

UNIVERSIDAD DE GUANAJUATO

# Analysis of the Energy Policy of Germany, Japan the United States and Mexico with a Global Perspective

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**Presenta: Juan Andrés García Padrón**

**Director de Tesis: Dr. Fernando Barrientos del Monte**

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## NOTES OF GRATITUDE

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## INTRODUCTION

“This man, on one hand, believes that he knows something, while not knowing. On the other hand, I, equally ignorant, do not believe that I know anything at all.”

Plato - *in Apology*

### **Introduction**

Human development could not be understood without energy. Civilization has been link to its expansion since the beginning of time. Energy is a human need since human development is tied to its use. Energy production has gone from windmills and water turbines, to the achievement of the steam engine to the usage of oil; to sophisticated nuclear fissions and on the way to renewable forms of clean energy. The demand for energy significantly increased after the start of the industrial revolution. During the twentieth century fossil fuels became the main supplier of energy global needs.

There is an unequivocal scientific consensus that human activity has affected the Climate. This largely related to the production of global energy mainly by adding Greenhouse gases (GHG) proceeding after the combustion of fossil fuels.

These Greenhouse gas emissions are responsible of enhancing the Earth’s natural Greenhouse Effect leading to a warmer planet producing climate change. This effect causes major risks to human wellbeing as well as human health making it a public global problem.

The consequences of climate change can be catastrophic and create many side effects to ordinary life. Impacts will affect patterns in nature, increase the sea level, temperatures, and expand droughts. It will lead to more sudden disasters, and consequently affect the economy and according to recent reports by the World Health Organization it will affect human health.

Climate Change could also lead to major social changes such as major migration movements and encourage economic crisis. Since it is a worldwide problem, the effects will vary from region to region. Deforestation, uncontrollable population growth and other mankind induce effects contribute to enhance this effect.

Meanwhile fossil fuels extended throughout the world, sustainability was not a strong concern, one of the reasons why, the world is facing a major environmental challenge. The high demand of energy represents one of the main challenges to mitigating climate change.

## INTRODUCTION

It was not until the 1970s that an international oil crisis, led nations to rethink the way they produce and use energy. After that time new policies came in place as a new option to cover the demand for energy and at the same time help the environment. Now with this enhanced climate, countries are urged to implement the right policies to transit to renewable clean energy in order to reduce their emissions.

Renewable energy can be considered not only a clean but a safe source of energy; as others represent a high threat such as nuclear energy or pollutant and non-renewable such as fossil energy. There are some challenges to the transition to clean energy for instance in order to increase greener energy: governments, local and international institutions must increase their participation through policy intervention. Today, many clean alternatives are prominently more costly than the traditional burning of fossil fuels making it harder for deprived nations or entities to have access to it. Therefore the International Energy Agency (IEA) suggests that “Greater investment in renewable energy systems, both by the public and private sectors, will enhance energy security at affordable costs with minimal environmental impact” (IEA, 2007). Sustainability in public policies must be considered as a pathway of development that would ensure not to compromise the levels of wellbeing for future generations. As well efficiency in the use of energy can also contribute to reduce the demand for it, being one of the best options to achieve the emissions’ reduction.

Considering the complex and extension of the topic, this thesis will analyze the actions related on a global scale to later analyze four country scenarios; it will revise the main public policies implemented after the 1970s Oil Crisis until recent days focused on reducing GHG emissions and the transition to clean and renewable energy considering the negative effects of climate change.

The first chapter introduces to distinct aspects of the theory of public policy. It tries to cover what are public policies and how they are defined after a public problem, who are the actors that influence the decision making process; to later describe how public agendas are set up as well as different approaches of analyzing Public Policy.

The second chapter discusses the importance of energy in contemporary life and how its main production based on fossil fuels is linked to climate change converting it on a global challenge.

## INTRODUCTION

This chapter classifies the forms of producing energy one being the pollutant and non-renewable fossil fuels and in the other hand the clean and durable alternative.

The third chapter analyses how the global scenario is integrated towards tackling climate change and increasing the presence of renewable energy. This chapter presents how global climate change policy interacts. Due to the lack of a strong integrated international system that regulates climate change policy. Nations were driven to establish a group of specific regimes labeled as a “regime complex”, a series of institutions working by their own means and resources to tackle climate change. This type of system might be inevitable and might be the ideal system, since an integrated regime might be inefficient and complicated to operate. Decentralization was presented as a good approach given the complexity of the issue and the differences among nations. Public policies that tackle climate change must be: coherent, accountable, determined, sustainable, well researched, and fair.

After explaining how the International regime operates this case study analyzes the scenarios of: (1) Germany, (2) Japan, (3) the United States (USA) and (4) Mexico. These four nations embody three important regions of the world in terms of social and economic development, Europe, North America and Asia. These countries together host a population of almost 700 million and in 2012 if joint a GDP of about 27 trillion dollars.

Germany plays a leadership role within the EU; it is the fourth largest global economy, and it has presented an ambitious plan to transit to Renewable energy and reduce its emissions. Japan is the third largest economy in the World. It is the second biggest in Asia following China. After the Second World War, it passed through an economic boom that industrialized the nation, as being an isolated nation with limited resources, it hope in Nuclear Power to be the biggest solution to increase its energy security. In 2011, it faced serious challenges after the nuclear accident at Fukushima, establishing a big debate on its energy policy. The United States is the largest economy in the World; it is the second biggest energy consumer after China but the largest GHG polluter, it maintained a hegemonic power during the last decades, playing an important role at the international community. The Mexican case is particular because while this study was presented, an Energy Reform was debating at different forums and at the Mexican Congress. Mexico is the 11<sup>th</sup> economy of the world and is developing with the entrance of industry in the last decades mainly due to its openness and free trade agreement. On each of them it takes a

## INTRODUCTION

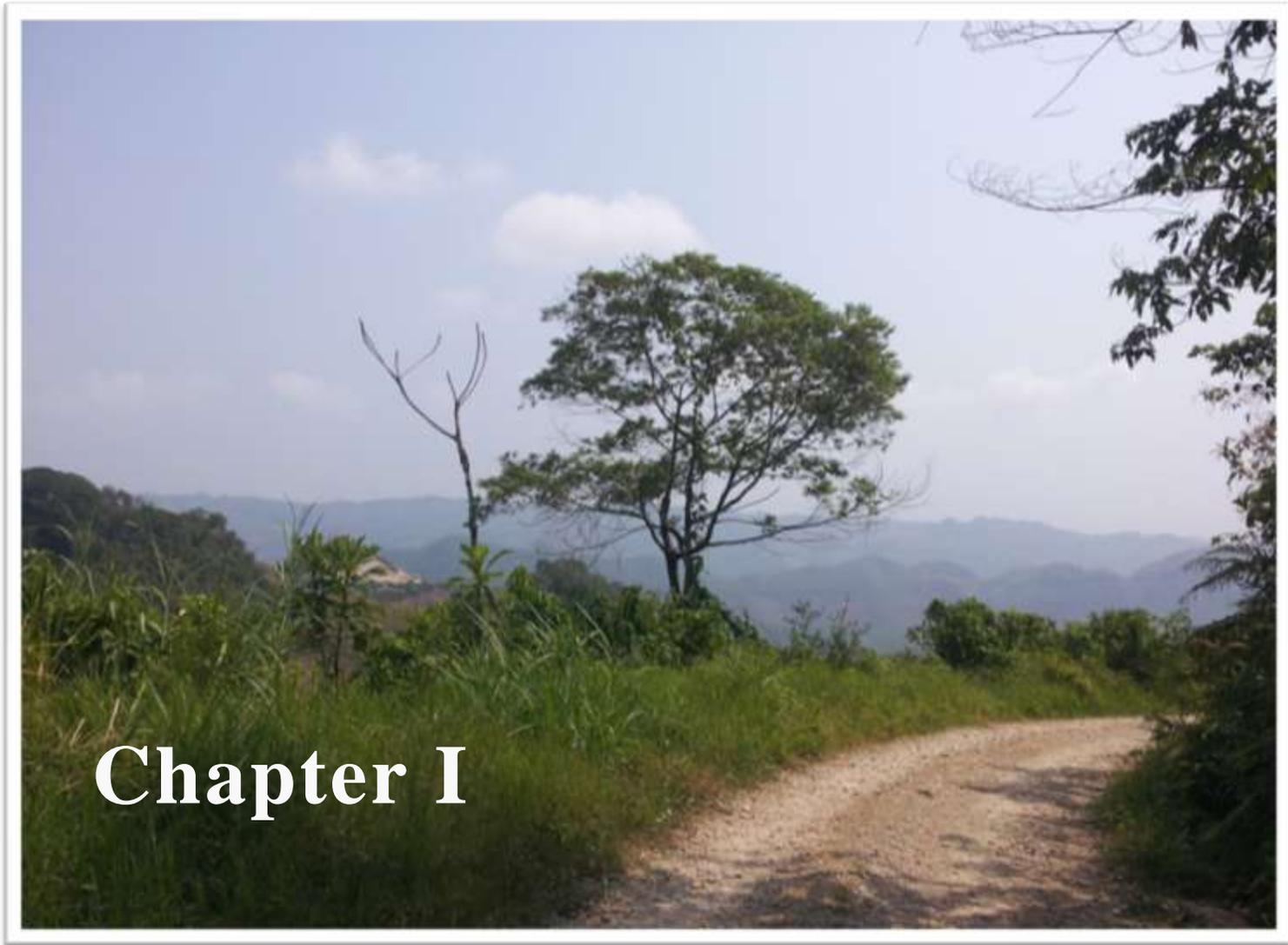
glance on the institutional context is in charge of the energy policy. It presents their past and current challenges facing climate change and energy policy. Then it presents some of the more relevant policies aimed to tackle the public problems related to transiting to renewable energy.

Finally it presents their goals to reduce emissions, increase efficiency and how they aimed to increase renewable energy on their production. One aspect to be considered after the scenarios of these countries in this thesis and this is what Jerome Danagerman's concluded that nowadays in order for countries to change their energy policy there must be a crisis or a very determined intervention that leads to the transition to clean energy.

This thesis is inspired thinking on a greener and livelier planet for present and future generations. The author invites the reader to keep in mind this work as a learning experience in order to graduate from University.



Alternative Energy – (Flicker - Jürgen from Sandesneben, 2005)



*A civilization flourishes when people plant trees under which they will never sit.*

— Greek proverb -

## **Chapter I**

This first chapter introduces distinct aspects of the theory of public policy. It is divided into four subchapters titled 1) Public Policy: what is it?; 2) What is a public problem and who are the actors involved in that process; 3) How are public agendas set up?; and 4) Different approaches of analyzing Public Policy.

### **I. Public Policy: What is it?**

To understand a concept and its surrounding one has to look at it from different perspectives, Public policy is a social science that uses different disciplines to solve community issues. Public policy is defined as a “set of actions—plans, laws, and behaviors—adopted by a certain government.” (Encyclopædia Britannica, 2013). Public policies are important because they govern the quality of life citizens get, the water we drink, the air we breathe in (Torjman, 2005, p. 1), and the prices we pay as well as the health and safety of streets, among many other aspects of contemporary life.

Approaching the history of public policy, its study is a recent discipline that formally began in the United States of America. According to Daniel McCool he suggested that policy studies began in 1922, “when political scientist Charles Merriam sought to connect the theory and practice of politics to understanding the actual activities of government.” (Birkland, 2011, pp. 6-10) According to Egon Montecinos, “one of the most important lines of development of public policies was the original concern to get to know the world and then change it, in this school of thought were inspired some of the pioneers of public policy”. (Montecinos, 2007, p. 323) Consequently different authors consider Harold Lasswell as the “preeminent father” of public policies. When in the 1950s he published his work on “Policy Orientation” in his book coedited with Daniel Lerner “The Policy Sciences”; where Lasswell defines policy sciences as: “the disciplines concerned with explaining the policy-making and policy-executing process, and with locating data and providing interpretations which are relevant to the policy problems of a given period.” (Lasswell, 1970, pp. 57-58)

Clarke Cochran states that the term public policy always refers to “the actions of government and the intentions that determine those actions.” Guy Peters suggests that “Public Policies are the sum of government activities, whether acting directly or through agents, as it has an influence on the life of citizens” (Birkland, 2011, pp. 6-10). George Greenberg, Jeffrey Miller, Lawrence Mohr and Bruce Vladek, come to agreement that “there exists in the literature a rather astounding number and variety of suggested boundaries about the concept, policy”. They present various definitions that come to be as follows: “all government action”, “a program of goals, values and practices”, “the impacts of government activity”, “important government decisions” among others (Greenberg, Miller, Mohr, & Vladek, 1977, p. 1541).

Public policy is understood by acknowledging the role and existence of the State. In an organized community where there is a form of government, there is a demand for order by the people being governed. Those individuals require a system of government that ensures access to elementary necessities which creates livable communities. For this mere reason there is the existence of the State, understanding it as where there is an organized group of people, with a define set of rules in a given territory adding what Max Weber said that “it has gotten the monopoly of the legitimate violence” (Weber, 2011, pp. 17-18).

The state is conceived as the legitimate monopoly on the means of violence. This approach emphasizes the informal and formal organization of political parties, interest groups and social movements, their links to the governmental bureaucracy and formal centers of policy making, the legitimating myths that are used to justify the system of rule, the organization of the legal system, and the sources and impact of public opinion, including the organization of the mass media and electoral politics (Jenkins, 2001, pp. 2162 - 2168).

In society there is a legitimate relation and a distribution of power, the State maintains its supremacy within this setting. Citizens deposit their trust in public institutions consequently they benefit from this social contract and legitimize their public authorities; then as postmodern philosopher Michel Foucault explained how people come to be dominated by power structures beyond their control (Birkland, 2011, pp. 6-10). The importance of these paragraphs is to acknowledge the importance of the relations between citizens and their State for the reason that one must notice that civilians are born in to an establish system and must follow the norms and

be aware that the system in place is for the common good of the people and to organize public matters.

Hans Kelsen affirmed that one of the three functions of a State is to administer its own duties. Kelsen states, “[t]he State can put up hospitals to cure the sick, it can build schools to teach the children or it can develop railways for the trains” (Kelsen, 1979, p. 193); in consequence one of the State’s duties is to administer and ensure public needs. One aspect to be mentioned is what Kelsen adds: the importance that the set of written rules concord with the administrative functions of the State.

Similar to the role and definition of the State, the role of politics is involved in the process of public policy. The study of politics has existed for centuries. Although politics is a hard term to define, some adhere to the Merriam-Webster dictionary definition of politics being “the art of government” or as Harold Laswell defines it as the process by which “society determines who gets what, when they get it, and how they get it” (Birkland, 2011, p. 6).

Also one should acknowledge the presence of several groups and elites within the community. Robert Spitzer calls to the study of power and the possible influence in policy making focusing on different roles. He states that there are different types of policies that “engender in their own unique set of politics and political relationships.” He continues that “opposing political forces tend to polarize in two sides” making it difficult for policy making, he also mentions that most of the time the final outcome is the consensus between the different political forces (Spitzer, 1987, p. 677).

Furthermore it is important to acknowledge that policies are created in the public and private sphere, corporations do designed and implement policies as well as public institutions do, thus there are two spheres of policy making, public and private. As Selden Biggs and Lelia Helms mention “issues become public, when the consequences of a situation get out of control and these affect outsiders, then the problem becomes public, and the government intervenes” (Biggs & Helms, 2007, pp. 39-53). Biggs and Helms consider that the private sphere does play an important role in public policy making and must not be excluded from this process.

Policy making is the process of making policies and it requires bearing in mind different disciplines such as philosophy, economics, public administration, sociology and political science.

According to Wildawsky, “public policies cannot be tied to the barriers between disciplines. But they should be open to the actual circumstances and nature of the problem” (Parsons, 2007, p. 63). That is the reference to the multidisciplinary nature of policymaking, understanding it as how public policies can be approached from different perspectives within sciences. As R. K. Sapru (1970, p. 256) acknowledges, “Policy making should not be confused with the sole action of planning”. Because as he adds, “a plan is a program of action for attaining definite goals or objectives” but then he adds that planning is certainly part of policy-making.

“Harold Laswell is regarded as a leading scholar of the policy approach. His writing is dated back to the 1930s, when he was inspired by the Chicago School to be concerned with use the multidisciplinary approach for solving social problems. Laswell was of the early scholars who formulated a set of seven stages in the policy process known as: Intelligence, promotion, prescription, invocation, application, termination and appraisal” (Laswell, 1970, p. 56).

Laswell proposed to divide the policy process into a sequence of successive stages and functions. This process of public policies takes place in different stages as follows (Laswell, 1970, p. 56):

1. Problem definition: Problem definition refers to needs that must be taken care for and that public opinion has focused on them.
2. Formulation of the policy. Formulation and “policy design” tend to be narrowed down to the period when elected officials got in power.
3. Policy implementation: The process of implementing, taking the planned actions.
4. Evaluation of the process. To examine and verify the whole process and get the feedback to improve the areas that need to.

Moreover Enrique Cabrero adds that the stage of implementing a policy sometimes happens to soon that goes along with the formulation process leading to interrupting it due to bad planning. He also criticizes the common lack of inexperience in the administrative bodies. Cabrero adds that “society expects quick solutions,” therefore when governments start evaluating their policies that process is sometimes mistaken with the level of satisfaction that citizens have; instead of measuring the real effects of the policy (2007, pp. 13-47). The CEMEFI (Centro Mexicano para la Filantropía), according to Freddy Mariñez, (2011, p. 35) proposed a cycle of a public policy with five stages, as follows:

## CHAPTER I

1. Problem Identification
2. Agenda Definition
3. Generating specific proposals
4. Design of Public Policy
5. Implementation and Evaluation

This proposal suggests that in order “to impact public policy it is necessary to consider the characteristics needed to participate in each stage of the cycle” (Weber, 2011, pp. 18-20).

According to R. K. Saprú, David Easton’s work incorporates an important contribution to the development of policy approach. It provided a model of the political system that greatly influence the way in which the study of policy tended to concentrate on the relations between policy-making policy outputs and its wider environment. Saprú draws this sketch that according to him “gives a rough idea of what political scientists have in mind when they describe Easton’s view of political system” (Saprú, 2011, p. 58).

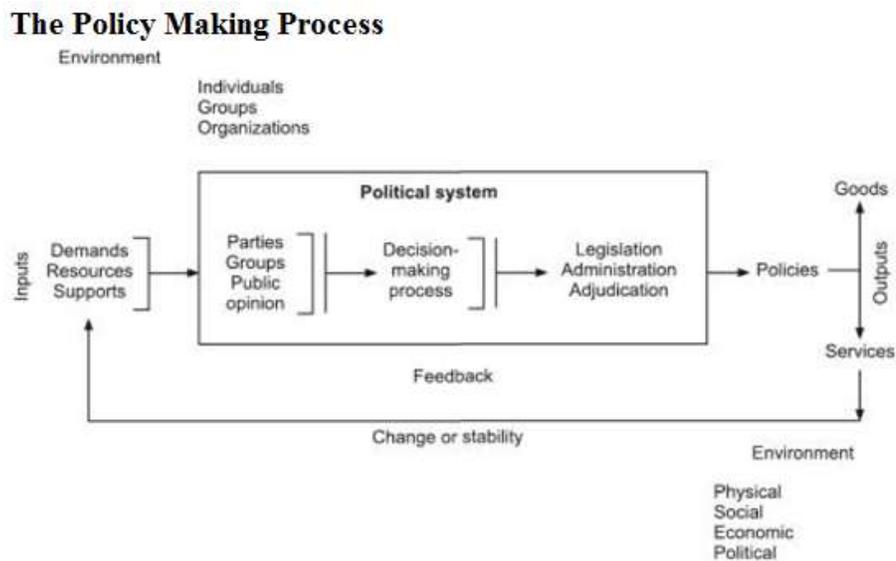


Figure I.1, Source: (Adapted from Easton, 1975) (Saprú, 2011, p. 58)

Inputs can be considered as the social and political products of the setting. Demands are the public requirements made on the system. The environment is the series of conditions of the political system. The supports refer to the laws that offer a basis of existence to the authorities.

“The outputs represent public policy as the output of the political system. And finally feedback that supports in generating a suitable environment for future policy” (Sapru, 2011, pp. 58-59).

In their book, Selden Biggs and Lelia Helms acknowledge “that most scholars of policy making concentrate in the process of formation and formulation of policy commitments and leave the process of implementation and evaluation as a brief less important process” (Biggs & Helms, 2007, p. 42). As a result they consider these two last processes (implementation and evaluation) the most important ones because they are the ones that come up with the results that citizens expect from their government.

Nevertheless Sherri Torjman suggests that it would be impractical and even wrong to state that policy making follows a clear and consistent path or method. Accordingly she says “Policy development is actually an involved and sometimes haphazard process that differs widely depending upon the concern being addressed. Sometimes it is a long and winding road with lots of detours and stops along the way.” But then she suggests a similar process of policymaking and the steps are: (Torjman, 2005, pp. 9-15)

1. Selecting the desired objective.
2. Identifying the target of the objective.
3. Determining the pathway to reach that objective.
4. Designing the specific program or measure in respect of that goal.
5. Implementing the measure and assessing its impact.

Continuing, public policies apply everywhere where there is a social problem. Government bodies respond to those demands designing and implementing policies through specific processes of policy making. Some definitions of policy making consider it as the set of activities aimed to solve a problem. Guy Peters defines this process “as the sum of the activities that governments do, either directly or through other agents” (Montecinos, 2007, pp. 323-336).

Another important issue concerns which principles should be used in the policymaking process. The General Assembly of the Centro Iberoamericano de Desarrollo Estratégico Urbano (CIDEU) posits that policies should be oriented towards a sustainable development in economic, social and environmental terms. Public policies must be articulated profitably and effectively to influence

the quality of life of people. Furthermore, Rodolfo García del Castillo says that “society as a whole demands that policies should be persuaded under the principles of efficiency, efficacy, quality, transparency and accountability” (García del Castillo, 2002). Egon Montecinos exalts the importance of considering “citizens as a key focus while creating public policies, which should be as well efficient and democratic” (Montecinos, 2007, p. 327). Montecinos adds that solutions must adapt to the definitions of public problems which are delivered using public policy.

Finally we can define public policies as those actions that governments implement in order to solve public problems. There are principles that must be considered while designing public policies such as sustainability, quality, efficiency, transparency, viability and certainly acknowledging the rule of law. In the same line of thought, policymaking is the process that develops public policies that are designed and implemented by a system of government. As mentioned above, there are four main stages in how public policies occur: problem definition, formulation of the policy, implementation and the evaluation of the whole process.

The aim of a “public policy is to achieve a desired goal that is considered to be in the best interest of all members of society. Examples include clean air, clean water, good health, high employment, an innovative economy, active trade, high educational attainment, decent and affordable housing, minimal levels of poverty, improved literacy, low crime and a socially cohesive society, to name a few.” (Torjman, 2005, pp. 6-7). However, Sherri Torjman also argues these examples are not intended to imply that all public policies are directed toward the entire population. “Sometimes public policies are deemed to promote the public interest of a certain group.” A public policy should be a “careful decision that provides guidance for addressing selected public concerns” (Torjman, 2005, pp. 6-7). Policy-making can be seen then, as a decision making process that identifies goals, problems or concerns.

In the following subchapter, I will address how a problem is defined to articulate a particular public policy.

## **II. What and Who Defines a Public Problem?**

Public policies are implemented in order to solve a particular problem. “Problems are situations that can be remedied through concerted action” (Biggs & Helms, 2007, p. 40) Aaron Wildavsky states that “a problem is a problem only if something can be done about it” (Anderson, 2010, p.

86). Yehezkel Dror argues “that most public problems have been present since the beginning of humankind but that modern science has brought them to public attention making them public and science provides better means for solving them” (Dror, 2003). Aguilar adds that “the process to create problems means to create solutions as well” (Aguilar Villanueva, 1992, p. 18).

Because there are a series of different problems in every society the scale to value them differs by preferences and public opinion. According to Bruce Mitchell public policy issues are usually difficult; they take place in hastily changing environments portrayed by uncertainty, and imply conflicts amongst diverse interests. Consequently, “those responsible for creating, implementing and enforcing policies must be able to reach decisions about ill-defined problem situations that usually are not well understood, have no one correct answer, and involve many competing interests” (Mitchell, 2006, p. 206).

According to Egon Montecinos, “traditionally the study of public policies was to focus on the stage of implementation” (2007, p. 325). But he argues that nowadays focus is on the stage of defining a public problem. Luis Aguilar (1992, pp. 20-26) suggests that governments nowadays should govern based on public problems that are defined in society to develop solutions and not by programs or plans without knowing the truth behind the problem.

In *Democracy in the United States*, Dahl suggests that to know “how severe a conflict is, it depends on how much is at stake” (Dahl, 1972, p. 303). Therefore as Selden and Biggs suggest we can classify problems as general problems and public problems. “General Problems find their own solutions without the need of policymaking-specialists intervening” for instance “parents educate their children, churches attend sinners, business take care of their clients, but when there is a problem within the development of these activities authorities do become involved in finding suitable solutions” (Biggs & Helms, 2007, p. 45) . Just a number of general problems are motif of being public; as a result “a public problem is something that can be made better by means of public policymaking” (Biggs & Helms, 2007, p. 45).

The agenda setting process concerns the way governments decide which issues need their attention. “It focuses on what constitutes the problem that policy actions are intended to resolve.” (Wu, Ramesh, Howlett, & Fritzen, 2010, p. Sección 2). John W. Kingdon (Kingdom, 1984) defines an agenda as “the list of issues or problems to which governmental officials and others in

the policy community are paying some serious attention at any given time”. Luis F. Aguilar defines the government agenda “as the set of issues officially accepted to be considered by government officials” (Aguilar Villanueva, 1992, p. 25). Furthermore “agenda setting is about a government recognizing that a problem is a public one worthy of its attention and not simply an issue affecting only a few people” (Wu, Ramesh, Howlett, & Fritzen, 2010, p. Section 2).

Egon Montecinos adds that once the government officials integrate the government agenda, this one needs to be delimited, specific and tangible. Moreover these problems must be feasible and realistic. “Problem structuring and definition are the first steps in the formation of policy inputs” (Montecinos, 2007, pp. 330-332). Moreover policymakers must look in to the public agenda to define whether a problem can and must become public. According to Montecinos “all problems can become public, they are not born public but need to be look at to be consider public” (Montecinos, 2007, pp. 330-332).

The actors involved in this process can vary depending on the situation, since these policies originate after a public problem; the people surrounding this problem can and sometimes become involved to make their voices be heard. Moreover and according to Sabatier there are sometimes policy debates to discuss whether a problem must be consider public, these occur “among actors involved in the policy process, he adds that the discussion involves very technical disputes over the severity of a problem, its causes, and the probable impacts of alternative policy solutions” (Sabatier, 1999, pp. 3-5).

James Anderson argues that “in order for a condition to become a public problem, society must value and set standards thus government takes care of it” (Anderson, 2010, p. 86). Then he adds that “Conditions do not become problems unless they are defined as such, articulated, and then brought to the attention of the public officials” (Anderson, 2010, pp. 86-87). Also a requirement is that they must be valued as an “appropriate topic for governmental action” and even more important that there exists a viable solution for solving the issue. Anderson set ups an example of how different perspectives can influence the process of considering a condition a public problem, he presents this following diagram that represents how conditions lead according to their value and viability to become public problems.

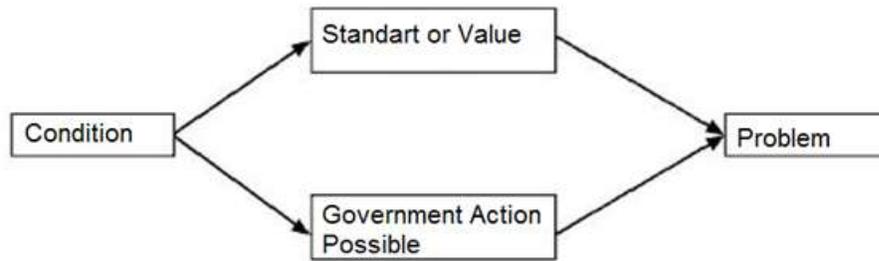
**Diagram of Problem Creation**

Figure I.2 Source: (Anderson, 2010, p. 86)

According to this diagram presented by Anderson, he explains how conditions become public problems, through the evaluation process of certain conditions, and the values and standards that society acknowledges in them.

Furthermore regarding the process of financing public policies, one must remember that there is a limited amount of resources in public service, one of the reasons why, public officials must look and really value what problems need to be prioritize in the institutional agenda. Besides that monetary part, some conditions signify big challenges in order to be taken serious, one could be that public opinion might not agree with the importance of the issue, or it could also be that if a problem is tackle it can affect certain private interests leading to conflict.

In addition Egon Montecinos expresses the importance of “problem definition”, he says that “if a problem is not well defined or there is lack of information on it, there will be serious consequences and then the remedies might be worse than the original situation” (Montecinos, 2007, p. 325). Similarly he declares that “in order for a condition to be treated as a public problem, a viable solution must be included in the “problem definition” within the economic, social and technical possibilities” (Montecinos, 2007, p. 325). According to Majone, the action of problem definition is very important because he considers this part to be a crucial stage in the policy process. He adds that “in most of the cases there will be a need to explain the reasons behind those definitions and why public officials took those paths towards the expected solution” (Montecinos, 2007, p. 328). Likewise, the analysis that implies considering a condition a public problem, it must be taken serious to locate and identify those conditions, which deserve to be included in the public agenda as well as mention their possible solutions.

In summary, public problems are defined by policy makers; these problems originated from certain conditions that were valued important enough to be worth for taking public action. Montecinos citing Bardach (1993) adds the importance that “the public problem definition process must be as sober and impartial as much as possible” (Montecinos, 2007, p. 325).

In the next subchapter, I will discuss another important topic related to the policy process which involves when those public problems become part of the institutional agenda.

### **III. Setting up the Public Agenda: Who Decides What Public Problems are included in the “Government Agenda” and How Do We Solve Them?**

An agenda is understood as “the set of policies or issues to be addressed or pursued by an individual or group” (Merriam Webster, 2013). As previously mentioned, “public policies are developed by officials within public institutions to address public issues through the political process” (Mitchell, 2006, pp. 206-209). George Greenberg, Jeffrey Miller, Lawrence Mohr, Bruce Vladek, suggest that the process of “Policymaking is complicated by the presence of a large number of participants” (Greenberg, Miller, Mohr, & Vladek, 1977, pp. 1532-1537). “Agenda setting is often considered to be the most critical stage in the policy process mainly due because there are only a limited number of public problems on the policy agenda that governments can address at any particular time” (Wu, Ramesh, Howlett, & Fritzen, 2010, p. Section 2).

According to Kingdon (Kingdom, 1984, p. 304), the agenda is defined as “the list of subjects or problems to which governmental officials, and people outside of government closely associated with those officials, are paying some serious attention at any given time.” He then adds that “[a]genda setting is a process in which certain public problems are identified, recognized, and defined, and specific solutions or alternatives are generated, considered, and attached to these problems. Due to the limited attention span and limited information-processing capacity of government, the lists of problems and solutions are usually very short” (Lindquist, Liu, Arnold, & Kenneth, 2010, p. 69).

According to Egon Montecinos there is a difference between a public agenda and a governmental agenda, he cites authors Cobb and Elder (1972) and mentions that a public agenda is defined as “the one that includes all the issues that people from a community perceive as those that need

public attention and that belong to the jurisdiction of public authority” (Montecinos, 2007, p. 328). And he defines governmental agenda by citing Luis F. Aguilar (1993) “as the set of matters explicitly accepted, for serious and active consideration by those who are responsible for making decisions” (Montecinos, 2007, p. 328). Montecinos adds that “including a public problem in the government agenda is necessary but not enough for a public policy to come in place,” (Montecinos, 2007, p. 328) This predicament then begs the question, how are public agendas set up and what drives a public problem towards the agendas?

Discovering how public agendas are set up and what public problems are included, involves different approaches. One approach is the classic pluralist approach which argues that “policymaking in a democratic system operates as a fragmented power structure that is open to considerable influences from various interest groups” (Lindquist, Liu, Arnold, & Kenneth, 2010, pp. 69-70). On the other hand, “the agenda-setting approach is more interested in how government, as a set of organizations with limited rationality and capability, copes with literally unlimited public problems” (Lindquist, Liu, Arnold, & Kenneth, 2010, pp. 69-70). According to Paul Sabatier “there are normally hundreds of actors from interest groups, government agencies, researchers, journalist, and judges involved in one or more aspects of the process” (Sabatier, 1999, pp. 3-13). He adds that these participants (either as a group or individual) “have potentially different values/interests, perceptions of the situation, and policy preferences” (Sabatier, 1999, pp. 8-9).

Consequently which drivers (causal conditions) cause policies to change? According to Gilberto Capano, “many theoretical frameworks for social and policy change combine different epistemological drivers, examples could be: institutional rules, competition, conflict and learning, contingencies among others” (Capano, 2007, pp. 2-25). According to Rebecca Sutton, policies happen when “public problem is analyzed in a scientific, technical way, producing tangible data that offers something concrete to act on”. She adds that policies happen when “events are timed in such a way that a person who is particularly interested in pushing forward an agenda is working at a time when a powerful political authority has reason to be interested in the same agenda. She refers to “change agents” as those who carry the idea forward, explaining it to others and building consensus towards a common interest” (Sutton, 1999, p. 32). Ronald

Brunner says that it not a secret that public officials often seek advice from researchers and vice versa for funds (Brunner, 1991, p. 295).

According to Bruce Mitchell (2006), powerful special interest groups can and do apply significant pressure on elected officials and public servants in order to achieve their ends, regardless of the public welfare. Mitchell develops these following core principles for policy makers:

1. Politicians and public servants are accountable to the public.
2. Elites, in politics and the private sector, do not have the right to pursue their interest without constraints.
3. Government bureaucratic and decision processes must be open, accessible, and transparent, as well as being responsive to public concerns.
4. Individuals and communities affected by projects have the right to be informed regarding proposed developments; the right to challenge the need for, and the design of, projects, and the right to be involved in planning and the decision making process.

Moving on to the contemporary context, James Anderson adds that in recent years important public issues have included “such matters as illegal drug traffic, research and treatment of AIDS, gay marriage, terrorism, etc” (Anderson, 2010, p. 91). Anderson adds that “many stands can be taken or alternatives proposed in such issues” (Anderson, 2010, p. 92), therefore there are several ways to approach social issues. Citing Professors Cobb and Elder, Anderson presents two basic types of agendas: the systemic agenda and the institutional or governmental agenda. Therefore the systemic agenda consists of “all those issues that are commonly perceived by members of the political community as meriting public attention” (Anderson, 2010, p. 91). In addition they define the institutional or public agenda as “the agenda that includes the problems to which legislators or other public officials feel obliged to give active and serious attention” (Anderson, 2010). Anderson also adds that many of the issues or problems that draw the attention of legislative or administrative policy-makers are not likely to be widely discussed by the general public. “The public’s cognizance of policy issues is often low, awareness and information are mostly confined to a narrow segment of the public, and he considers this segment the attentive public” (Anderson, 2010). One must consider that government officials or legislators possess

legal authority granted by statute and do exert great influence in the making of public agendas. “Various participants outside of government, who do not possess formal authority to make policies, can also influence agenda setting. Perhaps the most important are interest groups” in policy processes (Kingdon, 1995; Sabatier, 1988; Silvel et al., 2002).

Then various experts (academics, researchers, and consultants) are also found to be influential participants. “Other potential participants outside of government include the general public” (Jones, 1983; Silvel et al., 2002), “the mass media” (McLeod, Scheufele, & Moy, 1999; Scheufele, Shanahan, & Kim, 2002), “and local political parties and campaigners” (Katz & Eldersveld, 1961; Scholz, Twombly, & Headrick, 1991). Found on (Lindquist, Liu, Arnold, & Kenneth, 2010, p. 69).

According to Bruce Mitchell, “policymakers (government officials) focus on the short term (commonly, the time until the next election), and on actions that will have tangible results and outcomes while minimizing risk. Thus, the policy maker normally is interested in the simple rather than the complex, the concrete rather than the abstract, and the immediate rather than a distant result” (Mitchell, 2006, p. 208).

The agenda setting process or procedure where politicians set their institutional goals after defining public problems is presented in drawing by James Anderson in the next graph:

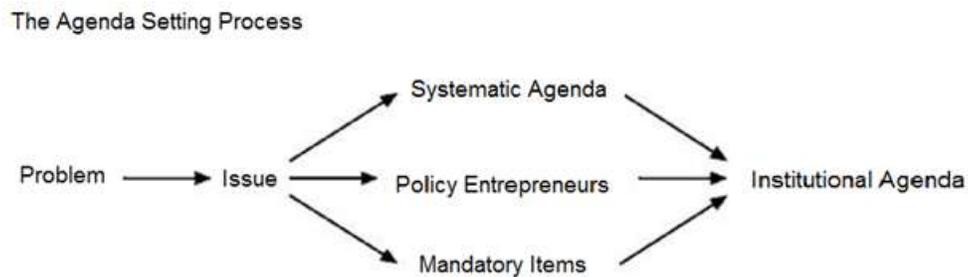


Figure I.3 (Anderson, 2010, p. 91)

According to the diagram, problems contain issues that are part of the systemic agenda, and participants involved in the process raise awareness to force those issues to be considered public. Additionally, public officials by mandate are obligated to bring issues to create the institutional agenda. As Frank Baumgartner and Bryan Jones suggest “drawing attention is a key concept in the agenda-setting process. Due to the limited capacity of policymakers, thus public issues must

compete to attract policymakers' attention” found on: (Lindquist, Liu, Arnold, & Kenneth, 2010, pp. 69-72).

But what makes policies change? According to Capano, “The dynamic of policy development may be intrinsically evolutionary or revolutionary, evolutionary refers to the process of continuous adaptation, which is of an incremental, gradual nature may be slow but may also be at times rapid, and that they may seem to be revolutionary. On the other hand, the revolutionary development of policy is characterized by radical, discontinuous, unpredictable breaks from the past” (Capano, 2007, pp. 12-18).

Capano adds that the theoretical framework designed to explain policy developments, “needs to be constructed on the basis of constitutive elements which have to be logically link together” thus: (Capano, 2007, p. 12)

- The definition of policy development and change
- The type of change
- The outcome of change
- The level of abstraction and the structure – agency dilemma
- The explanatory variables and the causal mechanisms.

As a result Capano delivers these reasonable set of elements to develop public policy.

Public policy is a complex phenomenon in which “institutionalized elements, formal rules, ideas, interests, and political institutions interact, often through structured networks” (Capano, 2007, p. 10). In Kingdon's framework, “politics is another stream that is largely distinct from an independent of problem and alternative streams. Major components and events in the political stream include swings of political mood, interactions among organized political forces, personnel changes in government, battles over issue jurisdictions, stresses and crises, and consensus and coalition building” (Kingdom, 1984, p. 69). The role of power plays an important part in the policy process: defined as “the capacity of a person or, more often, a group and institution to be able to manipulate and shape the views and actions of people” (Orum and Dale 2009). Power plays an important role in the process of setting up the institutional agenda. Thus Steven Lukes (1974) notes three dimensions of power: “decision-making power, agenda control, and systemic

power. Decision-making power is there when the subordinate members are obligated to follow instructions because it is on the interest of the person holding the power”, Lukes (1974) adds that they might hold this power due to their resources, wealth, or legal mandate. Lukes explains that “Agenda Control is central to the political system; these power holders control issues that will be included or removed of the institutional agenda. There have been studies that show how pressure from interest groups can have impact to force government officials not to act in accordance with public interest. In a power study, Gary, Indiana, and Crenson (1971) found that “powerful industrialists pressured local government to ignore local pollution problems created by them” (Jenkins, 2001, pp. 2162-2168) Then he completes that “because the mass media is central to creating public issues, they are typically important in the agenda setting process” (Jenkins, 2001, p. 2165).

According to Domhoff (1998) cited by Craig Jenkins, the upper classes control the mass media, leading to stop action in important issues, depriving them from becoming topics of decision making. News are largely created by press releases and interviews with government officials, which give them considerable say over what issues will be aired in the press. Subordinates may be aware that power is being wielded, but they cannot force their own perspectives onto the political agenda (Jenkins, 2001, p. 2162). Thus this second dimension strongly controls the decision-making process by determining what issues and views get included or ignored. Sabatier (1999, pp. 5-12) adds that in order to understand the policy process, most institutional choices approaches tell the analyst:

1. To focus on the leaders of a few critical institutions with formal decision making authority.
2. To assume that these actor are pursuing their material self-interests (e.g., income power, safety).
3. To group actor in to a few institutional categories, for example, legislatures, administrative agencies, and interest groups. (Shepsle 1989; Sharpf 1997).

But in contrast Sabatier adds that the coalition framework tells the analyst to assume:

1. Those belief systems are more important than institutional affiliation.
2. That actors may be pursuing a wide variety of objectives, which must be measure empirically, and

3. That one must add researchers and journalists to set of important policy actors. (Sabatier and Jenkins-Smith 1993).

Paul Sabatier concludes that these two analyses from two different approaches look at the same situation with different lenses and most likely will obtain different results (Sabatier, 1999, p. 26).

According to Baumgartner, “whether an issue gains enough attention to arrive on the political agenda is contingent upon a number of things. These range from institutional configuration, party system, and constitutional framework, to which party is in power and how many big issues are on the table” (Gupta, 2012, p. 11). Gupta explains how Ness (2010) highlights the motivations of legislators in a crucial way, “Ness discovered that politicians were supporting merit aid policies based on their constituents’ needs, hinting that re-election was their primary interest.” Thus here he explains how they try to keep and control power authority (Gupta, 2012, p. 11).

#### **IV. Which are the different perspectives of analysis and classification of public policies?**

According to Theodore Lowi (1964, pp. 677,678), “Case studies of the policy-making process constitute one of the more important methods of political science analysis. Analysis requires simply an inventory of the group’s participants and their strategies, usually in chronological form; for after all, politics is a process.” Kevin Smith remarks that “[p]olicy typologies are one of the most durable analytical frameworks in political science, originally conceived by Lowi almost 50 years ago” (Smith, 2002, p. 379). Lowi affirmed “I have taken to define policies in terms of their impact or expected impact on the society. My (Lowi’s) approach replaces the descriptive, subject-matter categories of the pluralist with functional categories”. These categories are not mere contrivance for purposes of simplification. They are meant to correspond to real phenomena. Thus, these areas of policy or government activity constitute real arenas of power “each arena tends to develop its own characteristic political structure, political process, elites, and group relations” (Lowi, 1964, pp. 689, 690).

Therefore “Lowi’s (1964) original typology theory was anchored in two basic ideas: (1) policy causes politics and (2) the central characteristic of government is coercive power, the ability to force individuals and groups into certain activities or behaviors.” He continues, “Lowi’s typology

was based on a two-dimensional table, with the dimensions indicating the likelihood of government applying its coercive powers and the target of its coercion.” (Smith, 2002, pp. 379-380) This produced Lowi’s policy categories drawn in the next table:

Arenas and Political Relationships: A Diagrammatic Summary

<i>Arena</i>	<i>Primary Political Unit</i>	<i>Relation Among Units</i>	<i>Power Structure</i>	<i>Stability of Structure</i>	<i>Primary Decisional Locus</i>	<i>Implementation</i>
<i>Distribution</i>	Individual, firm, corporation	Log-rolling, mutual non-interference, uncommon interests	Non-conflictual elite with support groups	Stable	Congressional committee and or agency**	Agency centralized to primary functional unit ("bureau")
<i>Regulation*</i>	Group	"The coalition," shared subject-matter interest, bargaining	Pluralistic, multi-centered, "theory of balance"	Unstable	Congress, in classic role	Agency decentralized from center by "delegation," mixed control
<i>Redistribution</i>	Association	The "peak association," class, ideology	Conflictual elite, i.e., elite and counterelite	Stable	Executive and peak associations	Agency centralized toward top (above "bureau"), elaborate standards

Figure I.4, Theodore J. Lowi’s Arenas and Political Relationships: A Diagrammatic Summary (1964, p. 713)

Despite that, “Greenberg et al. and Steinberger’s assessments was the observation that it was virtually impossible to objectively classify policy.” Thus far, “this is where the issue stands. Lowi’s policy typology and its derivatives continue to be gainfully and usefully employed as explanatory frameworks and are periodically refashioned in an attempt to respond to the problems identified by Greenberg et al. and Steinberger. But the important classification question remains unresolved” (Smith, 2002, pp. 380, 381).

According to Smith (2002, p. 381) “there are two basic approaches to policy classification: (1) the first is typology, which conceptually separates a given set of items multidimensionally, the key characteristic of a typology is that its dimensions represent concepts rather than empirical cases. A second approach to classification is taxonomy. “Taxonomies differ from typologies in that they classify items on the basis of empirically observable and measurable characteristics, although associated more with natural sciences than the social ones” (Bailey, 1994, p. 6). Smith adds “that taxonomic methodologies have never been systematically employed to address the problems of policy classification. But he claims that he has provided scientific evidence that policy taxonomies are possible” (Smith, 2002, pp. 383, 390).

Smith implies that “there is a class of value or morality based policies that can be distinguished from non-morality policies, and that these distinguishing characteristics can be used to explain and predict political behavior in morality policy arenas. Tatalovich and Daynes (1998) define morality policies as those that involve noneconomic values, are politicized by single-issue interest groups, and are cases in which the federal judiciary becomes the primary decision maker. Meier (1994) and Mooney (1999) define morality policies as those dealing with first principles (i.e. fundamental beliefs of right and wrong), high salience, and low information costs”. Smith (2002, pp. 382, 385) states that “experts, elites, or a single group will have a limited ability to single handedly control what is and is not framed as a morality policy. Lawmakers, for example, are tightly constrained by public opinion in making decision on morality policy, especially when public opinion is divided”. Smith presents the following scheme that helps understand the classification of morality policies from non morality ones, based on the work of Lowi, Meier & Mooney and Tatalovich & Daynes.

### **Classifying Morality Policy**

<b>Source</b>	<b>Distinguishing characteristics</b>	<b>Relationship to Lowi typology</b>
Tatalovich and Daynes (1998)	<ul style="list-style-type: none"> <li>● Noneconomic values</li> <li>● Politicized by single issue groups</li> <li>● Federal judiciary primary decision maker</li> </ul>	Regulatory policy (immediate likelihood of coercion targeted at individual, “social regulatory policy”)
Meier (1994)/ Mooney (2000)	<ul style="list-style-type: none"> <li>● First principles</li> <li>● High salience</li> <li>● Low information costs</li> </ul>	Redistributive policy (immediate likelihood of coercion targeted at environment, “redistribution with an attitude”)
Lowi (1998)	<ul style="list-style-type: none"> <li>● Unwillingness to compromise</li> </ul>	Regulatory, redistributive, distinctive, and constituent policy (all policy types can be “mainstream” or “radical”)

*Sources:* Tatalovich & Daynes (1998); Meier (1994); Mooney (2000); Lowi (1998).

Figure I.5, Classifying Morality Policy (Smith, 2002, p. 383)

According to Smith (2002, p. 383) “each classification approach is useful, but none provides a universal guideline for deciding what is and what is not a morality policy”. Capano conveys that

“there is a plentiful selection of studies, whether the process of change should be considered: evolutionary or revolutionary, reversible or irreversible, linear or non-linear, contingent or partially determined, etc.” (Capano, 2007, p. 2). According to Capano “more than 20 theories of social and political science have been provided in various academic fields” (Capano, 2007, p. 3). But then he points out “the fifth ideal type” that he considers the most important ones presented in the following table.

**Ideal Types of Social and Political Development.**

	<b>Life Cycle</b>	<b>Evolution</b>	<b>Dialectic</b>	<b>Teleology</b>	<b>Chaos and Complexity Theory</b>
<b>Key Metaphor</b>	Organic Growth	Competitive Survival	Opposition Conflict	Purposeful cooperation	On the edge of Chaos
<b>Logic</b>	Prefigured sequence with compliant adaptation	Natural selection among competitors in a population	Contradictory forces	Envisioned end state Equifinality	Co-evolution of different part of the system
<b>Event Progression</b>	Linear	Recurrent, cumulative and probabilistic sequence of variation. Selection and retention events. Disconnected linearity	Recurrent, discontinuous unpredictable sequence of confrontation, conflict and synthesis between contradictory values and events	Recurrent, discontinuous unpredictable sequence of goal setting, implementation and adaptation of means to reach the desired end state. Disconnected linearity.	Uncertain, unpredictable, non-linear
<b>Drivers of Change</b>	Prefigured program/rule regulated by nature or institutions	Competition. Scarce sources, learning and imitation	Conflict and confrontation between opposing interest or vales	Goal enactment, consensus on means. Cooperation	Self-organized innovation: agency, Chance and contingency
<b>Speed of Change</b>	Not prefigured	Not prefigured	Not prefigured	Not prefigured	Not prefigured
<b>Scope of change</b>	Not prefigured	Not prefigured	Not prefigured	Not prefigured	Not prefigured
<b>Outcome of change</b>	Irreversible	Not prefigured	Not prefigured	Not prefigured	Not prefigured
<b>Independent variables</b>	Exogenous	Not prefigured	Endogenous	Not prefigured	Not prefigured

Figure I.7 Ideal Types of Social and Political Development. Source: (Capano, 2007, p. 4)

Science tries to explain and understand from different postures how public policies work; as Capano says “Change is the core business of all sciences, from biology and genetics to anthropology and sociology. The questions are: why, when, and how does change occur and what does such change really mean, then he adds, that trying to provide answers to such questions is the unending task of all involved in the field of scientific study” (Capano, 2007, p. 2). Capano complements that “this fifth ideal-typical classification can help enlighten the spectrum of epistemological and theoretical problems which have to be deal with , in order to interpret and explain social change and also policy change” (Capano, 2007, p. 4). Then Capano adds that “making an epistemological choice simply means deciding on the viewpoint to be taken when considering reality. Thus in order to study and explain policy change, certain epistemological problems must be resolved regarding:

1. The direction of development and change,
2. The dynamics of development, and
3. The generating force leading to change.

Capano considers the sequence of public policies, he classifies them as “Linear policy development, it means the presence of unitary, cumulative sequences of events that are strictly related to each other, and that follow a pre-designed program or project” (Capano, 2007, p. 5). In the other hand Capano defines “non-linear as that policy progression that does not follow a pre-established sequence and that there is not necessarily any causal link between steps or stages” (Capano, 2007, pp. 4-5). Then Capano states that “it is clear that this choice determines how reality is handled, and how events are linked to each other” (Capano, 2007, p. 6). In line with this Capano complements that the dynamics of policy development may be evolutionary or revolutionary, evolutionary is the gradual adaptation within the process, and revolutionary is characterized by a sudden radical change from the past.

Thus the question arises of: which drivers cause policies to change? Capano argues that “different theoretical frameworks for social and policy change combine different epistemological drivers” (Capano, 2007, p. 7). Some of them could be, from “the Advocacy Coalition Framework (ACF) perspective: the institutional rules, competition, conflict and learning, while the Punctuated Equilibrium Framework (PEF) brings together agency and contingency, imitation

and rules” (Capano, 2007, p. 7). Therefore there exist different drivers. According to Capano (2007, p. 8) the choices that need to be taken when studying policy change are:

- Definition of policy development: that means to clarify the object of the analysis.
- Type of change: to discover the degree of change.
- Outcome of change: Reversibility and irreversibility. Can a process and its outcomes be reversed?
- Level of abstraction: Decisions have to be made about the micro-macro problem and the structure-agency relationship.
- Explanatory variables.

Capano (2007, p. 13) adds that in order to deal with the explanatory variables, “there are five constitutive dimensions of public policies:

1. Public policies are arenas of power;
2. They are institutions;
3. They can be ideas and forums;
4. They are a matter of the influence of political matters;
5. They are sets of networked relationships, sometimes strongly institutionalized”.

Then he concludes that “public policies are a complex phenomenon in which institutionalized elements, formal rules, ideas, interests, and political institutions interact often through structured networks” (Capano, 2007, p. 13). Capano claims that the most important theoretical frameworks on which to focus public policies are:

- “Multiple Stream Approach (MPS) ,
- Punctuated Equilibrium Framework (PEF),
- Advocacy Coalition Framework (ACF), and finally
- Path Dependency Framework (PDF).

In the next table he summarizes the characteristics of these four frameworks mentioned above.

<b>Epistemological choices</b>	<i>MSA</i>	<i>PEF</i>	<i>ACF</i>	<i>PD</i>
<i>Linearity/non-linearity</i>	non-linearity (ambiguous and unpredictable)	Disconnected linearity (partially predictable)	Linearity (partially predictable)	non-linearity
<i>Dynamics of development</i>	Not prefigured but predominantly evolutionary	evolutionary (sequence slow/rapid changes)	Not prefigured	Disconnected evolution
<i>Drivers of change</i>	Partially constrained chance and entrepreneurship	External crisis, partisan change	External factors, partisan change, confrontation, learning	Increasing returns, History
<b>Theoretical choices</b>				
<i>Definition of policy development and change</i>	Particularly focused on agenda setting. No distinction among different types of policy change	Particularly focused on punctuations in agenda setting, in policy image construction, and in legislative behaviour	Covering the entire process. Tripartition of content of changes (based on a tripartition of policy beliefs)	Covering the entire process
<i>Type of change (incremental or radical)</i>	Not prefigured even incremental oriented	Structural link between both types	both	both
<i>The output of change</i>	Not prefigured	reversible	reversible	irreversible
<i>The level of abstraction</i>	Co-evolutive perspective	Macro	Linking macro, meso and micro levels	Co-evolutive perspective
<i>the structure-agency dilemma</i>	Structural prevalence but with room for individualistic strategic behaviour	Structural prevalence	Linking constantly structure and agency	Structural prevalence
<i>Relevant dimensions of policy</i>	Semi-chaotic mix of 3 dimensions (policy as arena of power, as ideational forum, and as target of political institutions' influence)	Involving all five dimensions but under the prevalent influence of political institutions	Focused on the interaction of three dimensions: policy as arena of power, as set of networks and as ideational forum	Prevalence of the institutional dimension
<i>The explaining variables</i>	Critical external events (technological change, electoral victory, systemic or international crisis) plus the eventual role of single individuals	Critical external events; institutional arrangements, Cycles of public attention. Dynamics of processing information	Critical external events, ideas and beliefs competition, learning.	Self-organized innovation, chance, contingency
<i>Causal mechanisms</i>	Random combinative causality mixing exogenous and endogenous variables, but the exogenous ones seem prevalent	Combinative causality with the prevalence of exogenous variables	Combinative causality- the composition of which depends on the type of change. Major changes are exogenously determined.	Combinative causality; historical paths; Critical junctures.

Figure I.8 Epistemological and theoretical choices in four frameworks of policy change. (Capano, 2007, p. 15)

Then Capano offers an explanation of these frameworks, and it could be summed up that MSA “defines public policy as the world of structural ambiguity, it is the closest of the four frameworks of the epistemological character of chaos and complexity theory. It gives significant importance to the role of change and individual behavior, change is unpredictable. It adopts a complexity and chaos perspective and non-linear, unpredictable perspective” (Capano, 2007, p. 16). The PEF “tries to preserve a mix of stability and radical change, it places importance in the institutional setting, institutions are conceived as strictly conservative and argues how the system influences the external sources” (Capano, 2007, p. 17). The Advocacy Coalition Framework (ACF) “is probably the most ambitious to explain policy development and change, it is a linear framework, its drivers are: competition, learning and imitation, and it assumes confrontation and conflict between different ideas and values” (Capano, 2007, p. 19). And finally the Path Dependency Framework (PDF) it depends on a path, and explains stability rather than change, “contrary to popular belief is non-linear therefore is unpredictable, it is irreversible and despite the fact that it focus on small changes it leaves little room for individual actors” (Capano, 2007, p. 20).

Capano finished his workshop by recommending scholars to

1. “Be more aware of the epistemological choices they make.
2. Policy is an ongoing phenomenon, and stability and change constantly co-exist.
3. The object of the analysis has to be clearly defined.
4. The kind of change has to be clearly defined.
5. Policies are composed of different several factors and they should be analyzed by the interdependency and mutual compatibilities.
6. Time and history do matter, among others.

Then Capano (2007, p. 21) concludes that “the study of policy development and change is a never-ending task. Policy scholars are required to borrow a variety of different theoretical and epistemological concepts and perspectives”.

As Freddy Martinez mentions “public policies are not merely a field of theories. But a practice that demands specific skills of those involved, thus it is necessary to know the purpose, problems and solutions as well as the construction and representation of arguments, precision of ideas,

collective learning through mutual criticism and how to fix conditions and know limitations of each actor regarding politics” (Navarro, 2011, p. 24).

But as Greenberg, Miller, Mohr and Vladeck (1977, p. 1533) point out “public policy as a focus of comparative analysis is more complex than such phenomena as electoral votes, legislative roll calls, incidents of political violence, and elite ideologies”. They elaborate and illustrate four counts, as follows:

1. The policy process takes place over time, sometimes over a long period of time, this leads to difficulty in explaining “the process” as a simple unit.
2. Any policy proposal or outcome is itself complex, it may have several important aspects, and this makes it extremely difficult to place in a single category.
3. Policy making is complicated by the presence of a large number of participants.
4. Public policy cannot be described by simple additive models. Forces interact; the impact of one depends upon the value of the other.

As a result, “public policy is almost never a single discrete, unitary phenomenon” (Greenberg, Miller, Mohr, & Vladek, 1977, p. 1533). They add that “many of the problems arising from the complexity of using policy as a unit of analysis can be illustrated by the word of Theodore Lowi. No single theoretical construct has been more important to the development of public policy studies than Lowi’s categorization scheme.” (Greenberg, Miller, Mohr, & Vladek, 1977, p. 1539). “The heart of Lowi’s argument is that policies determine politics” “Policy making consists of an ongoing process in which beginning and ending states are unclear, and in which both outputs and intentions are continually modified” (Greenberg, Miller, Mohr, & Vladek, 1977, p. 1534).

Addressing the problem of multiplicity of policy aspects, Greenberg, Miller, Mohr and Vladeck (1977, p. 1538) point out that “public policy is rarely the result of a binary decision, or even a chain of such decisions. The problem arises from complexity from the nature of policy making”. They cite author Lewis Freeman and his hypothesis that “homogeneous communities will adopt real policies, while heterogeneous communities will adopt segmental policies”. He defines “areal policies as those which affect the total population of a city simultaneously by a single action, and segmental policies as continuing policies which affect different people at different times in

separate sections of the city”. Lowi argues explicitly that “the perceptions of actors determine the category into which a given policy must be classified” (Greenberg, Miller, Mohr, & Vladek, 1977, p. 1539).

According to Kuhika Gupta (2012, p. 11), “Public policy scholars have stressed the importance and need for comparing since the 1970s –including comparing different policies, inputs, outputs, and outcomes across institutional settings.”

Gupta proposes a clear example by posing the question of: why similar countries, despite their common background have experience different scenarios? Applying the comparative method, a large group of comparative public policy scholars study divergent policy outcomes in different countries. According to Gupta they focus on two primary research questions: First “How are policies different across counties?” And Second “Why those policies are different” Gupta mentions how different researches choose to trace historical, economic and constitutional development in these countries among other important element to look at these scenarios. Gupta adds that researchers must look in to “factors such as public opinion, electoral institutions, party and interest groups inputs, as well as role of the bureaucracy.” She adds that scholars must attempt to “understand how and why different governments make the choices they do” (Gupta, 2012, p. 11).

Another method is by answering the “how” questions and leaving the “why” questions for another research. In budgetary matters, Gupta adds that some researches analyze if there is a consistent pattern between countries or whether it differs based on the political systems, either presidentialism or parliamentarism. She adds that “it is crucial to recognize the way in which path dependence and past ideological biases can affect issue construction” (Gupta, 2012, p. 11)

When it comes to comparing theories among each other, Gupta argues that “some policy scholars have begun questioning whether we have too many theories.” Gupta cites Meier (2009) and says that “not only should we study policy areas, but also seek out what those theories can teach us about policy adoption, policy implementation and policy impact. Doing so, will help determine which theories are better suited to answer which kinds of questions.” And Gupta gives the example of a question, “Which theory better explains nuclear energy policy in India, and why?... etc.”(Gupta, 2012, p. 11). Gupta acknowledges the existence of different competing theories of

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policy making among other: the advocacy coalition framework (ACF), multiple streams (MS), and the electoral frame-work. Gupta cites Ness (2010) and how he “explicitly compares the ability of each theory to answer the following questions: does policy change occur as the result of external events or policy-oriented learning that lead to a shift in the core beliefs of advocacy coalitions. Or, does the policy streams framework advance by kingdom (1995) better explain patterns in policy design? And Finally Ness continues with the EC framework advanced by Fenno (1978) and Mayhew (2004), which argues that policy results are due to the action of elected officials who are constantly seeking reelection” (Gupta, 2012, p. 11).

Gupta concludes that “the subfield of comparative public policy is booming thus recent comparative policy research includes comparisons of policies across institutional settings. Using policy theories to compare issues across contexts and comparing theories to each other. The use of the comparative method drives scholars to pose the question of why and how they are different. She calls for scholars “to look beyond their boundaries, borrowing from each other to promote theoretical development and contribute to close the gap between comparative politics and public policy and build new connections among them”. (Gupta, 2012, p. 11)

As it was mentioned above the policymaking process is in general very complex, including dozens of characters from government, interest groups, political institutions, the media, and the interested part of community who pose various goals, perceptions and policy preferences. Sabatier states that “[i]n any given policy domain there are normally dozens of programs involving multiple levels of government”. As a result of this complexity, “the analyst must find some way of simplifying the situation in order to have any chance of understanding it. This normally involves the development of a theoretical framework, which identifies the factors and relationships that are critical and the ones that should be ignored” (Sabatier, 1999, p. 11).

Therefore there are different theoretical approaches as it was mentioned above, to analyze and understand the process of public policy, the next part of the chapter moves towards the conclusion of the same one.

## V. Conclusions of the Chapter

In summary, the concept of public policy is generally defined as those set of actions adopted by governments. It included the importance of the State and its active role in providing solutions for social problems. A social contract exists between the State and its citizens and people place their trust in public institutions. Then it covered the importance of the role of politics, and the different arenas of power where public policies exist. A brief history of public policy was presented considering Laswell as one of the preeminent pioneers of the science of public policy. The process of public policies was presented from different perspectives of authors and stages but it was suggested that it is considered incorrect to state that the policy process pursues a clear and consistent pathway or route.

Public policies are appropriate where there is a social problem, the government bodies respond to public demands by designing and implementing policies through specific processes of policy making. Policies must be designed pursuing the principles of efficiency and effectiveness towards a sustainable inclusive development.

Continuing with the importance of public problem definition and how its process takes place. A public problem is that situation that needs public attention and government action. In order for an issue to be consider a public problem, the public must value it as it, thus public officials put attention and actions towards it.

Consequently it was disclose how crucial problem definition can be for developing specific solutions while implementing public policies. Not all problems can become public and not all public problems get a real solution that translates into right decisions. The severity of a conflict is strongly related with the size of the interests clinging on it.

Following that, the public agenda was mentioned. How it is integrated by public problems and how it can differ from the institutional or governmental agenda defined as that official list of matters that are included as government's actions. It was commented how public servants are accountable to public opinion, and how public interest should prevail regardless of private interests hence the inalienable right of people to be informed of public decisions. As well how different actors, either single or groups, can influence the process of setting up the agenda and

## CHAPTER I

how relations of power interacts among them. The drivers that cause policy to change were presented as those institutional rules, competitions, conflict and learning, among others.

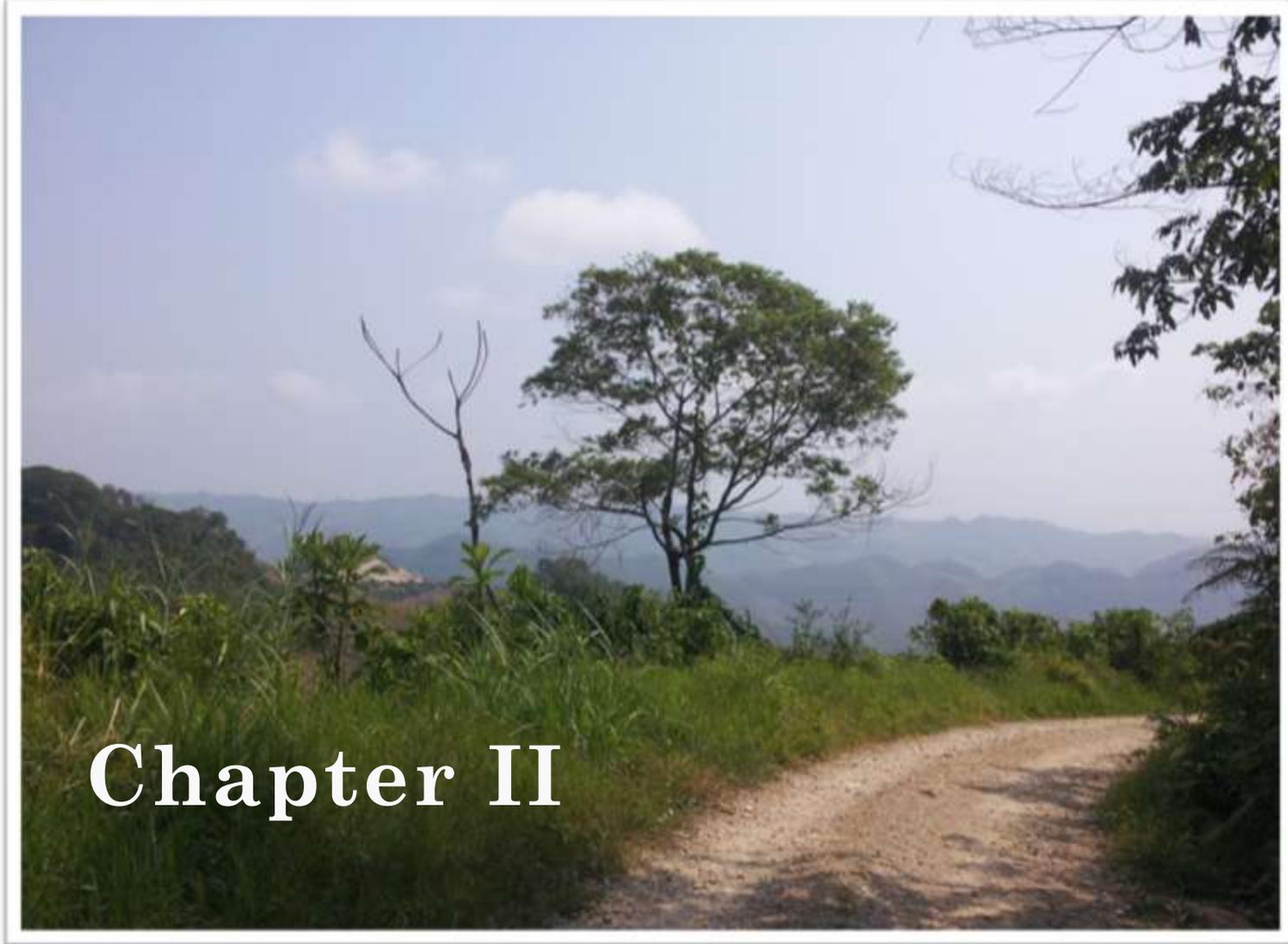
At the last part of the chapter, the different theoretical frameworks to analyze public policies were disclosed. Lowi's classification of policies was presented and how is anchored in two basic ideas, policy causes politics and the coercive power of government to force action to individuals. The classification of morality and non morality policies was presented and how scholars tend to define this approach to public policies.

It was added the importance and need for comparing public policies and why policies are different despite the same background of several countries.

Subsequently the work of Capano was presented, he mentions that there are more than twenty theories of political science that help understand the social and political development; but he considers that there are the five ideal types. Capano adds how there is a plentiful selection of studies, whether the process of policies change should be considered: evolutionary or revolutionary, linear or non-linear, contingent or partially determined.

This work thesis understands public policies as those set of actions taken by the government after the definition of a public problem. Within the third chapter the regime complex theory is mentioned. It will be used to explain the global scenario and the international efforts towards climate change and renewable energy. As well the third chapter will mention Jerome Dangerman's perspective on how energy policy is highly affected following crisis, specially thinking how this thesis concentrates after the 1970s oil crisis and other crisis such as the accidents in nuclear power plants.

It was concluded that public policies are a complex phenomenon that have different variables. And finally by cause of the complexity of public policy as an object of study, it is almost impossible to determine hard knowledge of the policy process as every case presents a different scenario. Finally it was concluded what Greenberg, Miller & Vladek (1977, pp. 1533, 1543) conclude that public policy is almost never a single discrete, unitary phenomenon.



## **Chapter II**

This second chapter will discuss the importance of energy in contemporary life. How it is classified and how its production is link to world phenomena such as climate change making it a challenge for human kind.

### **I. Energy History and its Importance**

Life on earth is in constant motion, humans move from one place to another, use different means to communicate, lead their life styles in different ways, and the constant element is the use of energy. Energy in diverse forms has an origin and a history; something or someone must generate that energy in order to deliver it to the final user.

Energy is defined “as the ability to perform a job”, another definition is “the power to act” (Newton, Energy, 2004). Energy is commonly defined as the “capacity to do work”, since work is defined as the movement of an object through a distance, energy can also be described as the ability to move an object through a distance” (Newton, 2004). Energy is present in several forms, including: (1) mechanical, (2) heat, (3) electrical, (4) magnetic, (5) sound, (6) chemical, and (7) nuclear. Although these forms appear to be very different from each other, “they have much in common and can generally be transformed into one another” (Newton, 2004). Over time, a number of different units have been used to measure energy. In the metric system, “the fundamental unit of energy is the joule (abbreviation: J), named after the English scientist James Prescott Joule (1818-1889). A joule is the amount of energy that can move a weight of one newton a distance of one meter. Although energy can never be created or destroyed, it can only be transformed into new forms” (Newton, 2004).

Energy sources are divided into two types: renewable and nonrenewable. Renewable sources include (1) solar, (2) wind, (3) geothermal, (4) hydropower, and (5) biomass; these are also referred to as alternative energy sources. Nonrenewable sources are (1) oil, (2) natural gas and (3) coal. For purpose of this discussion “nuclear” will be treated as a special case as a result that according to Carol Marshall diverse scientists make allusion of nuclear power as a third, separate category (Marshall, 2001, p. Web). These diverse forms of energy were discovered and develop by the work of many particularly after the beginning of the industrial revolution.

## **II. A Brief of History**

Actually, energy has always been present; all living beings naturally develop chemical processes to generate the energy needed to survive. For instance humans take energy from food; “for thousands of years, people relied solely on the chemical (caloric) energy that produced the kinetic energy of working muscles” (Williams, 2006, p. 2). Previous to the industrial revolution, energy needs were restrained, for instance for heating purposes people relied on the sun or fire, for transportation they would ride horses or other animals; the power of the wind was used to sail boats, etc. Consequently after the start of the industrial revolution, modern men developed a lifestyle that created great development in many areas. Countries developed with distinct scenarios, some became global powers with large production systems and infrastructures. As the population of the world enlarged, the need to produce goods and services increased accordingly with this growth and the demand for natural sources expanded, in some cases leading to pollution and scarcity.

During the epoch of the Industrial Revolution, there were improvements where the role of the use of energy was significantly present. As James C. William states “new technologies were developed such as the steam-power engine or machinery that used water or wind to generate energy capable of performing and facilitating processes. Thus with the help of human intellect, a system was put in place to facilitate human life, where most of the objects used today, for instance: transportation, appliances, or different technologies require energy to operate. Therefore energy plays a fundamental role in shaping human condition.” (Williams, 2006, p. 1). The use of energy is essential to modern life, James C. William asserts that “it is argued that energy is the key to the advance of civilization” (Williams, 2006, p. 1). That is the reason why energy issues are or should be of great importance to any institution, organization or nation. Nowadays most goods and services are produced or transformed by means of energy from production to the final point of sale. In addition there is a fundamental subject that is also of great importance, the use and disposal of natural resources on the planet, as well as the environmental impact created by the production of energy.

Historically most societies focused on the use of fossil organic fuels such as wood or coal for heating, lighting, cooking, or simply surviving. According to James C. William human existence is tied to the necessity for energy thus an important fact is that “economic and technological

## CHAPTER II

development is linked with shifts in sources of energy” (Williams, 2006, p. 1). The next table shows the evolution of energy sources in humankind during the last centuries.

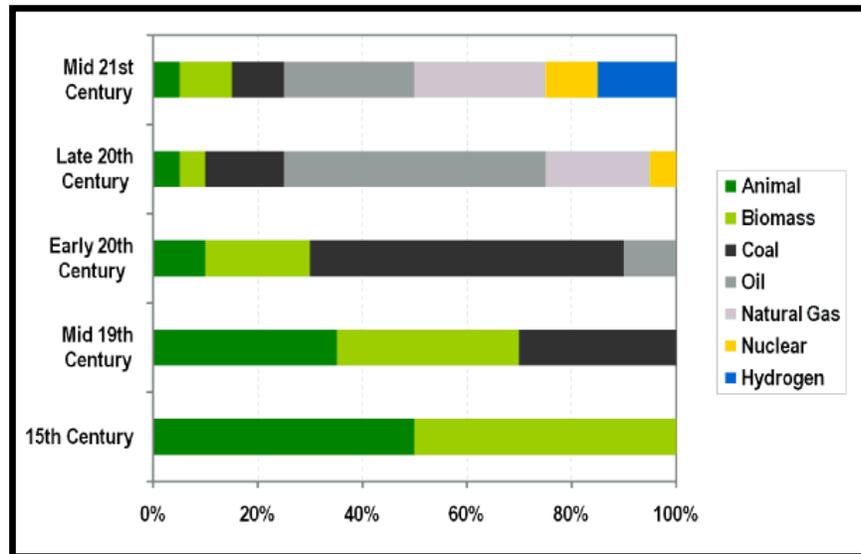


Figure II.1, source: *Table. Evolution of Energy Sources. (Rodrigue, 2013)*

According to the table, from the beginning of history up to the industrial revolution "mankind's use of energy relied only on animal, muscular and biomass sources; the tendency has been the adoption of sources that have higher energy content. By the mid-19<sup>th</sup> century, the industrial revolution brought a major shift in energy sources with the usage of coal; as the 20<sup>th</sup> century began the major reliance was on coal but then later the age of petroleum began, this major shift inaugurated the era of the internal combustion engine” (Rodrigue, 2013). In the late 20<sup>th</sup> century, petroleum was the main provider for energy needs in the world as well as nuclear power and other forms of renewable energy were developed. In the last decades it is important to note the influence of globalization within this topic, this phenomena knows no borders; that is why either world achievements or challenges do have an impact on a global basis, and deserve to be treated as global issues.

Moving on, electricity is a type of energy, According to James William, Thomas Edison played an important part in its development. “Edison's innovative approach to invention propelled the development of the electric light plus the generation and distribution system to make it work. In the 1880s, his incandescent lamp made possible widespread, reliable, commercial indoor lighting, and his generating system in Manhattan became the archetype for electric power generation and distribution. Edison's direct current power system became the initial standard for

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distributed electricity. Unfortunately, it could not be easily transmitted over long distances which Nicola Tesla's Alternative Current power system achieved." (Williams, 2006, p. 4). To understand how electricity works, one has to relate it to the atom. "Atoms are minute particles that make up everything in the universe. In the center of each atom there is a nucleus where electrons are circling. All the effects of electricity take place because of the electron. Hence electricity is made when electrons move from one atom to another" (Richardson, 2006, pág. 4). It is difficult to imagine the world without electricity, it influences life in several ways as a result it powers most of the devices needed on a daily basis.

After all, in the contemporary world it is clear that the use of electricity is essential, because of several reasons, it allows people to transport easier and faster, it improves the quality of life and standards of living, it facilitates people's lives and humans are so used to it now, making it almost impossible for humans to not depend on it. According to the International Energy Annual 2004 (Energy Information Administration, 2005, <http://www.eia.doe.gov/iea/elec.html>), "total world electricity consumption increased from 9 trillion kilowatt-hours in 1986 to 14.8 trillion kilowatt-hours in 2003. North America, Central America, and South America consumed 5.2 trillion kilowatt-hours, or 35% of the total; Asia and Oceania used 4.4 trillion kilowatt-hours (30%); Europe, 3.1 trillion (about 21%); and Eurasia, 1.2 trillion (7.9%). The Middle East and Africa each consumed about 3% of the world's electricity. (Alters, 2007)

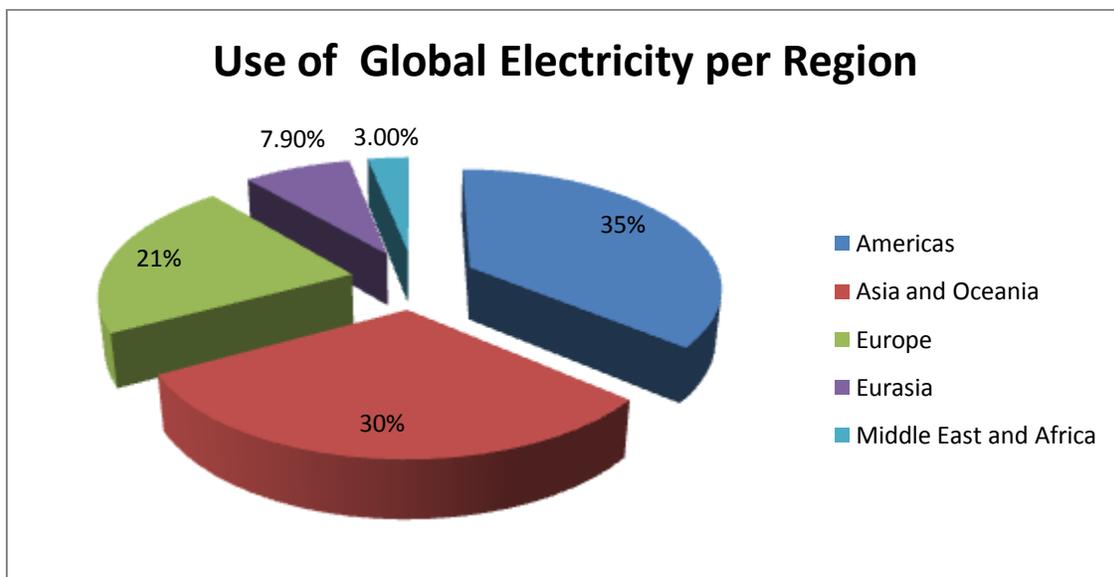


Figure II.2, source: Table, Self-made- with data from (Alters, Electricity, 2007).

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Electricity is practically everywhere in the modern world but an interesting fact is that even though electricity was started to be used more than 100 years ago, nowadays “worldwide, some 2 billion people are currently without it” (Student Sustainability Education, 2013, p. 1). The dilemma is the scarcity of energy resources, “they are not consistently distributed throughout the world, and they are often found at considerable distances from where their utilization is most desirable. As a result the location where energy resources are found is often a barrier to their use.” (Hamilton, 2013, p. 4).

### **III. Nonrenewable Pollutant Fossil Fuels**

As mentioned earlier, all energy production comes from somewhere and by different means. Anything that provides energy is called an energy source. Nonrenewable sources are those that are scarce and limited; and most of them are pollutant as well. “Fossil fuels are important for the production of electricity. Most power plants have generators that create electricity, which is then sent out through the wires and poles that distribute it to consumers. Some kind of fuel has to power those generators. Most power plants burn fossil fuels for this purpose.” (Schlager & Weisblatt., 2006, p. 7).

Power plants produce electricity day and night, all year long, “most of these plants burn coal, oil, or natural gas to boil water, because it creates a steam that turns a turbine that is connected to a generator that consequently creates electricity” (Richardson, 2006, pág. 8). Hence coal, oil and natural gas are considered fossil fuels. They are considered nonrenewable therefore eventually they will be exhausted and humans will not be able to create more of them. Also, the use of fossil fuels releases fumes (greenhouse gases) into the environment, which causes pollution (Ballard, 2008, págs. 5-7). According to the International Energy Agency (IEA) in 2010 most electricity generation was currently largely based on fossil fuels in many parts of the world. (International Energy Agency, 2010, p. 113). In the year 2006, “Nearly 90 percent of the world's energy came from fossil fuels. Humans use these fuels to meet nearly all of their energy needs, such as powering cars, producing electricity for light and heat, and running factories” (Schlager & Weisblatt., 2006, p. 2) among other things.

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### i. Coal

Coal is considered a nonrenewable fossil fuel. It has been used for centuries for heating and energy purposes. According to Alberta Energy, even though coal is present in most parts of the planet, it was not used widely for fuel until the epoch of the Industrial Revolution. “Coal is formed from the remains of land-based plants buried hundreds of millions of years ago and subjected to long periods of heat and pressure” (Alberta Energy, 2010, pp. 1-2). Coal can be processed to create various products, from carbon filters to pharmaceuticals. Nowadays, “coal remains an enormously important fuel because it generates the largest single source of electricity worldwide, it helps produce over 70 per cent of the world's steel, and is used by other industrial processes like cement manufacturing” (Alberta Energy, 2010, pp. 1-2).

According to Schaler & Weisblatt (2006, p. 39) coal supplies about one-fourth of the world's energy needs. Thus coal is a nonrenewable resource, meaning that “it was formed at times during Earth's history, but significant amounts are no longer forming. Therefore, the amount of coal that now exists below the earth's surface is, for all practical purposes, all the coal that humans have available to them for the foreseeable future. When this supply of coal is used up, humans will find it necessary to find some other substitute to meet their energy needs” (Lerner & Lerner, 2003, págs. 118, 119).

According to Lerner and Lerner, huge supplies of coal are known to exist (proven reserves) or thought to be available (estimated resources) in North America, the former Soviet Union, and parts of Asia, especially China and India. Thus according to a report in 2003, “China produces the largest amount of coal each year, about 22% of the world's total. China is also thought to have the world's largest estimated resources of coal, as much as 46% of all that exists (Lerner & Lerner, 2003, págs. 118, 119). It is important to emphasize that the largest single consumer of coal as a fuel is the electrical power industry.

### ii. Petroleum

Petroleum is considered another nonrenewable source of energy to produce electricity. According to Schlager & Weisblatt (2006, p. 21) it is the most widely used fossil fuel, supplying about 40 percent of the world's energy. Petroleum is also called oil. The most important uses of petroleum are to fuel automobiles. It is also used to pave roads, to make other chemicals, or even

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to moisturize skin. Therefore “It is known as the most flexible fuel resource available. Oil is in almost everything that humans use in their daily activities” (Falola & Genova, 2005).

Many geologists believe that petroleum, or oil “comes from the breakdown of plants and animals by some unknown process. Others think that living things had nothing to do with its formations. Regardless of its origin, the mining of this so called black gold has become the most lucrative and important industry in the world” (Falola & Genova, 2005, p. 4)

According to Yergin, “George Bissell” has been called the person most responsible for creating the modern oil industry (Yergin 1992). “Bissell realized in 1854 that rock oil could be used in lighting and cooking” (Fanchi, 2005). Falola & Genova (2005, p. 7) explain that the two principle elements that make up crude oil are hydrogen and carbon, which is why the term hydrocarbon is often used in references to crude oil. According to Francisco Parra the oil industry expanded quickly after the Second World War, largely because of the discoveries of oil reserves in Venezuela and diverse countries in the Middle East, by various US and European Companies (Parra, 2005, p. 6). Nowadays oil is still widely use and its availability as well as prices have influenced conflicts and challenges around the Globe. According to Schlager and Weisblatt (2006) there is a limited supply of petroleum on Earth. “Some experts believe that oil production will peak by 2020 and that current oil reserves will run out by 2050, if not earlier. Other experts disagree, believing that there are enough oil reserves to provide for the world's energy needs throughout the twenty-first century. Many areas in the Middle East and Russia are still unexplored. Oil companies can now drill in much deeper parts of the ocean than they previously could; oil rigs in the Gulf of Mexico now drill into wells below 3,000 meters of water.” (Schlager & Weisblatt., 2006, p. 29).

### iii. Natural Gas

Natural gas is considered another nonrenewable energy source to produce electricity around the globe. “Along with coal and petroleum, natural gas is one of main fossil fuels in use in the early twenty-first century. People use natural gas for heating, electrical power, and other purposes. Natural gas produces much less pollution than petroleum, so some people believe it could be an ideal substitute for petroleum and coal in the future. Natural gas is a gaseous hydrocarbon. It is colorless, odorless, and lighter than air. Natural gas is made up of 75 % methane, 15 % ethane,

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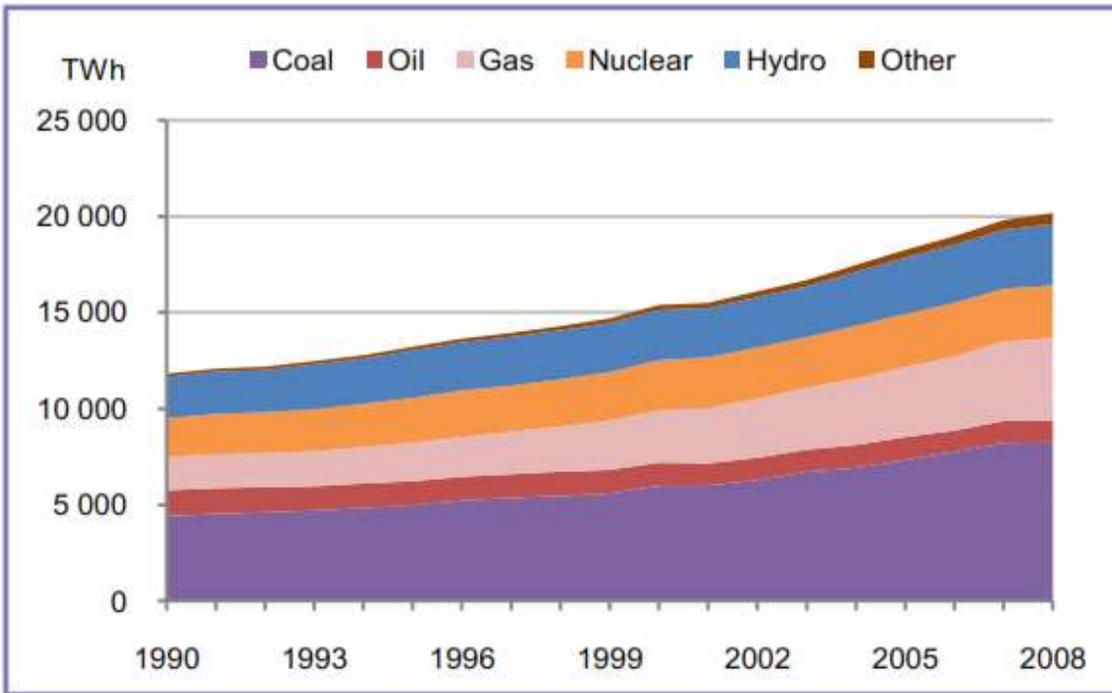
and small amounts of other hydrocarbons such as propane and butane” (Schlager & Weisblatt., 2006, p. 31). According to Schlager and Weisblatt an interesting fact is that natural gas is usually found with petroleum. Thus experts think there is plenty of natural gas to meet human’s demand for the next two hundred years, though much of this gas may be hard to reach. “When people first began drilling for oil, they believed natural gas was an unpleasant by-product. They would burn the natural gas away before removing the oil from the ground. Now companies know that natural gas is a valuable commodity and they extract it carefully. The process of drilling for natural gas is similar to that of drilling for petroleum. In many cases natural gas comes out of wells that have already been dug to extract oil” (Schlager & Weisblatt., 2006, p. 32)

As other common power plants “natural gas plants use turbines to spin generators. The turbines are connected to pipelines that provide a constant supply of natural gas. Some plants use the natural gas to power the generator directly. Others methods use natural gas to create steam, which spins the generator” (Weisblatt, 2006, p. 9). According to the IEA (2010) natural gas-fired power generation has been the preferred power generating technology over the past two decades in many countries. The report adds, “natural gas has shown higher efficiencies, lower capital costs, shorter construction times and lower CO<sub>2</sub> emissions, it potentially offers a number of advantages over coal-fired power generation” (International Energy Agency, 2010, p. 116).

Therefore nowadays “scientists are especially interested in technologies that combine natural gas with other fossil fuels to increase efficiency and reduce emissions. Hence natural gas is seen as a good source of fuel for the future, and as a result scientists are constantly inventing new ways to use it.” (Schlager & Weisblatt., 2006, p. 36).

According to the next graph the world electricity supply is presented by sector:

### Generation mix in power sector



Source: IEA, 2010.

Notes: Coal includes peat. Other includes geothermal, solar, wind, biofuels and waste, etc.

- Largest source of supply (2008) 40.9% (Coal)
- Fastest growth over the last decade 165.4% (Other)
- Slowest growth over the last decade -12.5% (Oil)
- Growth (annual rate):
 

1998-2008	3.5%
1990-1998	2.4%

Figure II.3 Source: *Supply*. (IEA, 2011, p. 64)

#### **IV. Fossils fuels and its Link to Pollution that Leads to Climate Change**

There is a major link between the production of electricity and the pollution it causes that leads to climate change among other risk factors. Hence “It is due to the emission of carbon and other gases into the atmosphere, that results from energy produced through burning fossil fuels” (Pollin, 2008, pág. 97). Schlager & Weisblatt (2006) indicate that “fossil fuels cause or contribute to environmental problems such as the following:

- Air pollution.
- Damage to the landscape.
- Water pollution.
- Oil spills.
- Radioactivity (Coal contains the radioactive elements uranium and thorium, and most coal-fired plants emit more radiation than a nuclear power plant.)” (Schlager & Weisblatt., 2006, p. 12).

Thus coal is not environmentally friendly. Schlager and Weisblatt argue that “coal produces large amounts of pollution, which contribute to acid rain and global warming. The difficulty with burning coal is that it rarely produces only carbon dioxide, water, and energy. If the temperature is not high enough or if not enough oxygen is available to keep the fire burning high, the coal is not completely burned. As result coal releases other substances into the air, these substances include:

- Carbon monoxide, which is toxic to humans and animals.
- Soot, which is pure carbon dust and can turn buildings, trees, and animals black.
- Sulfur dioxide, sulfur trioxide, and nitrogen oxides, which become part of acid rain.
- Lead, arsenic, barium, and other dangerous compounds that are in coal ash, which can float in the air or stay where the coal was burned and cause people to become ill”. (Schlager & Weisblatt., 2006, p. 12).

Petroleum is a pollutant fossil fuel as well, according to Schlager and Weisblatt using it as fuel either to generate electricity or to power vehicles contributes to environmental problems. These include:

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- Oil spills, which typically happen during the transportation of petroleum; the destruction done by drilling for oil; contamination from oil wells and pipelines.
- Air pollution
- Drilling for oil, for instance, requires massive pieces of equipment and results in giant holes in the ground. Contamination happens when oil seeps into local soil and water.
- The people who live near oil wells and refineries sometimes suffer health problems as a result of exposure to petroleum” (Schlager & Weisblatt., 2006, p. 29).

On the other hand, natural gas is the cleanest fossil fuel. Schlager & Weisblatt (2006) add that “the burning of natural gas releases no ash and produces:

- Low levels of carbon dioxide.
- Carbon monoxide.
- Other hydrocarbons and very small amounts of sulfur dioxide and nitrogen oxides.” (Schlager & Weisblatt., 2006, p. 29).

Schlager & Weisblatt conclude that natural gas is gradually more common as a fuel for electrical power plants and in industry. “Electrical power plants fueled by natural gas produce far fewer emissions than coal-powered plants. Burning natural gas does not contribute significantly to the formation of smog. Natural gas does contribute to some environmental problems. Burning natural gas emits carbon dioxide, which is considered a greenhouse gas that contributes to global warming. On the other hand, natural gas produces 30 percent less carbon dioxide than burning petroleum and 45 percent less carbon dioxide than burning coal, so it is still preferable to either of those. Using natural gas instead of other fossil fuels could reduce acid rain and particulate emissions. As people become concerned about emissions and fuel economy, they may want vehicles powered by natural gas. Thus natural gas has advantages over petroleum and coal. It burns cleanly, producing no by-products except for carbon dioxide and water, so it does not cause the same degree of air pollution as the other fossil fuels. It does not produce the sludge that results from coal-burning emissions.” (Schlager & Weisblatt., 2006, p. 37). All things considered the burning of fossil fuels to produce energy, including electricity leads to environmental problems, “energy use is central to many economic and environmental problems, particularly global warming.” (Barker, Ekins, & Jonstone, 1995, p. 1).

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Worldwide there are serious problems of polluted water, poor air quality, and deforestation, these lead to health problems and serious world challenges; such as an enhanced greenhouse effect that creates global warming and as a result climate change. It is obvious that it is a global problem and therefore should be taken as a serious public concern.

In regards to human health, “many fossil fuel byproducts can be harmful to humans: breathing toxic hydrocarbons, nitrogen oxides, and particulate matter can cause ailments such as chest pain, coughing, asthma, chronic bronchitis, decreased lung function, and cancer, and exposure to mercury can lead to nerve damage, birth defects, learning disabilities, and even death. Some experts believe the environmental problems are so serious that people need to find alternatives to fossil fuels even before all reserves are used up. Others believe that technological improvements will allow the use of fossil fuels for many years to come.” (Schlager & Weisblatt., 2006, p. 12).

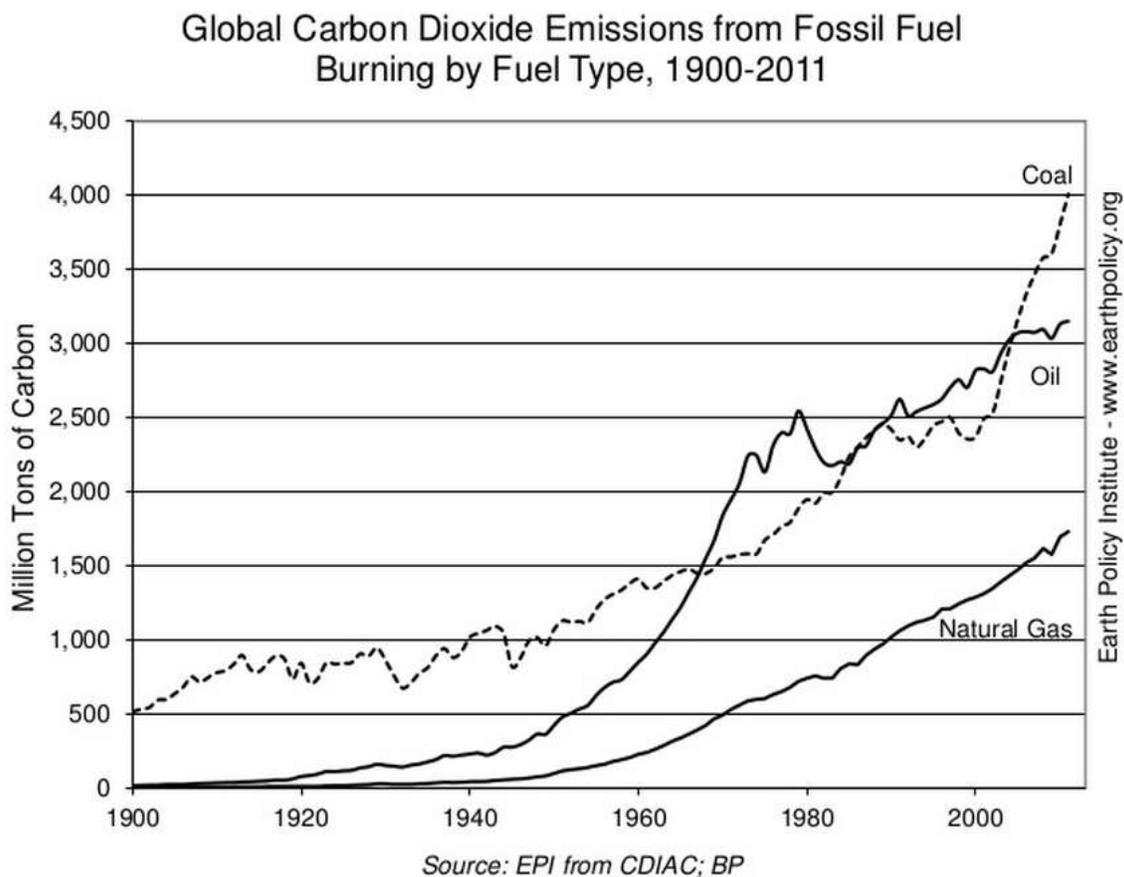


Figure II.4 Source: *Global Carbon Dioxide by Fuel Type* (Earth Policy Institute, 2012, p. 35)

According to the graph it is clear that there is no question that the earth is changing due to human activity; emission of greenhouse gases have altered the atmosphere and have modify climate through global warming. Moreover, with deforestation, desertification, soil erosion, and loss of biological diversity, the planet is under a threat that could lead to its inability to sustain life as usual. Thus there are three main effects that the World is facing and they are interlinked.

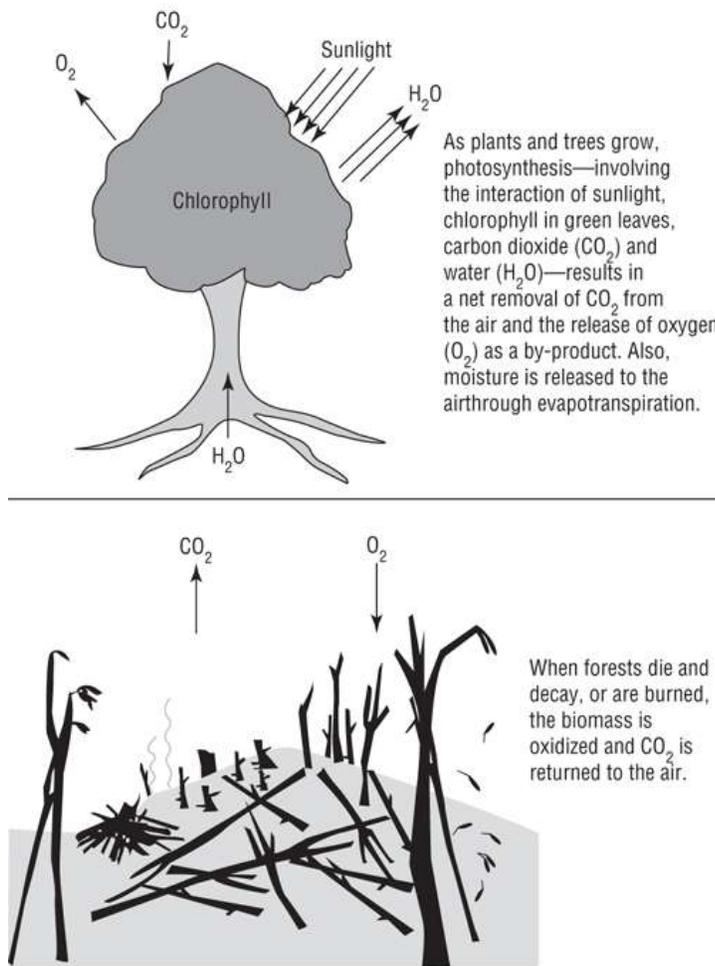
### **V. Climate Change**

In recent decades, environmental problems have become common to public knowledge. Technological advances allow people to be aware of what is happening in the current world. New discoveries allow scientist to develop new knowledge of these global challenges. “Climate and weather is not the same thing. Both describe conditions in the lower atmosphere—for example, wet or dry, cold or warm, stormy or fair, and cloudy or clear. Weather is the short-term local state of the atmosphere. Weather conditions can change from moment to moment and can differ in two places that are relatively close together” (Evans, 2010). Furthermore climate is defined as “the long-term conditions or average weather for a region” (Arthur & Lerner, 2005, p. 304).

In addition, climate change refers to a “change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity” (IPCC XXVII, 2007, p. 30). Although in the United Nations Framework Convention on Climate Change (UNFCCC), climate change refers to a “change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods” (IPCC XXVII, 2007, p. 30). In brief, “global climate change refers to the ways in which average planetary weather patterns alter over time” (Frodeman, 2005, p. 870). Scientists around the world have been studying climate change since the 1970s (NASA, 2013). The IPCC reports that “observations of the climate system are based on direct measurements and remote sensing from satellites and other platforms” (IPCC, 2013). The report adds that “Global-scale observations from the instrumental era began in the mid-19th century for temperature and other variables, with more comprehensive and diverse sets of observations available for the period 1950

onwards” (IPCC, 2013). There is no doubt that modern climate change is dominated by human influence. According to several experts, the main source of global climate change is due to changes in atmospheric composition, mainly from carbon dioxide.

**The effect of forests on carbon dioxide concentrations**



SOURCE: “Figure 2a,” and “Figure 2b,” in *Biosphere, NASA Facts*, National Aeronautics and Space Administration, Goddard Space Flight Center, April 1998

Another impact of climate change is the one caused on the ground surface, by the effects of desertification or deforestation - defined as “the longer-term conversion of forest to some other kind of ecosystem, such as agricultural or urbanized land” (Freedman, *Deforestation*, 2004, pág. 1169), - has shown evidence that there is influence on regional climate change” (Karl & E.Trenberth, 2003, p. 1720). Because the “earth’s vegetation releases and absorbs over 200 billion metric tons of carbon dioxide each year. The burning of fossil fuels adds an extra 7 billion metric tons per year. In the past 200 years, the concentration of carbon dioxide in the atmosphere has risen by over 30 percent”. Deforestation has also played a role in this increase, eliminating forests that would otherwise absorb tons of carbon dioxide.

Figure II.5, source: (The Enhanced Greenhouse Effect and Global Warming., 2010)

The impacts of climate change could be very diverse. “Some regions would warm while others would cool down. Precipitation patterns would change, and extreme events (e.g., droughts and hurricanes) would become more frequent. While this much is clear, it is extremely difficult to say how particular regions would be affected. The predictions generally agree about the global

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effects of climate change but disagree to a great extent about its regional effects” (Jamieson, 2004, pp. 428, 429). According to Dale Jamieson “impacts of climate change fall into three categories:

- First-order impacts: involve physical changes such as rises in sea level, effects on biological systems and circulation of water and so on. A large number of species will become extinct and many ecosystems will fracture and disintegrate. Some of the most dramatic first-order effects of a global warming would be the inundation of island nations, such as the Maldives, Kiribati (Gilbert Islands), and the Marshall Islands. Egypt could lose 1 percent of its land due to flooding.
- Second-order impacts: involve the direct social, economic, and health effects of first-order impacts. An example would be the economic, social, and cultural consequences of Egypt's loss of 1 percent of its land. The part of Egypt that would be threatened by a sea-level rise is the Nile delta, home to 48 million people and contributor of 15 percent of Egypt's GNP.
- Third-order impacts of climate change involve: the indirect social and political responses to the first- and second-order effects. Third-order impacts might include massive emigration from affected regions such as the Nile delta, and international conflicts resulting from economic dislocations and changing patterns of resource use” (Jamieson, 2004, p. 429).

An important impact of climate change is on human health. In particular, “there is concern that infectious diseases such as malaria and dengue fever will become more prevalent, along with water-borne diseases such as cholera. Infectious diseases are currently the largest source of mortality in the developing world, and until sometime in the twentieth century they were also the largest killer in most of the developed world. Increases in the prevalence of infectious disease could have devastating effects on the human population.” (Jamieson, 2004, p. 429). Overall continued climate change is expected to have major impacts on ecosystems. “These may include habitat loss, shifts in vegetation zones, altered ocean chemistry, increased vulnerability to forest fire, infestation of pests and invasive species, and risk to established agricultural productivity” (Serreze, 2009, pág. 11). Consequently climate change can have several consequences on contemporary life.

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So a question arises, how do scientist get to know about these changes, According to Karl & Trenberth “the primary tools for predicting future climate are global climate models, which are fully coupled, mathematical, computer-based models of the physics, chemistry, and biology of the atmosphere land surface, oceans and cryosphere and their interactions with each other and with the sun and other influences such as volcanic eruptions. There is a need to improve models to a point where they are more reliable, global climate models need to better integrate the biological, chemical and physical components of the Earth system.” (Karl & E.Trenberth, 2003, pp. 1721,1722).

To this end in 2007 the Intergovernmental Panel on Climate Change (IPCC) released its Fourth Assessment Report. Previous assessments (1990, 1995, 2001) “had provided strong indications that by various measures the Earth's climate was becoming warmer, but with the latest report the picture had become clearer: “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” (Streicker, 2013, p. 1) The IPCC was established in 1988 by the United Nations in recognition of the potential importance of climate change. “The IPCC is charged with reviewing comprehensive scientific climate-change studies and providing an objective understanding of climate change, its potential impacts, and options for adaptation and mitigation. Hundreds of climatologists, meteorologists, and other scientists from around the world are involved in the preparation of IPCC reports as authors, contributors, and expert reviewers.” (Streicker, 2013, p. 1). Thus in brief, “climate change is an inevitable and urgent global challenge with long-term implications for the sustainable development of all countries”. (United Nations, 2012).

A report from the National Oceanic and Atmospheric Administration (NOAA, 2009) link to the Department of Commerce in the U.S. poses 10 indicators that summarize scientific evidence that Climate Change is occurring and these are:

1. Less heat escaping to Space
2. Shrinking Thermosphere
3. Rising Tropopause
4. Cooling Stratosphere
5. Less oxygen in the air
6. More fossil fuel carbon in the air

7. 30 billion tons of CO<sub>2</sub> per year
8. More heat returning to Earth
9. Nights warming faster than days
10. More fossil fuel carbon in coral

In the next schematic framework, it shows the climate change drivers, its impacts and responses:

**Schematic framework of climate change drivers, impacts and responses**



Figure II.6, source: Schematic Framework of Climate Change (IPCC XXVII, 2007, p. 26)

## VI. Global Warming

According to several experts it is normal that the temperature of earth changes during time, however “global warming is the most obvious manifestation of climate change and refers to a warming of the Earth, outside of the range of normal fluctuations that have occurred throughout Earth's history” (Arthur & Lerner, 2005, p. 304) Some define “global warming as a long-term increase in the Earth's surface temperature that results in large-scale changes in global climate” (Freedman & Duncan, 2004, p. 1831). According to the IPCC report in 2007 “widespread changes in extreme temperatures have been observed over the last 50 years” (IPCC, 2007, p. 8) thus hot days and heat waves have become more frequent. Thus the problem arises because “the

## CHAPTER II

predicted climatic and biological changes associated with anthropogenic global warming could have potentially disastrous outcomes for the Earth's human population. Most scientists, and many international policy-makers, now consider global warming to be a credible threat to the Earth's natural environment and human population. However, because the specific consequences of global warming are difficult to predict, and in some cases unknown, the scientific community remains divided about the potential effects of the phenomenon.” (Freedman & Duncan, 2004, p. 1832). Therefore nowadays “most scientists believe that the use of fossil fuels has changed the world's climate, and that this change is continuing. Burning fossil fuels releases gases called greenhouse gases (GHG), which include carbon dioxide, methane, and nitrous oxide. GHG are good at trapping heat. When the sun's radiation hits Earth, some of the heat is reflected back into space. When GHG get into the atmosphere, they act like the walls of a greenhouse, holding the heat in so that it cannot escape back to space. Ordinarily, this would be a good thing, because life on Earth depends on keeping some of the sun's heat on the surface” (Schlager & Weisblatt., 2006, pp. 16, 18).

According to several experts after the industrial revolution the amount of greenhouse gases in the atmosphere increased. “The amount of carbon dioxide has increased 30 percent; the amount of methane has increased 100 percent; and the amount of nitrous oxide has risen 15 percent. These gases make the atmosphere better at keeping in heat. As a result, Earth's temperature has risen and continues to rise. The increase in global temperatures can cause many problems. A possible effect is a rise in sea levels, which can change the shape of coastlines; cause changes in forests, crops,

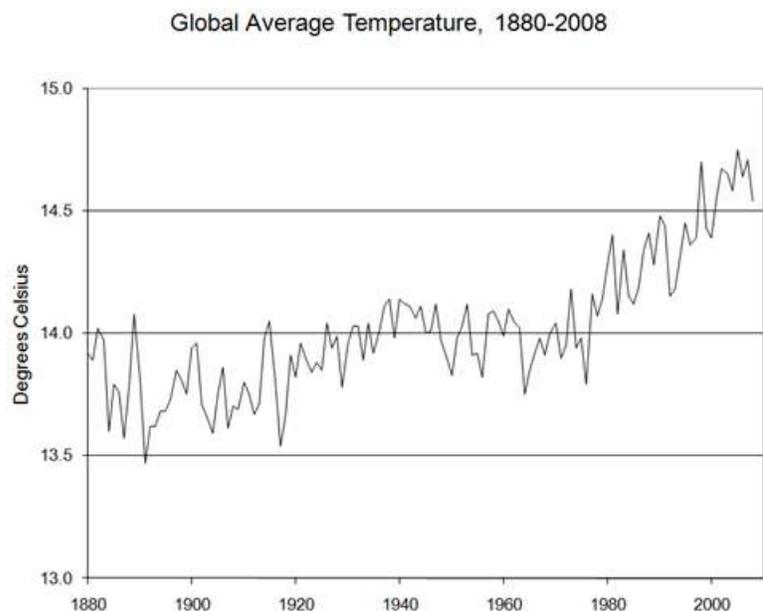


Figure II.7, source (NASA, 2008)

and water supplies; and harm the health of humans and animals. Fossil fuels account for 98 percent of carbon dioxide emissions, 24 percent of methane emissions, and 18 percent of nitrous oxide emissions” (Schlager & Weisblatt., 2006, pp. 16, 18).

Additionally Paul Arthur & Lee Lerner (2005) argue that “the fact that increased levels of greenhouse gases have occurred at the same time as recent increases in global temperature has generally strengthened arguments predicting increased global warming over the next few centuries. In 2001, the United Nations Intergovernmental Panel on Climate Change (IPCC) asserted that human activity was responsible for much of the recent climate change resulting in global warming. In the opposite, some scientists remain skeptical because the Earth has not actually responded as expected. For example, “some estimates based upon the rate of change of greenhouse gases predicted a global warming of (0.44°C to 1.39°C) over the last century. However, the actual increase—if measured at 0.5°C) is significantly less. Moreover, this amount of global warming may be within the natural variation of global temperatures. Most scientists agree, however, that an enhanced greenhouse effect will result in some degree of global warming.” (Arthur & Lerner, 2005, pp. 409, 410).

According to Barker, Ekins & Jonstone (1995) “the effects of global warming are far more uncertain than the warming itself. However, a relatively modest average warming of the earth’s surface is likely to include important effects on the environment and humanity”. Barker, Ekins & Jonstone summarize the perspectives of three economists who have made a detailed study of the consequences of the greenhouse effect and have come to the following conclusions:

- “Schelling (1992) says that natural ecosystem will be destroyed; plant and animal species will become extinct; places of natural beauty will be degraded.
- Cline (1992) says that global warming could cause agricultural losses in many regions. The level of the seas would rise, imposing costs of barrier protection of coastal cities and the loss of land area. There would be increased electricity needs for air conditioning, potentially serious declines in availability of water to agriculture and cities, increased urban pollution, increased intensity and frequency of hurricanes, increased mortality from heat waves.

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- Broome (1992) says that the danger will be amplified if storms become more frequent or more severe. The force migration of many people is inevitably a disaster. Tropical diseases will increase; this will shorten many people's lives" (Barker, Ekins, & Jonstone, 1995, p. 3).

On the other hand Solow (1991) points out that "the estimates from global warming have been moving away from "apocalyptic scenarios". Global warming could also have some beneficial effects. An atmosphere richer in CO<sub>2</sub> may enhance photosynthesis and raise productivity in agriculture and forestry. More northerly latitudes, becoming warmer, may become more agriculturally productive. Also benefiting industries as diverse as tourism and construction" (Barker, Ekins, & Jonstone, 1995, p. 4). However according to the IPCC report in 2007, there is very high confidence that "the global average net effect of human activities since 1750 has been one of warming" (IPCC, 2007, p. 3). The report adds that "Warming of the Climate is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, melting of snow and ice, and rising global average sea level" (IPCC, 2007, p. 5).

A simple example shows that according to the IPCC 2007 report from 1995 to 2006 were ranked as the warmest years in global surface temperature in record since 1850 (IPCC, 2007, p. 5). According to the IPCC report in 2007 "there is clear evidence for an increase in intense tropical cyclone activity in the North Atlantic since about 1970, correlated with increases of tropical sea surface temperatures" (IPCC, 2007, p. 9). As well it reports that there has been a global increase in the average sea level and it was likely 4 to 6 meters higher, mainly due to the retreat of polar ice (IPCC, 2007, p. 9).

Something is clear and that is the uncertainty as to accurately predict how anthropogenic global heating will affect the climate system, its duration and consequences. Nevertheless "climate has varied naturally in the past, but today's circumstances are unique because of human influences on atmospheric composition. As we progress into the future, the magnitude of the present anthropogenic change will become overwhelmingly large compared to that of natural changes." (Karl & E. Trenberth, 2003, p. 1721).

## VII. Enhanced Green House Effect

The Earth has a natural atmospheric effect, without which life would not be possible, this effect is called the greenhouse effect. This effect was discovered from experimental observations by John Tyndall in 1859, and fully discovered by Svante Arrhenius in 1896 (Kenne, 2013). Without this effect the Earth would not be livable due to its location to the sun. “Various atmospheric gases contribute to the greenhouse effect, whose impact in clear skies is 60% from water vapor, 25% from carbon dioxide, 8% from ozone, and the rest from trace gases including methane and nitrous oxide. Clouds also have a green-house effect.” (Karl & E.Trenberth, 2003, p. 1719). According to a report from the Intergovernmental Panel on Climate Change “concentrations of carbon dioxide, methane and nitrous oxide have increased noticeably as a result of human activities since 1750” (IPCC, 2007, p. 2). Moreover, “these gases are well distributed in the atmosphere across the globe, simplifying a global monitoring strategy. Carbon dioxide has increased 31% since preindustrial times, from 280 parts per million by volume (ppmv) to more than 370 ppmv today, and half of the increase has been since 1965” (Karl & E.Trenberth, 2003, p. 1720). Although small, “an ecologically critical quantity of solar energy, averaging less than 1% of the total, is absorbed by plant pigments, especially chlorophyll. This absorbed energy is used to drive photosynthesis, the energetic result of which is a temporary storage of energy in the inter-atomic bonds of biochemical compounds” (Lerner E. K., 2005, pág. 269).

Barker, Ekins and Jonstone suggest that “economic behavior and the availability of fossil fuels have led to greatly increases greenhouse gases emissions from human activity and the unrestrained future increase in emission is a risk to life on earth. However there are economic goods, which are wanted such as physical comfort from warm (or cool) buildings, transport services, and all other consumer goods which generate Greenhouse gas emissions in production” (Barker, Ekins, & Jonstone, 1995, p. 5). The OCDE reports that “Buildings account for almost a third of final energy consumption globally and are an equally important source of CO<sub>2</sub> emissions (OCDE, 2011, p. 27). These end-uses represent significant opportunities to reduce energy consumption, improve energy security and reduce CO<sub>2</sub> emissions. There is no question that the atmosphere is changing because of human activity, “today greenhouse gases are the largest human influence on global climate change” (Karl & E.Trenberth, 2003, p. 1720). Furthermore “human activities have increased atmospheric concentrations of carbon dioxide, methane, and

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other gases” (Serreze, 2009, p. 10). This has enhanced the greenhouse effect, resulting in global warming.

To better illustrate, “global radiative balance implies a steady global surface temperature. If the atmosphere system is thrown out of radiative balance, the surface temperature will change. The largest single force that enhances the greenhouse effect is from carbon dioxide. As a result the atmosphere becomes more opaque to long-wave radiation. More of the long-wave radiation emitted upward from the surface is absorbed by the atmosphere above and instead of escaping to space it is directed downward” (Serreze, 2009, págs. 12-13).

Therefore in recent years, “scientists have been exploring the possibility that various human activities also may influence the enhanced greenhouse effect. The most important of these activities is thought to be the combustion (burning) of fossil fuels, such as coal, oil, and natural gas” (Nagel, 2002, p. 1019).

Consequently “with more carbon dioxide in the atmosphere, more heat will be trapped. Earth's annual average temperature will begin to rise. In 2001, in a report released by the Intergovernmental Panel on Climate Change (a United Nations sponsored panel of hundreds of scientists), scientists concluded that if greenhouse emissions are not shortened, the average global surface temperature could rise by nearly 6°C over the next 100 years. As it was mentioned such a rise in temperature could have disastrous effects on the world. One result might be the melting of Earth's ice caps at the North and South Poles, with a resulting increase in the volume of the ocean's water” (Nagel, 2002, p. 1020). Equally important is that studies have shown that “two factors which appear to mitigate the effect of enhanced greenhouse gases are aerosols and dust. Aerosols, minute solid particles, are finely dispersed in the atmosphere and have become an influence on the greenhouse effect. Aerosols are produced by combustion, but they also come from natural sources, primarily volcanoes. By blocking light, aerosols and dust can offset warming from greenhouse gases” (Rehkopf, 2006, pág. 672). In brief enhanced greenhouse effect is caused mainly due to emissions from producing energy around the globe.

*Greenhouse Effect*

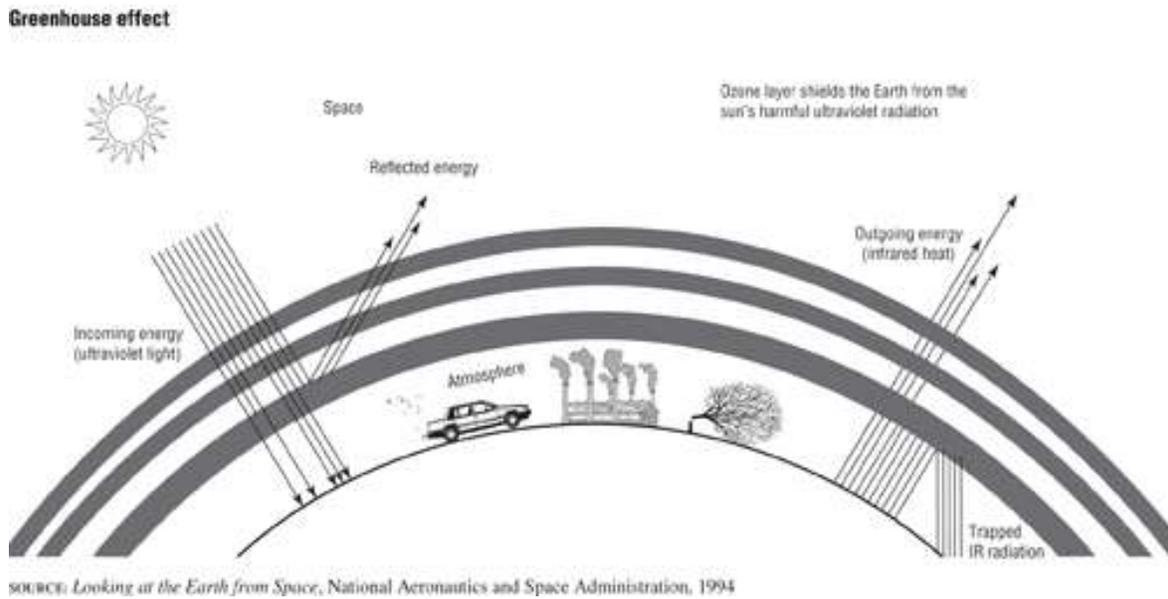


Figure II.8, source: *The Green House Effect* (Evans, 2010)

*Global Green House Gases Emissions*

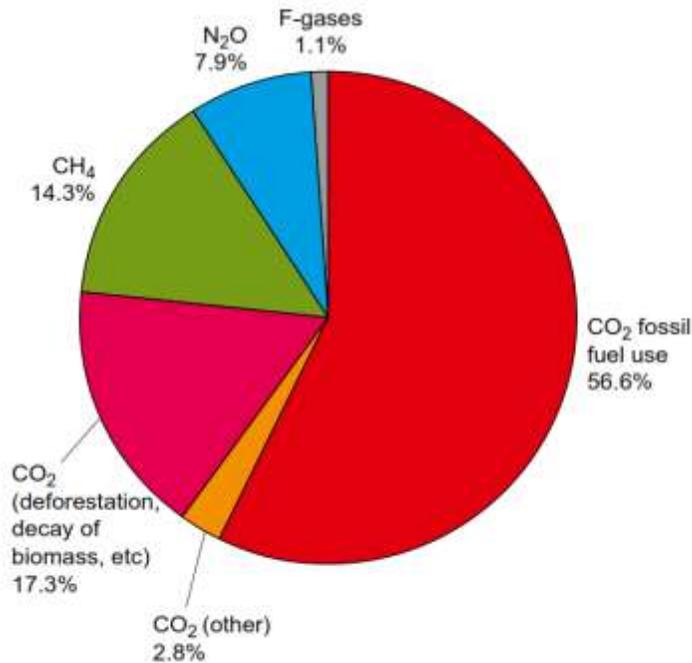
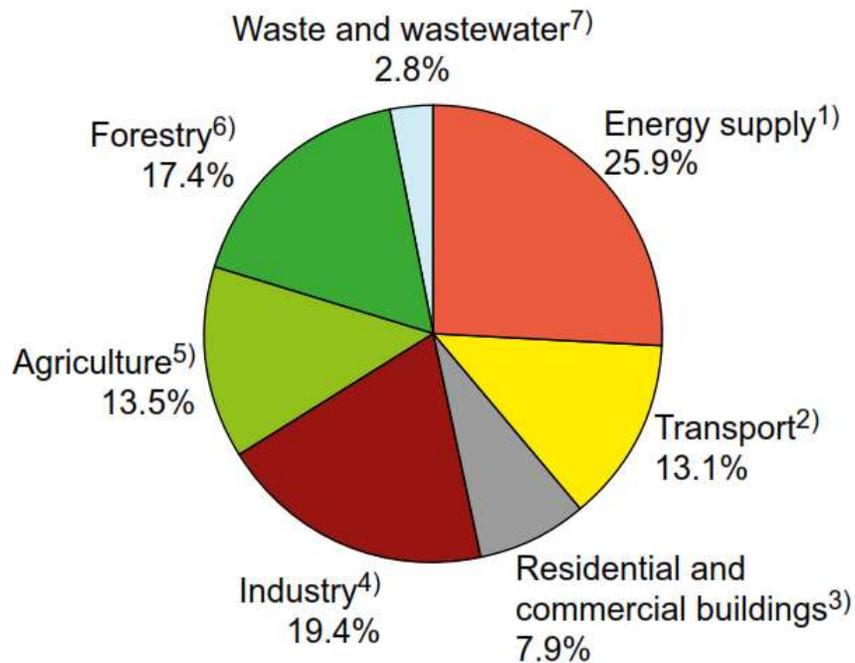


Figure TS.1b: Global anthropogenic greenhouse gas emissions in 2004 [Figure 1.1b].

Figure II.9, source: *Graphic, Global Green House Emissions in 2004. (IPCC 2007, p. 28)*



**Figure TS.2b:** GHG emissions by sector in 2004 [Figure 1.3b].

Figure II.10, source: Graphic, Green House Gas Emissions by Sector in 2004, (IPCC 2007, p. 29)

Equally important and according to different reports, they specially point out that “the wealthier countries of the world have added huge amounts of greenhouse gases to the atmosphere, thus contributing significantly to the process of global warming. By some measurements, the United States produces 25 percent of the world’s greenhouse gases. Therefore, many people believe that industrial nations should take responsibility for reducing emissions of these gases” (Opposing Viewpoints Online Collection, 2013) Thus “climate change will affect everyone, but the people who will suffer most are those who have done the least to bring it about. Poor countries will suffer more from climate change than will rich countries, just as they suffer more from climate variability and extreme events” (Jamieson, Global Climate Change, 2009, p. 459).

According to Jamieson “three types of responses to climate change have been identified:

- (1) Mitigation, involves reducing emissions and stabilizing GHG concentrations,
- (2) Adaptation, involves positive adjustments in biological or cultural systems in response to actual or expected changes in climate.

(3) And geoengineering involves positive adjustments in biological or cultural systems in response to actual or expected changes in climate. It involves the intentional large-scale manipulation of the climate system” (Jamieson, *Global Climate Change*, 2009, p. 459).

Jamieson continues and adds that “the consensus view is that if there is to be a reasonable chance of averting the most extreme risks of climate change, global emissions will have to peak in 2025 and decline by 50 percent by 2050 and the global economy must be virtually decarbonized by the end of the twenty-first century. Thus, cheap energy–high consumption lifestyles cannot be sustained in Europe and North America or replicated by developing countries without causing a climate cataclysm. People will have to find another way to live, and poor countries will have to find another model to guide their development” (Jamieson, *Global Climate Change*, 2009, pp. 459, 460).

**Changes in Key Global Climate Parameters Since 1973**

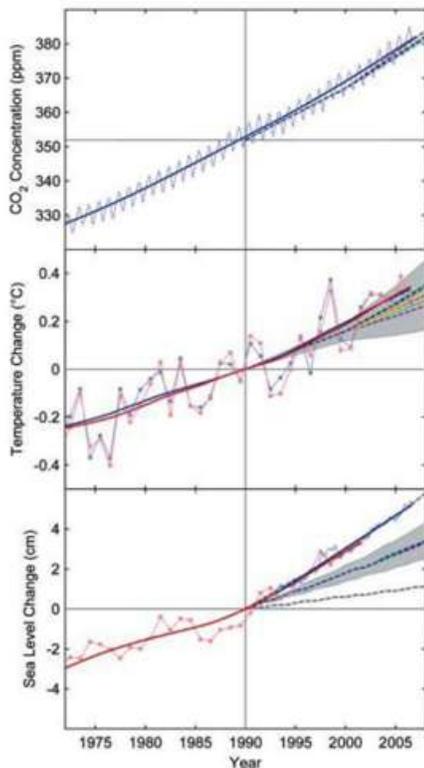


Figure II.11, source (Science Mag, 2007)

The Figure II.11 clearly shows the changes in CO<sub>2</sub> concentrations in the atmosphere, the Temperature Change and the Sea Level Change from 1973 to 2005 (Rahmstorf, 2007, p. 709).

In the last paragraphs, important challenges to human kind were presented; such as effects of energy production leading to enhanced greenhouse effect that leads to global warming causing climate change. It could be assumed that there is a public concern about global climate change. “This has led to a massive, unprecedented, and worldwide scientific, technological, and political effort to understand the causes and consequences of

climate change. The basic assumption underlying all of these efforts is that climate change science is necessary for the devising of climate change policy.” (Frodeman, 2005, p. 871).

Accordingly scientists and researchers have come with different solutions to these problems, thus there are sustainable and efficient methods to take care of these issues.

### **VIII. Sustainability and Efficiency**

According to the US Environmental Protection Agency (EPA) sustainability is based on a simple principle: “Everything that humans need for survival and well-being depends, either directly or indirectly, on the environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony. That permits fulfilling the social, economic and other requirements of present and future generations” (EPA , 2013). Furthermore David Pearce and colleagues defined sustainability in economic terms as “non-declining capital. They took capital to mean not just monetary and human capital, as economist conventionally consider capital to be, but natural capital, the value to human beings of the Earth itself” (Dresner, 2002, p. 82). Further John Pezzey defines “sustainability as a path of development that would not lead to declines in average levels of well-being in the future” (Dresner, 2002, p. 87). A good term to define here is “well-being”, and it “refers to the condition or state of being well, contented and satisfied with life. Well-being has several components including physical, mental, social and spiritual”. (Narum, 1993, p. 12)

In the same order of ideas, Herman Daly’s “four principles of sustainability reflect this:

1. Limit the human scale (throughput) to that which is within the Earth’s carrying capacity.
2. Ensure that technological process is efficiency-increasing, rather than throughput increasing.
3. For renewable sources harvesting rates should not exceed regeneration rates (sustainable yield); waste emission should not exceed the assimilative capacities for the receiving environment.
4. Non- renewable resources should be exploited no faster than the rate of creation of renewable substitutes”. (Dresner, 2002, pp. 88, 89).

Moving on Victor Urquidi argues that the concept of sustainable development has its origins during the sixties and seventies, when it began to warn of the risks of excess pollution. He adds that the Council of the United Nations Programme for the Environment endorsed the concept (V́ctor L. Urquidi, 2007). In addition B. Gleeson argues that “sustainable development is about

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the achievement on a global scale of three principles: (1) Economic development, (2) social justice and (3) ecological responsibility” (Hawkes, 2001, p. 11). Many institutions come together to conclude that “sustainable development is defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Hawkes, 2001, p. 12)

According to a report from the United Nations “it is clear that energy is central to sustainable development and is intrinsically linked to a number of major global challenges such as poverty, security and climate change” (UN - Energy, 2010). Most of reports that focus on sustainable energy conclude that “sustainable energy powers opportunity. Yet globally one person in every five lack electricity to light their homes or conduct business. Twice that number—nearly 40% of the world's population—rely on wood, coal, charcoal, or animal waste to cook their food—breathing in toxic smoke that causes lung disease and kills nearly two million people a year, most of them women and children” (United Nations, 2012). Altogether “Sustainable development involves stable, equitable and inclusive economic growth, based on sustainable patterns of production and consumption” (United Nations, 2012).

On the other hand “energy efficiency refers to any process by which the amount of useful energy obtained from some process is increased compared to the amount of energy put into that process” (Newton, Energy Efficiency, 2004). David Newton argues that the interest in energy efficiency is relatively new in the history of modern societies, “For most of the past century, energy resources seemed to be infinite, therefore little concern was expressed about the danger of exhausting the world's supplies of coal, oil, and natural gas, its major energy resources. He continues and points out that change in attitude came in the 1970s when the major oil-producing nations of the world suddenly placed severe limits on the amounts of petroleum that they shipped to the rest of the world. This Oil Crisis forced major oil users' nations such as the United States, Japan, and nations of Western Europe to face for the first time the danger of having insufficient petroleum products to meet their basic energy needs. Use of energy resources suddenly became a matter of national and international discussion”. (Newton, Energy Efficiency, 2004). Hence energy efficiency can be accomplished in a number of different ways. “One of the most obvious is conservation; that is, simply using energy resources more carefully. For example, people might be encouraged to turn out lights in their home, or use bicycles rather than cars for transportation.

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Energy efficiency in today's world also means more complex and sophisticated approaches to the way in which energy is used in industrial, commercial, and residential settings". (Newton, 2004)

According to the UN "investing in energy efficiency creates jobs, fosters economic growth and improves energy security for countries that lack domestic fossil fuel resources". (United Nations, 2012). Investing in efficiency is critical to meeting future energy demand and mitigating climate change. It reduces greenhouse gas emissions and improves productivity. By reducing energy demand, efficiency also makes renewable energy more affordable – shrinking the size of the solar panel needed to power a lamp, for example. Moving to sustainable energy and using it efficiently makes sense in a resource constrained global economy (United Nations, 2012).

Newton adds that energy efficiency can be accomplished in a number of different ways. "One of the most obvious is conservation; that is, simply using energy resources more carefully. For example, people might be encouraged to turn out lights in their home, to set their thermostats at lower temperatures, and to use bicycles rather than automobiles for transportation. Energy efficiency in today's world also means more complex and sophisticated approaches to the way in which energy is used in industrial, commercial, and residential settings" (Newton, 2004, p. 1477). He continues to mention that "about one-third of the energy used in the United States goes to moving people and goods from place to place. For more than two decades, governments have made serious efforts to convince people that they should use more energy-efficient means of transportation, such as bicycles or some form of mass transit (buses, trolleys, subways, light-rail systems, etc.). These efforts have had only limited success" (Newton, Energy Efficiency, 2004)

David Newton argues that "one of the most successful approaches to improving energy efficiency in industry has been the development of cogeneration systems. Cogeneration refers to the process in which heat produced in an industrial operation (formerly regarded as "waste heat") is used to generate electricity. The plant saves money through cogeneration because it does not have to buy electrical power from local utilities" (Newton, Energy Efficiency, 2004). Furthermore many other approaches are available for increasing the efficiency. Recycling has become much more popular around the world over the past few decades at least partly because it provides a way of salvaging valuable resources such as glass, aluminum, and paper. Recycling is also an energy efficient practice because it reduces the cost of producing new products from raw

materials. Another approach to energy efficiency is to make use of packaging materials that are produced with less energy. The debate still continues over whether paper or plastic bags are more energy efficient, but at least the debate indicates that people are increasingly aware of the choices that can be made about packaging materials” (Newton, Energy Efficiency, 2004). In brief “energy efficiency means delivering the same (or more) services for less energy. Hence using less energy means power plants generate less, which reduces greenhouse gas emissions and improves air quality (EPA , 2013).

### **IX. Ecological Foot Print**

How do you measure how sustainable or efficient is a process, a system or a simple product? Some scientists have developed measurements that have specific ways of calculating the impact of humans on the earth.

According to Dahlia Chazan & Jason Venetoulis “the ecological footprint is an environmental accounting tool that measures human impact on nature, based on the ability of nature to renewably produce the resources that humans use and absorb the ensuing waste” (Chazan & Venetoulis, 2005, p. 571).. The ecological footprint “can be calculated for individual households; for facilities such as hospitals, schools or businesses; for infrastructure projects such as highways, bridges or dams; for particular products, for communities, for nations, and at a global level” (Hancock, 2006, p. 353). Therefore Chazan & Venetoulis add that “Foot printing provides a way to aggregate into a single composite measurement of the ecological impacts associated with built-up land (i.e., roads and buildings), food, energy, solid waste, and other forms of waste or consumption. The result represents the impact or footprint. Using an area-based measurement, such as hectares or acres, the size of a footprint can be compared to the renewable services the Earth's biocapacity can produce in a given year. The footprint methodology can be used to evaluate a population's progress toward ecological sustainability. Although the footprint has been criticized on a variety of fronts, primarily related to the complex methodology that underlies the measure, as well as the applications for which it is appropriate.” (Chazan & Venetoulis, 2005, p. 571). Therefore the footprint methodology provides a way to evaluate humanity's impact on the earth in terms of ecological sustainability.

The carbon footprint is related to the concept of ecological footprint, “it refers to the amount of carbon dioxide (CO<sub>2</sub>) emissions associated with all the activities of a person or other entity (e.g., building, corporation, country, etc.). It includes direct emissions, such as those that result from fossil-fuel combustion in manufacturing, heating, and transportation, as well as emissions required to produce the electricity associated with goods and services consumed” (Encyclopædia Britannica, 2013).

### **X. Energy Security**

According to the International Energy Agency, “Energy Security refers to the uninterrupted availability of energy resources at an affordable price”. (IEA, 2012) In order for a country to achieve long-term energy security it requires investment to maintain demand energy coupled with sustainable economic growth with the environment. Thus “countries must ensure that consumers can access the energy they need at prices that are not excessively volatile” (UK Department of Energy and Climate Change, 2013). According to Craig & Penth (2012) energy security reflects the availability of affordable energy. “Demand for energy is increasing in a growing number of emerging countries – especially those with large populations, such as China and India – and may outstrip supply, which will lead to considerable price hikes. The more energy a country gets from within its own borders, the less vulnerable it is to political disruptions, for which it may not even be responsible. A diversification of energy carriers also means a diversification of producing countries”. (Craig & Penth, 2012).

According to Lee “as much as petroleum problems are the cutting edge of energy policy concerns, they are not the only ones. Electricity, once sold as an energy form to consumer because of its convenience and cleanliness is plagued with environmental difficulties from both the sulfurous fumes of coal-burning plants and the uncertain aura of nuclear power” (Lee, 1976, pág. 114). It is important to mention here the importance of petroleum. Many oil producing countries have developed thanks to this natural resource. “For many countries, noticeable differences occurred as they became major oil-production countries. Oil can influence almost every aspect of a country. A country’s current situation and the future, it can affect internal development plans, foreign policy, environmental and civil rights laws and government corporate relations” (Falola & Genova, 2005, p. 18). Oil producing countries also use their oil to satisfy their won nationalist agendas as well as supporting other nationalist movements

throughout the world. The most notable example of using oil as a political weapon to satisfy national interest occurred during the 1960s with the formation of OPEC. Another tactic in the international scene is embargos that have been used by oil-producing countries, and this political tactic has also been used against them” (Falola & Genova, 2005, p. 20). According to the IEA, “in recent years fossil fuel prices have been very volatile. They look set to remain at high levels compared to the past. A number of factors contribute to this trend, including rising energy demand, particularly in the developing world, and concerns over the security and availability of oil and gas supplies. Reducing fossil fuel dependency is an important energy policy target in many countries.” (International Energy Agency, 2010, p. 61)

The importance of renewable energy security is that “the growth of renewables generally contributes to energy diversification. Use of renewables can also reduce fuel imports and insulate the economy to some extent from fossil fuel price rises and swings. This certainly increases energy security. However, concentrated growth of variable renewables can make it harder to balance power systems, which must be duly addressed” (IEA, 2013).

In the 21<sup>st</sup> century and the future “Secure, reliable and affordable energy supplies are fundamental to economic stability and development. The erosion of energy security, the threat of disruptive climate change and the growing energy needs of the developing world all pose major challenges to energy decision makers” (International Energy Agency, 2010, p. 61). Consequently “these energy security concerns are compounded by the increasingly urgent need to mitigate greenhouse-gas emissions, including those relating to energy production and consumption. About 84% of all CO<sub>2</sub> emissions are energy-related, and about 65% of all greenhouse-gas emissions can be attributed to energy supply and energy use” (International Energy Agency, 2010, p. 61).

### **XI. Sustainable, Clean and Renewable Energy**

The IEA defines renewable energy as the energy that is derived from natural processes (e.g. sunlight and wind) that are replenished at a higher rate than they are consumed. Solar, wind, geothermal, hydro, and biomass are common sources of renewable energy (IEA, 2013).

According to Michael Hamilton “there is no physical shortage of energy in the world. There is more energy in the world than we could ever possibly use, thus the problem is not really a

## CHAPTER II

shortage, but barriers and the use of various energy sources. Those barriers could be technical, geographical, economic, political, environmental to energy resource conversion and distribution” (Hamilton, 2013). Reports from the UN indicate that “renewable energy technology development has accelerated tremendously in recent years; technology is improving constantly, making renewable more competitive in regards to its cost. Implementing those newer technologies requires human expertise and skilled professionals at all levels, from local communities and national policymakers.

A part of that energy, the IEA reported in 2011 that “electricity is unique when it comes to meeting the climate-change challenge: as the largest and fastest growing source of carbon dioxide (CO<sub>2</sub>), it also holds many of the solutions to a more efficient, less carbon-intensive economy” (IEA, 2011, pág. 9).

According to a report from the UN in 2007, about one-fifth of the global primary energy demand was met by renewable sources and the rest by fossil fuels and nuclear energy. However, “the largest share of renewable energy was attributable to biomass, primarily traditional biomass such as firewood and charcoal for cooking and heating. The rest was derived from large-scale hydropower (greater than 10 megawatts) or distributed among other renewable energy technologies—primarily biofuels, geothermal and wind power. In terms of electricity generation renewable energy represented about 16 per cent with non-hydro accounting for only a small fraction. Therefore “energy from renewable resources (wind, water, the sun, biomass and geothermal energy) is inexhaustible and clean. Renewable energy currently constitutes 15% of the global energy mix. Investing in energy efficiency creates jobs, fosters economic growth and improves energy security for countries that lack domestic fossil fuel resources.” (United Nations, 2012).

In the following section, a synthesis of renewable sources will be presented:

- i. Solar

Simply solar energy is the energy captured from the sun. This energy arrives in the form of solar radiation and must be converted directly or indirectly into electricity or other usable forms of energy. The IEA establishes that there are two main kinds of solar energy:

1. Solar photovoltaic (PV) directly converts solar energy into electricity using a PV cell made of a semiconductor material. See figure II.12.

### Solar Photovoltaic

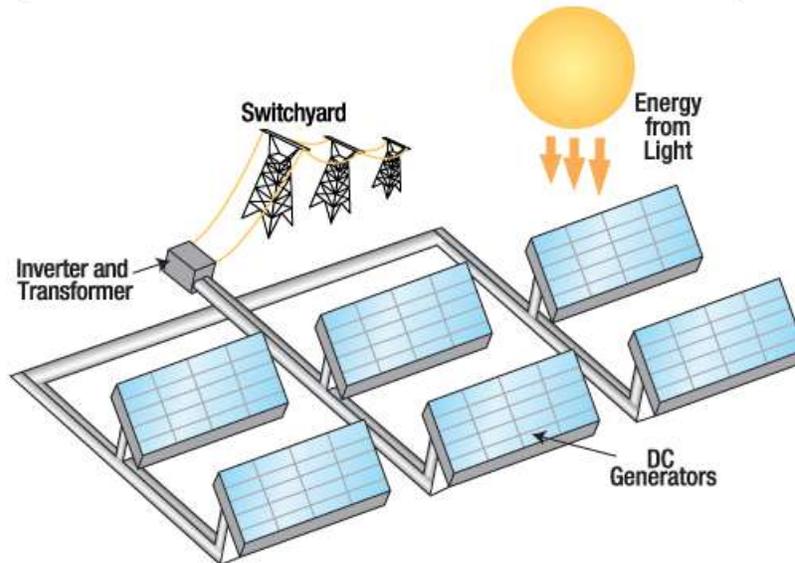


Figure II.12, Source (I-Witness News, 2013)

2. Concentrating solar power (CSP) devices concentrate energy from the sun's rays to heat a receiver to high temperatures. This heat is transformed first into mechanical energy (by turbines or other engines) and then into electricity – solar thermal electricity (STE) (IEA, 2013). See figure II.13

### Concentrating solar power



Figure II.13

Source: (skepticalscience, 2013)

Therefore “Environmentalists and other solar energy enthusiasts have long advocated solar energy as a clean and inexhaustible resource”. (Current Issues: Macmillan Social Science Library, 2010, p. 1) According to IEA analysis, under extreme assumptions solar energy could provide up to one-third of the world’s final energy demand after 2060 (IEA, 2013).

ii. Wind

The kinetic energy of the wind is used to develop useful power. “It is harvested using wind turbines that spin a generator that creates electricity.” (Current Issues: Macmillan Social Science Library, 2010, p. 2). According to Ghosh & Prelas wind energy is the second most technologically advanced renewable energy source; hydropower is the first.

Although there is a significant potential for converting wind energy to electricity, a number of issues must be addressed before it can be used to its full potential. Wind blows in every corner of the Earth; however, it does not blow constantly. In addition, it must maintain a certain speed to be effective for running a wind turbine and generating electricity” (Ghosh & Prelas, 2011, p. 1).

**Wind Energy**

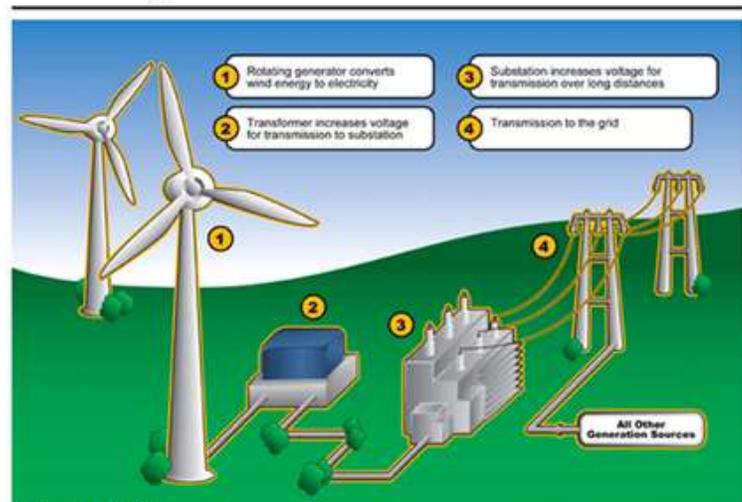


Figure II.14

Source: (Energy Use Problems, 2013)

A worldwide survey of wind energy by the Stanford University concluded that “harnessing one fifth of the earth’s available wind energy would provide seven times as much electricity as the world currently uses.” (Brown, 2009, p. 113) The IEA reports that “wind power experienced dramatic growth since the turn of the 21st century. Global installed capacity at the end of 2011 was around 238 GW (Giga-Watts), up from 18 GW at the end of the year 2000. Around 41 GW was added in 2011 alone. Over the last couple of years wind’s centre of growth moved from Europe and North America to Asia which emerged as the global leader. China became the global leader in terms of total installed capacity in a very short time, overtaking the United States in 2010” (IEA, 2013).

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### iii. Biomass

Biomass power comes from plants, trees, as well as some crops such as corn or the sugar cane, to name a few. It can be used to make biofuels that serve as alternatives to gasoline or diesel, or it can be burned to produce heat or power. According to Warren Gretz “Biomass energy is a double-edged sword, depending on how and where it is produced. It can be produced in ways that reduce global warming pollution or in ways that increase it. It can help clean up the air, water, and soil and protect wildlife, or it can degrade our lands, forests, and water, threaten biodiversity, and harm public health” (Gretz, 2013, p. Web). Reports show that “Ethanol is one of the most commonly produced biofuels. It is an alcohol fuel that is made from sugars found in sugar cane, potato skins, wheat, and rice. Ethanol is more expensive to produce than petroleum-based gasoline, but is renewable and produces fewer pollutants. They note that the diversion of corn into ethanol production has caused corn prices to rise and has led to food shortages in some parts of the world. In addition, clearing forests to increase corn production may worsen the problem of global warming. The problem with burning ethanol is that it also releases greenhouse gases”. (Current Issues: Macmillan Social Science Library, 2010) Gretz adds that “most of the biomass used commercially today comes from resources that are not sustainable”. Therefore the challenge is to ensure that biomass energy is produced in ways that not only reduce global warming pollution, but also protect the environment and do not increase the price of food. In other words, “biomass energy should do the job better than the fossil fuels it replaces”. (Gretz, 2013). The IEA reports that “Global biofuel production grew from 16 billion litres in 2000, to more than 100 billion litres in 2010. This biofuel provides around 3% of the world’s fuel for transport. (In Brazil, biofuel provides 23% of all transport fuel, compared with 4% in the United States and 3% in the European Union)” (IEA, 2013).

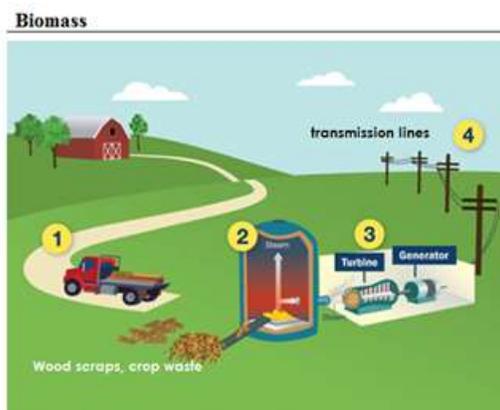


Figure II.15 Source: (Green mountain energy, 2013)

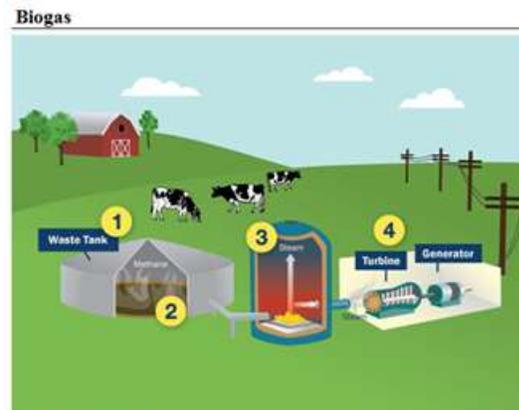


Figure II.16 Source: (Green energy mountain, 2013)

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### iv. Geothermal

According to Love & Smith (2010) the term "geothermal" comes from the Greek words for earth (geo) and heat (therme) and “refers to the energy that is produced from deep within the Earth’s crust. It comes in the form of hot water and steam that is created when water seeping underground comes in contact with hot rocks below the Earth’s surface. Geothermal energy is renewable because the Earth is producing heat, and water is constantly replenished by rainfall.

Therefore geothermal energy uses heat from heated rocks inside the Earth to generate electricity. (Love & Smith, 2010, p. 68). Thus the heat and steam produced by geothermal energy can be used directly to produce electricity. However, “geothermal energy is only feasible in parts of the world where hot rocks lie near the planet’s surface”. (Current Issues: Macmillan Social Science Library, 2010, p. 2).

### v. Hydro

Hydropower is energy that is generated by using sources of water moving. Today, “hydropower facilities make electricity by converting kinetic (moving) energy into mechanical (machine) energy as water flows in a river or over a dam. Hydropower is a relatively inexpensive, non-polluting form of renewable energy” (Duncan, 2005). According to Love and Smith a fifth of the World’s electricity comes from hydroelectric power. (Love & Smith, 2010, p. 70)

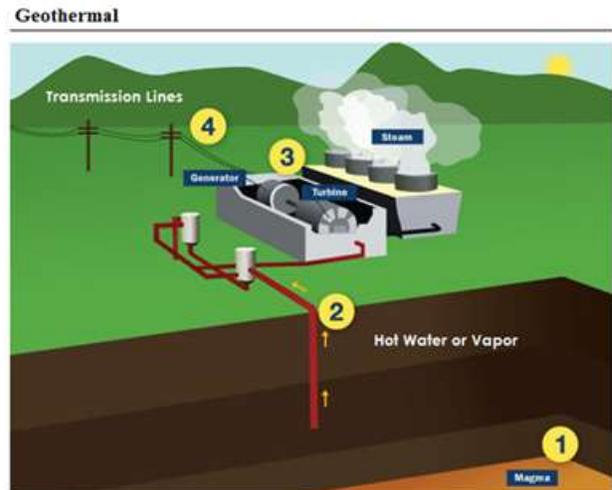


Figure II.17

Source: (Green Energy Mountain, 2013)



Figure II.18

Source: (Green mountain energy, 2013)

## CHAPTER II

According to Craig & Penth (2012) there are several reasons to switch to renewable energy and to increase energy conservation, and there are reasons to do so now.

1. “Fighting climate change
2. Reducing energy imports
3. Stimulating technology innovation and the green economy
4. Reducing and eliminating the risks of nuclear power
5. Energy security
6. Strengthening local economies and providing social justice”. (Craig & Penth, 2012)”

### **XII. Perspectives and Challenges for Implementing Renewable Energy Worldwide**

One of the challenges for implementing renewable sources is that “fossil fuels are widely used and widely accepted. Nevertheless, there are ways to make fossil fuels less polluting, such as the use of clean coal technology and hybrid automobiles. These technologies have not yet become widespread, in part because they cost more than the methods that are currently used. As pollution increases and fossil fuels become harder to get, new methods of using fossil fuels will probably become more common” (Schlager & Weisblatt., 2006, p. 20).

The Environmental Literacy Council (ELC) argues that renewable energy sources—wind, solar, hydropower, geothermal, and biomass—can help fight climate change because they generally have fewer greenhouse gas emissions than fossil fuels. However, renewable energy sources do have some associated pollution and currently they are expensive. The ELC says further investment in research and development is needed to promote renewable energy. Some renewable technologies still need policy support to drive down costs, boost competitiveness and widen their market reach. According to Craig & Penth, “a renewable energy economy will only be possible if we lower energy consumption considerably. Policies to improve efficiency are in place, but they consistently fall short of what is not only theoretically possible, but also what is reasonable” (Craig & Penth, 2012)

Jacqueline Langwith (2009) argues that the central obstacle to using renewable energy sources is its high cost. She adds that even though costs tend to decrease, they are still more expensive than conventional fossil fuel technologies. However, she says that “much of the high cost stemming

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from renewable technologies is in the initial set-up, after which, operating costs tend to be lower than that of fossil fuel power plants” (Langwith, 2009).

Langwith continues and say that some experts agree that if some of the costs associated with renewable energy were temporarily subsidized, it would help increase their production and capacity to produce energy. “While renewable energy technologies tend to be better for the environment, they also face additional criticisms. Although the majority of renewable energy sources do not directly emit pollution, the use of some materials in the production of renewable technologies, such as photovoltaic cells, generates both waste and pollution. Other sources require a large amount of land (harvesting for biomass, sitting for wind or hydropower), which could be used for agricultural or other purposes, or left undeveloped” (Langwith, 2009).

Langwith continues and mentions how hydro and wind power can also “have a negative impact on ecosystems, obstructing fish passage and bird migration, respectively” (Langwith, 2009, p. Web).

According to high cost of implementing renewable energy, investment in research and development is further needed to continue to lower costs. However, “renewable energy resources hold great potential for reducing the threat of climate change through decreased greenhouse gas emissions and, due to the fact that they can be replenished, could help alleviate the risk of exhausting the world's fossil fuel supply” (Langwith, 2009, p. Web).

According to the International Energy Agency (2013) coal power plants still dominate the growth in power generation. “This is a major reason why the amount of CO<sub>2</sub> emitted for each unit of energy supplied has fallen by less than 1% since 1990. Thus the net impact on CO<sub>2</sub> intensity of all changes in supply has been minimal. Coal-fired generation, which rose by an estimated 6% from 2010 to 2012, continues to grow faster than non-fossil energy sources on an absolute basis. Around half of coal-fired power plants built in 2011 use inefficient technologies. This tendency is offsetting measures to close older, inefficient plants” (IEA, 2013).

Thus the challenges for implementing Renewable Energy can be categorized in:

- Higher costs than Fossil Fuels
- Technology is not developed enough, lack of investments.

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- Implementation from private and public.
- Public awareness of the benefits

Considering what has been presented, there has been progress worldwide in the application of renewable energy some examples around the world include:

- According to a report from United Nations in 2011 José Manuel Barroso, President of the European Commission, announced a new initiative called “Energizing Development” It sets an ambitious goal—to help provide access to sustainable energy services to 500 million people by 2030 . In addition, a Technical Assistance Facility will be supported with 50 million Euros over the next two years, drawing on EU experts to develop technical expertise in developing countries. In Brazil, the Light for All initiative has brought about 15 million Brazilians out of darkness. China has become a world leader in renewable energy. India has set an ambitious target of more than doubling their renewable energy capacity in 10 years. And, the Energy international partnership demonstrates Norway’s strong commitment to universal clean energy access. (United Nations, 2012, p. 5).
- Most of the new development in hydropower is occurring in developing nations, which see it as an effective method of supplying power to growing populations. These massive public-works projects usually require huge amounts of money—most of it borrowed from the developed world. Hydroelectric dams are considered worth the cost and potential environmental threats because they bring cheap electric power to the citizenry. (Alters, Renewable Energy, 2009)
- The Chinese government (January, 2008) has constructed the world's largest dam, the Three Gorges Dam, on the Yangtze River in Hubei province, China. Five times the size of the Hoover Dam in the United States, the dam is 607 feet (185 m) tall and 7,575 feet (2,309 m) in length. One decade after the project was launched in 1993, the Three Gorges Dam began generating power. By 2007 the plant was generating 61.6 billion kWh of electricity. After installation of its twenty-six generators is completed at the end of 2008, the dam is expected to produce 84.7 billion kWh of electricity per year. Under an

expansion plan, six more turbines will be added to the dam by 2012. (Alters, Renewable Energy, 2009)

- Globally, renewable energy continued to grow strongly in 2012. Preliminary analysis suggests that capacity expanded in the most dynamic sectors – solar PV, by an estimated 29-30 GW (+42%), and wind (onshore and offshore), by 44-45 GW (+19%). This builds on robust performance in 2011, when total generation (as well as capacity) showed strong growth. Non-hydropower generation rose by an estimated 142 TWh (Terawatt-hour) from 2010 (+19%) and hydropower generation increased by 108 TWh (+3%), to bring total growth in renewable power generation to 250 TWh (+6%). Non-hydropower capacity increased by 77 GW (+19%) in 2011, while hydropower capacity expanded by 35 GW (+3%) (IEA, 2013, p. 24).
- Global investment in new renewable power plants excluding large hydropower was USD 240 billion in 2012. This is 11% lower than the record USD 270 billion in 2011 (IEA, 2013, p. 24).

Graph, Global Renewable Power by Fuel Type

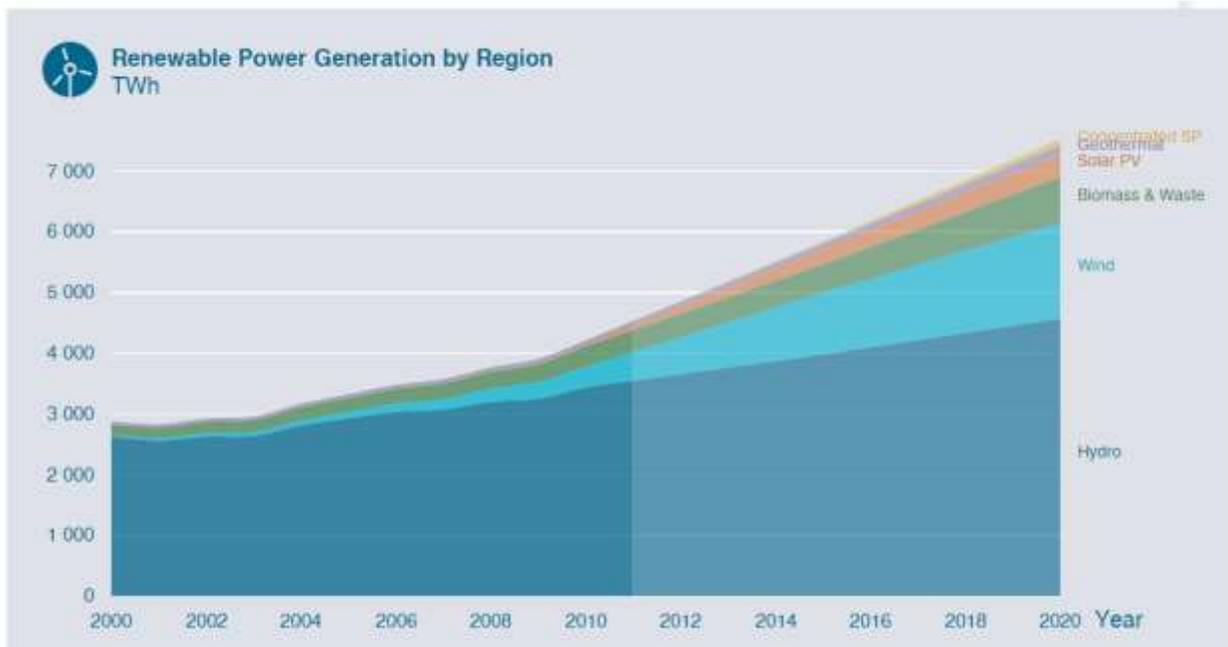


Figure II.19, source: Global Renewable Power by Fuel type (IEA, 2013, p. Web)

### XIII. A Special Case, Electricity from Nuclear Energy

Nuclear power comes from stations that create energy by splitting uranium atoms in a process called fission. “Fission releases energy that can be used to make steam, which is used in a turbine to generate electricity. According to some scientists, nuclear power is nonrenewable because there is a limited supply of nuclear fuels. Uranium is a nonrenewable resource that cannot be replenished on a human time scale. Uranium is extracted from the earth through traditional mining techniques or chemical leaching. Thus Nuclear power generates a number of radioactive by-products, including tritium, cesium, krypton, neptunium and forms of iodine. (EPA , 2013)

Moreover “It has been estimated that the world would only lower carbon emissions by 10 percent even if we built roughly 35 new nuclear plants each year – roughly the number currently under construction worldwide, many of which will not ever go online. In other words, it is unrealistic to expect nuclear to play a significant role in the world's future energy supply” (Renewables International, 2013).

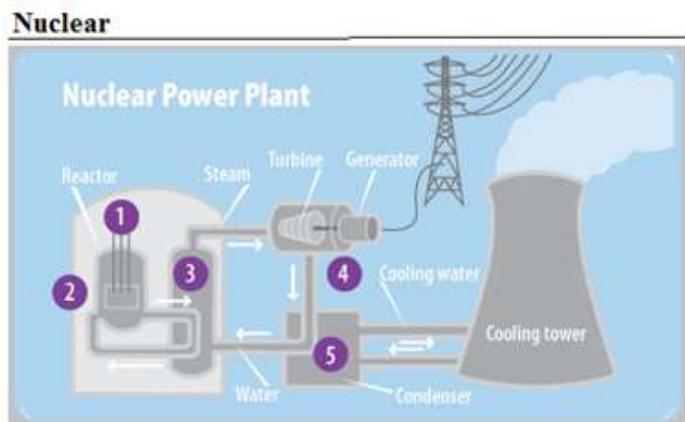


Figure II.20

Source: (EPA, 2013)

In a new study, “French expert Bernard Chabot discusses how overstated the share of nuclear is and finds that we have always gotten more electricity from renewable energy than nuclear. Furthermore, the share of nuclear energy has declined greatly since the accident at Fukushima, mainly because of the tremendous drop in nuclear power production in Japan. Finally, the share of nuclear in global electricity supply has fallen as demand increases from below 18 percent in 1986 to just over 10 percent in 2012 – a drop of more than 40 percentage points.” (Renewables International, 2013). This is because “there wide variation of environmental impacts associated with nuclear power generation technologies. Specifically in the air, water, land, and radioactive waste associated with the nuclear waste generated due to electricity generation” (EPA , 2013).

According to Craig & Penth (2012) there are five main problems with nuclear power:

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1. “the risk of a nuclear disaster at a plant (such as the rather well-known ones at Fukushima, Chernobyl, and Three Mile Island, but also lesser-known ones, such as the Kyshtym accident)
2. the risks of proliferation (plutonium from nuclear plants for military purposes)
3. the risk of radiation from the storage of nuclear waste;
4. cost, with nuclear being unbankable at the moment – banks will not finance the construction of new nuclear plants because the cost is too high in comparison to renewables, so all plants currently on the drawing board in Western countries have massive state support; and
5. The limited availability of uranium resources” (Craig & Penth, 2012).

For that reason, nuclear power represents a high threat for humanity and the communities near the generation plants, and it represents a small percentage of the world energy demand.

The production of electricity through Nuclear has not changed since 2007, a report from the Earth Policy Institute indicates. In fact, “the actual electricity generated at nuclear power plants fell 5 percent between 2006 and 2011” (Roney, 2012) The Figure II.21 shows the decline on the production of electricity from nuclear power reactors:

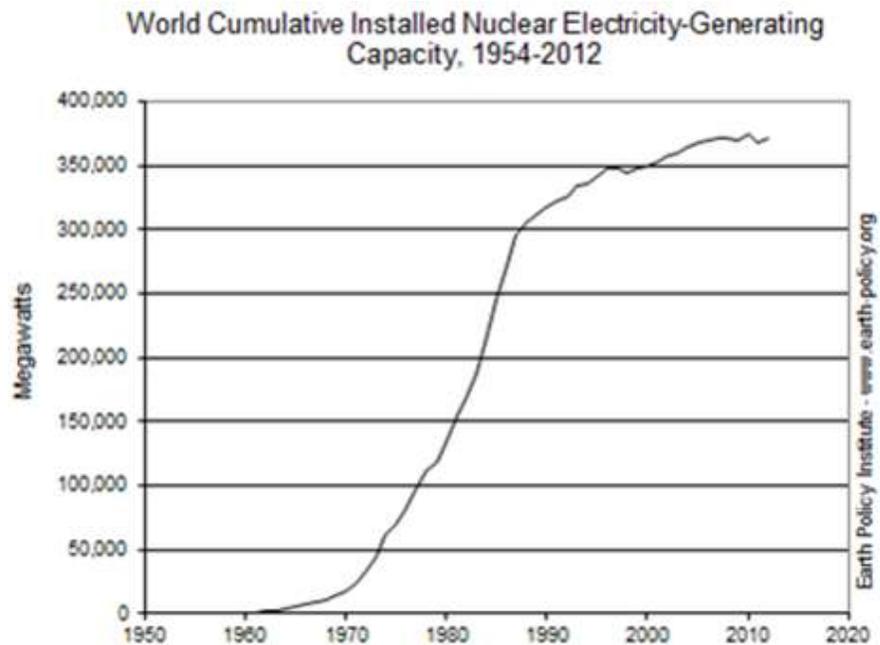


Figure II.21 Source: (Earth Policy Institute with Data from IAEA, 2012)

J. Matthew Roney reports that in 2011, after the devastating nuclear disaster in Fukushima, “13 nuclear reactors were permanently taken offline in Japan, Germany and the United Kingdom while 7 new reactors were connected to the grid three of them in China” (Roney, 2012).

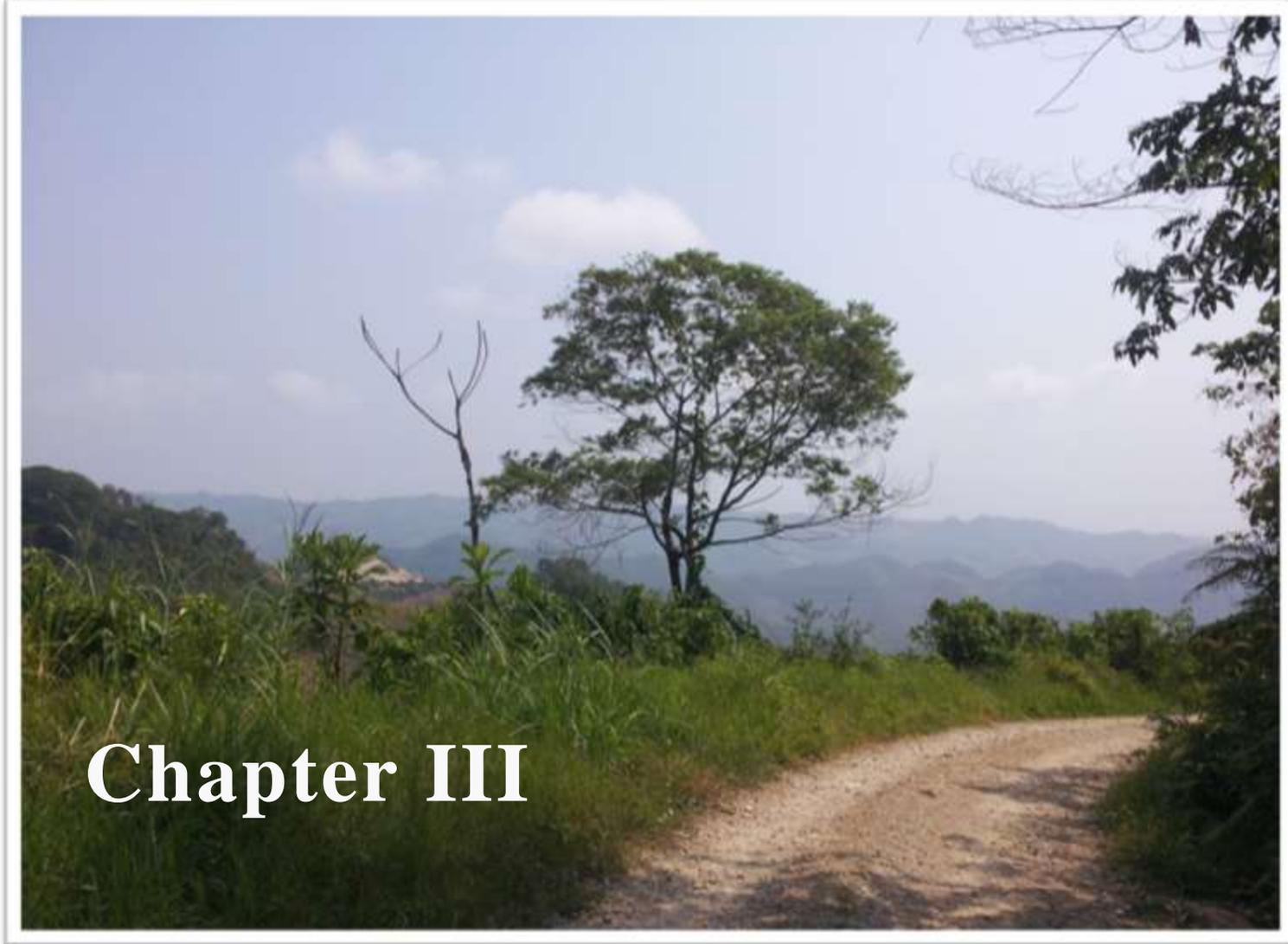
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According to Roney (2012, p. 1), the United States is the country with the largest nuclear generating capacity having 104 nuclear reactors that produce 19 percent of its total demand; followed by France with 58 reactors that “generate more than three quarters of the country’s electrical demand”. Roney adds that “new reactors are struggling to keep up with retirements, because of over costs, constructions delays and a dearth of private investment interest” (Roney, 2012, p. 2). Roney concludes that “in contrast to the decline in nuclear power, electricity generation from renewables such as the wind and the sun has grown 27 percent and 62 percent respectively, per year since 2006” (Roney, 2012, p. 3).

### **XIV. Conclusions of the Chapter**

This chapter started with a brief history of energy use from ancient times to the Industrial Revolution. It discussed how the patterns of energy use were linked to the development in many areas. It continued with the importance of electricity, a form of energy, and how it is obtain from several sources or fuels that are classified as renewable and non-renewable. It was considered how modern men have gotten used to electricity making it almost impossible to not depend on it. It was point out how most of the electricity comes from non-renewable sources, known as fossil fuels which are, coal, oil and natural gas. It was argued how fossil fuels are a pollutant and led to climate change, mainly due to the burning of fossil fuels that enhances the natural greenhouse effect of Earth causing global warming; thus increasing worldwide temperatures over a long period time.

Then some of the possible consequences were presented and it was mentioned how these are hard to predict, but it was stress the importance of these increases on global temperatures. In the second part of the chapter, the importance of sustainability and efficiency were presented. And how there are methods to reduce emissions and be more environmentally friendly while covering the needs of energy for the world. Renewable energy was discussed and the sources were briefly presented as well as the challenges and actions taken. Nuclear energy was defined as a nonrenewable and not reliable source of energy due to the high risks it represents and the tendency to lower the output from this kind of source. Furthermore continuing with this research work, the next part of the chapter will focus on the particular research intended for this thesis.



## CHAPTER III

*“Climate change is the greatest threat facing humanity. It threatens to undo 50 years of our development work and it will impact the poor in the greatest sense.”*

**Ban Ki Moon**

### **Chapter III**

Preceding chapters focused on the theory of *public policy* and *energy* and its stretch relation with *climate change*. Chapter I defined *public problem* as those issues that concerned the public and consequently require public action. It covered how elected officials set up their *institutional agendas* by selecting those problems they consider need attention. In consequence policies come to place and programs are implemented by governments aimed to solve issues classified as public problems.

Chapter II covered the importance of energy in the contemporary world, how humans have been using it since the beginning of time and the way it has become a human need in contemporary life. It also disclosed *climate change*, *global warming* and the *enhanced greenhouse effect* and its unmistakable linkage with energy generation.

Humans have impacted the planet since ancient times. Dale Tamieson points that out while he considers that: “this disturbing impact was already clear in 1864 when George Perkins Marsh wrote in “Man and Nature” man is everywhere a disturbing agent” (Tamieson, 2010, p. 642). Nowadays climate change is unequivocal happening due to human activity and a big part of that comes from the process of generating energy to cover human needs (Cook et al, 2013, p. 1). Climate change should be considered as a public problem. Its magnitude and consequences make it very difficult to handle; thus worldwide there have been efforts intended to face the augmenting challenges.

#### **I. Regime Complex**

In terms of policy associated to Climate Change and its related efforts. Oran Young (1989) defines regimes as: “social institutions that govern the actions of those involved in specifiable activities or sets of activities; regimes may be more or less formally articulated” (Narum, 1993, p. 28). David Narum states that “*Regime Theory* is useful because it provides a structure for the analyses of rights and duties at the international level” (Narum, 1993, p. 29). Narum offers the

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examples of the “Vienna Convention and Montreal Protocol” as a case of regime building in the international community.

Consequently there is a study by Robert O. Keohane and David G. Victor, respectively from Princeton University and the University of California - San Diego, where they labeled climate change policy as one of “*Regime Complex*”. Keohane and Victor define Regime Complex as when: “States construct international regimes on the basis of their interests under conditions of complex interdependence” (Keohane & Victor, 2011, p. 3). The influence of these interests in determining international outcomes depends on the relevant power resources, and the availability of them to the states involved. They consider that due to the struggle of governments to design a “strong, integrated and comprehensive regulatory system for managing climate change” mainly because of “structural and interest diversity in contemporary world politics” (2011, p. 7); climate change policy has become a *regime complex*: “an array of narrowly set of specific regimes” (Keohane & Victor, 2011, p. 7) instead of a Single Integrated Strong Regime. They consider that a Single Integrated Regime might sound ideal or “might be attractive as the most legitimate institutional form, but efforts to craft such a regime face enormous political and organizational barriers” (Keohane & Victor, 2011, p. 15). They conclude that a more wide range system is inevitable.

Keohane and Victor state that three strong forces have led governments and non-state institutions to invest in a wide range of institutions rather than a single one, especially when there are resources (money, ideas, and technology) implicated. These forces are: “the distribution of interest, the gains from linkages and the management of uncertainty” (Keohane & Victor, 2011, p. 8). They argue that regime complex, if it meets certain standards, has advantages over other politically feasible regimes. They suggest that “more focused and decentralized activities will have a bigger impact” because they add that in cases of high uncertainty, regime complexes are politically more realistic and offer more advantages in terms of flexibility and adaptability. (Keohane & Victor, 2011, p. 7). These two elements are important because governments change and do move or develop at different paces. (Keohane & Victor, 2011, p. 16). Keohane and Victor consider that however there have been efforts to create an integrated single regime, it is very doubtful for it to be successful. (Keohane & Victor, 2011, p. 8). They add that even though “*Climate Regime Complex*” can be beneficial, it will not lead quickly enough to the goals settled

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to reduce emissions (Keohane & Victor, 2011, p. 7). They continue and argue that “Regime complex does not imply that it will solve climate change problems in an efficient or timely manner” (Keohane & Victor, 2011, p. 16) because detached bodies might lead to chaos, creating a barrier that deters resources to face Climate Change.

Keohane and Victor consider that many of the International Policies aimed to reduce emissions face resistance due to the high costs involved equally from develop and developing nations. They believe that action can be still taken to face the problem of climate change and augment global cooperation (Keohane & Victor, 2011, p. 8).

Keohane and Victor continue and say that Regime Complex Policies must comply with six elements in order to be functional:

1. Coherence, scenarios where components are compatible and mutually reinforcing.
2. Accountability, regimes should be accountable to significant audiences, accountability defines as “some actors have the right to hold other actors to a set of standards, to judge whether they have fulfilled their responsibilities and if not impose sanctions” (Keohane & Victor, 2011, p. 17).
3. Determinacy, to reduce uncertainty and increase confidence.
4. Sustainability, to prove confidence that the system is durable.
5. Epistemic quality, to research and correct knowledge to take the right choices.
6. Fairness, to provide benefits widely without discrimination.

After, Keohane and Victor recommend more attention in certain policies, they encounter that deforestation is an issue since it has got great potential to reduce emissions at a very reasonable cost. They consider that "International efforts have not been able to come together to invest more on protection of forests and reforestation" (Keohane & Victor, 2011, p. 18). They comment on the initiative of establishing Border Taxes Adjustments (BTAs) on goods from countries that do not comply to lower their emissions, in order to guarantee those that are committed to be certain that their efforts will be fair and that the possible advantages from the pollutant countries will not affect their economy (Keohane & Victor, 2011, p. 18). Keohane and Victor encounter that if the community believes that a clean tech and green-jobs revolution will favor the economy it could help to mobilize in favor of it (Keohane & Victor, 2011, p. 18). They suggest creating an Institute that promotes Innovation, considering that “only six countries account for about 85% of

all research and development investment” in the World (Keohane & Victor, 2011, p. 19) hence to connect efforts in the field.

International non-governmental organizations (NGOs) can play an important role in the formation of a global warming regime by educating the public mainly because to their virtual autonomy (Narum, 1993, p. 36). An important major principle to consider while creating environmental policy must be the first principle mentioned in the World Commission on Environment and Developments in 1987 “All human beings have the fundamental right to an environment adequate for their health and well-being” (Narum, 1993, p. 23) David Narum adds that those rights must spread out to future generations as well. Another thing to consider is that new economic development in to poor or marginal areas must meet the criteria of sustainable development understanding this as “the development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Narum, 1993, p. 25). Narum cites William Ruckelshaus when he compares that this change towards sustainability will have a huge global impact such as the one that occurred while the industrial revolution (Narum, 1993, p. 25). Narum concludes that “the majority of policymaking in regard to climate change will occur at the national level” (Narum, 1993, p. 37), since nations are hesitant to sign complicated treaties. He also considers that “the international community is capable of taking difficult cooperative action for the benefit of future generations” (Narum, 1993, p. 38) such as the Montreal Protocol. Ronald Brunner states that policy oriented to face climate change must dominate the institutional agenda and that a “coalition of scientists, economists, and public officials coordinate and enforce a comprehensive policy on global climate change” (Brunner, 1991, pp. 307, 308). Another challenge for Policy of Climate Change is that it can take years from planning to implementation (Narum, 1993, p. 22). Thus the International Community must bring together political will and enough knowledge to face climate change in sustainable ways.

### **II. Prediction of Future Climate Scenarios**

Without a doubt the prediction of future climate scenarios is a hard and complex task, because there are many factors affecting the system. Scientists have developed advanced computer models to try to predict what will happen depending on the given conditions (Somerville, 2013). Most of the studies come from computer models or proven data from observations, such as climate registers, measures of ocean levels or components of the atmosphere (Somerville, 2013).

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In 2007 the Intergovernmental Panel on Climate Change (IPCC) concluded that most of the observed increase in global average temperatures was very likely due to the observed increase in anthropogenic greenhouse gas concentrations (IPCC, 2007, p. 10) but the report added that there is a consideration of uncertainty based on current methodologies. Consequently some studies, few of them, differ with the idea that greenhouse gases emitted by human activity is causing global warming, for instance in 2009 Wolfgang Knorr, a scientist from the Department of Earth Sciences at the University of Bristol in England suggested that Carbon Dioxide levels in the atmosphere were about where they were 160 years ago due to the not “significant trend in evidence since 1958” (Knorr, 2010, p. 1). His study found that since 1850, the airborne fraction remained relatively constant. He explains that at the time when CO<sub>2</sub> emissions were low, the amount of CO<sub>2</sub> absorbed by nature was correspondingly low. And as human CO<sub>2</sub> emission increased, the amount absorbed by nature increased correspondingly (Knorr, 2010). This study was labeled as the “Bombshell from Bristol” by Anthony Watts (Skeptical Science, 2010), an American Meteorologist because of its potential devastating results on anthropogenic global warming.

As a consequence studies like this show that there is some level of uncertainty associated with climate change studies. But the truth is that scientists around the World have concluded that global warming is happening and it is certainly due to human activity and most likely because of greenhouse gas emissions and deforestation (IPCC, 2013). Scientific studies showed that temperature of the earth has been increasing considerably after the start of the Industrial Revolution due to the emissions of greenhouse gases (IPCC, 2013). “The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years” (IPCC, 2013). The report adds that “Carbon dioxide concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions and secondarily from net land use change emissions” (IPCC, 2013). It also considers that “the ocean has absorbed about 30% of the emitted anthropogenic carbon dioxide, causing ocean acidification” (IPCC, 2013). Hence global warming is unequivocal concludes the IPCC report in 2013 “the observed changes are unprecedented. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased” (IPCC, 2013, p. 2).

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The IPCC concludes that Climate change will cause “damage to populations, ecosystems and resources, as well as to infrastructure and living conditions, ranging from an increase in mortality and disease linked to changes in temperature”, the report also concludes that it will cause “damage by more frequent flooding and a rise in the sea level, increasing desertification in Southern countries and scarcer fresh water resources” (EU Legislation, 2013).

Since humans originated this issue, actions need to be taken from people and their governments to create the path to change the style of living in order to reduce emissions. Nowadays mitigation and adaption are the main possible paths that humans can take to face the challenges generated by Climate Change. Mitigation is the “human intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks” (FCCC, 2013). And in the other hand adaption refers to the “adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change” (FCCC, 2013). In order for these two actions to take place, there needs to be financial support known as “Climate finance”, this term “refers to local, national or transnational financing, which may be drawn from public, private and alternative sources of financing” (FCCC, 2013). Climate Change (CC) is considered a public problem because human activities created the emissions that enhanced the Earth’s greenhouse effect. Scientific studies (Barnett, 2013) suggest that CC already or eventually will affect different aspects of human life such as: Human health by the enhancement of: asthma, malaria, and diarrhea (WHO, 2003). Barnett considers that CC could have an impact on food security, scarcity of fresh water, more common hurricanes that affect public infrastructure. CC could also increase the cost of living such as needing to spend more on electricity (Barnett, 2013). In conclusion CC already impacts on the way people live. Since it is a global problem it needs the same level of action. Unilateral proceedings might be little effective but Barnett considers that “there needs to be an effective collective agreement that aims to face these challenges in a major scale” (Barnett, 2013).

The IPCC reports that if the World continue to emits the current or more rates of GHG emissions “it would cause further warming and induce many changes in the global climate system during the 21<sup>st</sup> century that would very likely be larger than those observed during the 20<sup>th</sup> century”

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(IPCC, 2007, p. 13). Considering this phenomenon as a public problem, countries around the Globe started to transit from the burning of fossil fuels to clean renewables forms of producing energy. It is important to highlight that according to the IPCC report in 2007, it is clear that developed nations are the main responsible actors of generating greenhouse gases (GHG). Noticing that it is electricity production mostly based on fossil fuels, thus electricity is the largest and fastest-growing source of GHG emissions (IEA, 2011). It is a big issue since “the Carbon Dioxide radiative forcing increased by 20% from 1995 to 2005, the largest change in any decade” (IPCC, 2007, p. 4). In 2010 electricity accounted for about half of the global growth in emissions. In consequence society as a whole must aid to substantially lower those emissions. Research from the IEA concludes that “decarbonizing” electricity and enhancing efficiency can significantly contribute against climate change (IEA, 2011).

According to study, funded by and NGO - Optimum Population Trust, “there are intrinsic links between increasing CO<sub>2</sub> emissions, climate change and the world’s ever-growing population” (Wire, 2009). The research concludes that “investing in family planning is a cost-effective policy” (Wire, 2009) to reduce CO<sub>2</sub> emissions and climate change compared to other measures. Their study proposes that “family planning methods should be an optimum strategy for reducing carbon emissions” (Wire, 2009).

In terms of Energy Policy, Jerome Dangerman states that transition to sustainable energy will not be automatic or painless. Thus he concludes that the “production and consumption of energy cause serious problems such as global warming, pollution and geopolitical conflicts that make the current energy system unsustainable” (Dangerman, 2013, p. 1). Consequently alternating to sustainable energy system is essential. He concluded that the world energy system “is locked into its current situation and it will not transform without determined intervention or an uncontrolled crisis” (Dangerman, 2013, p. 2). Dangerman highlights the importance that subsidies and investment, which are aimed to conventional energy, are redirected to renewables.

**International Joint Efforts and Institutions on Climate Change and Energy Policy**

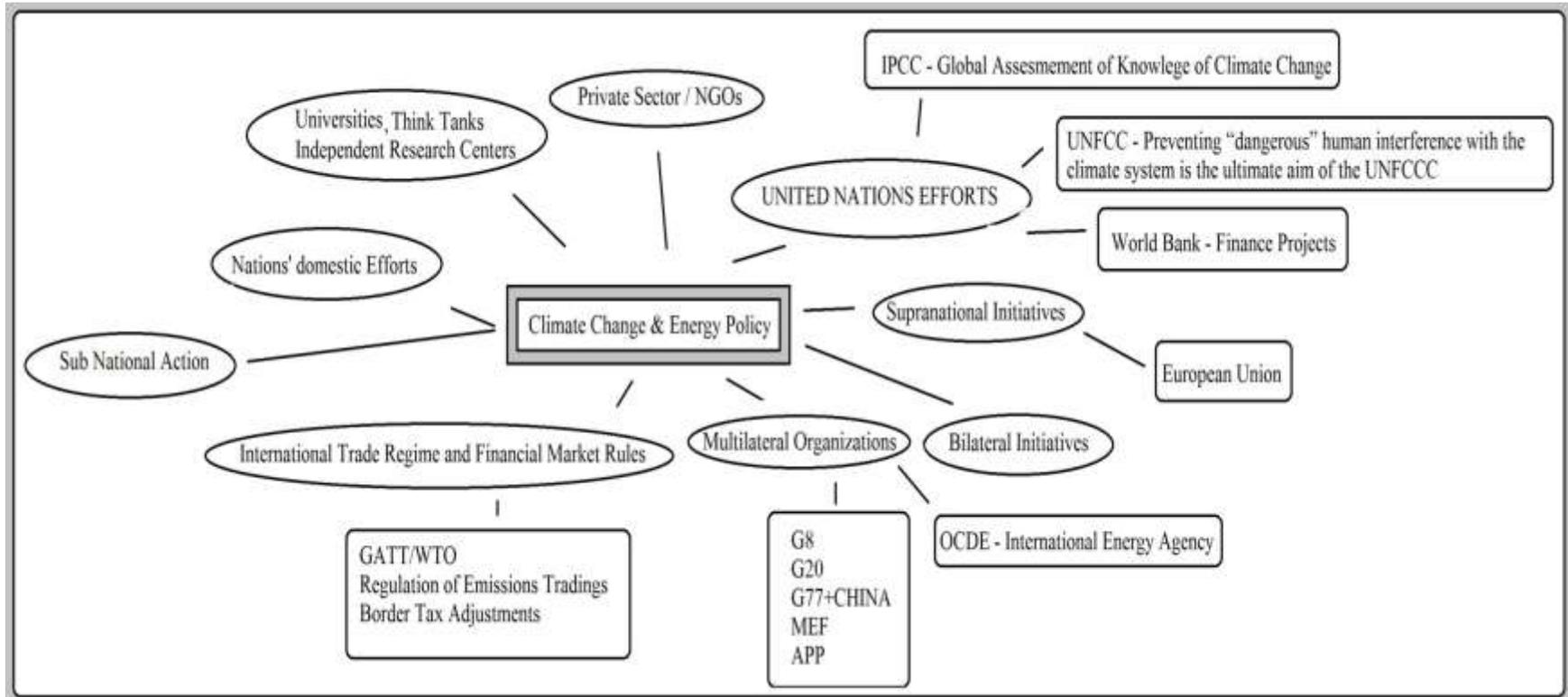


Figure III.2 – Self-made based on (Keohane & Victor, 2011, p. 10)

### **III. International Joint Efforts and Institutions**

Nowadays most the international community is well aware of climate change and has engaged in strong efforts to face it. There are various institutions at the international or local level from public or private aimed at this issue. They have been established in different times, conditions and hold account different members. Even though there have been major efforts to face climate change as well there have been resistances against it. Without a doubt the biggest efforts to face climate change come from the United Nations' Institutions bringing together more than 195 countries (UNFCCC, 2014).

#### *i. The United Nations and its coordinated efforts*

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to provide assessments and understanding of the climate system and its impacts. It is a major and authoritative source of information about climate change research (IPCC , 2007). The IPCC has said that the “worldwide emissions of CO<sub>2</sub> will have to be halved by 2050 if global warming is to remain under control this century”. (Facts about Germany, 2013)

The UN continue with its efforts to combat Climate Change and in 1992 countries joined an international treaty, known as United Nations Framework Convention on Climate Change (UNFCCC), to jointly face climate change and cope with its impacts. Since then, Conferences are held in different countries on a yearly basis. National Governments, via the UN Framework Convention on Climate Change (UNFCCC), are committed in principle to seeking this outcome. In practice, “it is proving difficult to find a politically acceptable course of action—often because of apprehensions about possible short-term economic consequences” (WHO, 2003).

The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997; it was created within the bounds of the UNFCCC. The protocol was placed as an instrument to tackle climate change by reducing greenhouse gas emissions responsible for global warming. The participant countries were divided in two groups: the developed and developing nations. The developed ones negotiated its targets to reduce their emissions compared to their 1990 levels. Whereas developing nations were not required to cut emissions hence it would not harm their economic

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growth; instead they were accountable to develop renewable projects with the help of developed nations (Aljazeera, 2012). The goals were set to reduce total emissions of developed nations by at least 5 % over the period 2008-2012 compared with their corresponding 1990 levels (EU , 2013). The Protocol entered into force on 16 February 2005. Several industrialized countries refused to ratify it, including the United States and others withdrew from it such as Canada (Aljazeera, 2012). The six greenhouse gases tackled by the Protocol are:

1. carbon dioxide (CO<sub>2</sub>);
2. methane (CH<sub>4</sub>);
3. nitrous oxide (N<sub>2</sub>O);
4. hydro fluorocarbons (HFCs);
5. perfluorocarbons (PFCs);
6. sulphur hexafluoride (SF<sub>6</sub>).

According to EU's legislation it represented an important step forward in the effort to tackle global warming as "it includes binding, quantified objectives for limiting and reducing greenhouse gases" (EU Legislation, 2013).

The Protocol suggested various means of attaining these objectives:

1. Introducing policies to reduce emissions through the development of renewable forms of energy, increase efficiency, and sustainable forms of agriculture,
2. Cooperation among Members (exchange of information, coordination of policies and joint implementation and a transparent mechanism). (EU Legislation, 2013)

In 2009 the Copenhagen Accord recognized "the scientific view that the increase in global temperature should be below 2°C, in a context of sustainable development, to combat climate change." (UNFCCC, 2009) According to the Copenhagen Diagnosis if global warming is to be limited to a maximum of 2°C above pre-industrial values, "global emissions need to peak between 2015 and 2020 and then decline rapidly" (UNFCCC, 2009). These Nations saw the need of "decarbonizing" global society within this century.

In 2010 the Cancun Agreements presented collective efforts to reduce emissions. They included a plan to help developing nations protect themselves from climate change impacts and build on sustainable development. (UNFCCC, 2014)

Later in the Conference in Qatar in 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

1. New commitments to the Kyoto Protocol for a second commitment period from 1 January 2013 to 31 December 2020;

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2. A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
3. Amendments to several articles of the Kyoto Protocol (UNFCCC, 2014).

In 2013 the Conference was held in Warsaw, there was taken the decision in the direction of a universal climate change agreement in 2015. The objective of this agreement would be to:

1. Bind nations together into an effective global effort to reduce emissions rapidly.
2. Stimulate faster and broader action (UNFCCC, 2014).

The next conference will be held in Lima in 2014 (UNFCCC). There have been many outcomes of these Conferences such as the Kyoto Protocol, according to the UNFCCC the Protocol was the first important step towards a global emission reduction that provided the architecture for the international agreement on climate change (UNFCCC, 2014). To summarize the outcomes of the Kyoto Protocol in the first commitment period, “37 industrialized countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels” (UNFCCC, 2014). For the second commitment period, “Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020” (UNFCCC, 2014). Currently, there are 192 Parties incorporated to the Kyoto Protocol.

Although most efforts to lower warming emissions have focused on the UNFCCC, other treaties have had a big impact on emission of these gases. As some studies have concluded “the Montreal Protocol on the Ozone Layer has actually had a much bigger impact than the Kyoto Protocol on warming because the gases that are responsible for ozone depletion are also very warming gases (Velders, 2007).

The World Bank has also led efforts on Climate Change. Keohane and Victor highlight that the World Bank because it manages the financial mechanisms for the participation of developing countries under the Kyoto Protocol (Keohane & Victor, 2011, p. 11). The World Bank also finances projects to reduce deforestation.

### *ii. The OCDE and the IEA*

The Organization for Economic Cooperation and Development (OECD) is a multi-disciplinary inter-governmental organization that comprises 34 member countries. According to a report “the OECD has been working on climate change economics and policy since the late 1980s” (OCDE, 2011, p. 2) by assisting governments to identify and implement efficient policies to reduce GHG

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emissions, by comparing and exchanging policy experiences, and by identifying and promoting good practices through policy decisions into all relevant sectors and policy areas (OCDE, 2011, p. 2). The OECD delivered a “Green Growth Strategy” in 2011, that provides a “framework for growth that ensures that natural assets continue to provide the resources and environmental services on which well-being relies” (OCDE, 2011, p. 2). The Strategy calls to evade unsustainable patterns of growth that can direct to negative feedbacks that can weaken growth and development. The strategy was designed to encourage low-carbon and climate resistant investment and innovation (OCDE, 2011, p. 3).

The International Energy Agency was founded in response to the 1970s oil crisis to co-ordinate countries in a cooperative response to disruptions in oil supply. As the energy market has changed, its duty has broadened to incorporate the “Three E’s” of balanced energy policy: energy security, economic development and environmental protection (IEA, 2013, p. 417). The IEA is an “autonomous organization which works to ensure reliable, affordable and clean energy for its 28 member countries and beyond” (IEA, 2013). Since the 1990s the IEA has been focus on the dimension of energy and climate change. In 2005 the “G8 leaders mandated the IEA to provide advice on a range of energy policy issues linked to climate change” (OCDE, 2011, p. 26). In 2008, “the IEA published a book on Energy Efficiency Policy Recommendations which made energy efficiency recommendations in over 25 areas” (OCDE, 2011, p. 27). In 2010, “the IEA launched a series of publications called Policy Pathways” (OCDE, 2011, p. 27) aimed to provide essential steps in implementing specific energy efficiency policies.

Other international groups of nations took up the climate issue in their Agendas, such as the G8, G20, and G77+China. This was relatively easy these groups already existed, started in different circumstance and were in search of agenda items. Keohane and Victor say that “every G8 meeting since 2005 has included prominent states on climate change” (Keohane & Victor, 2011). Among intergovernmental institutions, the G8 and EU have offered the earliest and clearest articulation for the global goal of limited warming at 2 degrees Celsius above pre-industrial levels. The G20 was created “to help finance ministers coordinate their actions”. Since 2008, the G20 has met regularly and has focused on measures that help reduce emissions.

The World Trade Organization (WTO) has establish a “clear link between sustainable development and disciplined trade liberalization in order to ensure that market opening goes

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hand in hand with environmental and social objectives” (WTO, 2013). Recently they launched the first multilateral trade and environment negotiations. That can “contribute positively to efforts to mitigate and adapt to climate change” (WTO, 2013). As well, The WTO addresses issues concerning trade and climate change.

### *iii. The European Union*

The European Union (EU) was developed gradually after the devastating Second World War (1939–1945), “France and other nations wanted to "cage" Germany so that it could never again threaten its neighbors” (Adamski, 2006).

Efforts focused to integrate a political union through increasing economic interdependence. First in 1951 the European Coal and Steel Community (ECSC) was created to coordinate the production and trading of coal and steel (elements of war) among its members (Eldridge & Nixon, 2006). The ECSC helped pacify the fears for another possible subsequent war (Adamski, 2006). After that, in 1957 the ECSC ratified two treaties creating the European Atomic Energy Community (Euratom) to collaborate in the development of nuclear power, and the European Economic Community (EEC), to progressively eliminate tariffs and other barriers among member countries (Eldridge & Nixon, 2006). At the time, the EEC was formed by Belgium, France, Germany, Italy, Luxembourg, and the Netherlands. After the EEC’s existence another similar confederation was created by Austria, Britain, Denmark, Finland, Norway, Portugal, Sweden, and Switzerland labeled as the “European Free Trade Association” (EFTA) (Eldridge & Nixon, 2006). The EEC was substitute by the European Community (EC) in 1967. When the EC became larger, by the addition of new members, it contributed to expand its role, by strengthening cooperation and coordinating foreign policy (Adamski, 2006).

In 1993 the member states ratified the treaty of the European Union, thus it replaced the former EC. The EU set a common currency, the euro, in 1999 among other guidelines such as environmental and energy policy (Adamski, 2006). Nowadays the European Union (EU) is considered a “supranation” of autonomous European nations. The member nations decide to participate in EU’s institutions, “delegating sovereignty in order to achieve common goals” (Lerner, 2004). The mission of the EU is to encourage economic growth, lobby for European interests, coordinate policies, raise standards of living, and promote peace. The EU embraces

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democracy and the rule of law; it requires members to have a form of a representative government (Lerner, 2004). According to the EU its Members pursue a pro-environment policy (EU, 2013) and since the 1970s Europe has been committed to the environment. European environment policy is based on Article 174 of the Treaty establishing the European Community,” it aims to ensure sustainable development of the European model of society”. (EU Legislation, 2013)

The European Union is making efforts to transit to Renewables and limit their emissions a proof of that is that on 2002, the European Union ratified the Kyoto Protocol. (EU , 2013) Environmental protection is one of the major challenges facing Europe and is therefore a Community objective.

According to EU Legislation here are the EU institutions and bodies that deal with Energy and Climate Change:

- European Parliament
  - Environment, public health and food safety committee
- Council of the European Union
  - Climate change
- European Commission
  - Climate action
- European Economic and Social Committee
  - Agriculture, rural development and environment section
- Committee of the Regions
  - Commission for environment, climate change and energy (ENVE)
- EU agencies
  - European Environment Agency (EEA) (EU, 2013)

Thus the European Commission suggested that the EU should adopt targets to reduce greenhouse gas emissions The European Union (EU) has set the goal to reduce its emissions by 20 % by 2020. However, it estimates that the goal of a 30 % reduction is also viable, providing the international situation allows for it. (EU Legislation, 2013).

The Commission recommends taking the following measures on energy policy:

1. improving the EU's energy efficiency by 20 % by 2020;
2. increasing the share of renewable energy to 20 % by 2020;

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3. developing an environmentally safe carbon geological storage policy. (EU Legislation, 2013)

Therefore the production of electricity from renewable sources is a priority, the EU is doing so to “promote the security and diversification of energy supply, environmental protection and social and economic cohesion” (EU Legislation, 2013). Local and regional governments participate as key players in the implementation of EU energy and climate policy” (EU Legislation, 2013). Thus the European Commission also established a series of guidelines to integrate the policies in the Region (EU, 2013).

Other efforts come from bilateral agreements, Keohane and Victor point out that a proof of this is that the United Kingdom, Australia, France and The US are signing bilateral deals regarding coal and nuclear power with the Chinese Government, considering China as the largest producer in Electricity (Keohane & Victor, 2011, p. 11).

National efforts may ultimately play an important role in climate change as well. Their regulations might help front warming. Several Nations have created their own Institutions to research about Climate Change with an International Perspective (Keohane & Victor, 2011, pp. 11, 12). Keohane and Victor say that there has been some sub national efforts as well, they are presented as unilateral actions, such as the one presented in California (AB32 Legislation) and the northeastern states (Regional Greenhouse Gas Initiative).

As well there have been efforts by Civil Society though NGOs, Keohane and Victor state that mainly they have organized to build awareness and to focus on practical solutions for controlling emissions. As well they add that some Private Firms have created their own regulatory programs (Keohane & Victor, 2011, p. 12).

#### **IV. Global Scenario**

The World is home to more than 7 billion people. The surface of the Earth is approximately 30% land and 70% water including five oceans and six continents divided in to 195 countries with a total GDP in 2012 of \$71.62 trillion dollars (CIA World Fact Book, 2013). Even though there are major efforts worldwide in favor of energy, there are 1.2 billion people without electricity, and most of them being (87%) are either in sub-Saharan Africa or South Asia (Reuters, 2013).

In 1973 the total electricity supply of the world was 6,115 Terawatt hour (TWh). Renewable energy contributed to 21.6% of the global electricity generation. The contribution of other energy sources was 38.3% for coal, 24.7% for oil, 12.1% for natural gas and 3.3% for nuclear. At that time 53.5% went to supply the industry sector, 44.1% to others (agriculture, commercial and public services, residential) and 2.4% to transportation (IEA, 2013). (see Figures III.3 & III.9)

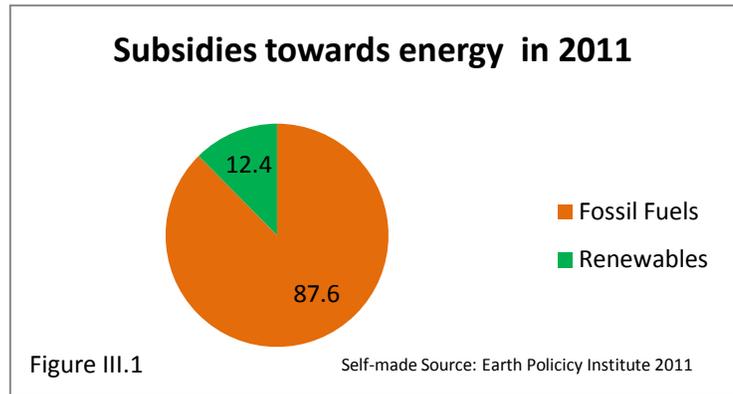
In 2010, the total electricity supply of the world was 21,431 TWh. Renewable energy contributed to 19.7% of the global electricity generation. The contribution of other energy sources was 40.6% for coal, 22.2%, for natural gas, 12.9% for nuclear and 4.6% for oil. At the time 56.9% went to others (agriculture, commercial and public services, residential) 41.5% to the Industry and 1.6% to transportation (IEA, 2013). (see Figures III.4 & III.10)

Since the last two decades the transition to renewable energy in the world has been motivated by a series of factors, mainly to increase energy security in order to be less dependent on supplies from other countries; the high volatility of the price of fossil fuels, the environmental impacts of energy generation and its link to climate change, and the lowering of cost of renewable energy along with technological innovation. Since the 1990s this transition to renewables has accelerated in countries such as: Germany, China, Brazil, Denmark, India and the USA (IEA, 2012). Between 2006 and 2011, the global production capacity of renewable energy grew at average annual high rates (between 17% and 58%). Solar Photo Voltaic recorded the fastest growth, with an increase installed capacity averaged at 58% annually over that period. In addition, solar thermal energy increased almost 37%. Biofuels production varied, with an expansion of biodiesel in 2011 and ethanol being stable. Wind power grew at an annual rate of 27%. Other technologies, including hydropower and geothermal, have grown at more moderate

rates, ranging from 2% to 3%, with comparable behavior with the overall growth rates of fossil fuels from 1% to 4% (IEA, 2012).

*i. Subsidies to Fossil Fuels*

According to the UN the World invests more than \$1 trillion per year in energy, much of it going toward fossil fuels sources. (Sustainable Energy for All, 2013) According to a report from the Earth Policy Institute citing the IEA “Governments around the World spent more than \$620 billion to subsidize fossil fuel energy in 2011: some \$100 billion for production and \$523 billion for consumption”. For that reason, in 2009, the G20 countries agreed to progressively eliminate these subsidies. Therefore those countries heavily subsidizing gasoline and diesel have overwrought their budgets.



Contrasting the subsidies in 2011 for renewable forms of energy there were only \$88 billion representing only 12.4% of the total amount of subsidies (Earth Policy Institute, 2013, p. 3).

Another aspect to take in to account is that according to a report from the World Bank and the IEA the price of renewable energy is reducing, for instance the cost of wind energy has fall in the last two decades from \$2,500 per kilowatt/hour during the 1980s to \$630 to recent days and the cost of solar systems went down from \$7000 per kilowatt/hour in the mid of the 1980s to \$750 in 2012 (Reuters, 2013).It was until the 1970s that scientists became fully aware of the connection between human activity and climate change (NASA, 2013). It would be ideal that every single actor worldwide would comprehend the seriousness of the problem and would act in consequence. Even though the strong efforts there has been some resistance to reduce emissions because mainly and according to David Narum some studies in the 1990s argued that “the cut of emissions would lead into loses of trillions of dollars” (Narum, 1993, p. 22). About the consumption of non-renewables resources, Narum (1993) considers that the fast consumption of these resources is unsustainable and does not consider the needs of future generations. He continues and says that in the 1990s a problem was when politicians would not know the severity of climate change; and even worse they considered measures as a threat to the economy.

### Global Electricity Context

**% of Generation by Fuel Source  
in 1973**

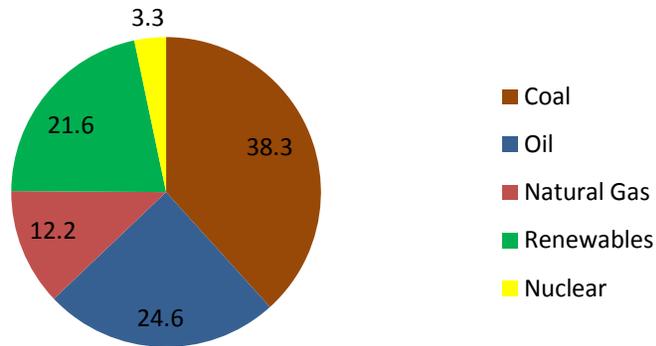


Figure III.3

Self-made, source: (IEA, 2010, p. 24)

**% of Generation by Fuel Source  
in 2010**

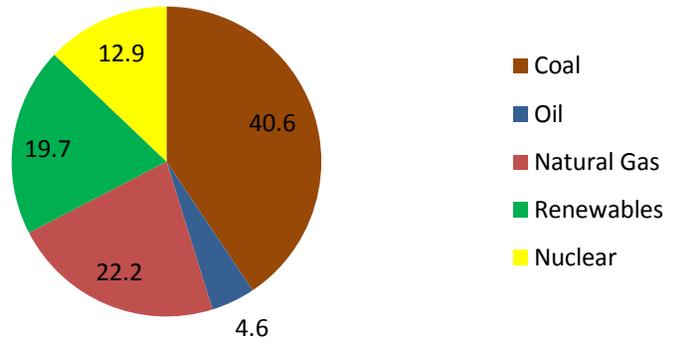


Figure III.4

Self-made, source: (IEA, 2010, p. 24)

Notes: Renewables includes hydro, geothermal, wind, bio-fuels and waste, and heat.

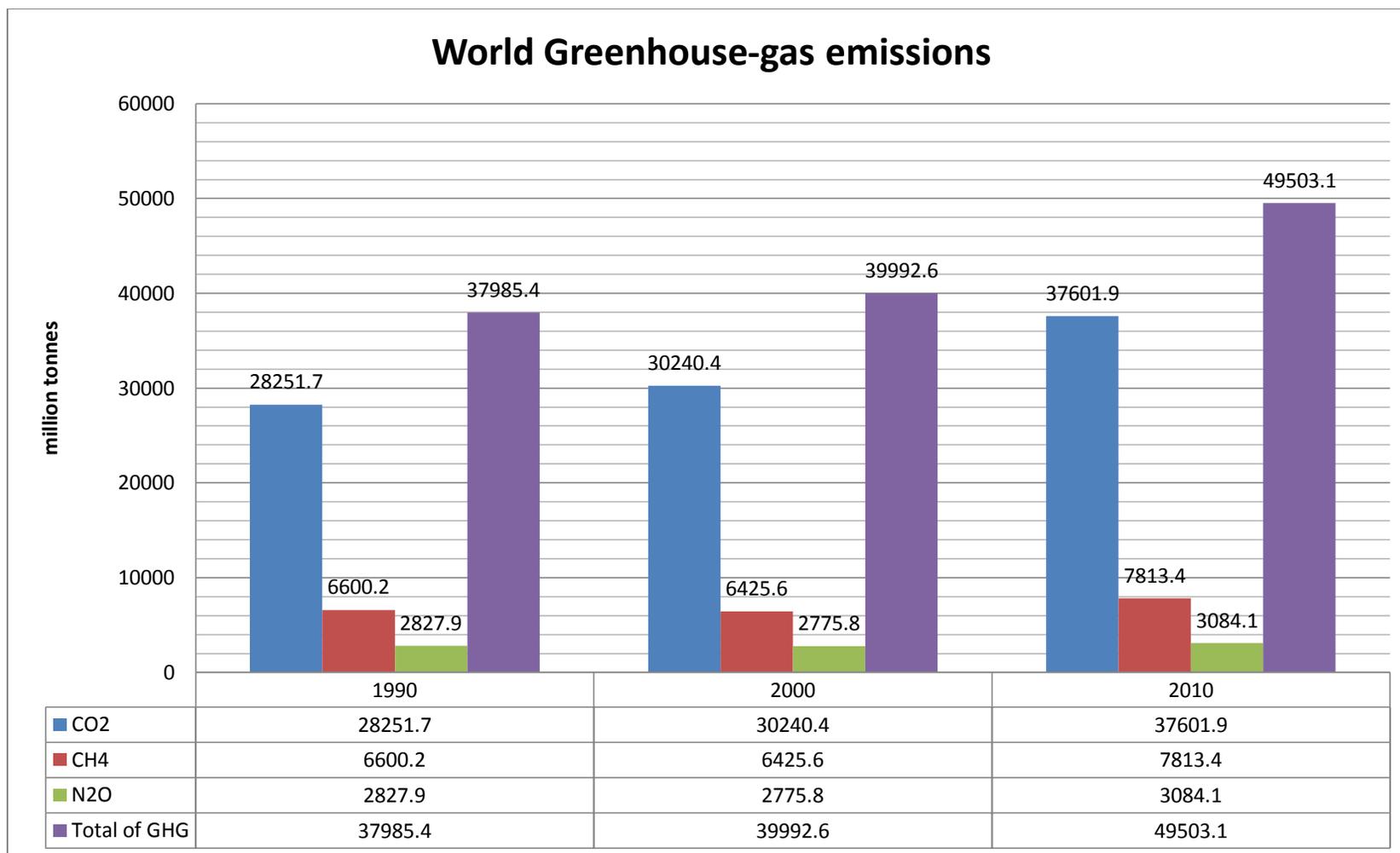


Figure III.5 Self-made with information from (IEA, 2012)

**Fuel Share of CO<sub>2</sub> emissions in 1973**

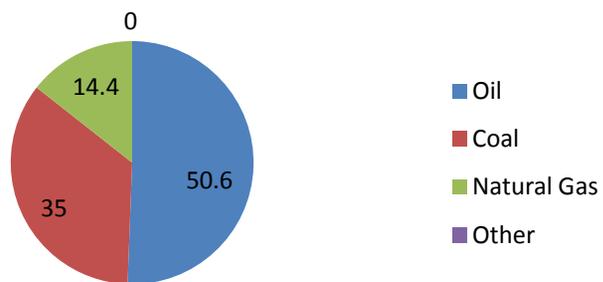


Figure III.6

**Fuel Share CO<sub>2</sub> emissions in 2010**

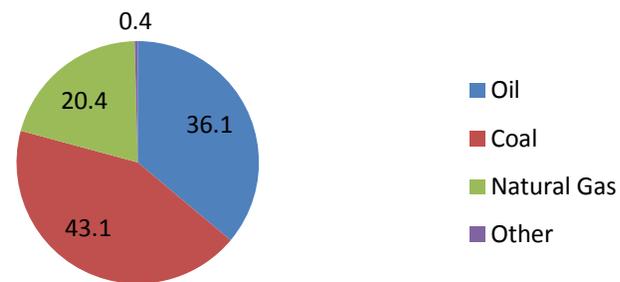


Figure III.7

Self-made, source: (IEA, 2010, p. 44)

Self-made, source: (IEA, 2010, p. 44)

Notes:\* Other includes industrial waste and non-renewable municipal waste.

**World Electricity Consumption by Sector in 1973**

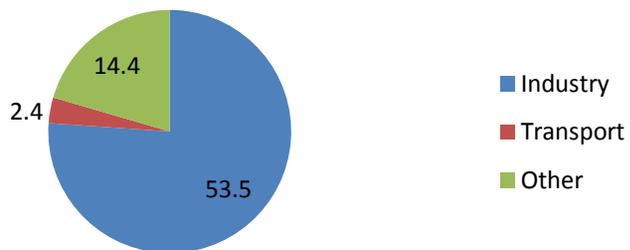


Figure III.8

**World Electricity Consumption by Sector in 2010**

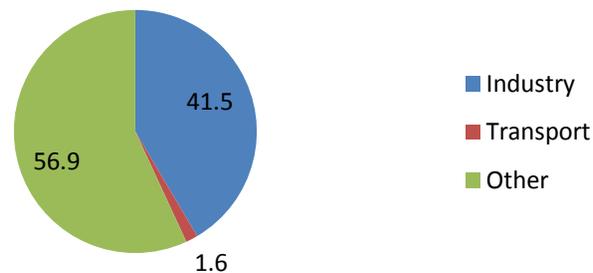


Figure III.9

Self-made, source: (IEA, 2010, p. 35)

Self-made, source: (IEA, 2010, p. 35)

Notes: Other includes agriculture, commercial and public services, residential and non-specified other.

## V. Case Study

At the international community nations play different roles according to its size in terms of population, territory, military, the natural resources it poses and the relations they maintain with other nations. As seen already, Public Policies are implemented accordingly to each scenario and decisions are not only influenced by the international community but also with a bigger role in each domestic community. They poses different regimes of governments, some being more democratic than other or more or less accountable for their actions.

This case study will analyze the scenarios of: (1) the Federal Republic of Germany (Germany), (2) the State of Japan (Japan), (3) the United States of America (USA) and (4) the United Mexican States (Mexico). These four nations embody three important regions of the world in terms of social and economic development, Europe, North America and Asia. These countries together host a population of almost 700 million and in 2012 if joint a GDP of about 27 trillion dollars.

Germany plays a leadership role within the EU; it is the fourth largest global economy, and it has presented an ambitious plan to transit to Renewable energy and reduce its emissions.

Japan is the third largest economy in the World. It is the second biggest in Asia following China. After the Second World War, it passed through an economic boom that industrialized the nation, as being an isolated nation with limited resources, it hope in Nuclear Power to be the biggest solution to increase its energy security. In 2011, it faced serious challenges after the nuclear accident at Fukushima, establishing a big debate on its energy policy.

The United States is the largest economy in the World; it maintained a hegemonic power during the last decades, playing an important role at the international community. It is the second biggest energy consumer after China

The Mexican case is particular because while this study was presented, an Energy Reform was debating at different forums and at the Mexican Congress. Mexico is the 11<sup>th</sup> economy of the world and is developing with the entrance of industry in the last decades mainly due to its openness and free trade agreement.

It will include the following:

1. Background and country profile
2. Institutional bodies in charge of policy of Climate - Energy
3. Overview of the policies implemented
4. Illustrate past and recent scenarios from electricity sources and electricity use-ends from 1990-2000-2010. GDP, Population in 1990-2000-2010. Current Sustainability Index.
5. Possible long term goals in 2020 and 2050.

An important aspect to take in to account before proceeding is that transiting out of fossil fuels is not an easy or smooth way. First of all because: There exists a multibillion dollar global industry in the field of fossil fuels, according to a report from the Earth Policy Institute in 2012, the Big Five Oil Companies –ExxonMobil, BP, Chevron, ConocoPhillips and Royal Dutch Shell, jointly made \$137 billion in profits (Earth Policy Institute, 2013). In 2011 more than 68% of electricity global production came from Fossil Fuels (IEA, 2013).

According to a report from the UN investing in Sustainable Energy, “is a smart strategy for growing markets, improving competitiveness, and providing greater equity and opportunity”. The report continues and adds that the transition to Sustainable Energy might be the biggest business opportunity of this Century (Sustainable Energy for All, 2013). Today all 195 Countries must focus on energy that is clean, efficient and accessible to all.

## **VI. Germany**

Germany is the most populous nation in Europe with about 82 millions. It stretches from the North Sea to the Alps in the south. It is surrounded by nine neighboring countries. Its territory is about 357,000 square kilometers. Some of the largest European rivers, the Rhine, the Danube and the Elbe, flow through Germany (Facts about Germany, 2013). Germany is the fourth largest economy in the world and the largest in Europe (CIA World Fact Book, 2013). Germany’s economy is characterized by the manufacturing auto industry, mechanical engineering, electrical

engineering, chemicals, environmental technology and nanotechnology (Facts about Germany, 2013).

i. Institutional Context

Germany is the strongest economy in the EU, “It accounts for a fifth of the European Union’s output and a quarter of its exports” (The Economist, 2013), making it one of the most important members of an institution though to be of equals. Even though the EU’s origins were influence to limit Germany’s power, it rather increased it (Simons, 2013). After the euro crisis, political and economic relations modified within the EU, “as the largest creditor country, Germany has gained disproportionate political influence within Europe” (The Economist, 2013). Thus Germany is the “EU’s dominant country, both politically and economically” (The Economist, 2013). The Economist explains how this is possible after the “French economy is dormant, statist and uncompetitive and the U.K. keeping its British Pounds “is distracted by domestic debate about its EU membership” (The Economist, 2013). This German leadership has created some frictions after its role to exert too much influence over the poorer states given its relative higher position (Simons, 2013). Hence Germany’s influence is huge within the member states of the EU in consequence the energy trail it follows will shape how others follow.

*National Context*

Germany is a parliamentary democracy with its figure of a Chancellor, where public authority is divided among federal, state, and local levels of government. Federal elections are held every four years (Eidson, 2001). Germany is an active member of the European Union. At the Federal level there are two legislative chambers: The “Bundesrat” consists of a federal council comprehending 69 representatives appointed by the land governments; the other chamber is the “Bundestag” a federal assembly comprehending 662 members. The chancellor is the leader of the executive branch; he/she is elected by an absolute majority of the Bundestag (Gall, 2004). Gianfranco Pasquino considers that this makes the figure of the Chancellor, who acts as the Head of the Government, especially strong because he/she is the leader of a parliamentary majority and competent for the reason of the absolute majority (Pasquino, 2004, p. 114). Its government policy is determined by the chancellor and the cabinet ministers, and not by the head of state thus

the President (Facts about Germany, 2013). The duties of the president are largely ceremonial. Germany poses 16 federal states (Länder) (Gale, 2012).

The main German Institutions in charge of managing the climate and energy policy are:

The *Federal Ministry of Economic Affairs and Energy* is the main administrative body responsible for the formulation and implementation of energy policy (BMWI , 2013). Their objectives related to Climate Change and Energy include: linking economic and ecological goals and ensuring a secure energy supply at appropriate prices (BMWI , 2013).

The Ministry for Environment, Nature Conservation and Nuclear Safety (BMU) is in charge of the environmental policy as well as the Nuclear Safety. Their goal is to “preserve nature as the foundation of life, for future generations as well, and to promote environmental thinking and action as a matter of course” (UBA, 2013).

The German Government funds the Potsdam Institute for Climate Impact Research (PIK) PIK “addresses crucial scientific questions in the fields of global change, climate impacts and sustainable development” (PIK, 2013). The German Federal Government put in place in 1992 the German Advisory Council on Global Change (WBGU) which provides independent scientific advice to make policy and it also emits research recommendations (WBGU, 2013).

## **ii. Problematic**

### *Increase Energy Security*

The Oil crisis in the 1970s obligated many nations reconsider their energy policy. The high oil prices pointed out the vulnerability of energy security. This brought the need of securing energy supply at affordable prices. Germany is the greatest consumer of electricity in Europe (IEA, 2013). Therefore Germany imports most of the fossil fuels needed to generate part of its electricity demand due to a lack of their own resources (IEA, 2013). “Germany currently imports 97 percent of its oil, 90 percent of its natural gas, and two-thirds of its coal” (Paulos, 2013). As well it imports all the uranium needed for its nuclear plants (Morris & Pehnt, 2012). This makes Germany vulnerable to abrupt changes in the fossil fuel prices. Fossil fuels are non-renewable therefore they will become more expensive when they start to run out. This creates an impulse to

find renewable sources of producing electricity and an opportunity to reduce emissions in the energy sector, notably by replacing polluting power plants with renewable ones.

According to the IEA the transition to renewable energy poses the challenge for the electricity networks. “The existing grid system is reaching its limits thus to ensure a secure energy supply in every region, the grid must be rapidly expanded and upgraded” (IEA, 2013).

*Protect the climate and commit to international agreements*

Combustion of fossil fuels produces emissions of GHG that enhance climate change. Developed nations have a bigger responsibility towards reducing their emissions because simply they have emitted a lot more. Germany is the 4<sup>th</sup> largest economy making it largely industrialized. Thus it is one of the larger emitter nations in the World. Germany ratified the Kyoto Protocol on 31 May 2002 as part of annex 1 or as a develop nation (UNFCCC, 2014). It produced about 20% of total EU CO<sub>2</sub> emissions in 2009 (Klein, 2012, p. 6). “The relatively high emission intensity of the German economy is not due to a high level of energy consumption but rather to a carbon intensive energy mix” Germany committed itself to reduce its emissions by 21% in the period 2008 to 2012 compared with 1990 (Klein, 2012).

*Eliminate the risk of Nuclear Power*

According to the US Energy Information Administration, Germany was the sixth largest generator of nuclear energy in the world in 2011. It was also a leading exporter of nuclear technology (Petroleum Economist, 2013). Considering that Nuclear power is unsafe, costly and generates radioactive waste (Green Peace, 2009). The Chernobyl disaster in 1986, not far from Germany, created awareness of the large dangers of Nuclear power. Thus there was created an anti-nuclear movement in Germany mainly motivated by this disaster (Paulos, 2013).

*Imminent technological change, promote green growth*

Transition to renewables from fossil fuels is imminent in the long term. The economy needs investment put in place in to research of new technology and development that leads to job creation, and promote it in terms of sustainable development.

### **iii. Policies Implemented**

After the oil crisis in the 1970s Germany started to invest in renewable energy. That is why its energy policy is oriented towards “economic efficiency, security of supply and environmental compatibility” (BMW I , 2013). Despite significant GDP growth since 1990, (see figure III.16) energy use was reduced by 6% and energy intensity has decreased on average by 1.7% per year (Klein, 2012). The restructuring of the economy after the two Germany reunited contributed to the decline in energy use, after the collapse of inefficient firms in East Germany (OECD, 2001). There were policies set in place in the 1990s that made renewables attractive and economical. “The Renewable Energy Sources Act (EEG), promoted the use of renewable energies” (Facts about Germany, 2013). This Act is considered as the main policy behind its renewable energy growth. “The increased use of renewable energies and the efficiency formed part of the Agenda of the Federal Government’s 2009 coalition agreement on the topic” (Facts about Germany, 2013). According to the IEA, the two main programs defining the climate change and energy strategies are “the Integrated Energy and Climate Program (2007) and the Energy Concept (Bundesregierung, 2010)”. The German government has set itself “the goal of making the country one of the most energy efficient and environmentally sound economies in the world (IEA, 2013).

The “Energiewende” is referred as the strategic plan to shift Germany from fossil fuels and nuclear in to renewable energy. In 2011, “Germany was the world’s largest producer of electricity from solar power and the largest European producer of non-hydro renewable electricity, including wind power and biofuels. (Petroleum Economist, 2013)

The main policy tool for renewable power is the feed-in tariff (FIT) program, which pays renewable producers a fixed amount for the electricity produced in periods of 20 years. “The BDI, Germany's industry lobby group, has called for an overhaul in renewable energy subsidies and for feed-in tariffs, which guarantee producers a long-term price for power they add to the grid” (Petroleum Economist, 2013). Thus it is guaranteed that producers will get its money invested back and most likely more. As John Farrell points out, “German energy policy is explicitly encouraging citizen investment in renewables”. “Over half of renewable energy projects are owned by individuals and farmers, amounting to over \$100 billion of investment”

(Farrel, 2013). Germany's power market was deregulated since 1998. "Citizen ownership has taken a 20 percent bite out of utility market share, creating a major form of competition" (Farrel, 2013). In 2013 the federal government set the framework to accelerate the expansion of the transmission grid to cover the present challenge (IEA, 2013). Germany has design a plan of subsidies to attract investors to the renewable sector. The government also helps by taking financial liability in certain project thus investment can be reach (Petroleum Economist, 2013)A report highlights how these actions are admirable but they signal that "it has come at a high price for German taxpayers" (Petroleum Economist, 2013). Germany's renewable energy policy has increase electricity bills within the nation (Petroleum Economist, 2013) Thus "around 30% of German consumers' electricity bills constitute taxes and the costs of implementing government energy policies" (Petroleum Economist, 2013).

*Reduce emissions, increase efficiency and protecting the climate*

Germany's government assumes the responsibility for the future generations, not leaving up to them the problems created in the present (BMW I , 2013). "Carbon emissions were reduced by the switch from gasoline to diesel cars and from heating oil to natural gas, which are less carbon intensive" (Destatis, 2011). Higher energy prices as well as European and national environmental policies, such as the implementation of an "eco tax" and energy standards in the automotive sector, also played a role by creating incentives for energy savings (OECD, 2011). According to a report from the OCDE, "Germany has committed itself to become one of the most energy-efficient economies in the world and fixed ambitious targets for GHG reductions going beyond the EU requirements" (Klein, 2012). Germany set itself ambitious targets for GHG emissions, energy efficiency, and renewable energy sources (Weidner and Mez, 2008). Relative to 1990, Germany had reduced its carbon emissions by 27 percent at the end of 2011, thereby overshooting its target for the Kyoto Protocol of 21 percent by the end of 2012. The largest reductions occurred mainly in the manufacturing and construction sectors as well in transportation (Klein, 2012). Mitigation was less from the electricity and heating sectors given it a large share of total emissions (Klein, 2012, p. 6). In the international arena Germany has played an active role in getting environmental and climate protection on the agenda. Thus the German

EU and G8 presidencies in 2007 made climate protection objectives and energy policy two of their main goals. (Facts about Germany, 2013)

### *Phasing out Nuclear Power*

In 1986 after the disaster in Chernobyl, the Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety was founded (Morris & Pehnt, 2012). In 2010 “the German parliament adopted legislation that sets ambitious targets for carbon reductions, renewable energy and energy efficiency, and commits to a phase-out of nuclear power” (Farrel, 2013). In 2011, after the nuclear disaster in Fukushima, public protests forced the German government decide to change its energy policy and accelerated the shutdown of nuclear energy. Eight of the 17 nuclear power stations were immediately shut down. In addition the Bundestag, with a big majority, passed a schedule according to which the remaining nine reactors would also be closed by 2022 (Petroleum Economist, 2013). Germany’s plan to transit to renewables and shutting its nuclear power has increase the amount of coal used due to high prices of European natural gas (Petroleum Economist, 2013). As a result Germany’s GHG emissions increased by 1.6% in 2012 according to data from Germany’s Ministry of Environment (Petroleum Economist, 2013).

Following that, the energy from nuclear power is thought to be replaced with renewable energy. Klein considers that “an early phase-out of nuclear power and the development of renewable energy sources will require high levels of investment and public financial support” (Klein, 2012, p. 5). According to Altmaier, the environment minister for Angela’s Merkel Administration, “this decision is unprecedented and brings to an end decades of public debate in Germany” (Paulos, 2013). The Minister considers that now the nuclear debate is over, the issue now is how to do it with a low cost and efficiently.

### *Promote Green Growth, Adapt to the Technological Change*

The Energy policy is a key element to the competitiveness policy. “Major corporations like Siemens and BASF, along with many smaller ones, are selling clean energy technology around the world” (Paulos, 2013). Jobs in renewable energy have grown 129 % since 2004, employing over 370,000 people.

<b>Germany</b>			
Public Policies			
Target of Policy	Time Frame	# of Policies	Total
Renewable Energy	2000-2013	26	42
	1990-1999	14	
	1970-1989	2	
Energy Efficiency	2000-2013	130	154
	1990-1999	22	
	1970-1989	2	
Addressing Climate Change	2000-2013	169	193
	1990-1999	21	
	1970-1989	3	
<b>Grand Total</b>			<b>389</b>

Source: (IEA,2013)

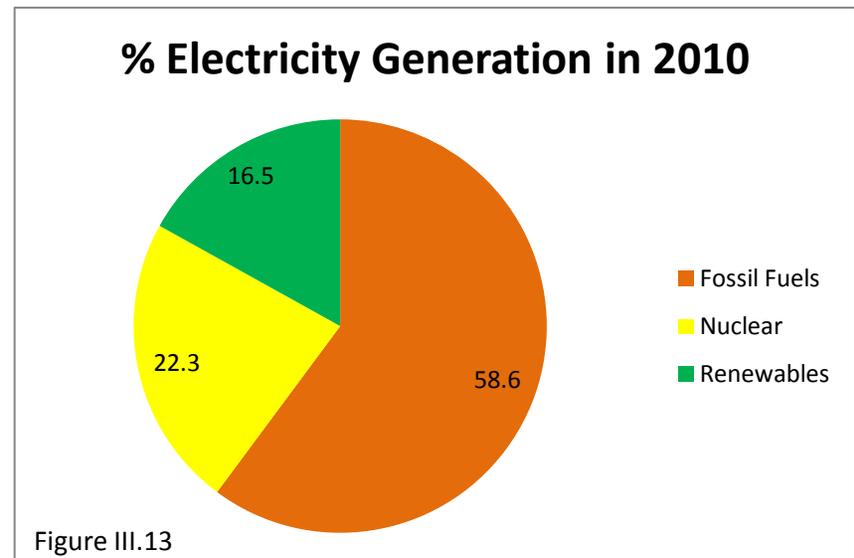
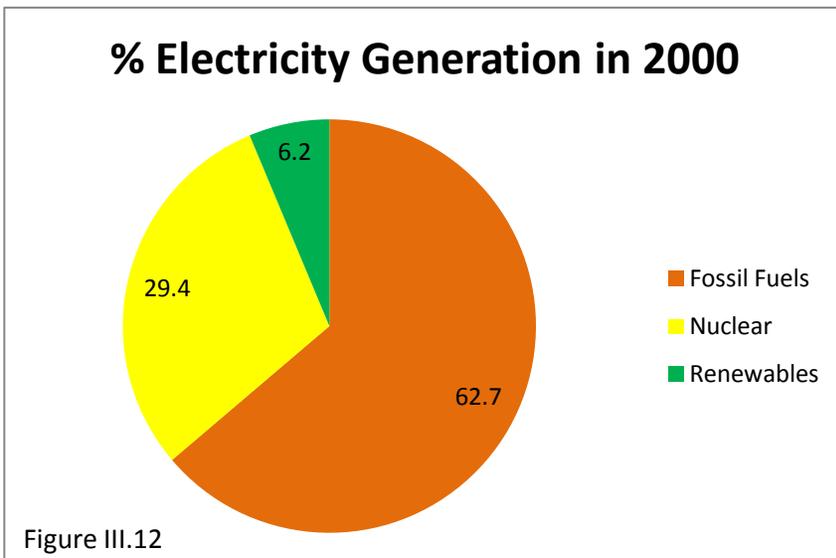
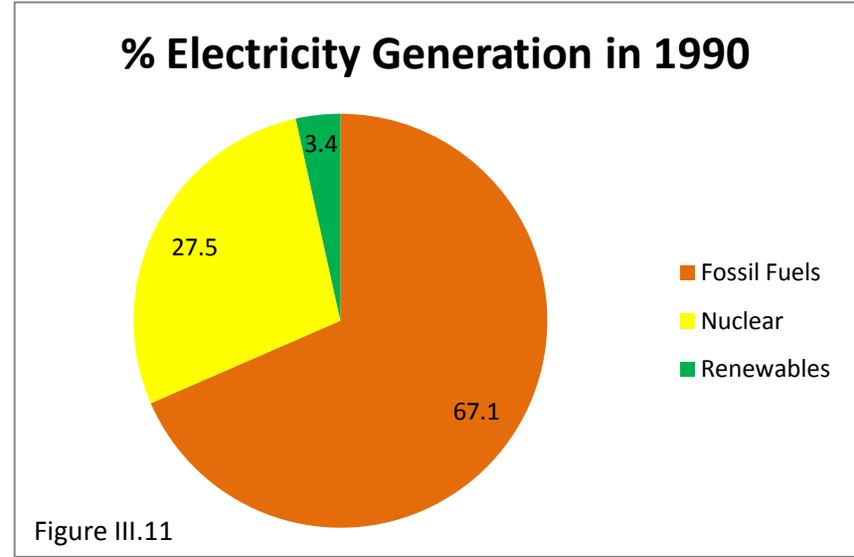
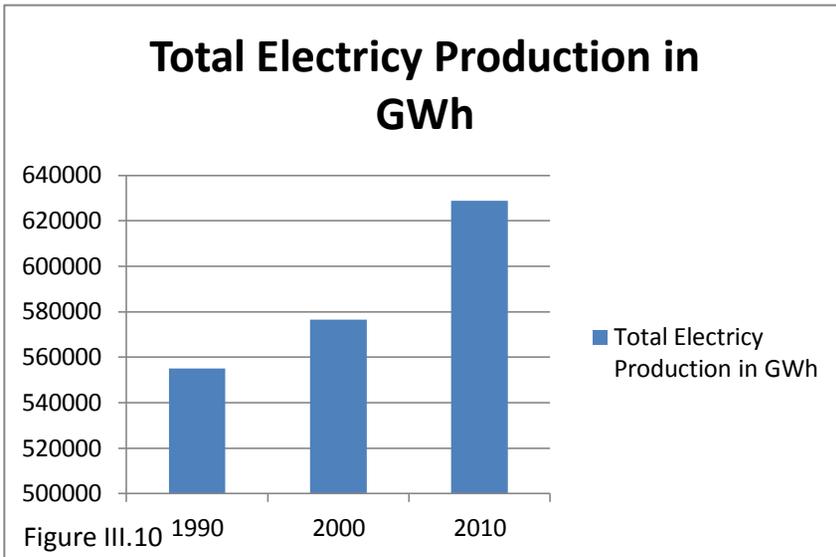
#### iv. Goals and Forecast

Goals are important to make sure effort completes an objective. The goal of German energy policy is to “reduce emissions by at least 40 percent by 2020 and by 80 to 95 percent by 2050, relative to 1990 levels” (UBA, 2013). Germany plans to this by switching to renewable energy entirely and increase efficiency further (UBA, 2013, p. 9). The UBA estimates that electricity will be predominantly generated by wind and PV installations and most of it will be domestically generated (UBA, 2013, p. 9). By the year 2020, renewable energy sources are intended to account for 35 percent of electricity, and by the year 2050 for 80 percent (UBA, 2013, p. 9). “The bulk of our energy is to come from renewable sources by the middle of the century,” writes the German former economics minister Peter Rosler. He adds that along with that, “Germany is to remain a competitive business location” (Paulos, 2013). Caroline Klein considers that “in order to maintain the German leadership in green sectors and preserve future sources of growth, competition in the energy sectors should be increased and eco-innovation further developed” (Klein, 2012).

<b>Germany</b>					
Goals and Targets					
	Target	By:	Reference Year	Set In:	Main Scheme
Renewable	18%	2020	n/a	2010	Feed-in tariff
Efficiency	20%	2020	2008	2010	n/a
Reduce Emmisions	40%	2020	1990	2007	n/a

Source: (IEA,2013)

**Germany Electricity Scenario by % of Fuel Source**, Self-made graphs source: (IEA, 2013)



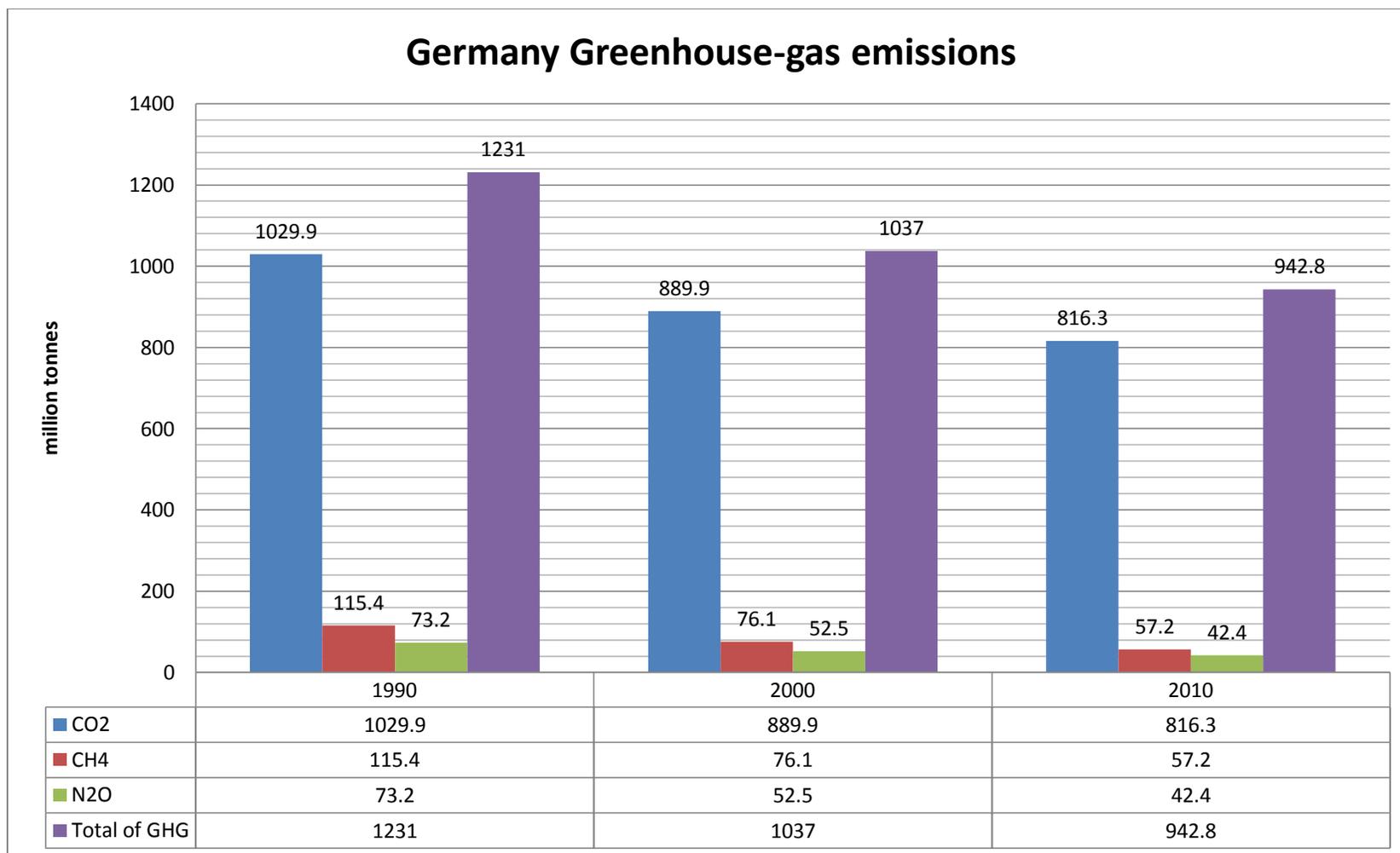
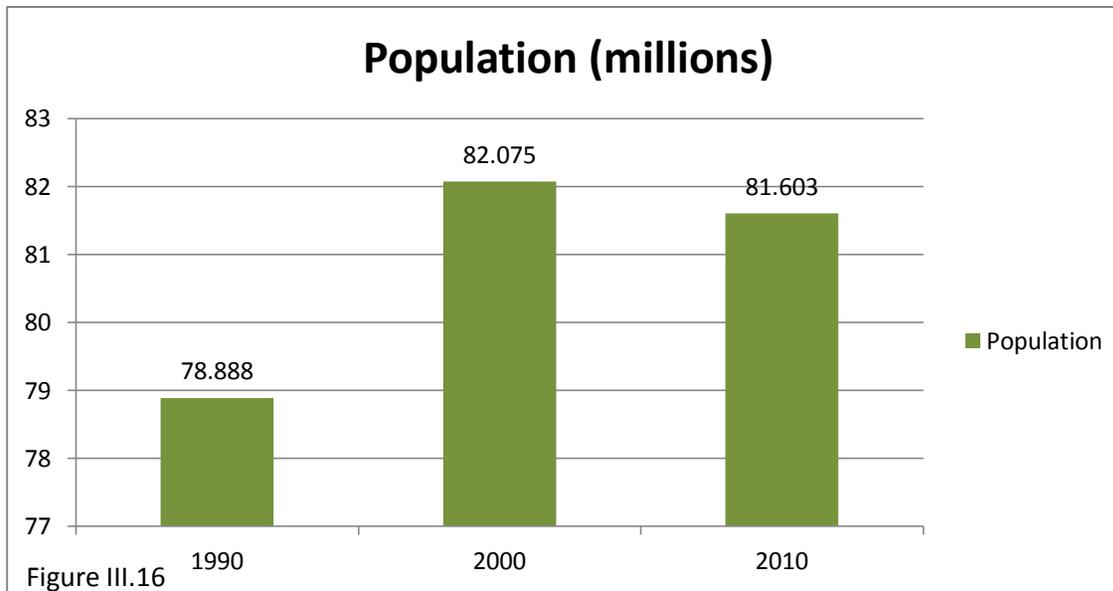
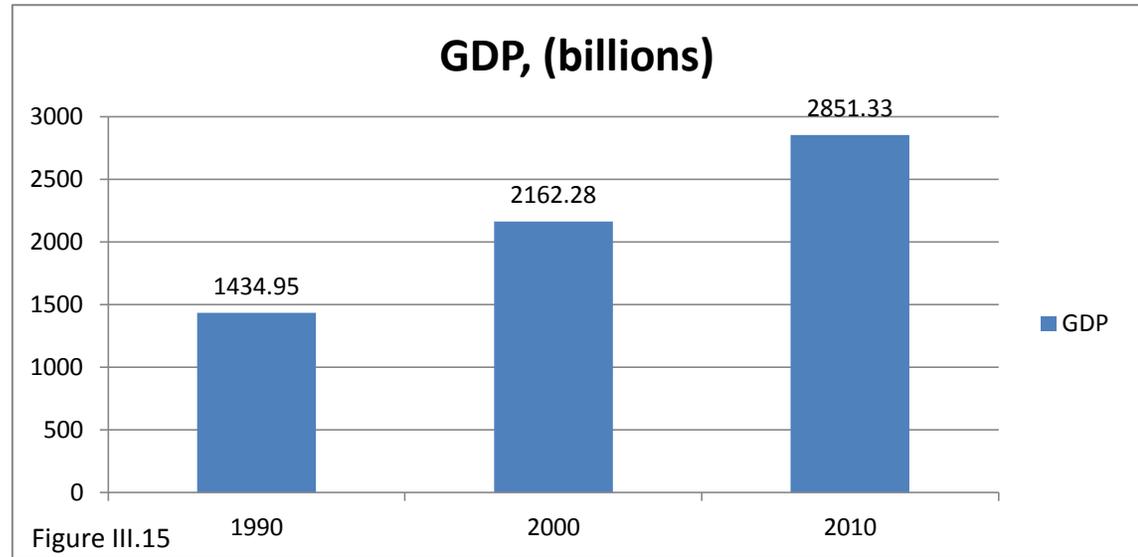


Figure III.14 Self-made with information from (IEA, 2012)

**Germany**

Self-made, Source (IMF, 2011)



Self-made, Source: (IMF, 2011)

## **VII. Japan**

The State of Japan is an archipelago in Asia with a nearly flat population growth rate since 1990 (see figure III.22) and currently holds a population of 127 million people (CIA World Fact Book, 2013). Japan is bordered by the Pacific Ocean and the Sea of Japan. It has four principal islands: Hokkaidō, Honshu, Shikoku, and Kyushu. Japan is one of the most seismically active locations in the world. It comprehends a total area of about 377,835 sq. km and subdivides itself in forty-seven prefectures (Gale, 2007, pp. 953 - 973). Japan's economy is based in the manufacturing sector particularly electronics and vehicles. Japan has a small agricultural sector and it is the largest fishing nation in the world (IEA, 2008, p. 17).

### **i. Institutional Context**

Japan is a constitutional monarchy with a parliamentary government with a bicameral Diet (Kokkai, or Parliament). It has authority over all legislative matters (Asia for Educators, 2013). The Head of the State is the Emperor, having mostly symbolic powers. The prime minister is the head of the government he/she must be a member of the Parliament (House of Representatives and House of Councilors) and is designated by his equals (Gale, 2007, pp. 953 - 973). "The constitution requires that the prime minister commands parliamentary majority; following legislative elections, the leader of majority party or leader of majority coalition in House of Representatives usually becomes Prime Minister" (CIA World Fact Book, 2013). The prime minister appoints the majority of the cabinet members from among members of the Diet. Hence the cabinet works together with the Diet sharing responsibility (Office of the Prime Minister, 2013). Japan does not have a federal system; its 47 prefectures are not sovereign entities. They largely depend on the central government for subsidies (Gale, 2007, pp. 953 - 973). The Prime Minister has the right to control the direction of the State, he submit bills to the Diet and reports to it as well. Decisions are therefore centralized in the National Diet and executive branch (Office of the Prime Minister, 2013).

The main Japanese national institutions in charge of managing the climate and energy policy are:

The Ministry of Economy, Trade and Industry (METI) is in charge over Japan's industrial, trade and Energy Policy. The Agency for Natural Resources and Energy (ANRE), which is part of

METI is responsible for “comprehensive energy policies to ensure strategic energy security, realize an efficient energy supply and promote energy policies in harmony with the environment” (IEA, 2008).

The Ministry of the Environment is in charge of the environmental policy and planning and recycling measures aiming to create a sustainable society (Ministry of the Environment, 2013). Other government departments are involved in the energy and climate policy including the Ministry of Education, Culture, Sports, Science and Technology, in charge of research and development, and the Ministry of Foreign Affairs in charge of maintaining Japan’s international role (IEA, 2008).

## **ii. Problematic**

Japan comprehends a series of islands; anything going there must cross the sea, historically making it an isolated country. After World War II, Japan faced large changes, from the 1950s to the 1970s it experienced great economic growth, along with it the nation’s energy consumption increased as well (METI, 2010). Making Japan a very industrialized nation, until China’s recent growth Japan was the second largest economy in the World, now it is the third largest.

Japan is limited to the amount of energy resources it has, thus about 96% of the resources needed are imports; 90% of the oil imports are from the Middle East and most of the natural gas imports are from Russia (METI, 2010). This high dependence on foreign fossil fuels makes Japan a vulnerable country in terms of energy security due to the prices and supply.

Japan is active in the effort to limit climate change. Japan ratified the United Nations Framework Convention on Climate Change in 1993 (OCDE, 2009, p. 6). In June 2002, Japan ratified the Kyoto Protocol, there it was required to reduce greenhouse gas emissions by 6% as compared to the 1990 level within the time frame of 2008 to 2012 (Ministry of Foreign Affairs of Japan , 2010). Japan considers that the current framework of the Kyoto Protocol is unfair and ineffective, as “the total of CO<sub>2</sub> emission from the Parties under the obligation of the protocol account for only 27%” (Ministry of Foreign Affairs of Japan , 2010).

After the 1970s the oil crisis Japan started to promote energy conservation measures (METI, 2010) At the time Japan was depending deeply on fossil fuels. To promote energy conservation

and to stabilize its energy supply, Japan looked to reduce its dependence on oil through the introduction of nuclear power and natural gas (METI, 2010). Japan succeeded with its plan to promote nuclear power and in 1990 it provided 24% of its total generating capacity and in 2000 it accounted for 30.4% of it (see figures III.17 & III.18).

Considering that Japan is one the most seismic areas in the World. In 2011, a tsunami hit the east coast of Japan causing a big catastrophe; mainly it destroyed four nuclear reactors at the Fukushima Dai-ichi nuclear power station (Joyce, 2012). Radiation spread through the air in land and into the ocean displacing over 160 thousand people and killing many others” (Joyce, 2012). The company that owns the Fukushima nuclear plant admitted that it failed to take proper safety measures that could have prevented the meltdowns (Halper, 2012). “Currently there are no safe technologies to store high-level radioactive waste from nuclear power plants for long periods of time” (The Japan Times , 2013). No one knows what will happen in several years with nuclear waste buried in the Earth’s surface. It takes thousands of years for the radiation emitted to become safe. It would not be ideal to leave the problem for future generations. (The Japan Times , 2013)

Since the disaster, Japan's 50 nuclear plants were shut down “temporarily”, nuclear power accounted for 25.8 percent of Japan's electricity generation in 2010 (see figure III.19); instead they started burning more fossil fuels to keep up with the demand causing its emissions to considerably increase (METI, 2010). An analysis from the IEA concluded that replacing the nuclear electricity with fossil fuels was costing Japan a \$100 million a day. Japan experienced a tight power supply after the Fukushima disaster, thus Japan needs to improve its energy efficiency policy. This nuclear situation created a big debate in Japanese society; there are people pro-nuclear that see it as the only available option and some that are totally against it (Wagner, 2012).

### **iii. Policies Implemented**

#### *Increase Renewables*

According to the IEA, Japan is a global leader in progressing energy and environmental policy. Japan experienced several grave forms of environmental pollution in the 1960s and 1970s. Since then Japan's settled strict regulations to protect the environment (Web Japan, 2013). Following the two oil crises of the 1970s, the need for energy diversification increased. In 1974, the MITI announced its Sunshine Project for developing new energy technologies aimed at cope with the energy crisis and protect the environment (Web Japan, 2013). In 1980, Japan created the New Energy and Industrial Technology Development Organization (NEDO) a semi-government organization to promote the development of renewable energy. Nowadays this agency leads Japan's research and development in the energy sector (NEDO, 2013). In 1993, the Sunshine project was re-launched to develop innovative technology and create sustainable growth (Web Japan, 2013). Currently Japan is one of the leaders in solar energy. As of 2009, Japan was ranked third in the world with regard to solar electric capacity (Web Japan, 2013).

Considering that Japan imports most of the fossil resources, it has rank energy security as a top policy priority (IEA, 2008). In December 1995 competition was introduced to generate electricity. In March 2000 the sale of electricity was deregulated, with an aim to ensure stable supply and help counter global warming (Web Japan, 2013). In 2001 Japan upgraded the Environmental Agency to a cabinet ministry level, becoming the Ministry of the Environment (Web Japan, 2013, p. 3). In 2002 the government passed the Basic Law on Energy Policy in order to integrate energy policies, this law set the principles of ensuring a stable energy supply, harmonization with the environment (Web Japan, 2013, p. 2). Japan also makes energy efficiency a top priority, helping achieve the twin goals of energy security and environmental protection (IEA, 2008).

Japan's energy policy is based on three basic aspects, energy security, environmental protection and efficient supply. (METI, 2010). As shown in figure III.19, in 2010 about 11% of Japan's electricity was generated from renewables. Hydro power is the largest share of renewable electricity. In 2011 Japan introduced a Feed-in tariff for renewable energy, meaning that all

renewable electricity will be purchased at a fixed price following Germany's principle. Japan is actively engaged in the international policy-making process and is committed to a sustainable and secure energy pathway. Japan held the G8 presidency in 2008. There Japan brought to the agenda the urge to focus on concrete goals to face the challenge of climate change (IEA, 2008, p. 33).

Japan emphasizes energy efficiency as one of the most effective measures for mitigating climate change. Japan improved its energy efficiency by over 30% since the 1970s oil crisis (IEA, 2008, p. 33). In regards to emissions Japan implemented a voluntary emissions trading program to reduce greenhouse gas emissions from small and medium sized enterprises (IEA, 2008, p. 45). According to the IEA, the Kyoto Protocol was Japan's main guide to reduce greenhouse gas emissions. Along with that in 2007, the government launched the "Cool Earth 50 initiative", which proposed a global target to cut greenhouse gas emissions in half by 2050 and proposed a global goal of improving energy efficiency by 30% by 2020 (IEA, 2008, p. 47). Japan adopted a range of tax and subsidy policies to promote energy efficiency (METI, 2010). The government amended its Act on the Rational Use of Energy in May 2013. The act aims to improve thermal insulation performance of houses and buildings. These amendments aimed to encourage energy conservation and innovation (IEA, 2013). Japan's energy efficiency is among the best in the world, the IEA highlights that "Japan's effort to make further improvements shows that even an efficient country can do better" (IEA, 2013).

In 2009 Prime Minister Hatoyama announced Japan's plan to provide more financial and technical assistance to developing countries that take measures to address climate change, (Ministry of Foreign Affairs of Japan , 2010). After the ineffectiveness of the Kyoto Protocol, Japan believes it necessary to establish to find and effective international framework to tackle climate change including the biggest emitters. (Ministry of Foreign Affairs of Japan , 2010)

In 2012, Japan established a "Carbon Tax" charging accordingly to the amount of CO<sub>2</sub> emissions to all fossil fuels. The tax payers' money will be used to promote renewable energy as well as to enhance saving and energy efficiency. As well in 2012, "Japan's Fourth Basic Environment Plan" was introduced by the Cabinet. According to the Japanese Ministry of the environment the goals are: To promote a green economy and society, promote green innovation,

and invest in new environment-related markets and new jobs. In regards to its international policies, Japan plans to keep supporting developing nations by providing experience and technology, as well as to promote strategic policy measures and promote global environmental interests. Japan plans to maintain and increase the share of society to engage in preserving nature, use local resources and enhance environmental information (Ministry of the Environment, 2013).

#### *What to do with Nuclear Power in Japan?*

As it was mentioned already, after the nuclear disaster in Fukushima, the Japanese government closed temporarily down all of its nuclear facilities. The Japanese government recently admitted that “it was behind in the Fukushima cleanup schedule, which will take decades to dismantle and require the use of new technologies” (Philips, 2014). Up to this date the debate continues whether Japan should continue to produce electricity from nuclear sources or shuts it down completely. In the meantime the Japanese Government approved a series of safety measures to check the levels of safety of the idled nuclear plants to inspect if they are capable of providing a reliable energy supply. The future of nuclear power will face a referendum in February 2014 during the Tokyo gubernatorial election (Philips, 2014).

During the nuclear crisis, local officials were disappointed at the slow and inefficient response from the central government, thus it led them to find their own solutions (Wagner, 2012). This brought a bigger role from local governments, as a result Japan is considering if it should reform itself to create a federal system thinking on making local governments more efficient and independent (Wagner, 2012). There are some pro nuclear power groups that advocate for Nuclear, they consider that it was a onetime event and should not repeat in the future (Wagner, 2012). But according to an opinion poll most of the Japanese are against nuclear power (The Japan Times , 2013) nuclear might be the only option in the short time in order to reduce emissions while they create enough infrastructure for renewable energy. “The removal of nuclear energy from Japan’s energy mix has also helped lead to a revival of solar power, with the country experiencing a projected 350 percent solar market growth from 2012 to 2013” (Philips, 2014).

<b>Japan</b>			
Public Policies			
Target of Policy	Time Frame	# of Policies	Total
Renewable Energy	2000-2013	14	27
	1990-1999	10	
	1970-1989	3	
Energy Efficiency	2000-2013	58	78
	1990-1999	14	
	1970-1989	6	
Addressing Climate Change	2000-2013	74	92
	1990-1999	17	
	1970-1989	1	
<b>Grand Total</b>			<b>197</b>

Source: (IEA,2013)

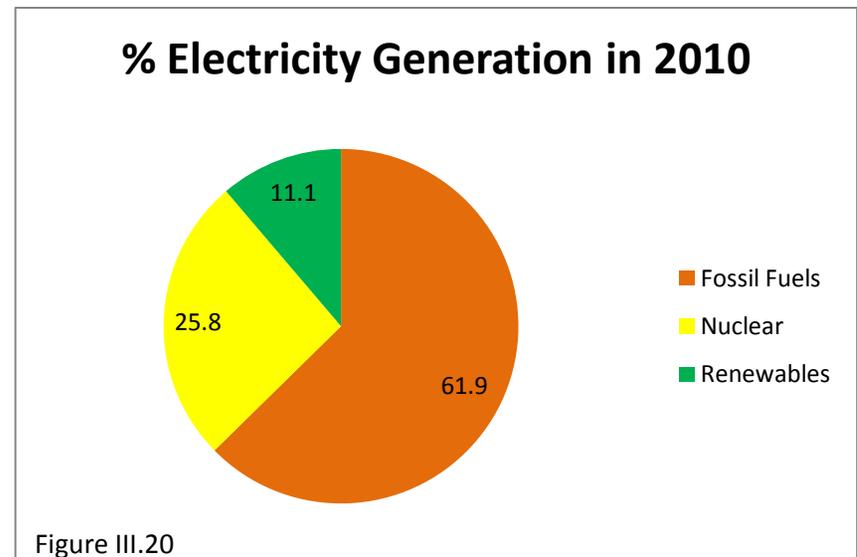
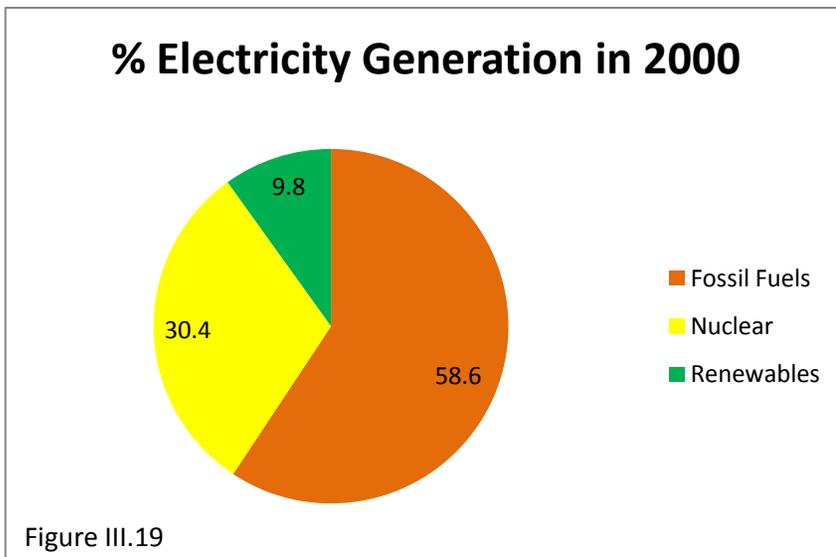
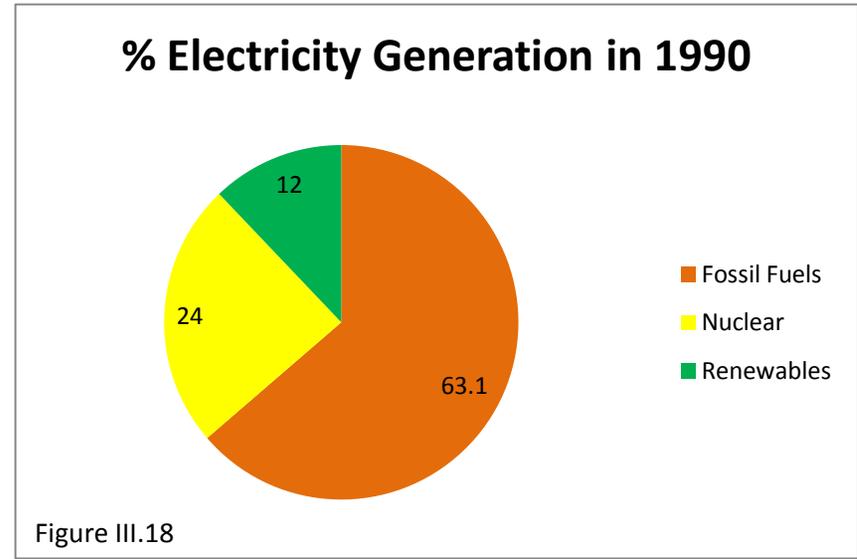
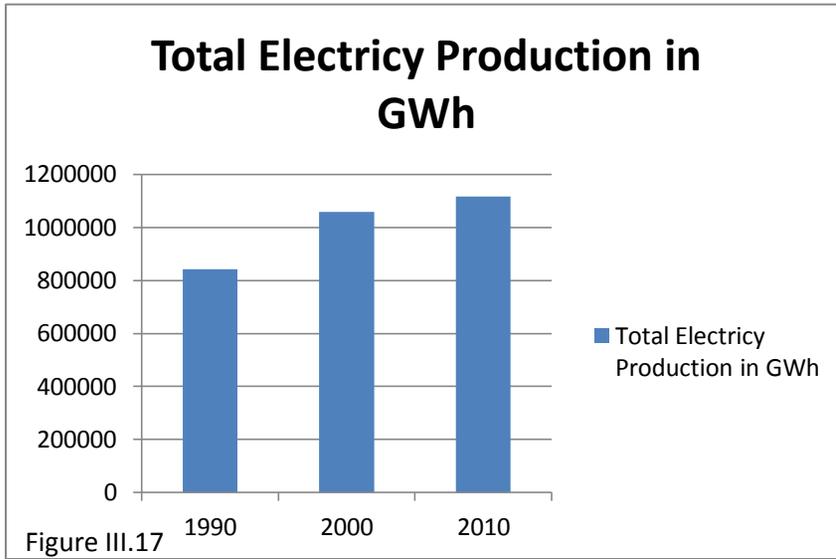
#### iv. Goals and Forecast

At the UN summit in Climate Change in 2009, Prime Minister Yuko Hatoyama announced a target of reducing greenhouse gas emission by 25% by 2020 based on 2005 figures. (Ministry of Foreign Affairs of Japan , 2010) In November 2013 Japan's Government announced that it would cut its 25% target to just 3.8% (Philips, 2014). Their excuse was "that none of the nuclear reactors were operating; hence to reach the target was unavoidable" (Halper, 2012). By 2030 Japan expects to lower its emissions by 30% and in 2050 by 80% compared to the 1990 levels (UNFCCC, 2014). Depending on the scenario and the policy pathway it takes, Japan hopes to produce between 25 and 35% of its electricity from renewable sources by 2030 (METI, 2010). Japan still faces many policy challenges after the Fukushima Disaster. After this crisis it is certain that it motivated a change in the mind of Japanese people to rethink and reconsider their energy policy and bring serious reforms to its local government's structure.

<b>Japan</b>					
Goals and Targets					
	Target	By:	Reference Year	Set In:	Main Scheme
Renewable	10%	2020	n/a	2010	<a href="#">Feed-in-tariff</a>
Efficiency	30%	2030	2006	2006	n/a
Reduce Emmisions	25%	2020	1990	2013	n/a

Source: (IEA,2013)

**Japan Electricity Scenario by % of Fuel Self-made, source: (IEA, 2013)**



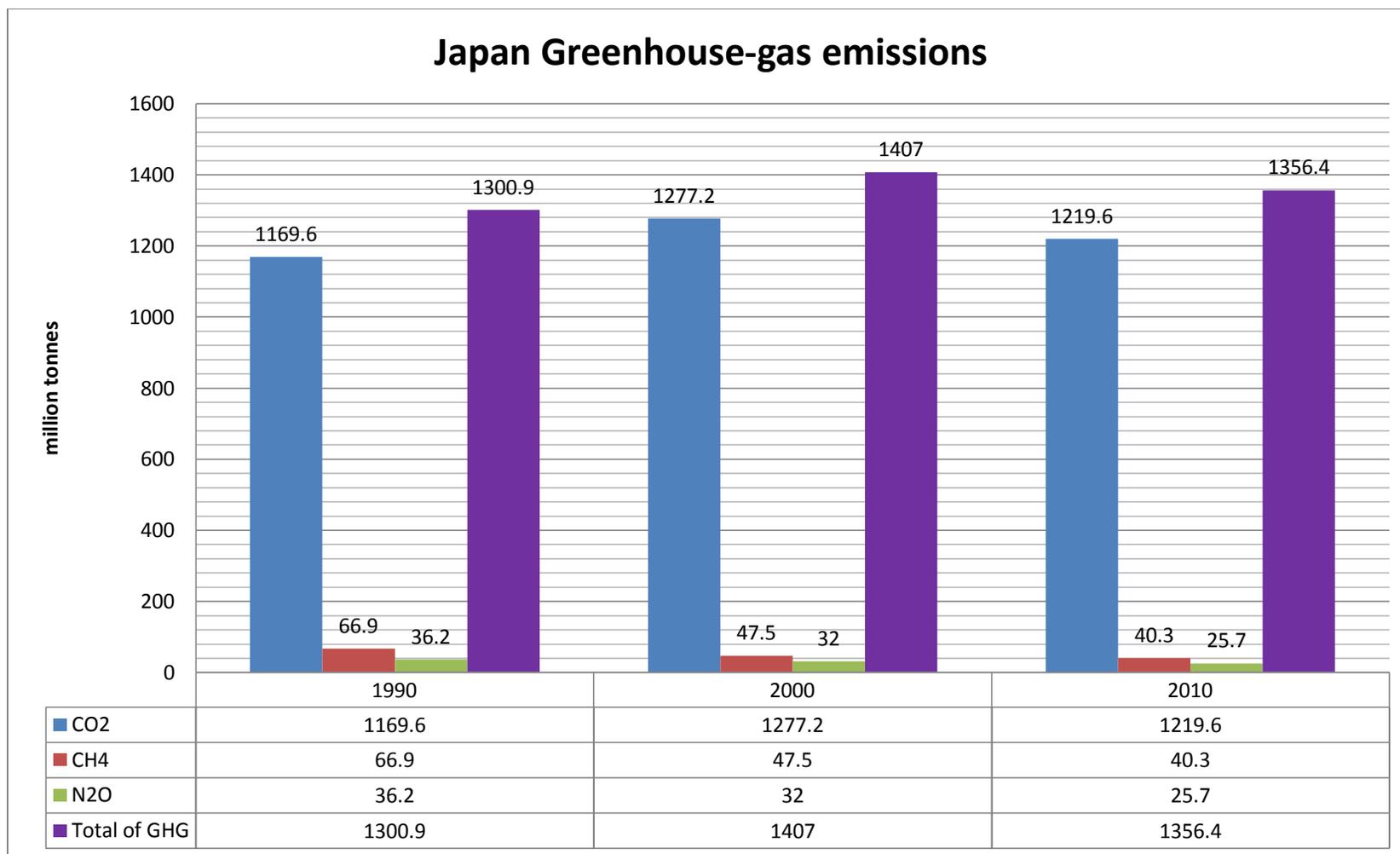
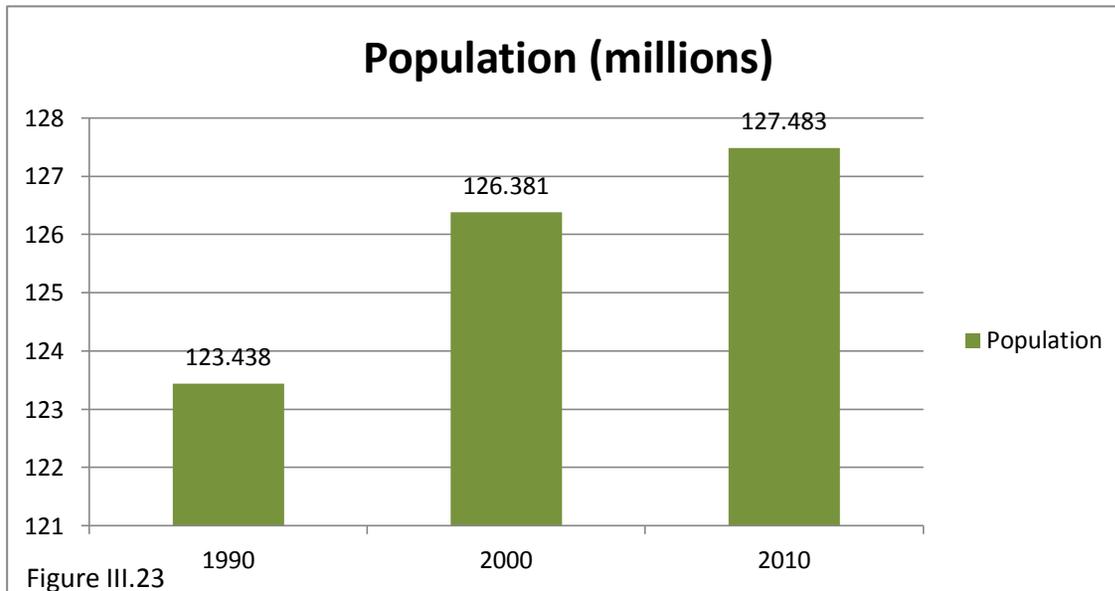
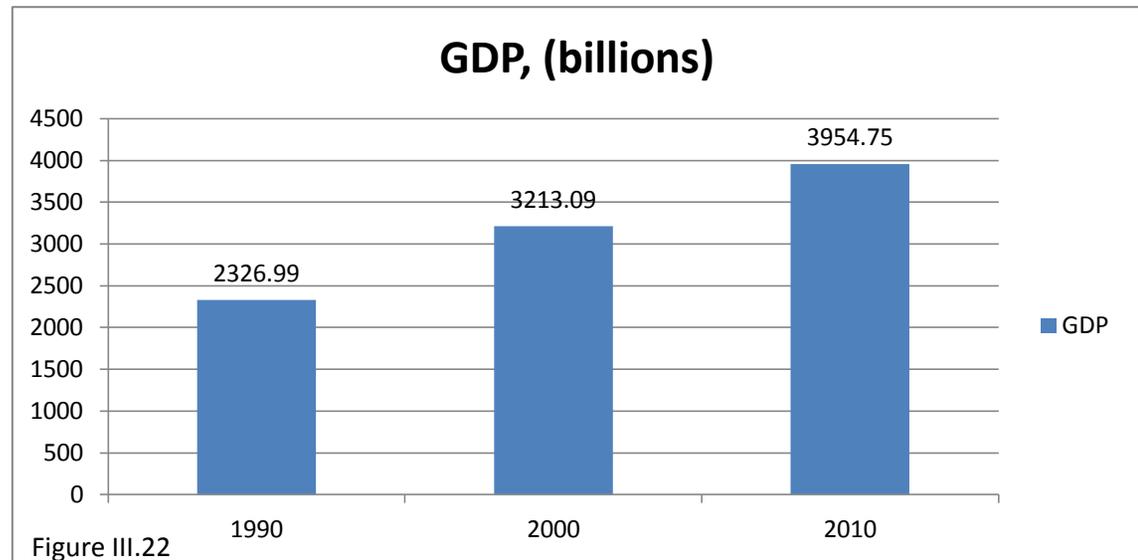


Figure III.21 Self-made with information from (IEA, 2012)

Japan

Self-made, Source (IMF, 2011)



Self-made, Source: (IMF, 2011)

## **VIII. United States of America**

The United States of America (USA) is located in North America, it shares borders with Canada and Mexico it has coastline in line with the Pacific and Atlantic oceans. It has a current population of about 316 million people (CIA World Fact Book, 2013). The USA is the third largest country in the World after Russia and Canada with 9,826,675 sq. km. Its economy is the largest and one of the most technologically developed in the world (Gale, 2012).

### **i. Institutional Context**

The USA is a constitutional federal republic with a presidentialism system. The president is both the chief of state and head of government. The President is responsible for enforcing and implementing the laws emitted by the Congress (White House, 2013). The Cabinet is appointed by the President with the Senate approval. The Vice President figure exists in the event that the President dies resigns or he or she is removed by the Congress then he becomes the President. The USA possess a bicameral Congress consisting of the Senate with 100 seats representing the States and the House of Representatives with 435 seats representing according to the population (Gale, 2012). It is composed by 50 sovereign states and a federal district. Policy decisions are taken by Congress and the President and his Cabinet. The President's agenda is "presented through speeches, press releases, the "State of the State" and executive orders, and instructions to department heads" (Tableman, 2005). The "Cabinet and independent federal agencies are responsible for the enforcement and administration of federal laws" (White House, 2013).

The Department of Energy (DOE) is in charge of energy policy in the USA. This Department "promotes energy security by encouraging the development of reliable, clean, and affordable energy" (White House, 2013).

The Department of the Interior (DOI) is the nature conservation agency. Among its tasks are: "protect natural resources, conduct scientific research" (White House, 2013); it also conserves biodiversity; it administers national parks and protects endangered species (White House, 2013). There are many other agencies that depend on these departments that take care of specific issues in the climate and energy policy.

**ii. Problematic**

The United States of America is the largest economy in the World, making it largely industrialized and demanding an equally amount of energy; as a consequence it is the second biggest emitter of GHG in the World accounting for about 20% of the global emissions (IEA, 2013). In 1990 around 68.7% of the electricity produced in the USA came from fossil fuels, twenty years later in 2010 it was almost 70% (see figure III.24 and III.26). However their GHG emissions decrease within the decade of 2000 to 2010 (see figure III.27). The entire amount of coal consumed in the USA comes within itself and almost all of the natural gas consumed is domestic as well only one fifth being imported, in 2005 50% of the oil consumed in the USA came from imports. (IEA, 2007). In consequence the USA is really dependent these imports, according to IEA import dependence almost doubled from 16% to 30% from 1990 to 2005 (IEA, 2007).

According to the IEA in 2007 the two main energy policy problems in the USA were to increase energy security due to the high and growing dependence on imported supplies and reduce the amount of GHG emissions that this sector accounts. The IEA points out that the USA is the only major country, within the OCDE, where the share of fossil fuels in total energy supply is projected to increase (IEA, 2007). The IEA points out that the lack of coordination in the public agenda among the federal and state governments causes a problem in the energy policy.

According to Oil Change International, an advocacy group towards clean energy, in the USA, “it is obvious that the oil and gas industry is one of the most influential industries on Capitol Hill” (Oil Change International, 2013). They conclude that the major barrier to transit to renewables comes from the fossil fuel industry. They put a figure on that influence by tracking the campaign contributions that the industry makes to elected representatives, and the amount spent on lobbying (Oil Change International, 2013). By using these techniques this NGO suggests that “over \$114 million has been paid by the oil, gas and coal industries over the last decade to buy access and influence in the USA Congress” (Oil Change International, 2013).

*“Lack of attention” during the Bush Administration*

According to Fred Powledge, in January 2001, on his last day in office, Bruce Babbitt (Secretary of the Department of the Interior during Clinton’s administration) wrote: “Each Bureau and office of the Department will consider and analyze potential climate change impacts when undertaking long-range planning exercises” Powledge concludes that when Bush’s government came in, this order was completely ignored (Powledge, 2008, p. 912). A year before that in 2000 “Al Gore along with the IPCC had won a Nobel Peace Prize for their efforts to explain climate change to the public at large” (Powledge, 2008, p. 913). This issue was clear when Jill Baron, a scientist with the United States Climate Change Science Program, a consortium of federal agencies said that “at interior, we weren’t allowed to address climate change openly up until a year ago (2007)” he continued and said that there was “a government embargo on the word climate change” (Powledge, 2008, p. 913). According to Dale Jamieson the US government, “which has the power to invade countries half-way across the world in defiance of international opinion” (Jamieson, 2010, p. 639), it was unable to enforce restrictions on the energy-consuming habits of its inhabitants. It was until 2007 that Bush “mentioned climate change briefly and tangentially in both cases as a problem that could be cured by technological breakthroughs” (Powledge, 2008, p. 915). But even though he acknowledges it at the time, Kieran Suckling an executive director of a Biological Center doubted he had real intentions of changing any policy or any behavior to face climate change (Powledge, 2008, p. 915). Henry Waxman, a Californian and democrat congressman, concluded that: “the Bush Administration has engaged in a systematic effort to manipulate climate change science and mislead policy-makers and the public about the dangers of global warming” (Powledge, 2008, p. 916). According to research led by John Cook polls indicate that around 60% of the US population did not know the reality of climate change and that it was linked to Human Activity, despite of the 98% scientific consensus on the issue (Cook et al, 2013, p. 2). According to James Hansen “The Bush Administration went from promising to regulate CO<sub>2</sub> under the Clean Air Act to flirting with climate change denial” (Jamieson, 2010). To conclude Powledge states that a final convincing proof is that “the US Strategic Plan for the years 2007 and 2012 did not mention anywhere climate change” (Powledge, 2008, p. 918). The hurricane Katrina and Sandy help Americans realize the importance of mitigating Climate Change and the importance of building the appropriate

infrastructure to its impacts (Cohen, 2013). According to an official report from the White House in 2012 climate weather disasters cost the USA economy more than \$100 billion (White House, 2013).

### **iii. Policies Implemented**

Energy policy in the USA is made by federal and state laws and programs that guide energy generation and use (Macmillan Social Science Library, 2010, p. 2). After the Oil Crisis in the 1970s, the USA was forced to integrate its energy policy; it created the Department of Energy in 1977 in charge of the overall energy policy aiming “to provide affordable energy while protecting the economic, environmental and security interests of the USA” (LII, 2013, p. 1). The Federal Energy Regulatory Commission was created in 1977; to oversee and regulate the sale of the natural gas, oil, and electricity markets in the USA (LII, 2013, p. 1).

The United States has created a “combination of incentives, regulation, persuasion, and innovation at the federal and state level, which has contributed to a recent decline in emissions” (IEA, 2007). According to the IEA the state and federal governments created policies to support renewable energy. The more major two are the federal renewable energy tax incentives and state level renewable portfolio standards (IEA, 2007). The Energy Policy Act of 2005 set a new direction in the area of clean energy use, mainly through federal funding with subsidies. In 2009, the Recovery Act designated 3.5 billion dollars to a program in to research and develop renewable energy and its conservation (Macmillan Social Science Library, 2010, p. 3). In 2010, 34 states as well as the District of Columbia have passed laws setting dates by which a certain percentage of energy produced within the state is required to be generated by renewable sources (Macmillan Social Science Library, 2010, p. 3). The Environmental Protection Agency reported that GHG emissions in the USA dropped 7% since 2005 to 2013. They consider that it was due to the enhancement of automobile fuel efficiency and the increase of natural gas use (Opposing Viewpoint in Context, 2013, p. 4).

According to Steven Cohen, in 2013 President Barack Obama decided to use the power of his presidency to promote renewable energy and mitigate climate change due to the lack of action from Congress and other administrations. “The president has the authority under the “Clean Air” Act to regulate greenhouse gasses as air pollutants” (Cohen, 2013). Steve Cohen says that the

President must create an immense propaganda machine to promote this agenda; to build public support for these important policies In 2013 the US Department of Energy reported that wind became the top source of new USA electricity generation over a single year (The Kansas City Star , 2013).

In 2013, Barack Obama presented the “US Climate Action Plan” to reduce GHG emissions. The plan has three pillars: (i) cut carbon pollution in the United States; (ii) prepare the United States for the impacts of climate change; and (iii) lead international efforts to combat global climate change and prepare for its impacts (IEA, 2013).

According to the last State of the Union in January 2014, President Obama announced that the USA is leading towards energy independence He confirmed that "Over the past eight years, the U.S. has reduced our total carbon pollution more than any other nation on earth” Thus the USA is investing in new generation of fossil fuel technologies which are considered to be low-carbon technologies (Department of Energy, 2014). Goals and forecast

<b>United States of America</b>			
Public Policies			
<b>Target of Policy</b>	<b>Time Frame</b>	<b># of Policies</b>	<b>Total</b>
Renewable Energy	2000-2013	64	98
	1990-1999	20	
	1970-1989	14	
Energy Efficiency	2000-2013	130	174
	1990-1999	34	
	1970-1989	10	
Addressing Climate Change	2000-2013	232	312
	1990-1999	63	
	1970-1989	17	
<b>Grand Total</b>			<b>584</b>

Source: (IEA, 2013)

#### iv. Goals and Forecast

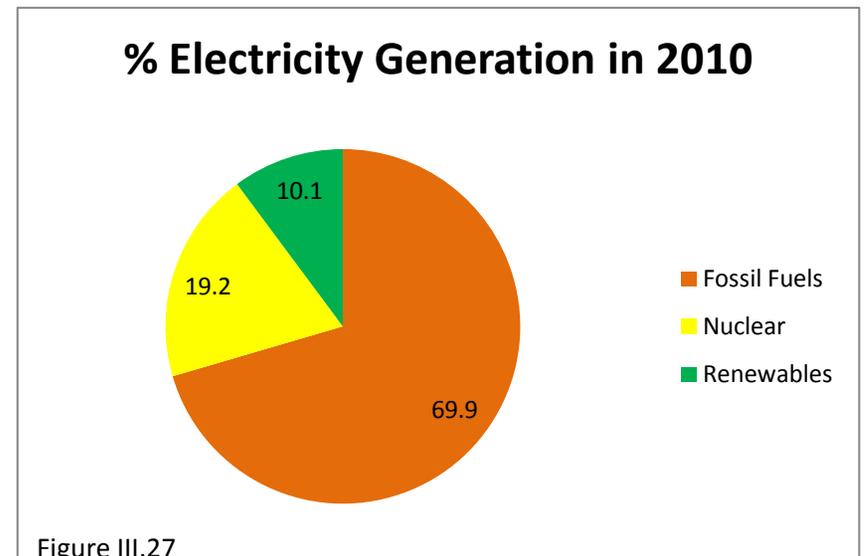
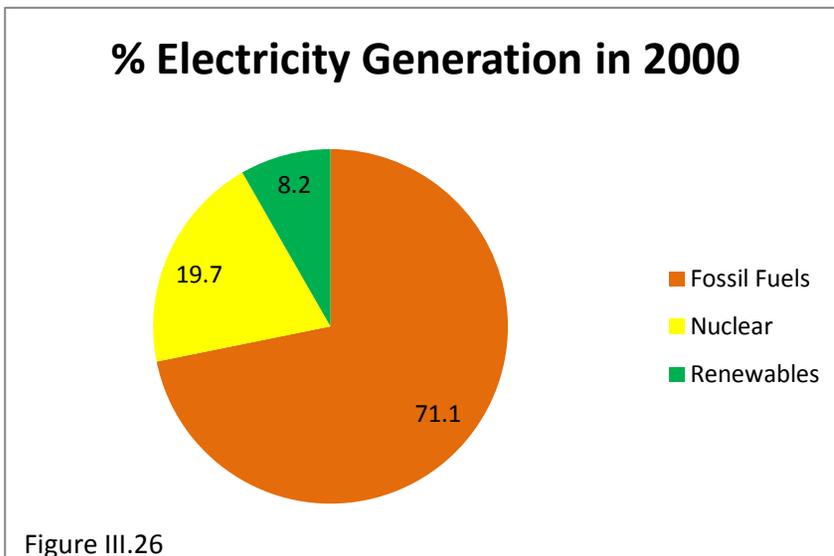
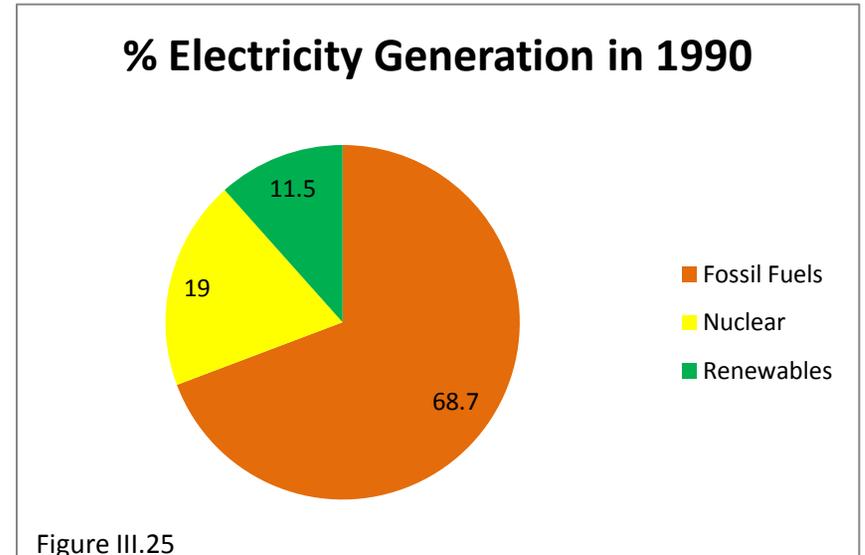
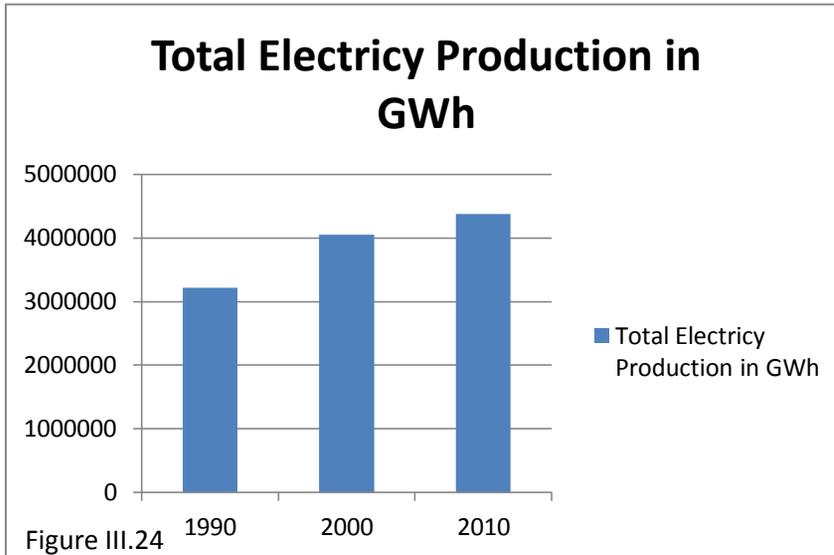
The USA wants to double renewable electricity generation by 2020 (IEA, 2013). The federal government will consume 20% of its electricity from renewable sources by 2020. The Department of Defense – the single largest consumer of energy in the USA – is committed to install renewable energy capacity on military installations (White House, 2013). In order to reduce emissions they have set standards for the fuel efficiency in the auto industry.

The USA is committed to reduce its emissions by 17% according to 2005 levels by the year 2020, as agreed in the United Nations climate negotiations (IEA, 2013)..

According to a report from IMCO the United States became the country with the greatest potential for hydrocarbons in the world. In 2015, The USA will overtake Russia to become the largest gas producer in the world. Before ending the decade, the United States will surpass Saudi Arabia as the largest oil producer. And in just over two decades, the American colossus is a net exporter of oil (IMCO, 2013).

<b>United States of America</b>					
Goals and Targets					
	<b>Target</b>	<b>By:</b>	<b>Reference Year</b>	<b>Set In:</b>	<b>Main Scheme</b>
Renewable	Double by 2020	2020	n/a	2013	<u>n/a</u>
Efficiency	200 Billion Kwh	2025	2006	2008	<u>n/a</u>
Reduce Emmisions	17%	2020	2005	2009	n/a
Source: (IEA, 2013)					

**United States Electricity Scenario by % of Fuel Source** Self-made source: (IEA, 2013)



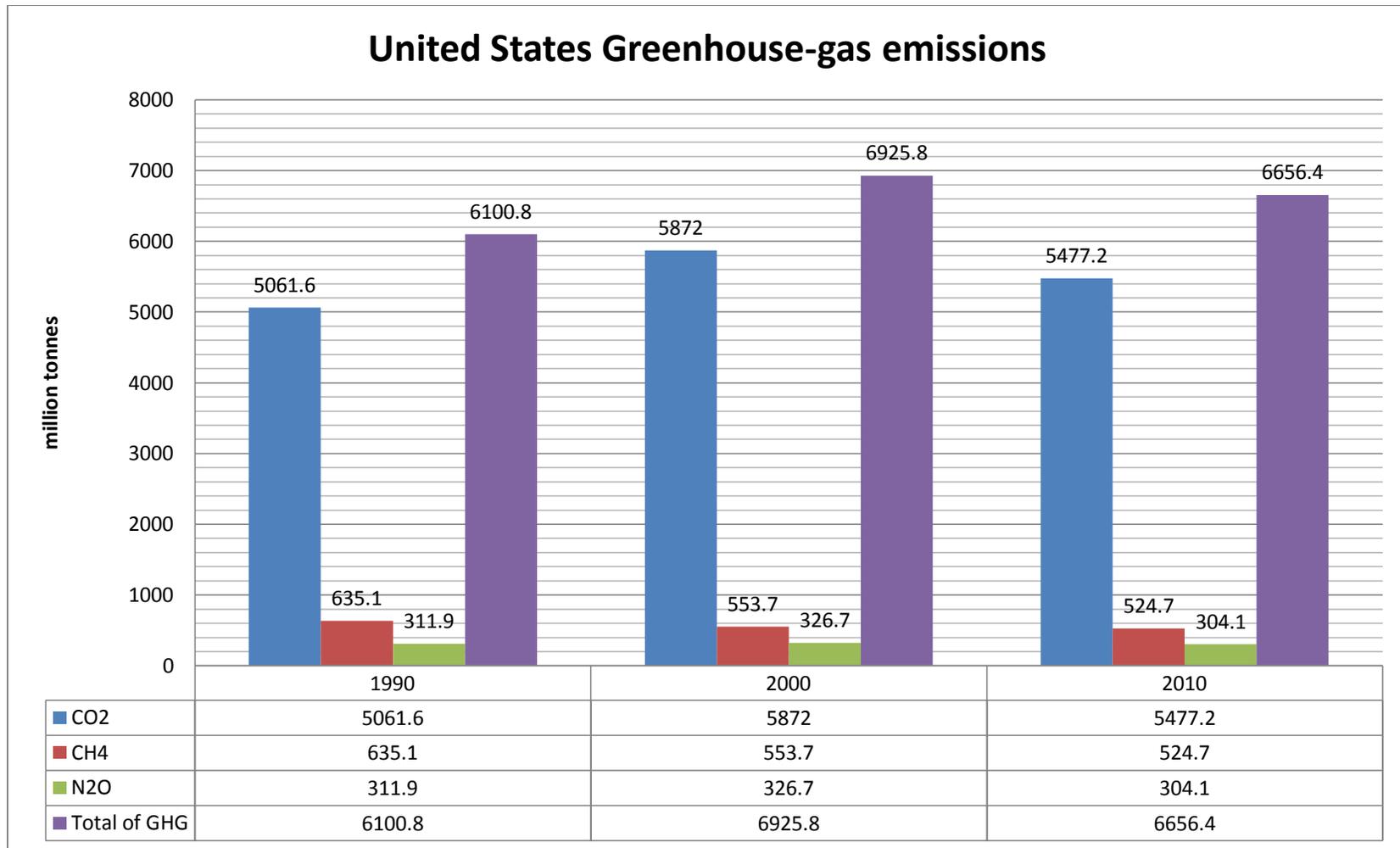
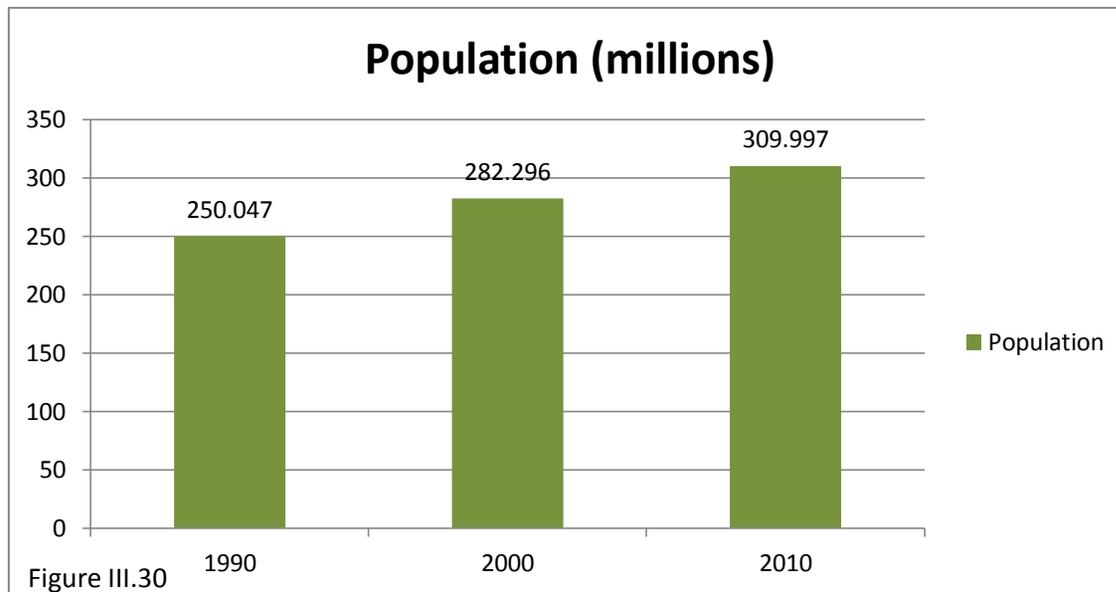
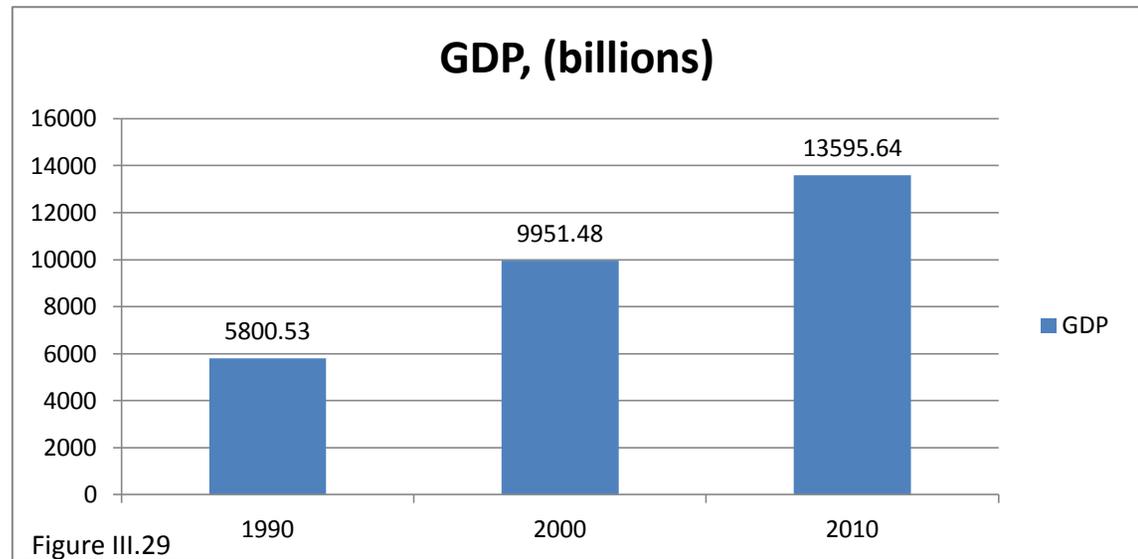


Figure III.28 Self-made with information from (IEA, 2012)

**United States**

Self-made, Source (IMF, 2011)



Self-made, Source: (IMF, 2011)

## **IX. Mexico**

Officially named The United Mexican States (Mexico) is a country in North America with shared borders in the south with Guatemala and Belize and in the North with the United States of America. In 2013 it had an estimated population of 118 million people, of which according to reports from the OCDE half of the population living with some type of poverty. It has a total area of 1,964,375 sq. km (CIA World Fact Book, 2013). According to the OCDE almost half of its population lives in poverty. Thus the economy is considered an export-oriented economy; more than 90% of Mexican trade is under free trade agreements. NAFTA is the most visible (OCDE, 2013).

### **i. Institutional Context**

Mexico is a federal republic with a presidentialism system. The current Constitution divides the power in three separate independent powers. Historically “the executive has been the dominant branch, with power vested in the president, who promulgates and executes the laws of the Congress” (Gale, 2012). Mexico has 31 sovereign states and one federal district. The president is both the head of the government and the state; he can legislate by decree in certain areas using his attributions.

The Mexican institutions in charge of guiding the energy and environmental policy are:

The Ministry of Energy (SENER) is the one in charge of the energy policy to ensure viable, sufficient, high quality, and environmentally sustainable energy for the Nation (SENER, 2013). Petróleos Mexicanos (PEMEX) is the parastatal enterprise responsible for the extraction and processing of oil and gas (PEMEX, 2013). The “Comisión Federal de Electricidad” (CFE) is the parastatal enterprise in charge to produce and provide electricity in the country (CFE, 2013).

The Ministry of Environment and Natural Resources (SEMARNAT) is the federal agency responsible for promoting the protection, restoration and conservation of ecosystems and natural resources in Mexico, in order to promote their use in means of a sustainable development. They work in four priority areas: The conservation and sustainable use of ecosystems and their biodiversity, the prevention and control of pollution, the integrated management of water resources, the fight against climate change (SEMARNAT, 2013).

Originally, the electricity sector was formed by private companies formed mostly with Mexican capital and afterward by a number of foreign companies (CFE, 2013). In 1937 the Comisión Federal de Electricidad (CFE) was created under the government of President Lázaro Cardenas. It was formed to guide the national system of generation, transmission and distribution of power. By 1960 despite the efforts of electrification, at the time only 44% of the population had electricity. Thus President Adolfo Lopez Mateos decided to nationalize the electricity industry. With this nationalization, the state had the exclusive right to generate, transmit, transform, distribute and supply electricity for public service provision. (CFE, 2013).

It was until now that it has stayed like that, there were some regulations in between that systematically allowed particulars to produce electricity, first for emergencies and until now to generate their own electricity and sell it to CFE, the State Company. Now this will change again with the new “Energy Reform” just approved in December 2013.

## **ii. Problematic**

During the 1970s oil crisis, the Mexican economy benefited somehow from the high price of oil thus the government had an extra money coming from the oil exports. Mexico’s economy has been growing since the last couple of decades, it became a bigger industrialize nation. It extended after opening the country to free trade agreements, especially after NAFTA, many transnational companies came along and installed within the country. The demand for energy has increased relatively to the GDP growth of the country (IMCO, 2013).

### *Increase Energy Security*

Currently, about 97% of the population has access to electricity, one of the highest proportions in the world. (Breceda, 2007). The electricity production has been depending more and more on fossil fuels, in 1990 the share of fossil fuels in the electricity generation was 72.8%, and later in 2010 it grew up to 80.2% of the total supply (See Figures III.30 & III.32). The industrial sector is the largest consumer of electricity with 58% of consumption according to 2010 data, followed by the residential sector which accounts for 26.3% (IMCO, 2013). In 2011 Mexico imported more than 27% of its energy, of which 49% accounted to gasoline and diesel, 30% to natural gas, 8% to coal and 6% to liquefied gas oil (Sistema de información energética, 2011).

### *Increased GHG Emissions*

Mexican population has been growing along with the economic growth, almost tripling its size since the 1960s (see Figure III.37). Thus after the expansion of the industry and population among other factors, the GHG emissions have been augmenting considerably within the last decades (see Figure III.32). A report from the World Bank indicates that Mexico will be affected due to the effects of Climate Change, more hurricanes means more disasters, already seen in two parts of the country in 2013 in Guerrero in the South and Tamaulipas in the north. This report indicates that for poor areas it is extremely difficult to recover after such disasters, compared to richer areas that have been hit such as Cancun that due to the amount of tourism and investment was more resilient to face challenges like this. The lack of fresh water will be another challenge to face due to the prolonged periods of no rain. As well it traduces to less food from crops that directly depend on rain water, leading to higher rates of malnutrition mainly in rural areas going against the efforts of reducing poverty rates (World Bank, 2013).

### *Inefficient institutional Set Up*

Up to this date there are two state monopolies in charge of the energy industry, CFE and PEMEX, these two industries have been accused of inefficient practices, corruption at the high bureaucracy plus they argue that there has been a lack of investment to improve their technological means. According to IMCO due to the size and complexity of these “enterprises”, it makes it difficult to control and manage them effectively (IMCO, 2013).

Thus the report continues and says that before the recent “Energy Reform (2013)” PEMEX was already allowed to sign contracts with particulars but the means were not efficient since the hired parties were not assuming any risks, in consequence lacking a share of responsibility. If the outcome would not come as expected the only losers will be the State Company since these hired parties were getting paid regardless of the outcome. The institutional context did not allow investment and better technology from the private sector. This led to a lack of competition, affecting prices, leading to subsidies, and a paralysis of the system. Another problem is that PEMEX provides for 34% of the average income of the Mexican government every year. The tax regime imposed was producing a lack of investment and was not competitive compared to other case scenarios of the World (IMCO, 2013). According to IMCO the USA will become an

exporter of oil, which would affect Mexico because it would reduce the demand for Mexican oil going to the USA. (IMCO, 2013).

Mexico needs to increase its energy security by diversifying its electricity sector, and producing its own energy to reduce imports. According to IMCO Mexico has a great potential for renewable energy. Efficiency and competition in the sector must be met. And another imminent change is to transit from the dependence of fossil fuels in the renewable forms of renewable clean energy, thus it can reduce its GHG emissions and create new jobs and technology in the green sector.

### **iii. Policies implemented**

#### *Renewables*

There have been some efforts to increase renewable energy in Mexico; there have been some modifications within the legal framework to encourage it and to reduce the dependence on fossil fuels. It was until 1975, that regulations made it possible to the participation of private investment in power generation, exclusively for their own use. In 1983, the law was amended to extend the production of self-sufficiency, to allow cogeneration and power generation exclusively for emergencies resulting from outages of electricity (CFE, 2013).

In 1992 further reforms were made to allow private investment in power generation for exclusive sale to the CFE. This opened the possibility for individuals to generate electricity in the form of independent power producers. Thus the “Ley del Servicio Público de Energía Eléctrica” was amended creating the following forms (Secretaría de Economía, 2013):

1. Self-sufficiency: generation of electricity for consumption for individuals and corporations.
2. Cogeneration is the use of thermal energy from other processes to generate electricity to be use by those people producing it.
3. Independent production of energy: electricity generation in large-scale power plants for sale to CFE. (Bigger than 30MW)
4. Small production: individuals and corporations to sell the total production to CFE (smaller to 30 MW).

In 1993, the “Comisión Reguladora de Energía” (CRE) was created as an advisory agency on electricity to promote the development of the sector aimed to benefit the final user (CFE, 2013). By the year 2000, the “Programa Sectorial de Energía 2001-2006” mandated that by 2006 there should be at least 1,000 MW of installed capacity from renewable energy sources (excluding large hydro).

In 2008, the “Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición” (LAERFTE) was adopted. The Law intended, in accordance with its Article 1: to “Regulate the use of renewable and clean energy to generate electricity for purposes other than the provision of electricity for public service” (Secretaría de Economía, 2013).

By 2012 the “Estrategía Nacional de Energía 2012-2026” (National Energy Strategy) has incorporated four objectives for the sector:

1. Diversifying energy sources by increasing the participation of clean technologies.
2. Increase levels of efficiency in energy consumption.
3. Reduce the environmental impact of the energy sector.
4. Operate in an efficient, reliable way and secure electricity infrastructure.

#### *Addressing Climate Change*

In 2012 the “Ley General de Cambio Climático” was adopted to face the adverse challenges of Climate Change in terms of environmental protection, sustainable development, preservation and restoration of ecological balance. It is intended to regulate GHG emissions and regulate the actions to mitigate and adapt to the consequences of Climate Change. It aims to promote research and innovation to transit to a more competitive “greener economy” while creating new jobs (LGCC, 2012). According to a report from the OCDE, over the past decade, environmental sustainability has been given a higher profile in Mexico’s policy agenda. “This was reflected in additional budgetary resources, the strengthening of environmental institutions and regulatory frameworks, and the establishment of environmental institutions and regulatory frameworks, and the establishment of better coordination mechanisms” (OCDE, 2013).

*Energy Reform*

In December 2013 the Mexican Congress approved an Energy Reform; a report from IMCO highlights the following aspects (IMCO, 2013):

1. Petroleum and gas will continue to belong to the nation. Private participation will be permitted in exploration, extraction, refining, petrochemicals, transport and storage.
2. Nuclear energy will continue to be an exclusive sector from the State.
3. Private investment will be allowed in the generation, sale, transmission and distribution of electricity under a contract with CFE.
4. The law gives preference to the exploration and extraction of hydrocarbons, as well as the transmission and distribution of electricity, over any other activity that involves the use of the land.
5. Creation of a National Fund from the oil revenue, towards: research of new technology, renewable energy, among others.
6. It aims to make stronger the Control Agencies.
7. Creation of the Agencia Nacional de Seguridad Industrial y de Protección al Medio Ambiente to regulate and supervise safety and environmental protection.
8. Provides that the State shall ensure the protection and care of the environment, improve: energy efficiency and reduce emissions from the Industry.
9. The SENER will develop and strategy for the transition to renewables
10. It promotes a program to focalize subsidies to lower income families.
11. Increase efficiency in PEMEX and CFE and labels them as Productive State Enterprises.
12. Creation of mechanisms to combat corruption.

Remaining secondary laws are expected no later than 120 days after its promulgation.

<b>Mexico</b>			
Public Policies			
Target of Policy	Time Frame	# of Policies	Total
Renewable Energy	2000-2013	15	16
	1990-1999	0	
	1970-1989	1	
Energy Efficiency	2000-2013	4	5
	1990-1999	1	
	1970-1989	0	
Addressing Climate Change	2000-2013	12	14
	1990-1999	1	
	1970-1989	1	
<b>Grand Total</b>			<b>35</b>

Source: (IEA,2013)

#### iv. Goals and Forecast

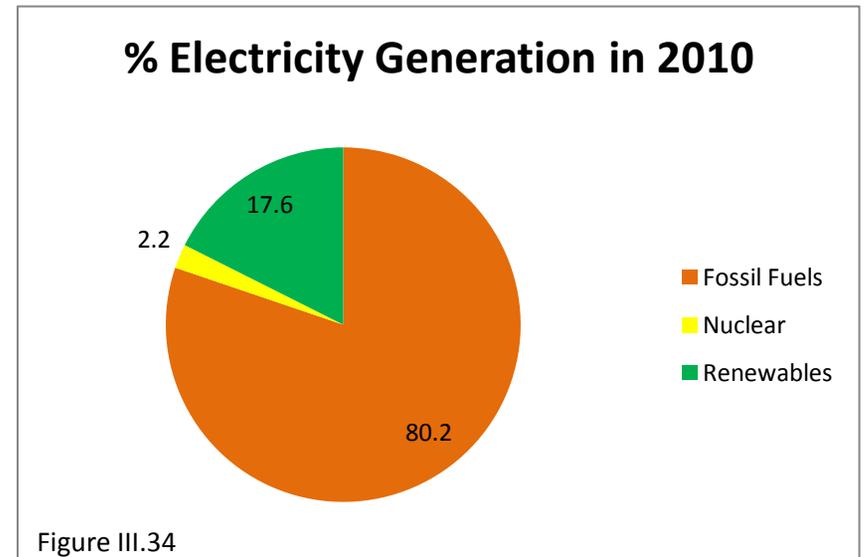
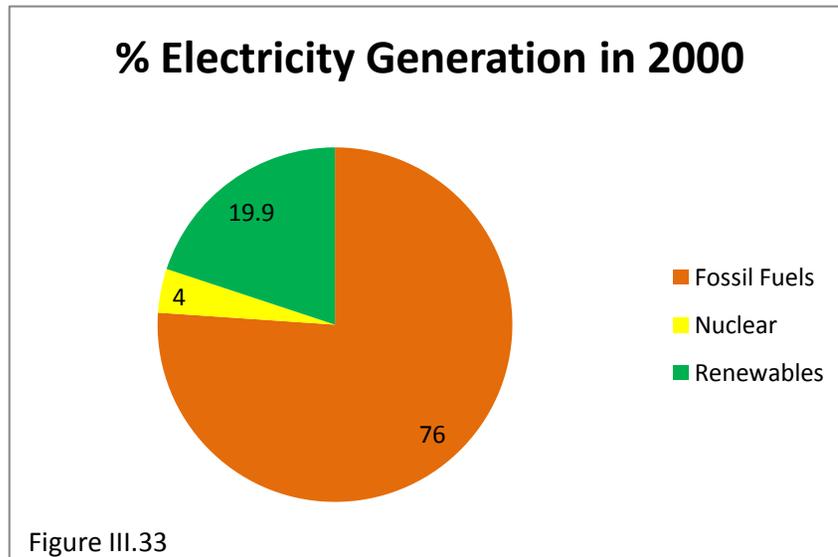
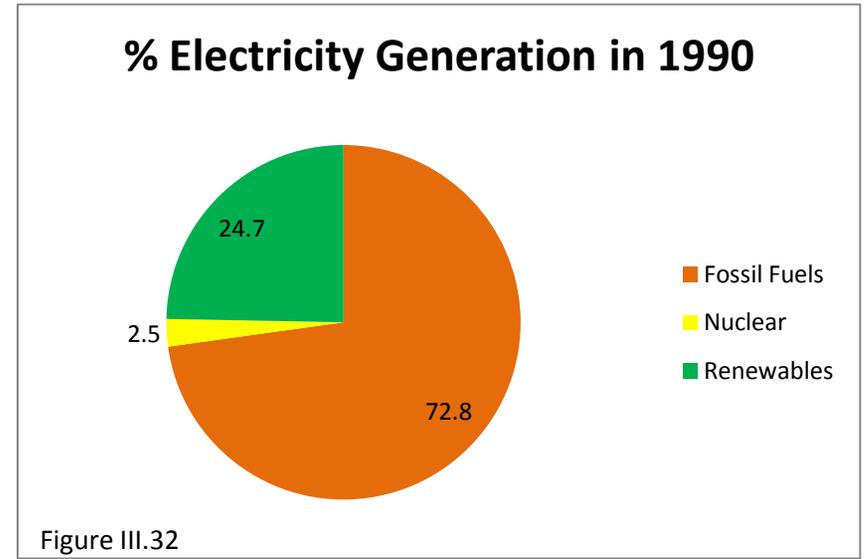
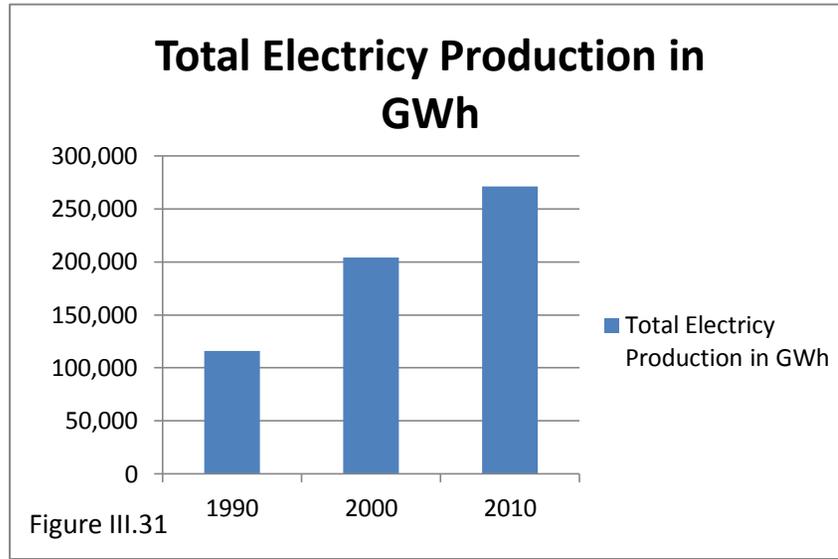
The target set in the “Ley para El Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética” (LAERFTE) is to have at least 35% share of non-fossil generation technologies to 2024.

According to “Ley General de Cambio Climático” (LGCC) the target is to reduce 30% of the emissions by the year 2020 and 50% by the year 2050 compared to the emission from the year 2000.

<b>Mexico</b>					
Goals and Targets					
	Target	By:	Reference Year	Set In:	Main Scheme
Renewable	35%	2026	n/a	2012	Accelerated Depreciation for Environmental Investment
Efficiency	n/a	n/a	n/a	n/a	n/a
Reduce Emmisions	30%	2020	2000	2012	n/a

Source: (IEA,2013)

Mexico Electricity Scenario by % of Fuel **Self-made, Source (IEA, 2013)**



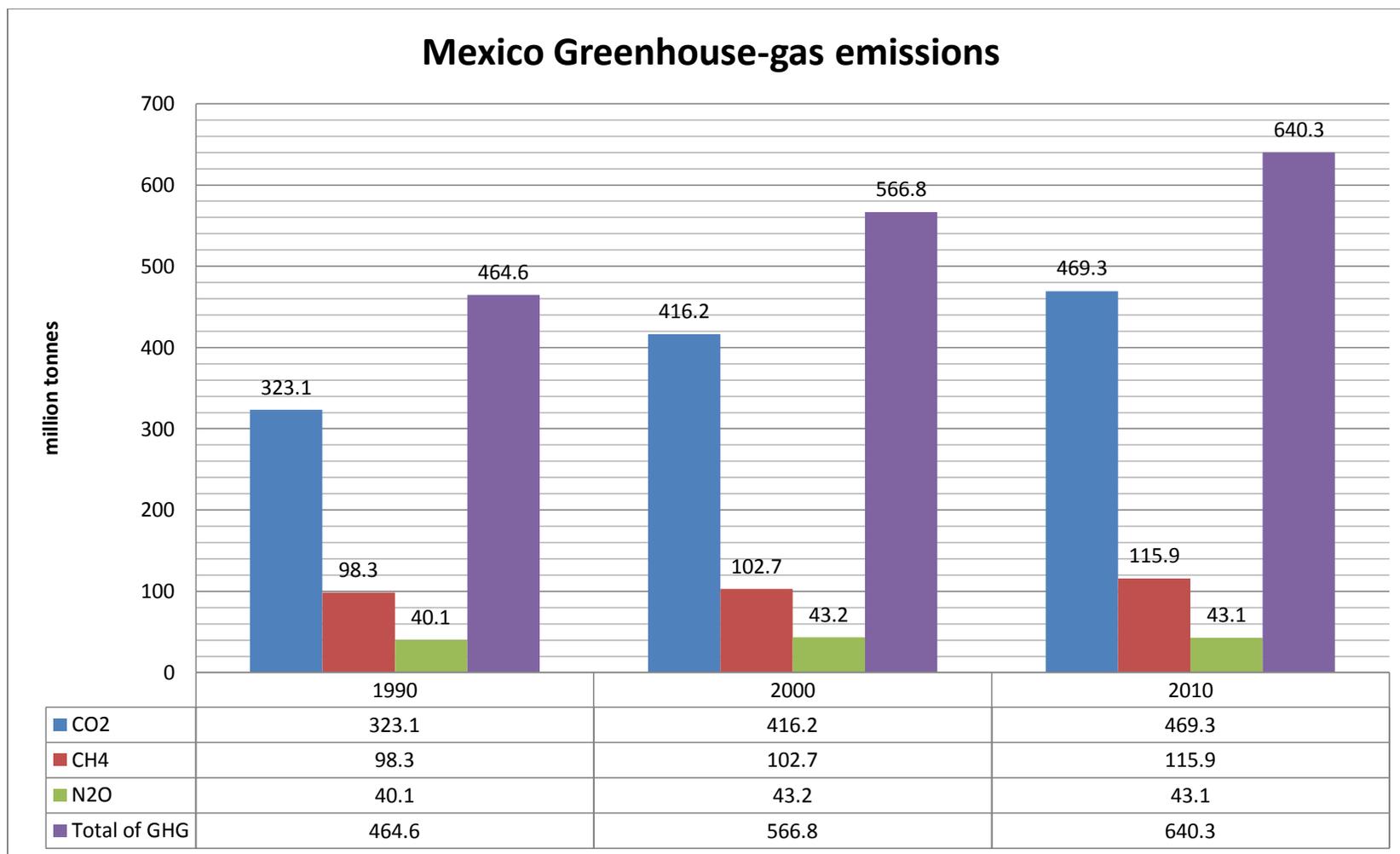
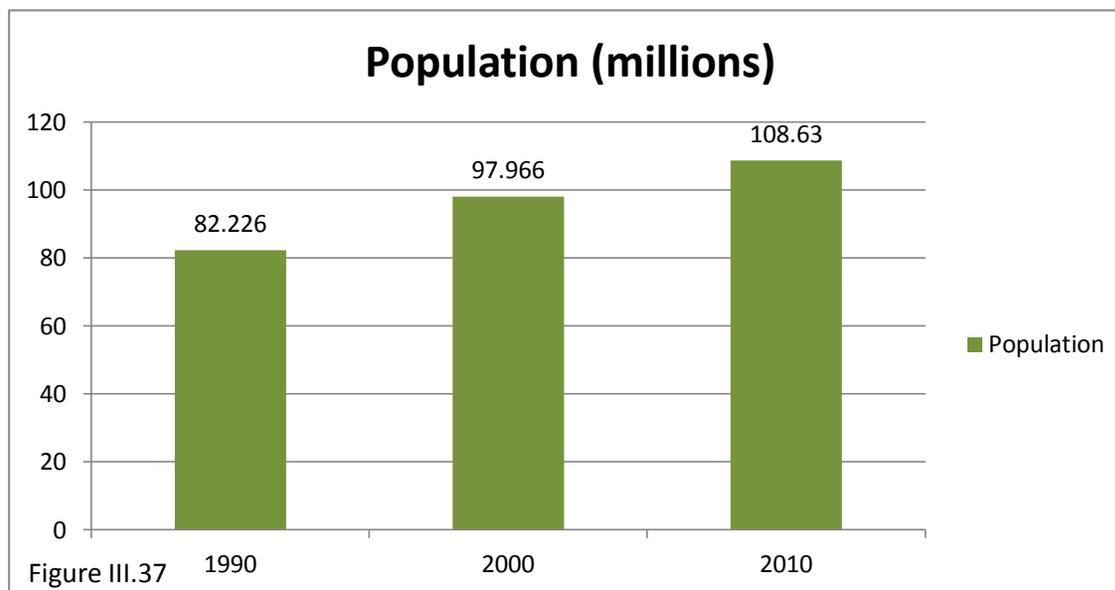
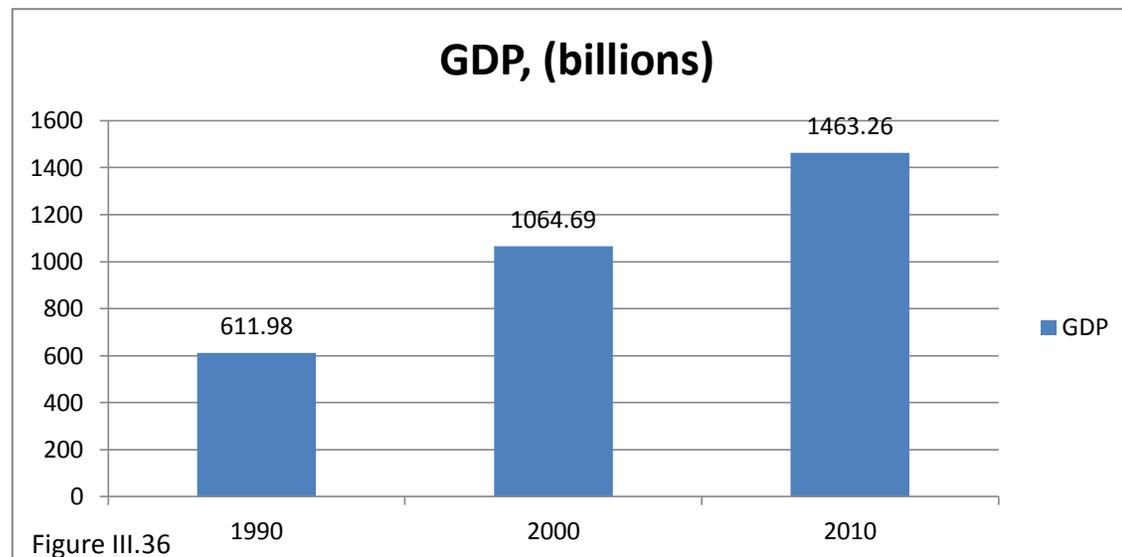


Figure III.35, self-made with information from (IEA, 2012)

Mexico

Self-made, Source (IMF, 2011)



Self-made, Source: (IMF, 2011)

## **X. Conclusions of the Chapter**

This chapter presented how do global climate change policy interacts. Due to the lack of a strong integrated international system that regulates climate change policy. Nations were driven to establish a group of specific regimes labeled as a “regime complex”, a series of institutions working by their own means and resources to tackle climate change. This type of system might be inevitable and might be the ideal system, since an integrated regime might be inefficient and complicated to operate. Decentralization was presented as a good approach given the complexity of the issue and the differences among nations. Public policies that tackle climate change must be: coherent, accountable, determined, sustainable, well researched, and fair. World’s electricity production is depending on fossil fuels. Thus there is an unequivocal scientific consensus that this is linked to an enhanced Green House effect leading to climate change. There is a link between population growth and the increase of GHG emissions leading to a stronger climate change effect. Jerome Dangelman’s concluded that nowadays in order for countries to change their energy policy there must be a crisis or a very determined intervention that leads to the transition to clean energy.

The most important International Institutions were presented, such as those bodies that interact in a regime complex to tackle climate change and transit to renewable energy. Some of these efforts include the United Nations Framework for Climate Change (UNFCCC) set in place to join the efforts of 195 nations establishing a common goal to tackle climate change and its most visible treaty, the Kyoto Protocol that aimed to reduce GHG emission from the develop countries that have a bigger share of responsibility to tackle climate change, since they are the biggest emitters the protocol also encouraged sustainable projects for developing nations. Some other efforts linked to the UN such as the IPCC were also presented as those Institutions that gather and process all research and present joint results from the International Scientific Community. Some other groups of Nations such as the G8, G20, G77+China were presented as those set of institutions that took the climate change and clean energy policy as part of their agendas. Some other groups such as NGO’s were said to provide invaluable help to address this issues mainly though promoting it as a public concern.

The high cost of renewable energy might be a short term problem around the world, but the tendency clearly shows that they are becoming less expensive by the day. New efforts and technological development might overcome such problems and will help increase renewable share in the global energy mix. After taking a glance on the Global Scenario, this Chapter presented four different cases, Germany, Japan, the United States of America and Mexico. First it looked at how the institutional context is in charge of the energy policy. Secondly it presented their past and current challenges facing climate change and energy policy. Then it presented some of the more relevant policies aimed to tackle the public problems related to this sectors. Finally it presented their goals to reduce emissions, increase efficiency and how they aimed to increase renewable energy on their electricity production.

Germany is a global leading country that is clearly aimed to reduce GHG emissions through increasing the share of renewables while increasing energy security, the feed in tariff program was their main strategy intended for this goal, another goal is to close all their nuclear energy facilities by 2022 and replace its share with renewables. Germany poses a high share of companies related to renewables thus its economy became a source of growth.

After the 1970s Oil crisis, Japan was placed to base its main share of electricity production in nuclear energy; it outcome as a fatal tragedy after the 2011 tsunami that provoked a nuclear disaster. Japan is currently producing most of its electricity based on fossil fuels, thus increasing emissions and losing its target, this provoked after it close down all its nuclear plants. The Nuclear tragedy set up a debate on how to produce its electricity, being in the main concerns in its institutional agenda. Plus the 2011 crisis pushed to an important increase in the renewable growth.

The United States, being the largest economy of the World, produces a big share of the GHG total emissions, during the Bush administration, enough proof was presented as not doing enough to tackle climate change and while not ratifying the Kyoto Protocol. The United States is home to the largest oil companies, thus making it a big obstacle for the transition to new forms of clean energy. Most of the efforts have gone to how to extract fossil fuels such as shale gas and oil fracking; thus the USA is expected to become a self-independent country in fossil fuel production that will impact geopolitics.

## Chapter III

Mexico, being a developing nation, has increased its industry after implementing free trade agreements leading to more energy consumption. Its production augmented mostly based on fossil fuels leading to a clear expansion on its GHG emissions. In 2013, Mexico passed an energy reform that was clearly focused on Fossil Fuels, while putting in place insufficient measures to transit to renewables.

Graphs were presented in this chapter; they covered how Electricity Generation Scenario has changed since 1990 to 2010 as well as their GHG emissions and GDP and population growth. In the following part a more in depth analysis will be presented related to this Chapter.



Sustainable Energy is the answer



## General Conclusions



## GENERAL CONCLUSIONS

“Earth provides enough to satisfy every man's needs, but not every man's greed.”

— Mahatma Gandhi

### **General Conclusions**

The importance of public policy is vital to public affairs understanding that the main functions of any state are to take care of its own duties. First the theory of public policy was presented, how it evolved to become a science during the past century along with some of the main precursors such as Harold Laswell. Public policies can be considered as those set of actions designed and implemented by governments to tackle public problems and have an influence in citizens' life. Public problems are considered as those issues that embody a challenge and are worth to be handled outside the private sphere. There are several factors and actors that influence which public problems make it to the institutional agenda; considering the institutional agenda as the one that contains the official set of actions that shall be face by the current government. Since public needs tend to be unlimited there is only a number of them that can be handle by governments. For that reason government officials must prioritize public problems according to their importance and urgency with professionalism and impartiality.

The process of policy making follows several steps that generally tend to: define the problem, formulate the policy, implement the proposal and finally review it in order to improve the process. That process must be transparent and inclusive and public servants should be held accountable for their actions. There are several factors that play a role in defining the agenda but studies demonstrate the big role that politics and interest groups do play within the process, the mass media has certainly a great influence as well, by raising awareness on the issues they covered. It is important to compare policies but one must consider that even though the problematic might be similar the approach can be different. There are more than twenty theories of political science that aid to understand the social and political development of public policies.

It can be concluded that the policy making process does not necessarily follows a linear or steady path considering the constant change of the environment of each unique scenario. As Capano states “change is the core business of all sciences” thus scientists tend to answer the questions that arise within the scientific spectrum and the field of policy making is not the

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exception. Hence there were presented different approaches to cover how policies can be analyze or classified. Capano poses that the dynamics of policy development can be either evolutionary or revolutionary, evolutionary refers to the gradual adaptation along with the process; and revolutionary is characterized by a sudden radical change and rupture from the past. Public policies are a complex phenomenon that it is almost impossible to determine hard knowledge of the policy process as every case presents its own scenario.

### **I. The Importance of Energy and its link to Climate Change**

Energy is a basic need in any country, it is present almost everywhere thus current life would be almost not possible without it, therefore the importance of its constant supply and accessibility labeling this as energy security. Bearing in mind there exist various types of energy, energy has been next to human kind since ancient time, considerably by means of the burn of biomass. After the period of time of the development of science along with the industrialization revolution that started in England during the XIX century, energy adopted a relevant importance in ordinary life. Following this Industrial Revolution the momentum drove to an exuberant increase for the demand of new forms of producing energy, such as the use of fossil fuels like coal, the discovery and master of electricity, and later to the discovery and use of oil all the way to the development of nuclear energy. Clearly the use of energy is linked to the development of any nation. Electricity plays a crucial role in economic and social development of a country; one example is the relationship between changes in the gross domestic product (GDP) and energy consumption.

While renewables forms of energy were present since old times. It was the boom, relative convenience and higher capacity of fossil fuels that did not allow them to expand renewables to expand faster. Humans of the time never really consider that fossil fuels are limited and the increase in the demand will deplete them sooner. Most of the energy use today originates from fossil fuels, 65% of the world electricity production comes from Fossil Fuels. Hence a public problem arises taking in to account that fossil fuels are limited and pollutant. It was not until the Oil Crisis of 1970s that certain countries considered developing new policies that promoted conservation and clean and renewable forms energy. Examples are that decades ago solar energy was confined for certain purposes such as for

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space shuttles or satellites. Renewable sources of creating energy include: wind, the sun, the use of biomass, geothermal and hydro power. Clearly the feasibility and access to them depends on the availability of the location, for instance certain countries depending on their location get more insolation or better-quality of wind currents making it more feasible for renewable energy to operate.

With the precarious relief that nuclear power offered at the end of the last century; many developed countries invested in this kind of energy thinking that it was a safe and reliable source of energy, examples are France or Japan. After the Chernobyl and Fukushima disasters, nuclear power proved to be defined as a nonrenewable and not reliable source of energy due to the high risks it represents. It can be classified as a pollutant and dangerous form of producing energy. Radioactive waste presents a real hazard for future generations and the high uncertainty of a disaster can bring loads of destruction. Worldwide production of nuclear power is declining meaning that more nations are investing in other forms instead. The recent Fukushima disaster brought up concerns again about the safety of nuclear power, and according to the IEA resulting in cancellations of new plants, and decisions to phase out nuclear power in Germany, Belgium and Switzerland. However, there are envisioned plans to operate new plants mainly in the Asian Continent specifically in China, Russia and India.

Studies from diverse international organizations such as United Nations and related agencies clearly showed the link between the burn of fossil fuels that generate greenhouse gases enhancing the greenhouse effect leading to global warming and causing climate change. Hence there is no doubt that modern climate change is dominated by human influence, the main reason is due to changes in atmospheric composition, mainly from carbon dioxide. According to the IPCC, for the next two decades, a warming of about 0.2C per decade is projected. Even if the concentrations of all greenhouse gases and aerosols had been kept constant at year 2000 levels, a further warming of about .1C per decade would be expected (IPCC, 2007, p. 12). The IPCC concludes that “anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized” (IPCC, 2007, p. 16).

## GENERAL CONCLUSIONS

The consequences of climate change can be catastrophic and create many side effects to ordinary life. Impacts of Climate Change fall in to three categories: first order that involve physical changes that will affect patterns in nature, increase the sea level, increase temperatures, and expand droughts. Second order impacts that involve social, damages from more common disaster, economic and health effects such as an increase in infectious diseases such as malaria, dengue fever or cholera. Currently being infectious diseases the largest source of mortality in the developing world. And third order impacts such as massive emigration from affected locations or international conflicts originated of scarcity of resources.

Deforestation, changes in the use of terrain and other mankind induce effects contribute to enhance climate change. Since it is a worldwide problem, the effects will be different from region to region.

Sustainability is defined as a pathway of development that would not compromise the levels of wellbeing for future generations. Efficiency is also an important measure that can reduce the use of energy efficiency. It can be accomplished in different ways, being conservation one of the best; simply using energy more vigilantly. For example, people might be encouraged to turn off lights in their home, or buy energy efficient home appliances or simply walk or take public transportation instead of cars. Energy efficiency in today's world means more sophisticated approaches to the way in which energy is used.

Countries are entitled to develop sustainable public policies that tackle the diverse effects of climate change. Considering that develop countries are the ones that pollute the most, they have a bigger share of responsibility to tackle climate change and its effects since they are the biggest GHG emitters. There is a link between world population growth and the increase of GHG emissions leading to a stronger climate change effect. Adaption and Mitigation are the two main roads to fulfill this mission. Adaption refers to the actions focus to adapt the current style of life and its needs to the effects of climate change. Mitigation is the set of actions intended to reduce the effects leading to climate change such as reforestation or reducing GHG emissions.

According to the UN investing in Sustainable Energy, “is a smart strategy for growing markets, improving competitiveness, and providing greater equity and opportunity”. The

## GENERAL CONCLUSIONS

UN report adds that the transition to Sustainable Energy might be the biggest business opportunity of this Century (Sustainable Energy for All, 2013). Today all 195 Countries of the world must focus on energy that is clean, efficient and accessible to all. The high subsidies to fossil fuels encourage the waste of energy and slow down the transition to Renewable forms of energy. Sustainable Energy for All an initiative from the UN suggest that governments and institutions should develop national energy plans and targets, provide financial support, and remove counterproductive tariffs and subsidies to promote sustainable and clean energy. According to the OCDE removing fossil fuel subsidies can contribute significantly to reduce GHG emissions and improve economic efficiency in the countries that do so. Climate Change should be tackle with different mechanisms and diverse actions, there should be more severe laws restricting the amount of waste or biohazard products, as well as promoting more efficiency and investing in mass transportation and recycling systems.

At the international level, efforts have been made at different paces and following momentums. Due to the lack of a strong integrated international system that regulates climate change policy, nations were driven to establish a group of specific regimes labeled as a “regime complex”, a series of institutions working by their own means and resources to tackle climate change. This type of system might be inevitable and might be the ideal system, since an integrated regime might be inefficient and complicated to operate. Decentralization was presented as a good approach given the complexity of the issue and the differences among nations. Public policies that tackle climate change must be: coherent, accountable, determined, sustainable, well researched, and fair. It seems that unilateral actions aimed to not ratify agreements or egoistic pollutant policies injure the efforts of the International Community.

Globally there are efforts led by the United Nations Framework Convention on Climate Change UNFCCC and its treaties such as the Kyoto Protocol, conceived to join efforts to reduce GHG emission. The Intergovernmental Panel on Climate Change IPCC is a panel that gathers all the significant scientific data from around the world and emits a general report, making it of a great help considering the complexity of the problem. Other international institutions such as The World Bank or the Organization for Economic Co-

## GENERAL CONCLUSIONS

operation and Development OCDE along with the International Energy Agency IEA have contributed to research and promote mechanisms to tackle climate change and increase the share of renewable energy.

Jerome Dangerman concluded that in order for countries to change their energy policy they must pass through a crisis or a very determined intervention that lead to the transition to clean energy. It can be determined that after the 1970s oil crisis, it was that extraordinary event that led countries to change their energy policy, or the Fukushima accident in Japan recently promoting the transition to renewable energy.

Over the last decades it was clear that the high price of renewable energy versus traditional forms of energy made it less attractive to invest in renewable. But today there are several projects focused in increasing energy efficiency, developing new technology such as battery storage making it more affordable. The World still subsidizes a great part of fossil fuel energy; those subsidies could be used towards the development of renewable energy.

Along with new technology come new ways to invest in renewables. Some examples show that companies are developing new models such as where initial installation costs for renewables are paid for by investors who are later paid back with interests. In the US “scientists are developing methods of generating electricity to produce hydrogen from water to power cars”. In Oslo, organic garbage is transformed in to bio gas that runs some of the city’s buses; in India they are developing air conditioners powered by the sun (Reuters, 2013), among many other examples. Therefore it is certain that new technology can reduce the dependence on fossil fuels and consequently lead to a cleaner environment. Rajit Gadh considers that the world has been used to large-scale power plants but he suggested that many of the new power plants will be in the micro-scale providing enough energy for single homes and that might be the best way to increase the share of renewables.

The World Bank considers that there are still feasible emissions pathways to stop the warming of the planet. Decisions need to come jointly from all actor of society, governments, private sector and society overall are accountable for the actions taken today as well as the lack of action.

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It is true that certain environmental policies or energy transition might harm some communities such as coal mining communities or oil based firms. But the benefits from it will be certainly larger than those small harms. Actions must come from governments to be able to create an economic transition for those communities or affected firms.

Concerned to this case study it can be concluded that Germany is a leading country in terms of transiting to renewable energy and implementing efficiency policies. There were mainly driven after the 1970s Oil crisis and consideration of the dangers of Nuclear Power after pressure groups. Dangerman observes that experiences gained in Germany are highly instructive for the rest of the world. The Enerwiende suggests that Germany turned environmental challenges into a source of growth. One must observe that even though Germany has reduced substantially its greenhouse gas emissions it continues to be an important emitter.

Japan, a historically isolated country, depends heavily on imports in order to meet its energy demand, Japan envisioned Nuclear Power to be its main provider for electricity but the Fukushima Disaster proved it wrong. Recently Japan has increased its GHG emissions due to the increase in the burn of fossil fuels to cope with the demand after closing all its nuclear power plants. There have been extraordinary efforts to promote a rapid transition to renewable energy.

The United States being the largest economy of the World, it is as well one of the biggest polluters. While the Bush Administration tackling climate change was clearly not part of the institutional agenda. The USA has been promoting the use of fossil fuel energy, such as shale gas and it might soon meet its own requirement for oil and gas. There are many interest groups that have a big influence on the decisions taken by the Congress making it hard for new investment in renewables. The Obama administration as well as some local governments have promoted actions to tackle climate change and increase the share of renewable energy, some of the biggest worldwide energy projects are under construction in certain areas of the USA but it seems insufficient hence more action is urged from their part.

## GENERAL CONCLUSIONS

After Mexico approved an opening energy reform, it opens up to private capital to be invested in the energy sector, promising to make the State own companies more competitive and efficient. In the last decade there have been efforts to promote the transition to renewable energy and it is expected for a bigger share of them to come mainly from private investment. While this thesis is being written, secondary laws that must come along with the Constitutional Reform are awaiting to be approved by Congress. Unfortunately the Energy Reform centered its efforts and the debate was on the promotion of fossil fuels, little or no action was towards the promotion of clean and renewable energy. Mexico should take advantage of its strategic geographic location and promote the investment of more renewable energy as a measure to enhance economic development

### **II. Proposals and Expectations**

Establishing eco-taxes in appropriate sectors as well as getting rid of harmful subsidies can contribute to reducing GHG. Dangerman suggested that shareholders should pay for environmental damage with such measures, investment flows will shift towards companies that produce and use energy more sustainably.

International efforts have been less effective such as the Kyoto Protocol with the lack of support of key nations. There needs to be more efforts to force nations to comply with international law and treaties. More coordination between nations might lead to a better integration system that can tackle the particular challenges faced in each region.

The benefits of Renewable and energy efficiency can contribute to countries to depend less on others, by satisfying their own needs. It could help reduce international conflicts through increasing global peace, considering that many wars have been fought sowing to control more resources. Renewable energy can contribute as a measure to tackle global warming. It can also strength local economies. Environmental actions must be look at as an investment to a better quality of life and as a right to future generations. If the World's population keeps adding up, there is a larger need for sustainable economic growth.

The Planet cannot wait any longer for the right public policies to be implemented. Climate Change is a serious threat to current life and every country and person in this planet must

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contribute to stop it. Renewable energy is one door to the many that must be open to face it. The transition to renewable energy will take decades and the use of fossil fuels will be reduced gradually. The Sun, the wind, the inside heat of the planet, the biomass and the water are free and environmentally friendly elements that must be used to make this our home a better planet.

*“Ask not what your country can do for you, ask what you can do for  
your country”*

*John F. Kennedy*

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## **Glossary**

- AIDS - Acquired Immune Deficiency Syndrome
- BMU – German Ministry for Environment, Nature Conservation and Nuclear Safety
- BMWI – German Federal Ministry of Economic Affairs and Energy
- CFE – Mexican Comisión Federal de Electricidad
- CIA – USA Central Intelligence Agency
- CO<sub>2</sub> – Carbon dioxide
- DOE – USA Department of Energy
- EPA – US Environmental Protection Agency
- EU – European Union
- FIT – Feed-in tariff
- G20 – Group of 20 Nations
- G8 – Group of eight nations (After year 2014: G7)
- GDP – Gross Domestic Product
- GHG – Greenhouse Gases
- GNP - Gross National Product
- GW – Gigawatt
- IEA – International Energy Agency
- IMCO – Instituto Mexicano para la Competitividad
- IPCC – International Panel on Climate Change
- J – Joule

## GLOSSARY

- kWh – Kilowatt-Hour
- METI – Japan Ministry of Economy, Trade and Industry
- NAFTA – North American Free Trade Agreement
- NASA – USA National Aeronautics and Space Administration
- NOAA – USA National Oceanic and Atmospheric Administration
- OCDE - Organisation for Economic Co-operation and Development
- PEMEX – Petróleos Mexicanos
- ppmv – Parts per million by volume
- SEMARNAT – Mexican Secretaría del Medio Ambiente y Recursos Naturales
- SENER – Mexican Secretaría de Energía
- TWh - Terawatt-hour
- UN – United Nations
- UNFCCC – United Nations Framework Convention on Climate Change
- USA – United States of America
- WHO – World Health Organization
- WMO – World Meteorological Organization
- WTO – World Trade Organization

Table of Data used to create Graphs

Country	Germany			Japan			United States			Mexico		
Year	1990	2000	2010	1990	2000	2010	1990	2000	2010	1990	2000	2010
Total Production of Electricity (GWh)	555.015	576.543	628.896	842.044	1.058.548	1.117.122	3.218.621	4.052.667	4.378.422	115.837	204.177	271.050
From Fossil Fuels (GWh)	372.498	361.442	368.656	531.675	620.665	691.989	2.211.966	2.882.270	3.060.149	84.296	155.224	217.473
From Nuclear (GWh)	152.468	169.606	140.556	202.272	322.049	288.230	611.589	797.718	838.931	2.937	8.221	5.879
From Renewables (GWh)	19.093	35.475	103.602	100.663	103.819	124.157	369.241	330.364	440.669	28.604	40.732	47.698
% From Fossil Fuels	67,1	62,7	58,6	63,1	58,6	61,9	68,7	71,1	69,9	72,8	76,0	80,2
% From Nuclear	27,5	29,4	22,3	24,0	30,4	25,8	19,0	19,7	19,2	2,5	4,0	2,2
% From Renewables	3,4	6,2	16,5	12,0	9,8	11,1	11,5	8,2	10,1	24,7	19,9	17,6
Production of Electricity from Wind	71,0	9352,0	37793,0	0,0	109,0	3962,0	3066,0	5650,0	95148,0	1,0	19,0	1239,0
% of Total Production from Wind	0,37	26,36	36,48	0,00	0,10	3,19	0,83	1,71	21,59	0,00	0,05	2,60
Production of Solar Electricity	1,0	60,0	11682,0	1,0	347,0	3800,0	666,0	709,0	3934,0	1,0	7,0	31,0
% of Total Production from Solar	0,01	0,17	11,28	0,00	0,33	3,06	0,18	0,21	0,89	0,00	0,02	0,06
Production of Geothermal Electricity	0,0	0,0	28,0	1741,0	3348,0	2632,0	16012,0	14621,0	17577,0	5124,0	5901,0	6618,0
% of Total Production from Geothermal	0,00	0,00	0,03	1,73	3,22	2,12	4,34	4,43	3,99	17,91	14,49	13,87
Production of Hydro Electricity	19791,0	25962,0	27356,0	95835,0	96817,0	90682,0	288960,0	279986,0	286333,0	23478,0	33133,0	37121,0
% of Total Production from Hydro	103,66	73,18	26,40	95,20	93,26	73,04	78,26	84,75	64,98	82,08	81,34	77,83
Production of electricity from biofuels and waste	5186,0	10121,0	39865,0	10520,0	15213,0	35827,0	86362,0	71713,0	75429,0	0,0	1672,0	2689,0
% of Total Production from biofuels and waste	0,93	1,76	6,34	1,25	1,44	3,21	2,68	1,77	1,72	0,00	0,82	0,99
Green-House Gas Emissions (Million Tonnes)	1.231,0	1.037,0	942,8	1.300,9	1.407,0	1.356,4	6.100,8	6.925,8	6.656,4	464,6	566,8	640,3
% Share of Energy	82,1	82,7	83,4	83,7	85,4	85,2	85,4	87,2	85,0	64,4	68,3	72,6
GDP, PPP (constant 2005 international \$) Billions	1434,95	2162,28	2851,33	2326,99	3213,09	3954,75	5800,53	9951,48	13595,64	611,98	1064,69	1463,26
Population (Millions)	78,888	82,075	81,603	123,438	126,831	127,483	250,047	282,296	309,997	83,226	97,966	108,627

**Sources:**

- International Energy Agency (2013)
- Organization for Economic Co-operation and Development (2013)
- International Monetary Fund (2013)