th, 2015, at the 21st CoP, in Paris. It was ratified by 196 countries and it targets at limiting global warming at 1.5 degrees Celsius compared to pre-industrial levels. The agreement foresees economic and social development by nations, as well as international contribution financially, technologically and resource-wise. According to the UNFCCC, it is projected that, by 2030, 70% of worldwide emissions will be coming from no-carbon energy.

## Global Roadmap for Accelerated Sustainable Development Goal 7 (SDG7) Action

On September 24th, 2021, the United Nations Secretary-General released a global roadmap for Accelerated SDG7 (affordable and clean energy) action. In the roadmap, a fast transition to no-carbon energy is suggested, as well as attempts to reduce the energy access gap and a reformation in the financial system to support the new energy market. The SG, in order to achieve SDG7 more quickly, he has set some milestones to help with such actions (e.g., no coal power plans after 2021).

## Kyoto Protocol

The Kyoto Protocol is a regulation which was adopted on December 19th, 1997, by the UNFCCC and forced into action on February 8th, 2005. The protocol foresees the more industrialized nations to reduce the greenhouse gases emissions and transition to no-carbon resources, in accordance to the UNFCCC's guidelines, with a frequent report given back to the convention by those countries on the project's progress. The protocol hoped at a 5% reduction of greenhouse gases emissions during 2008-2012 (first commitment period) compared to the early 1990's levels.

## The Doha Amendment

The Doha Amendment is an amendment made to the Kyoto Protocol on December 8th, 2012, which furthers the action of the protocol for a second commitment period (2013-2020). In the amendment, firstly, the parties referred in the Kyoto Protocol are increased and, secondly, the greenhouse gases which the parties should report to the UNFCCC during the second commitment period are also increased.

## PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

### NetZero by 2050 (IEA)

The NetZero by 2050 plan is a roadmap by the IEA targeting at decarbonizing the whole energy system by 2050. In the roadmap, the current data regarding CO2 emissions, energy use, financing, etc., are mentioned. Mainly, though, there are measures suggested for uses like transportation, proper fuel selection, industry and more to achieve a fully non-carbon world in three decades' time.

### REmap (IRENA)

The REmap-Renewable Energy Roadmap is a program by the IRENA for countries to increase their use of renewable energy sources. The Remap, other than renewable technologies, helps in the technological development of transportation, heating, and more. To suggest solutions, the REmap takes into account indicators like CO2 emission levels, economic growth, available technology, etc.

## POSSIBLE SOLUTIONS

### Construction/Installation of renewable energy generators

A feasible and efficient way to decarbonize the current energy system is to use renewable energy. However, to use such energy, the necessary infrastructure needs to exist. Thus, renewable energy generators should be constructed or installed in various areas, where there are plenty of renewable energy resources. For example, in places where there is a lot of wind, like on top of a hill, a wind generator should be constructed, which would transform the energy produced by the wind into electricity; in places where there's plenty of sunlight, like a plain, solar panels should be installed; in places where water flows, ideally with a high velocity, like at a river dam, hydroelectric units should be installed. The electricity provided to businesses, households and others that would be used for transportation, the production of goods, personal use, or any other kind of action, would in a large percentage be generated by renewable sources.

These constructions/installations, though, cannot be made solely, though, from a country's national budget. Of course, every government would focus a part of their financial agenda on the construction of such infrastructure, however, UN programs, such as the United

Nations Environmental Program (UNEP), the European Union for its members, intergovernmental organizations, like the IEA, and various non-governmental organizations would budget that kind of projects.

### Regulations for factories/industries/businesses

A measure to further secure that energy transition will be achieved at the time planned, regulations for factories, industries and businesses should be set by legislation. Specifically, the legislation would foresee the limitation, or preferably elimination, of greenhouse gas emissions to a specified number or percentage according to the production of the referred actor.

In order to persuade the actors discussed, penalties and "gifts" should be given according to each one's actions. For example, for businesses who meet part of the regulation (e.g., emitting a small amount above the allowed), taxation should be imposed for them to meet the standards in the future, while for the ones who do not meet the regulations at all, or after a determined period of taxation still do not comply, a complete shutdown of the referred actor should be imposed. On the other hand, businesses who are completely eco-friendly and do not produce any greenhouse gases at all, a budget should be given to them, as motivation to continue helping the environment and the world.

### Redesign of the power systems

As a part of constructing infrastructure to sustain decarbonization, a vital and core solution is to redesign the power systems, more specifically the electrical power grids, the most common power system and the most appropriate to sustain the transition. A redesign would foresee first of all a change in the supplies. Zero-carbon supplies would be renewable energy collectors, such as wind generators and solar panels. Secondly, copper conductors should be preferred over other metals, like aluminum, as it is less possible to find nuggets of carbon in copper than in other conductors. Moreover, more technologically advanced power electronics should be used, to find flaws whenever there is a production of greenhouse gases more than a sustainable limit. Lastly, protective relays should be implemented in every power system to prevent overflow of electricity, thus decrease the energy lost, which could be used in other cases.

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