

PALACKÝ UNIVERSITY OLOMOUC
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Emission Markets and Developing Countries

Bachelor Thesis

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Abstract

The aim of the bachelor thesis is to describe and research the mechanisms used in the developing nations that can lower the gas emissions. Taking into consideration the state of public administration in the developing countries, the clean development mechanisms are to be the most probable to be implemented. Nowadays, the main targets are the countries described by the World Bank as the "Least Developed Countries". Focus is being put on the Kyoto Protocol, its acceptance among the developing nations and their following of the commitments. An opinion is also given for examples of policy suggestions based on the information given in the rest of the thesis.

Key words

Emission markets, developing countries, climate change, mitigation, greenhouse gases, Clean Development Mechanisms, offsets

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Z á s a d y p r o v y p r a c o v á n í :

The intent of the bachelor thesis is to describe and research the mechanisms used in the developing nations that can lower harmful gas emissions. Focus will be put on the Kyoto Protocol, its acceptance among the developing nations and their following of the commitments to the Protocol. Taking into consideration the state of public administration in the developing countries, Protocol's Clean Development Mechanism is to be the most probable to be implemented and thus analyzed. The main targets are the countries described by the World Bank as the "Least Developed Countries". Policy suggestions will be given based on the information presented in the rest of the thesis.

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Declaration

I declare that the bachelor thesis Emission Markets and Developing Countries was written by me under the guidance of Mgr. Petr Pavlík. All used sources cited in any form have been acknowledged in the text and in the list of sources.

In Olomouc,

.....

Michal Kukučka

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“.....We are facing a global climate crisis. It is deepening. We are entering a period of consequences.

—Al Gore

1. Introduction

The aim of the bachelor thesis is to research and describe the mechanisms used in the developing nations that can lower greenhouse gas emissions. Taking into consideration the state of public administration in the developing countries, the UNFCCC Clean Development Mechanism (CDM) and its associated greenhouse gas reduction protocols will likely be the foundation of the greenhouse gas reductions. Currently the main targets are the countries described by the World Bank as the “Least Developed Countries”. Focus is being put on the Kyoto Protocol, its acceptance among the developing nations and their following of the commitments. An opinion is also provided for examples of policy modification suggestions based on the findings of the thesis. We also need to realize that the Kyoto Protocol and the CDM does not create commitments for LDCs unless they implement a CDM project on their own and have a commitment to follow through on the project.

1.1 The Impact of Climate Change

First of all, we should start by a brief explanation what is the global climate change. People, the fauna, flora and entire ecosystems across the globe are today under threat from a variety of dangers such as deforestation, global warming or on biomass dependence for energy. In sub-Saharan Africa for example, over 80 percent of the population depends on traditional biomass for cooking (United Nations, 2007).

The Earth is undergoing severe floods, droughts, hurricanes. The temperatures are decade by decade higher, as well as the sea levels caused by the melting icebergs in polar oceans. Global sea level rose about 17 centimeters in the last century. The rate in the last decade, however, is nearly double that of the last century (Church and White, 2006). There has been unprecedented increase in carbon dioxide concentrations in the last 20,000 years along with increases in other emissions. So says a report from the U.N International Panel on Climate Change (IPCC). It can be deduced from the foregoing that humans are responsible for the observed effects of climate change.

Climate change is already affecting extreme weather, and worst-case predictions that by 2100 temperatures could increase by as much as 3.7 degrees Celsius (IPCC, 2007). Most of this warming has occurred since the 1970s, with the 20 warmest years having occurred since 1981 and with all 10 of the warmest years occurring since the beginning of the 21st century (Peterson and Baringer, 2008). The key vulnerable sectors identified by IPCC include agriculture, food and water. Countries where agriculture is the major sector of their economies (developing countries) will suffer the most. This is not only because of reduced agricultural productivity and increased water instability, but also in increased exposure to coastal flooding as a consequence of the sea rising. Other results will be extreme climatic events, and increased risks to human health.

Every week we're seeing new and undeniable climate events, evidence that accelerating climate change is here right now. We know that droughts are intensifying, our oceans are warming and acidifying, with methane plumes rising up from beneath the ocean floor. We are seeing extreme weather events, increased temperatures, and the West Antarctic and Greenland ice-sheets melting at unprecedented rates, decades ahead of scientific projections. We need to put a pricetag on carbon emissions, and eliminate government subsidies for coal, gas, and oil companies. As it has been said during the UN Climate Summit (2014) - we need to end the free ride that industrial polluters have been given in the name of a free-market economy, they don't deserve our tax dollars, they deserve our scrutiny. For the economy itself will die if our ecosystems collapse. Global temperatures are rising, heat waves are becoming more common, sea surface temperatures are also rising and glaciers are melting.

The world leaders realize the situation and have made several efforts to find the best solutions. One example is The United Nations Framework Convention on Climate Change. The UNFCCC was started in 1994 and sets an overall framework for intergovernmental efforts to tackle the challenges posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership (United Nations, 1994). Under the Convention, governments can share information on greenhouse gas emissions, national policies and best practices, launch national strategies for addressing greenhouse gas emissions, including the provision of financial and technological support to developing countries to cooperate in preparing for adaptation to reduce the impacts of climate change.

The evidence is clear and we should not ask if the climate change is happening, but what we should do about it. There are numerous options that have been offered to us and we will discuss few of them in this paper.

1.2 Climate change as an equity issue

It is obvious that all primary industries will be considerably distressed by climate change. It is therefore crucial that a heavy effort is made to mitigate emissions from all the sectors. We must also bear in mind that some change is unavoidable and so the primary industries have to come up with solutions how to adapt to climate change. (NSW GOVERNMENT, 2014)

Reducing emissions (as part of a global approach) would prevent some of the worst-case scenarios of climate change occurring in different parts of the world. This brings into focus the dainty issue of equity in climate change. Management of crop and pasture and forest systems to enhance carbon stocks in vegetation and soil, and reduction in the use of agricultural biomass for energy are all mitigation issues that should be seriously considered.

Climate change is now recognized as an equity issue, because the problem is that areas where there is a major part of population living in poverty, such as Sub-Saharan Africa, contribute the least to the global amounts of CO₂ emissions, are also the least equipped with the options how to deal with the negative effects of the impacts that global warming brings to our planet. On the other side, the already developed western nations that have contributed throughout the history the most to the atmospheric buildup of greenhouse gasses have much better means for how to adapt to the changes that will come. This is why the issue of unevenness between the developed and underdeveloped countries is so critical and must be addressed in order to have the success of global climate change adaptation and mitigation. The key goals for the developing countries resulting from this are:

- achieving high political recognition for African and other developing nations on the platform of international negotiations;
- allocating resources appropriately;
- ensuring food and energy security;
- managing and adapting to long-term climate risk.

These goals require good governance; access to technology; investment in innovation; the involvement and commitment of all segments of society; and international, national and regional cooperation.

Climate-proof development implies extra costs over and above business as usual and a need to assess and address climate risks in national development programs. This means that additional resources are required. Who will provide them, under what mechanisms and in what time frame are the key questions to be answered. (FAO, 2009)

2. The Least Developed Countries

The world we live in is very diverse, starting from plants and animals, continuing by people and all the way to the economic development of countries. The developing countries are nations with a less advanced economy, underdeveloped industrial and service sectors and low Purchasing Power Parity and Human Development Index. But also between developing countries, there are some which are in a better state than the others. Therefore we further categorize these countries. In order to find the ones that are in the worst condition, emphasizing their need for rapid development and give them more attention, the United Nations created a special group of countries – the Least Developed Countries. The more focused public support measures may help to overcome their basic structural problems and handicaps, or their impediments to development as is said by the special advisor to the Secretary-General of the United Nations Conference on Trade and Development *Debapriya Bhattacharya* (Making it Magazine, 2010).

2.1 History

The establishment of a category of least developed countries (LDCs) was first advocated in the 1960s to attract special support measures for the most disadvantaged economies. The United Nations General Assembly acknowledged the need to alleviate the problems of underdevelopment of the poorest countries and requested the Secretary-General, in consultation with, among others, what was at that time the Committee for Development Planning, to carry out a comprehensive examination of the special problems facing the LDCs and recommend special measures for dealing with those problems.

From the outset, LDCs were recognized as the most vulnerable members of the international community, that is to say, low-income countries which faced severe structural handicaps to growth. The Committee for Development Planning proposed an initial list of 25 LDCs based on a simple set of criteria (per capita gross domestic product (GDP), share of manufacturing in GDP and adult literacy). The list was approved by the Economic and Social Council and formally endorsed by the General Assembly in November 1971. Since the establishment of the category, the Committee has been responsible for undertaking a review of the list every three years, on the basis of which it advises the Council regarding countries which should be added to or those that could be graduated from the list. (United Nations, 2008)

Countries classified as the LDCs may for example qualify for various development projects helping them to get on the track to achieve a higher economic growth. Next, the trade benefits like low or no import tariffs are a great way for LDCs to accelerate their development. The Least Developed Countries are also the biggest receiver of the Official development assistance.

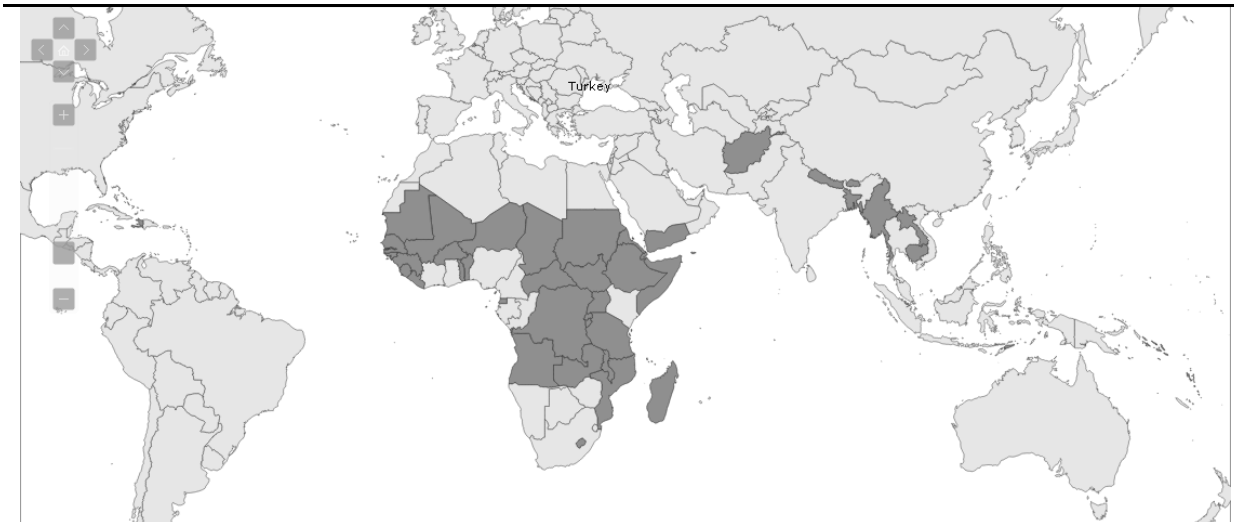
As it might seem, there is a lot to gain for a country to be considered as LDC, but there are still some that do not want to fall into this group, even though they meet all the criteria. Three countries—Ghana, Papua New Guinea and Zimbabwe—were considered by the CDP to be eligible for LDC status, but declined to be included in the list. They either questioned the validity or accuracy of the data presented by the CDP, arguing that the indicators had not captured the relevant aspects of their respective economies, or they emphasized an improvement in the socio-economic conditions of the country since the time of the CDP recommendation (United Nations, 2008). Also, from a political point of view, they do not want to be seen as the countries that have just fallen into the Least Developed Countries group and of course, this option was given to them.

2.2 Definition

To be classified as the LDC, a country needs to meet today three criteria:

- Income criterion, based on a three-year average estimate of GNI per capita for the period 2011-2013, based on the World Bank Atlas method (under \$1,035 for inclusion, above \$1,242 for graduation as applied in the 2015 triennial review).
- Human Assets Index (HAI) based on indicators of: (a) nutrition: percentage of population undernourished; (b) health: mortality rate for children aged five years or under; (c) education: the gross secondary school enrolment ratio; and (d) adult literacy rate.
- Economic Vulnerability Index (EVI) based on indicators of: (a) population size; (b) remoteness; (c) merchandise export concentration; (d) share of agriculture, forestry and fisheries; (e) share of population in low elevated coastal zones; (f) instability of exports of goods and services; (g) victims of natural disasters; and (h) instability of agricultural production. (UN-OHRLLS, 2015)

There has been a lot of discussion about the definition, criteria and concept for the Least Development Countries, mostly debating if they can indeed distinguish these countries from the rest of the world. It is worth noting that the criteria have undergone several changes throughout their existence. The UN evaluates the countries on the list every three years and suggests new countries to be added, or others to graduate from it. For example: the UN's General Assembly adopted in December 2013 a resolution where it decided that Equatorial Guinea will graduate three and a half years after the adoption of the resolution and that Vanuatu will graduate four years after the adoption of the resolution (UN, 2014).



Picture 1 Geographical distribution of LDCs throughout the world

Source: United Nations (2014), made by author in program Armcharts

The Least Developed Countries are very fragile. Many of them are landlocked, which hardens their position in the world trade and is making them more vulnerable to their strong, often more industrialized neighbors. Others are belonging to the Small Island Development States and can be wiped out with every tidal waves resulting from the changes in our climate. These are large handicaps that need to be taken in to account. These problems will not be solved by offering large foreign direct investments for mining and other extractive industries, but by creating more sustainable and cleaner industries or clean mechanisms that after time will help to protect the climate.

3. Global Warming and Greenhouse Gasses

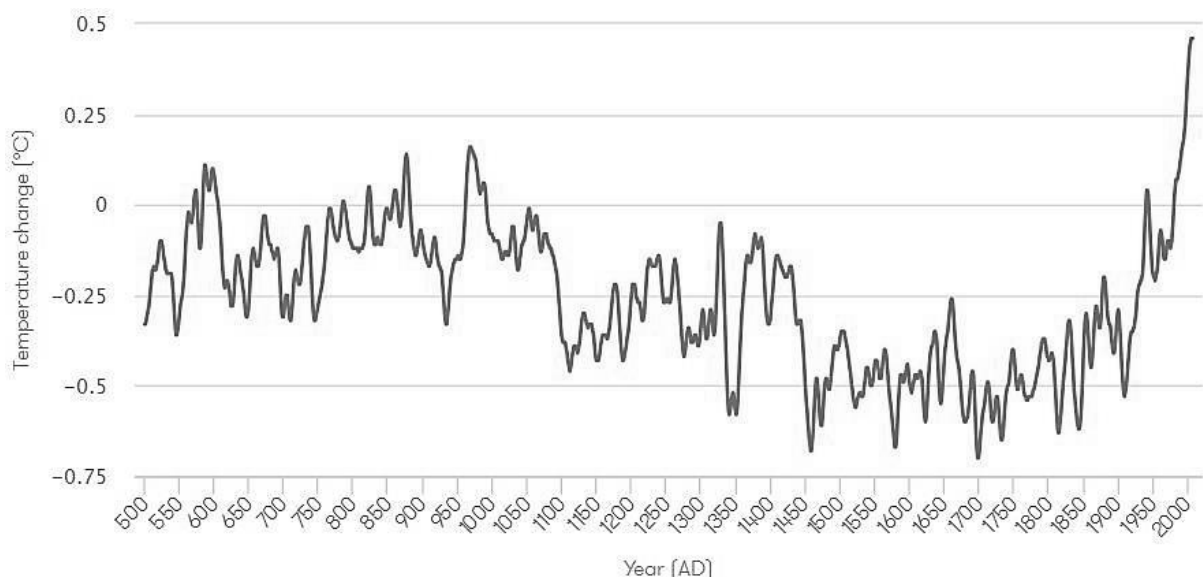
What is global warming? Where did it come from? What is causing it?

In today's medias, the topics about environment and its issues are not well covered and that is one of the reasons why the public lacks the general knowledge about this topic.

3.1 What is Global Warming?

Global warming is the continuing rise in the average temperature of Earth's climate system. Through the sudden use of factories, gas consuming cars and other emissions from fossil fuels the Earth's temperature has gradually increased since the beginning of the industrial age. Global warming is a natural event, but it is being exacerbated by humans. Today the levels of greenhouse gasses in the atmosphere are at a record high and if nothing is done about it, the Earth will ultimately swelter.

People all around the globe have been noticing changes. Summers might be longer and hotter, the extended periods of unusual heat last longer (NCA, 2014). Winters are generally shorter and warmer with lower snowfalls. Rain comes in heavier downpours, tropical storms are much more destructive and frequent, often bringing flash floods with them. However, the climate change is not happening everywhere the same way. In different parts of Earth, there are different exhibitions of it. In some places might be even positive changes. We will discuss the potential positive impacts of climate change in the subsection 3.3.



Picture 2 Temperature change from the 6th until the 21st century

Source: Australian Academy of Science, 2015

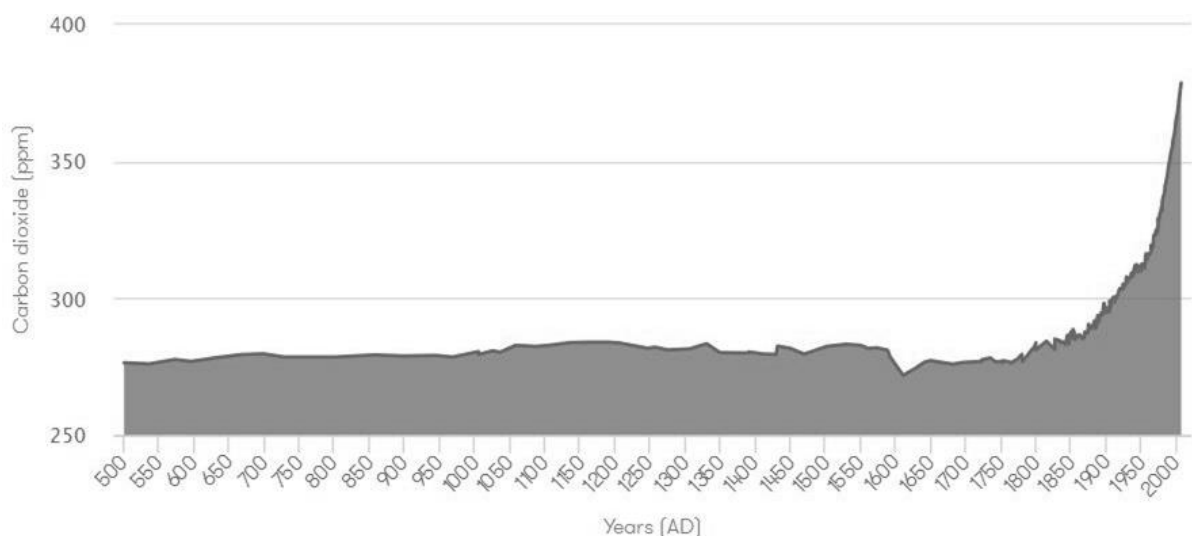
3.2 Enhanced Greenhouse Effect

But how did the climate change happen? It is through something called the enhanced greenhouse effect. First of all, we need to understand what the basic greenhouse effect is. The greenhouse effect is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. (Australian Government, 2014)

Greenhouse gases (GHG) include water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), ozone (O₃) and some artificial chemicals such as chlorofluorocarbons (CFCs).

GHG help regulate the temperature of the Earth. The rays of the Sun warm the Earth and the Earth reflects the radiated heat outwards. GHG prevent this heat from escaping from the surface of the Earth. Without these gases, the temperature on the Earth would be unbearably colder - around 33 degrees Celsius lower than now, allowing no life on Earth to exist.

The problem we now face is that human activities – particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing – are increasing the concentrations of greenhouse gases. Since the beginning of the industrial revolution, the amount of N₂O which is used in fertilizers has increased by 18 %. CO₂ from fossil fuels and combustion engines 40 % and CH₄ by 148 % (Torre et al., 2009). By adding more GHG we have altered the natural cycle of the atmosphere, making it harder for radiation to escape to outer space, thus trapping the extra heat. This is the enhanced greenhouse effect, which is directly contributing to warming of the Earth.



Picture 3 CO₂ concentration (parts per million) from the 6th until the 21st century

Source: Australian Academy of Science, 2015

3.3 Winners and Losers of Climate Change

Even though it may sound odd, the climate change can actually benefit some regions of the World. While global warming would be bad for the Earth as a whole, the accumulation of greenhouse gases in the atmosphere would affect different areas in different ways, and local climate change is what matters to many people (The Washington Post, 2012), so if the outcome can bring them bigger economic prosperity and easier lives, it would be unreasonable for them to fight the climate change.

The factors that can determine the likelihood of a positive change for a particular region are: starting temperature and adaptability. If we look at the Northern Sea Route¹, a new short and fast shipping route could open up after melting some of the ice there for ships carrying merchandise from Asia to Europe and back. It could also make up for a cheaper way for tankers full of oil from Russia or Norway and maybe allow companies to extract oil from new places. Migration patterns are also a subject to change. If the ocean levels rise, people will be pushed out of their coastal cities to areas inside, protected by kilometers of land at a higher elevation. Some scientists (Smith, 2010) forecast a great future for Canada as its climate is today cold, but with global warming will become very convenient to live in. There's also a potential farming benefit. According to the International Panel on Climate Change, global warming could improve agricultural productivity in northern Europe. The region might see as much as a 30 percent increase in wheat production by 2080. (The Washington Post, 2012)

As we now understand, all of the benefits would be influencing the already developed countries of the north. On Picture 1 we can see that none of the Least Developed Countries are located in this part of the Globe. What does it mean for them? Even more suffering and more obstacles on their way to development?

3.3.1 Land and Water

The economic theory tells us that if there is a fixed supply of a good and increasing demand for it, the value will increase. According to that, we should believe that the value of land on Earth will appreciate and it could seem as a great investment opportunity. But with global warming, some parts of the World can become undesirable to live at. The low-latitude and equatorial areas will become much hotter, food supply can become difficult because the vegetation will not be able to stand the heat anymore and therefore these regions will lose their attractiveness. Unfortunately, these are already areas of developing countries.

¹ Northern Sea Route, sometimes called also the Northeast Passage, is a shipping lane alongside the coast of Norway, Russia and all the way to Alaska (Buixadé, 2014).

Geopolitical moves are already being made depending on global warming predictions. A great example of this is Pakistan. A country where temperatures around 40°C are nothing unusual has since its independence tried to have a strong control on the neighboring nation of Afghanistan. Today through cooperation with Taliban, the Pakistani people can migrate to Afghanistan when conditions in their home country would become unbearable (ISW, 2010). And from the history we have the experience with massive population movements on Indian Subcontinent.

The scientists have been communicating the warnings about climate change for decades. One of the main reasons the global warming has not happened as quickly as predicted, is the capacity of the oceans to absorb the CO₂ emissions coming from human activities. Currently, 48% of the carbon emitted to the atmosphere by fossil fuel burning is sequestered into the ocean. Carbon chemistry of seawater acts as a buffer, enabling the oceans to hold 50 times more carbon dioxide than the atmosphere does (Climate Institute, 2010). When these limits fill up, it could accelerate the temperature rise and we can already see some terrible evidence of how little changes can influence the fragile lives of organisms living in the depths of seas.

Clear freshwater is one of the biggest problems in the developing world. Today, the climate scientists do not know if the climate change will bring more or less precipitation. Agriculture is also very dependent on clean water, which is the main source of income in these countries. The main source of this water is rain and all rain that falls into oceans can be considered as a lost resource. But the biggest problem concerning the Least Developed Countries is the rising level of oceans. This concerns especially Small Island Developing States – Comoros, São Tomé and Príncipe, Kiribati, Solomon Islands, Tuvalu, Vanuatu and Haiti. The sea levels are rising an average of 3 cm per year (NOAA, 2014) and some of these Islands can disappear in the first half of the 21st century.

3.3.2 Adaptation and Market Solutions

Today, the question also is, how should we prepare for the climate change and what factors play a role in it? India and the United States provide an example of this. The researchers in the USA have looked at the death records for the past several decades in those countries to see how changes in temperature affect national death rates. They found that hotter days have only a modest effect on the U.S. mortality rate. In rural India, however, changing just a single day from a comfortable low 20s to a stifling low 30s increases the annual mortality rate by more than 1 percent. That's from just one day of additional heat. The scary part of the research is that most climate models predict a far more dramatic change than that, with 30 or more additional days of extreme heat in India by the end of the century. The explanation is that the USA has plentiful access to heating and cooling technologies and the resources to smooth out their consumption patterns. People in India don't have that option.

(Kahn, 2012) This is just one example of how right adaptation can save many lives in upcoming future.

As it may seem now, the higher global temperatures are inevitable. The world leaders should start coming up with ideas that will help to deal with this issue when it will have a more severe impact than what we are used to today. But they should also come up with incentives how to motivate the private sector to create solutions that will lead to new greenhouse-gas reducing technologies. Today, the reality is usually the following: governments support few scientists to study the global warming and the private sector is untouched. What if the government would change the direction and instead of spending money on few scientists would create a set of rules that would motivate the private sector to invest into research and development which could be a highly profitable business?

The emission tax, carbon credits, cap and trade and other systems are great ways how to give the private sector a financial reason to lower their emissions. Nowadays the firms have more money that any government could ever spend for science and this kind of incentive can already be seen working in numerous parts of the world. After all, the market caused the global warming crisis, so the market should be the best hope for solving it.

3.4 Air Pollution and the Developing Countries

The developing countries are still undergoing the process of industrialization where they are trying to shift the primarily agricultural society into a secondary - manufacturing one. Industrialization requires an enormous consumption of energy and this energy is usually achieved by the usage of fossil fuels. Industrialization and urbanization are believed to be one of the necessary parts for the *Take-off* in Rostow's *Stages of Economic Growth*. Developing countries are undergoing economic development at a rapid rate, resulting in levels of urban air pollution in many cities that rival the levels that existed in Europe and North America in the first decades of the 20th century (HEI, 2010).

There are numerous reasons why the impact of air pollution in developing countries is different than the impact of air pollution in countries developed since the Industrial Revolution. Air pollution is definitely more severe in developing countries, where there is a lack of financial resources and of technology available for dealing with this problem. The governing bodies, understandably, instead tend to use their budgets to support education, health care or water supply for their people. As a result of the health risks and the potential impact of climate change, there have been efforts to reduce pollution. However, while this may be easy for developed countries, halting environmental pollution may undermine economic growth and competitiveness of developing countries whose economies depends on natural resources (Braking Energy, 2014). Another reason why developing countries may not invest into cleaner energy and focus more on their environmental targets is the

fact that they have not already achieved certain standards of living and the basic living necessities for their residents have not been supplied as is the case in the developed world.

Air pollution in developing countries is derived not only from stack emission of pollutants from relatively large industries, such as iron and steel, non-ferrous metals and petroleum product industries, but also from fugitive emission of pollutants from small-scale factories, such as cement mills, lead refineries, chemical fertilizer and pesticide factories and so on, where inadequate pollution control measures exist and pollutants are allowed to escape to the atmosphere (ILO, 2011).

But we have to be careful. Even though today the Least Developed Countries emit only a small fraction of emissions into the atmosphere, we can predict from the numbers of the more advanced, but still emerging economies like China, Brazil, India or Nigeria that the developing world is the place where climate change will be won or lost. Energy-related carbon dioxide emissions from developing countries will be 127 percent higher than in the world's most developed economies by 2040, according to figures of EIA (2013). Energy-related emissions will total around 45.5 billion tons in 2040, up from a reference level of 31.2 billion tons in 2010. Developing countries' carbon dioxide emissions will outpace emissions from the developed countries of the Organization for Economic Co-operation and Development over the next three decades due to their generally stronger rate of economic growth and continued use of fossil fuels (EIA, 2013).

An explanation for these numbers may be traced to the year 1997, where industrialized countries were obligated to ratify the Kyoto protocol which stated that they would have to cut 5 % of their greenhouse gas emissions by the year 2012, whereas the developing countries were not required to do so as it could limit their potential economic growth.

4. The Protocols

The world leaders are well aware of the current situation and of the outcomes it will have to the future generations if there will be no actions taken. To ensure that the governments of the countries throughout the globe will accept the responsibilities, they established a number of different environmental protocols. An environmental protocol is a type of international law, an intergovernmental document intended as legally binding with a primary stated purpose of preventing or managing human impacts on natural resources (Swart and Perry, 2007).

The first international environmental protocols came to light in the 1960s, after the rise in popularity of the so-called *environmental governance*, which is a concept that tries to pursue the idea of sustainability as the main consideration for managing all human activities – economic, political or social.

4.1 Stockholm Declaration

The next discussion took place in 1972 at the United Nations Conference on the Human Environment, also known as the Stockholm Intergovernmental Conference. There, they agreed that stimulating and providing guidelines for action by national government and international organizations facing environmental issues should be one of the main focuses of the UN (Desombre, 2006). The Assembly passed the Declaration of the United Nations Conference on the Human Environment as the first document in international environmental law to recognize the right to a healthy environment. Some of the principles of this Stockholm Declaration are the following:

- *Principle 2:* The natural resources of the earth, including the air, water, land, flora and fauna, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.
- *Principle 3:* The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.
- *Principle 6:* The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of ill countries against pollution should be supported.

- *Principle 8*: Economic and social development is essential for ensuring a favorable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life.
- *Principle 11*: The environmental policies of all States should enhance and not adversely affect the present or future development potential of developing countries, and appropriate steps should be taken on meeting the possible national and international economic consequences resulting from the application of environmental measures.
- *Principle 20*: Scientific research and development in the context of environmental problems, both national and multinational, must be promoted in all countries, especially the developing countries (UNEP, 1972).

This conference laid the basic ground for the future agreements and protocols, such as the Montreal or Kyoto Protocols, and was the foundation of the environmentalism.

4.2 Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer is an international treaty designed to protect the ozone layer by eliminating the production of various substances that are responsible for ozone depletion. The Protocol was agreed upon in 1987 and has undergone 8 revisions, the last in 2007 (UNEP, 2007).

The Montreal Protocol was a reaction on the emerging problems with the depletion of the ozone layer, a steady decline in the total volume of ozone in Earth's stratosphere and a much larger springtime decrease in stratospheric ozone around Earth's Polar Regions in 1970s.

The most important process in the destruction of the polar ozone and of the mid-latitude thinning is the catalytic destruction of ozone by atomic halogens (University of Cambridge, 2007). The main source of these halogen atoms in the stratosphere is photodissociation of man-made halocarbon refrigerants, solvents, propellants, and foam-blowing agents (CFCs, HCFCs, freons, halons). These compounds are transported into the stratosphere by winds after being emitted at the surface (Andimo, 1999). Both types of ozone depletion were observed to increase as emissions of halocarbons increased.

All these compounds were then divided into several groups, with each group within the Protocol given a specific timeline for the total elimination of the usage of the compound. In every single substance there was either chlorine or bromine and the compound given the most attention was the

CFC – chlorofluorocarbon, also known as Freon, mostly used in refrigerants and as aerosol propellant.

The concentrations in atmosphere of the most important chlorofluorocarbons and other related chlorinated hydrocarbons have either leveled off or decreased, since the Montreal Protocol came into effect (ARVANITOYANNIS, 2007). Statistical analysis from 2010 shows a clear positive signal from the Montreal Protocol to the stratospheric ozone (Mäder et al., 2010). The Montreal Protocol has been ratified by 197 parties, which includes 196 states and the European Union, making it the first universally ratified treaty in United Nations history and consequently has often been called the most successful international environmental agreement to date.

4.3 Kyoto Protocol

4.3.1 Background

The far most important protocol for this thesis is the Kyoto Protocol. It is an international treaty, which is extending the United Nations Framework Convention on Climate Change (UNFCCC) from the year 1992, that commits State Parties to reduction of greenhouse gas emissions, based on the premises that: global warming exists and man-made CO₂ emissions have caused it. The Protocol was adopted in 1997 in Kyoto, Japan, entering to force in 2005 (UN, 1997). The Kyoto Protocol had as an objective to implement the goal of the UNFCCC to fight the global warming by reducing the amount of greenhouse gas concentration in the atmosphere to a level that would limit and prevent the anthropogenic tampering of the global climate system. The Protocol is based on the revolutionary principle of common but differentiated responsibilities, where the obligation to reduce the emissions is put on the developed countries, as being the ones historically responsible for the current situation and levels of greenhouse gases in the atmosphere.

4.3.2 Objectives and Flow

Since the beginning of the second half of the 20th century, the scientific world believed that humans are responsible for the change in temperature and structure of atmosphere in the last decades. They came to an agreement that the greenhouse gas emissions should be reduced in order to avoid further rise in global temperature (global warming).

As we have mentioned in the section 5.3.1, the developed countries were supposed to take the responsibility for the current state. Therefore countries were split into groups. They are divided in the annexes of the Protocol. The Annex I countries (developed countries of the World) are the ones

with an obligation to either lower their emission² or keep them at the same level³ to the value from 1990. This was going to happen during the Kyoto Protocol's first commitment period from 2008 to 2012⁴.

The targets apply to the four greenhouse gases carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), sulphur hexafluoride (SF₆), and two groups of gases, hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). The six greenhouse gases are translated into CO₂ equivalents in determining reductions in emissions based on their global warming potential (GWP). These reduction targets are in addition to the industrial gases, chlorofluorocarbons, or CFCs, which are dealt with under Montreal Protocol, described in the chapter 4.2.

4.3.3 Flexible Mechanisms

In order to achieve the reduction targets, there was a need to find a way that could be used to do so and would also prevent the countries from risking a fall in their GDP by lowering the costs of achieving the goals. The system design is referred to as the *Flexible Mechanisms*. The mechanisms refer to: Emissions Trading, Joint Implementation and Clean Development Mechanisms.

These mechanisms are giving the opportunity to countries to remove the carbon emissions from the atmosphere in a different country, seeing that the cost of limiting the emissions may vary region to region, but the reduced CO₂ will have principally the same beneficial effect on the atmosphere no matter where it happens (UNFCCC, 2011).

- *Emission Trading*: the carbon emission trading works on a principle where countries can sell their *carbon credits*⁵ to a different country so they can meet the targets set by the Kyoto Protocol. These credits are specifically targeted on carbon dioxide, but also other compounds are eligible as they are converted into tons of CO₂ equivalent (CO₂e) depending on their global warming potential, more precisely, what is the concentration of CO₂ that would result

² EU-15, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland, Canada, the USA, Hungary, Poland and Japan. Canada withdrew from the Kyoto Protocol in 2011. The US has since the beginning indicated its intention to never ratify the Kyoto Protocol. (UNFCCC, 2011)

³ New Zealand, Russian Federation, Ukraine (UNFCCC, 2011).

⁴ Norway, Australia and Iceland had their target levels in positive values. This means that they were allowed to have comparably higher CO₂ in the years 2008-2012 than in the base year 1990. (UNFCCC, 2011)

⁵ Carbon Credit, sometimes called also the Carbon Offset, is a financial instrument CO₂ or CO₂e (carbon dioxide equivalent gases) removed or reduced from the atmosphere from an emission reduction project, which can be used by governments, industry or private individuals to offset damaging carbon emissions that they are generating (Carbon Planet, 2016).

into the same level of radiative forcing⁶ as a given greenhouse gas (Blasing, 2013). Emission Trading and its forms will be further discussed in the chapter 5.

- *Joint Implementation*: the mechanism known as “joint implementation,” allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Party) to earn emission reduction units (ERUs) from an emission-reduction or emission removal project in another Annex B Party, each equivalent to one tonne of CO₂, which can be counted towards meeting its Kyoto target. Joint implementation offers Parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host Party benefits from foreign investment and technology transfer (UNFCCC, 2011). An example of a joint implementation project can be a replacement of a coal-fired power plant with a cogeneration or combined heat and power station. Most of these projects take place in the transitional economies, majority of which are performed by Russia and Ukraine (JI Projects, 2016).
- *Clean Development Mechanisms*: the Clean Development Mechanism allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing (non-Annex I) countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO₂, which can be counted towards meeting Kyoto targets. The mechanism is seen by many as a trailblazer. It is the first global, environmental investment and credit scheme of its kind, providing a standardized emission offset instrument, CERs (UNFCCC, 2011). This mechanism is by far the most important in relation to the developing countries, therefore we will analyze it more in the thesis and dedicate a part of the chapter 5 to it.

4.3.4 Criticism of the Kyoto Protocol

The Kyoto Protocol has been one of the most important international treaties dealing with the problem of climate change, even though we do not dispose with a unanimous opinion on its importance within the experts. Some politicians believe that the whole protocol lost relevance when the United States of America decided not to ratify it and Canada withdrew. Arguments against the Kyoto Protocol can be usually divided into three categories: too demanding; achieving little; or that it is unnecessary.

⁶ Radiative Forcing is the measurement of the capacity of a gas or other forcing agents to affect the energy balance, thereby contributing to climate change. Thus, the radiative Forcing expresses the change in energy in the atmosphere due to GHG emissions. (CORE, 2011)

In previous years, there were few scientists whom were skeptical of the underlying evidence associated with global warming and say there is no real evidence that Earth's surface temperature is rising due to human activity. This was changed in very recent years when the global scientific consensus was reached and pointed out a definite connection between the human activity and climate change.

Also, some opponents say the treaty doesn't go far enough in the reduction of greenhouse gases, and many of those critics also question the effectiveness of practices such as the Clean Development Mechanisms. Others believe that if industrialized nations reduce their need for fossil fuels, the cost of coal, oil and gas will go down, making them more affordable for developing nations. This would only mean a shift in the final consumer, not a decrease in consumption. Finally, some critics say the treaty focuses solely on greenhouse gases and is not addressing population growth and other issues that also affect global warming. According to them, the Kyoto Protocol is an anti-industrial agenda rather than an effort to address global warming (Environmental News & Issues, 2015).

5. Emission Trading and the Clean Development Mechanism

5.1 Clean Development Mechanism

As we have started already in the section 4.3.3, the Clean Development Mechanism is one of the Flexible Mechanisms set by the Kyoto Protocol adopted in 1997. Basically it allows the countries which are in need of lowering their emissions under the Kyoto Protocol to do so in the developing (non-Annex I) countries in forms of environmental projects and receiving in return so-called Certified Emission Reductions (CERs). A CER represents one metric tonne of carbon dioxide not emitted to the atmosphere. The CERs should serve mainly two purposes: firstly, they should assist developing countries to achieve sustainable development. Secondly, the industrialized countries of the “North” may lower their emissions by purchasing the CERs and therefore reducing the costs of greenhouse gas abatement. This does not imply solely on countries but also on companies which have the chance to buy the emission reduction credits to comply with national-level legislations.

According to several experts, such as Jean-Marc Burniaux (2009), the Clean Development Mechanisms are one of the best ways how to achieve the climate change mitigation. This can be done by the following:

- *Improvement of the policies*: the environmental policies in the developed countries should reflect mechanisms just as the CDMs and lead to an increase of incentives of lowering the greenhouse gas emissions by polluters, because of the *monetization* of emissions.
- *Carbon leakage reduction*: carbon leakage is caused when there is an increase of CO₂ emissions in one country as a result of a change in policies in another country. This might happen because of reallocation of an industry to a country with more relaxed environmental laws, usually from a developed to a developing country, all in order to save the company money from potential penalties because of the stricter laws. This at the end negates the basic point of the policy which was aimed at the reduction of the overall CO₂ in the atmosphere and it only shifts the emissions to a different place on the planet.
- *More technologies in developing countries*: by using the mechanisms as the CDM, it becomes much easier for the developing countries to obtain the *newer* and *greener* technologies because of the compensation incentives. For the investors from developed countries it can be much more lucrative to lower their emissions through carbon credits acquired as a result of a project in a developing country, rather than making large investments at their home country. As a result, the new technologies find their ways to the developing countries much faster than they would otherwise. (Burniaux, 2009)

Type	number		CERs/yr (000)		CERs Issued (000)	
Wind	2605	31%	238093	20%	178593	11%
Hydro	2228	26%	329260	27%	217966	13%
Biomass energy	750	9%	51281	4.3%	49844	3.0%
Methane avoidance	689	8%	29142	2.4%	28052	1.7%
Solar	428	5.0%	13748	1.1%	2955	0.18%
Landfill gas	403	5%	58136	5%	75709	5%
EE own generation	383	5%	50431	4%	74089	4.5%
Fossil fuel switch	133	1.6%	69499	6%	56614	3.4%
EE Industry	129	1.5%	4638	0%	3582	0.2%
Coal bed/mine methane	111	1.3%	72975	6%	45278	2.7%
EE Supply side (power plants)	105	1.2%	51662	4%	6080	0.4%
N ₂ O	105	1.2%	57010	5%	294749	18%
EE Households	102	1.2%	3742	0.3%	767	0.05%
Afforestation & Reforestation	70	0.8%	2482	0.2%	11328	0.7%
Fugitive	56	0.7%	48540	4.1%	38791	2.3%
EE Service	36	0.4%	645	0.05%	99	0.006%
Geothermal	35	0.4%	12401	1.0%	10163	0.6%
Transport	32	0.4%	4400	0.4%	2401	0.1%
Cement	27	0.3%	4574	0.4%	6290	0.4%
HFCs	22	0.3%	81319	7%	539942	33%
Energy distrib.	22	0.3%	7260	0.6%	1576	0.1%
PFCs and SF ₆	17	0.2%	5393	0.5%	5409	0.3%
Mixed renewables	14	0.16%	611	0.1%	23	0.001%
CO ₂ usage	4	0.05%	91	0.01%	10	0.001%
Tidal	1	0.01%	315	0.03%	1074	0.1%
Agriculture	1	0.01%	8	0.001%		
Total	8508	100%	1197656	100%	1651382	100%
HFCs, PFCs, SF ₆ & N ₂ O reduction	144	1.7%	143721	12%	840100	51%
Renewables	6061	71%	645711	54%	460618	28%
CH ₄ reduction & Cement & Coal mine/bed	1291	15%	213467	18%	194130	11.8%
Supply-side EE	510	6%	109353	9%	81745	5.0%
Fuel switch	133	1.6%	69499	5.8%	56614	3.4%
Demand-side EE	267	3.1%	9025	0.8%	4447	0.3%
Afforestation & Reforestation	70	0.8%	2482	0.2%	11328	0.7%
Transport	32	0.4%	4400	0.4%	2401	0.15%

Table 1 CDM projects grouped in types

Source: UNEP DTU CDM (2014)

In Table 1, all the CDM projects are grouped in types that are sorted according to descending frequency in the Pipeline. The accumulated 2012 CERs is the total GHG reduction in the projects from the start or the crediting period until the end of 2012. EE - industry has been split into EE - own generation, where electricity is produced from waste gas or wasted energy, and EE - industry, which now only covers end-use savings. (UNEP DTU CDM, 2014)

As we see in Table 1, over 70 % of all the projects have been in the Renewables category, but by far the most CER rewarding ones were the HFCs, PFCs, SF₆ and N₂O reduction projects delivering 51 % of all CERs, compared to 28 % of CERs for the Renewable energy group. These projects tend to be more expensive to complete, but can also have a much more significant impact on the mitigation of the GHGs and therefore a greater return in the form of the CERs.

The Clean Development Mechanism (CDM) was expected to generate 1 billion CERs. Despite thousands of different projects, the experts have not been sure of its actual role in delivering on its goals of climate change mitigation and sustainable development. Many CDM projects and the resulting offsets do not result in actual emissions reductions. Carbon offset mechanisms such as the

CDMs can only be effective if they are producing an actual reduction of emissions. This is being called the *environmental integrity*. Offsetting mechanisms such as the CDM are zero-sum mechanisms. In other words they do not lead to additional emission reductions beyond those determined under the cap. This is the cap-and-trade system and we will further explain in the section 5.4. The CDMs only lead to a geographic shift – e.g. instead of reducing their own emissions, a European power plant buys CDM credits to comply with its obligations in the European trading scheme. There are two main components that influence the environmental integrity: additionality and baselines (Carbon Market Watch, 2015).

- *Additionality*: The CDM wants to make sure it gives the CERs only to projects that would not have happened otherwise. This means that the projects were realized because of the financial benefit provided by the sale of the created carbon offsets. Each non-additional CDM project that sells credits under the CDM allows an industrialized country to emit more than their targets without causing the equivalent emissions to be reduced in a developing country. Assuring that each project is additional and integral to the integrity of the CDM (Carbon Market Watch, 2015). Large projects, for example infrastructure or power plant projects, are usually not considered as additional, due to the fact that there is only small revenue from the sale of carbon credits compared to the total profits and therefore lack of motivation at the side of investor⁷.
- *Baseline*: In order to find out how many carbon credits should be awarded for a project, there needs to be set a value of emissions that would go into the atmosphere without the realization of the project. These are called the *baseline emissions*. After we know how much of the CO₂ has been saved because of the project, we subtract the project emissions from the baseline emissions and this gives us the number of CERs for the project. Unfortunately, in many cases, the baseline emissions are being exaggerated. To figure out the baseline, often time hypothetical scenarios are used referencing emissions from comparable activities and technologies from other projects. To minimize the potential of such activities, an independent third party is assigned to assess the project at both the design validation phase (pre project) as well as the CER verification stage (post project) and to verify the baseline emissions.

⁷ The additionality is often being tested by various schemes. One of them is the *financial additionality* which directly assesses whether a project would go ahead without the financial incentive from the scheme. For instance, an energy efficiency project might go ahead without crediting because it reduces electricity consumption and therefore energy costs. A financial additionality test requires a scheme administrator to assess the investment environment, business operations and motivations of the investor to determine their likely actions in the absence of the scheme incentive. (AGCCA, 2012)

5.2 Issues with Clean Development Mechanism

Even though the CDMs have been looked at as a revolutionary system of delivering climate mitigation and sustainable development, there have been several difficulties facing their realizations.

In the next section we will look at several of them:

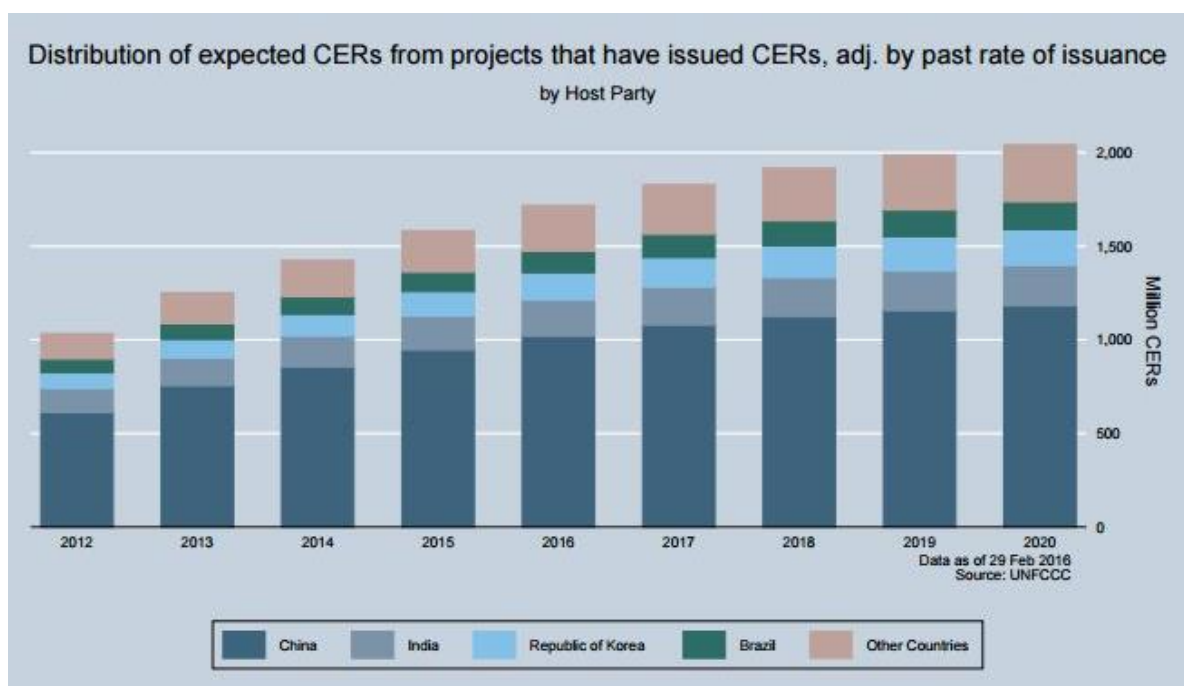
- *Sustainable Development*: numerous studies (Petersen and Bolerup, 2012; Gillenwater and Seres, 2011) show that most CDM projects fail to deliver sustainability benefits. The reasons for the failure of the CDM are numerous. One reason is that host countries define their own sustainability criteria. Developing countries rejected attempts to establish an international sustainability assessment process, arguing that it would violate their national sovereignty. It is in the interests of the host country to secure as many CDM projects as possible because of the investment they bring. This means that host countries have little or no incentive to require strong sustainability criteria that could dampen investment. Also, even if in the few countries that have well developed sustainability requirements (such as Brazil), the requirements are undermined by the lack of follow up or verification of the sustainability criteria. Possible solutions for these issues could be an implementation of international sustainable development criteria, including best practice guidelines, and also an introduction of sustainable development monitoring plans to assess sustainable development benefits. (Carbon Market Watch, 2015)
- *The Additionality Issue*: for many experts, the fundamental flaw of the whole concept is the mandatory proving of additionality. A project is “additional” if it was only able to go forward because of the extra carbon credit income from the CDM. Any project registered under the CDM that would have been built anyway, without carbon credit income, allows an industrialized country to emit more than their targets, without causing any changes on the ground where the project is located. In reality, non-additional projects are going forward under the CDM on a large scale. By some experts, even up to surprising 75 % of all approved CDM projects were already up and running at the time they were approved (FOE, 2010).
- *Speculations*: as we have already stated the CERs are in general being rewarded for a decrease in overall emissions. This might lead to certain speculations where companies can increase their emissions in the short run just to boost their reward in the form of CERs for reducing the artificially inflated emissions (Burnieaux, 2009). As a solution for this could be a change of the CDM policies that would in the final evaluation also reflect the short-term increases in the GHG emissions and thus would penalize the CER recipient.

Regional distribution of CDM projects	Number of small-scale		Number of full scale		Number of all projects		kCERs	2012 kCERs		population	per cap.
Latin America	400	11.6%	701	13.9%	1 101	12.9%	144 110	319 328	14.4%	449 mil	0.71
Asia & Pacific	4 894	83.9%	4 073	80.5%	8 967	81.9%	946 098	1 786 233	80.4%	3418 mil	0.52
Europe and Central Asia	26	0.8%	60	1.2%	86	1.0%	19 515	20 748	0.9%	149 mil	0.14
Africa	85	2.5%	159	3.1%	244	2.9%	63 816	63 549	2.9%	891 mil	0.07
Middle East	43	1.2%	67	1.3%	110	1.3%	24 117	30 828	1.4%	186 mil	0.17
Less developed World	5 448	100%	5 060	100%	10 508	100%	1 197 656	2 220 686	100%	5093 mil	0.44

Table 2 CDM Projects by Region

Source: UNEP DTU CDM (2014)

In Table 2 we can see that the vast majority of the CDM projects was carried out in the regions of Latin America (12.9 %) and Asia & Pacific (81.9 %) which combined hosted almost 95 % of all the projects until the end of 2012. When we look at the per capita ratio, we see that Africa has been the most overlooked region, having only one tenth of the Certified Emission Reductions compared to the Latin American countries. When we look at Picture 4, we see that the host countries to the projects with the most CERs are China, India and Brazil, where China's share is 59.9 % (UNFCCC, 2016).



Picture 4 Distribution of expected CERs from projects that have issued CERs, adj. by past rate of issuance (by Host Party)

Source: UNFCC (2016)

5.3 Controversial CDM Projects in Developing Countries

There have been thousands of different CDM projects realized. Many of them were a success and achieved what they were striving for but we can also find more than few that were not as useful and despite the CDM's goal to contribute to sustainable development have actually caused more harm

than good to the local communities. In the following section we will look closely at several of them and describe the potential danger to the recipient's area and to the people living in it.

5.3.1 Nallakonda, India – Wind Farm

Wind power can be a great source of renewable energy, but if put in the wrong place it can have considerable negative impacts on local livelihoods and resources. Twenty years ago Anantpur district in Andhra Pradesh was barren – a desert like landscape scarred with erosion. For two decades the volunteer organization *Timbaktu Collective* worked together with eight villages to slowly nurture the area back to life. Over 7000 acres of land became protected and regenerated into a forest. But in the last year, the decades of eco-restoration effort are being ruthlessly annihilated to set up a 50MW wind park inside this area.

Even after protests from the locals, the surrounding areas of the forest were set up for 48 new wind turbines. Studies showed that the area had high potential for wind energy. Despite the area then being covered by forests, both the government and the company referred to old revenue records which classed the area as “wastelands” and therefore justified it for the construction.

Already during installation work the wind energy company has violated many national and state level forest protection and biodiversity conservation laws. After the realization, neighboring communities have identified environmental impacts such as deforestation, heavy land degradation and biodiversity loss already occurring from project activities. Local water bodies are being negatively affected as well. These significant negative environmental and social impacts have been completely left out from the project documents. Besides that, there was also other important information left out from the final documents for the registration of a CDM project. (Carbon Market Watch, 2012)

So as we can see there are some major flaws in this project. There is definitely a lack of additionality. The wind farm would have been built anyway, as many other have in similar areas, and would have happened also without the financial benefit from the CERs. Besides that, the local stakeholders were never invited for the discussions about the project, which is something that could and should have definitely been addressed. There are serious outcomes of the project in form of environmental damages, in example soil erosion, destroyed areas of vegetation or damage to the pasture routes. Furthermore, the investors promised new jobs and sources of electricity for the locals where none of that has been delivered. It is also very interesting that sustainability metrics were not applied as a part of the baseline study. At a minimum, they should have looked at the carbon release due to deforestation and made the project developer count for those as a negative or a GHG release.

Possible improvement to the CDM process could include: reforestation and restoration of the damaged ecosystems and some form of compensations of the local communities by the project

participants; more strict oversight of the projects by the CDM executive board which is approving the projects; employment creation by the investors as promised in the project proposal. Lastly, to cherish the principle of sustainable development, the project participants should fulfill their promise and provide electricity to the surrounding areas.

5.3.2 Barro Blanco, Panama – Large hydro project

Barro Blanco is the latest dam planned for the historic Tabasara River in the Chiriqui Province of Panama. Originally the Ngäbe indigenous people surrounding the river had formed a movement against the dam and demanded protection of their rights to the resources that the Tabasara River provides. Since then concessions have been granted by local communities which has enabled the construction of the dam to begin without their approval. The Ngäbe Bugle, the largest indigenous peoples group of Panama, took to the streets at the beginning of 2012 to demand that all concessions granted without their approval be cancelled and to prohibit all mining and hydroelectric concessions within the region of the Ngäbe Bugle.

Violent repression by the former President of Panama Martinelli against the peaceful Ngäbe protests left three of them dead and more than a hundred wounded. Communications were cut and human rights were severely violated. Minors were beaten and pepper-sprayed while handcuffed. Police raided hospitals to abduct the wounded.

Peace negotiations between the government and the Ngäbe Bugle have occurred shortly after. A compromise agreement between the two parties has resulted in the passing of Special Law (11). This new law cancels mining concessions and prohibits future mining. It also states that any future hydroelectric projects the government plans in the territory must be subject to approval by indigenous authorities and a referendum of the area's residents. On top of that, the Ngäbe Bugle people are to receive 5% of the projects annual billing as well. (Carbon Market Watch, 2012)

As of March 2016, the project is under construction and is 95 percent completed, even though it has been repeatedly suspended by the government (last time February – August in 2015). As in our first case – the wind farm in India, the first critical issue with this CDM project is the lack of communication across all the stakeholders. The permission to start building the dam was given without any talks with the local communities and thus the investors and government have completely ignored the people that are the most affected by the construction. Another problem is the human rights violations during the protests which led to physical and sexual abuse on protesters or even several casualties. The building of the dam has caused significant social and environmental impact until today (Carbon Market Watch, 2012).

To avoid similar human rights abuse in any other future projects, there should be a strict clause prohibiting all advantages of such a mechanism as the CDM if there is a potential human rights issue⁸. If the status of a given project would have been already approved, the Executive Board would have the power to remove registration status of the project, either temporarily or permanently. Also, the host country should not allow any projects on its land if it has negative effects on the local ecosystems or livelihood of the local people and does not contribute to the sustainable development.

5.4 Emission Markets and Their Reality

Today, a vast part of the world we live in is a part of the global market. Since the times of Adam Smith, there is a belief that the market solution is the best and the most effective for everyone involved. The invisible hand controls the supply and demand when it comes to prices of bananas, computers or shoes. So why should the market with emissions be any different? The emission markets, more specifically the carbon markets, focus on keeping the overall costs of the emission reductions to their minimum. Nowadays, there are being used two main systems for emission trading: the *cap-and-trade* and the already described *offsetting mechanisms*.

5.4.1 Cap-and-Trade

The cap-and-trade system sets an overall limit of emission that can be released and if a country or company does not fulfill the limit, it is given a penalty. The cap is measured in billions of tons of CO₂ (or equivalent) per year. It is set by the overlooking body (government) and is based on science and averages from previous years. A good fact about the system is that it covers various major sources of pollution. The cap should limit emissions economy-wide, covering electric power generation, natural gas, transportation, and large manufacturers (EDF, 2015).

The emitters, either countries or companies, are given a certain number of allowances of tons of CO₂ that they can emit. This is done by one of the two ways. The first one is a distribution decided by an independent body where the current amounts of emissions are taken into account. The second, and in the opinion of the author the better way, is the auction of allowances, where all the polluters can auction as many of the allowances as they can afford and need. The auction forms a better market environment and brings more justice to the system. The total amount of allowances is equal to the cap and a company may only emit as much carbon as it has purchased allowances. These allowances would also be reduced by the cap declining factor.

⁸ We need to also bear in mind that stopping a project because of any human rights issue might be too difficult, as sometimes unrealistic and unnecessary human rights issues can be brought up and exaggerated by the people whom simply do not want the project.

Some might argue that the system of auctions might bring speculations into the market, when a third party buyers may come in and purchase allowances just to resell them at a higher price, or that industry does not know how much it will need to lower the emissions in the following years and it cannot plan ahead. Whereas the first argument is in fact correct, it works the same way as in all other free markets. The regulator has always the chance to limit the participants based on some rule, but this is already interference to the basic free market logic. The second argument can be limited by a published predictable schedule for several years in front. Usually, each year the cap is lowered. Companies can plan well in advance to be allowed fewer and fewer permits – less global warming pollution – each year (EDF, 2015).

The other half of the cap-and-trade system is *trade*. In general, trade leads to investments and innovations. In the emission market scheme, it allows some companies to take advantage of the fact that they can adapt to the limits much easier, but also it gives some flexibility to the polluters that do not have it as easy and therefore can buy the missing tons of CO₂ to fulfill their caps. So, this creates a powerful incentive for everyone, because by innovations that lead to new and better ways of emission savings, they can even turn pollution into revenue.

5.4.2 The Emission Market Reality

Creating a market for environmental products such as greenhouse gasses can qualify as potentially trading with our future. In this part we will explain this statement. So as we know by now, in 1997 the world leaders came together in the Japanese city Kyoto where they decided to put a *cap* on the amounts of GHGs emitted into the atmosphere, in order to save the Earth from a disaster in the form of the climate change. Already then they understood that the developed nations would have found it too difficult to significantly cut down their emissions if they were supposed to maintain their economic growth. So they found a way to let the large polluters keep growing, but also to reduce the emissions at the same time. This is the basic principle of the emission trading – the market based solution to climate change.

The essence of the strategy is to put a price on pollution, turning carbon into a commodity that then can be bought and sold, exactly like stocks or bonds. If companies then decide that they need to exceed their cap on how much they can emit, they can simply buy permits from someone else that is polluting less. The idea is that the buyer is paying a charge for polluting while the seller is being rewarded for having reduced emissions, thus giving economic boost to cleaner companies.

As well as trading between themselves, the polluting industries can pay for apparently green projects overseas, using these credits to offset their emissions at home. This also might serve as a marketing tool to boost the appeal of their brand to the environmentally aware public where they can be seen

as the *green* companies, where actually they did not have to lower their emissions whatsoever. But offsetting has a major issue, which we have already discussed in the subsections 5.1 and 5.2 – additionality. The Clean Development Mechanism has allowed companies to register offset projects supposedly reducing the extra emissions when in reality they did not do that (Kill, 2010).

The companies have a temptation to exaggerate how many emissions have been saved so their picture of how many emissions would have been there, if the project would not happen, is inflated. This way they can claim a bigger difference between the two scenarios. As Kill (2010) continues in her study on carbon trading, those non-additional offset credits are then being sold to the companies or countries that have a Kyoto limit, and those non-additional reductions that in reality are not happening, are allowing the companies that are under the Kyoto Protocol to go above the limit that has been set to them. So instead of helping reduce the emissions, the CDM is allowing increases in global green-house gas emissions, not reductions.

But shockingly, the biggest buyers of the offsets coming from the projects from the developing countries are not actually the polluting companies for which mechanism is set up, but the financial firms from Wall Street and other major investment hubs in the World. And why do they buy all those offsets? It is not to lower the emissions coming from their offices, but to speculate with them, to make profits of them. So we can ask ourselves a question – is this mechanism working, when its main purpose – bringing new technologies to developing nations while allowing the developed countries to keep growing, is being overlooked because of the abuse by the “*big players*” only with the vision of new profits?

6. Emissions in Developing Countries and Sustainability

There have been many discussions and papers written about the effects of economic growth on environment and whether growth is even necessary to achieve a faster development. We can find arguments and empirical studies to make a case for either side, but in this chapter we will try to focus on the question, if the economic growth is good for sustainable development.

6.1 Emissions and Development

Global climate is considered as a common resource with an unrestricted access. This means that it will keep being exploited until it is completely damaged or starts being regulated. However is the environmental degradation rising with economic growth? To answer this question, we can help ourselves with the following chart. We can thus see the connection between the tons of CO₂ emissions and gross national income (in USD) on country level.

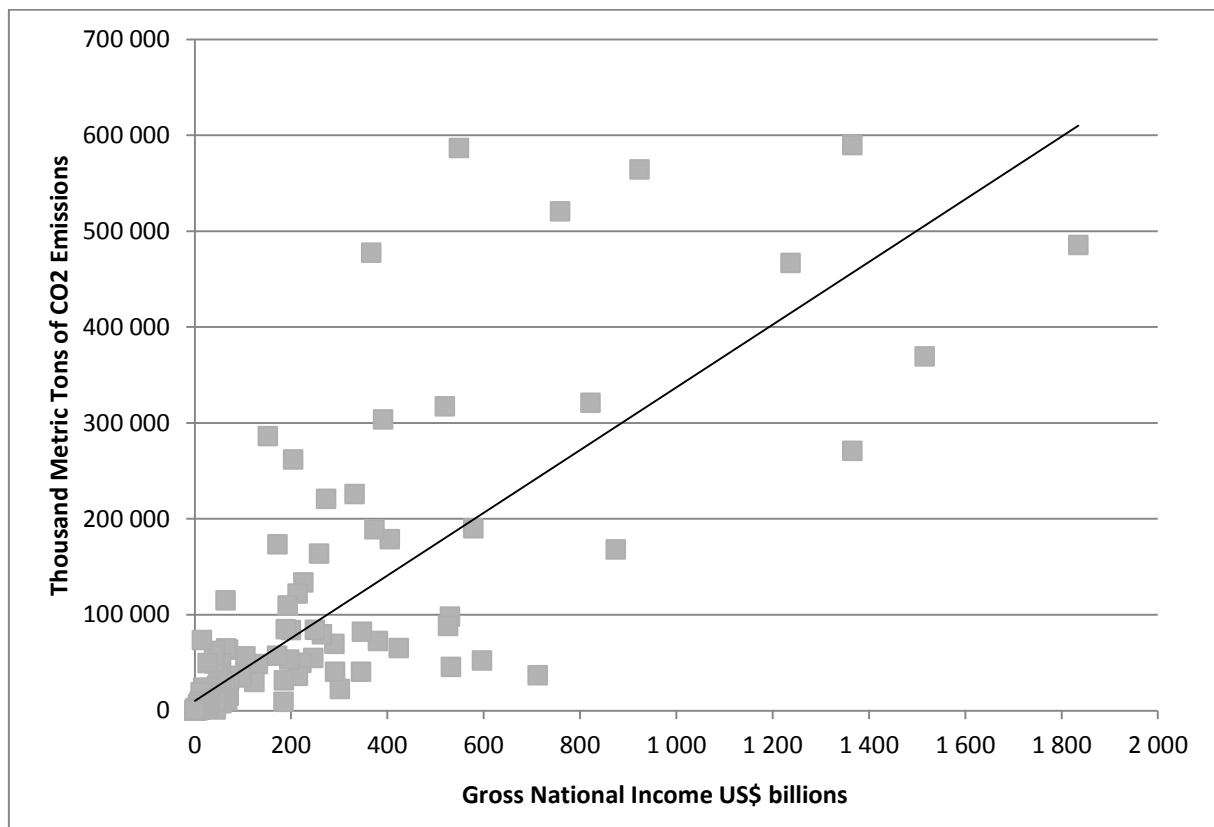


Table 3 CO2 Emissions to GNI

Source: World Bank (2016), made by author

For the purposes of a better portrayal of the graph, the first ten countries with the biggest GDP were taken out. As we can see, there is a clear connection between the emissions and income. This tells us that with a growing national income there are more emissions emitted into the atmosphere. That is

also why developed countries tend to be more industrialized and also blamed for the current situations of emissions in the atmosphere. Therefore we have global warming.

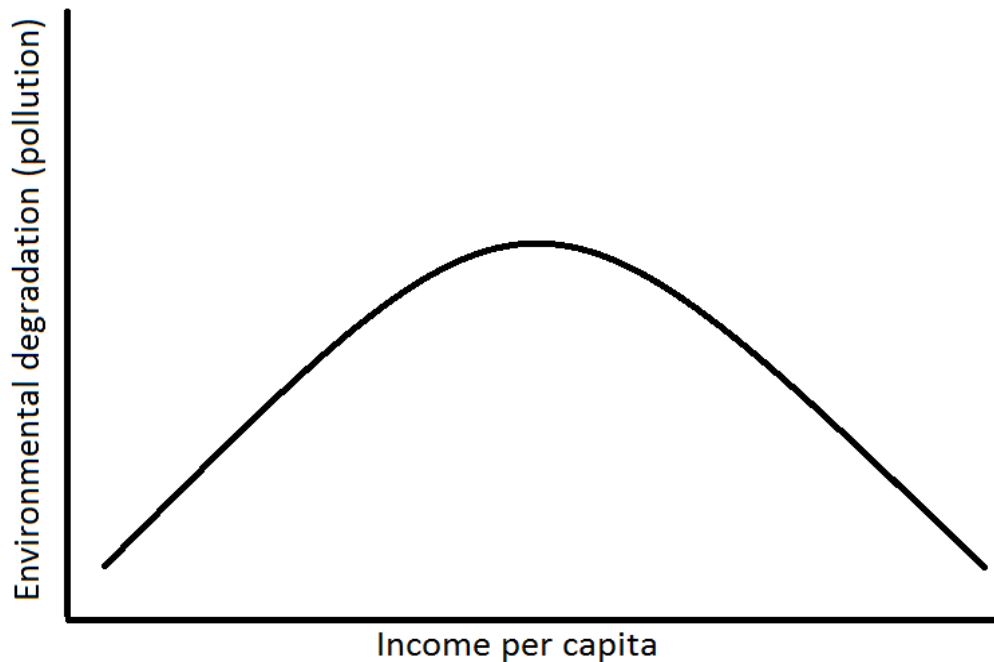
For even better understanding, we can make a CO₂/GNI index and put into a world map (Appendix 2). Afterwards the map can tell us how each country stands compared to the global levels. Here is evidence that the highest CO₂/GNI index is in Asian countries and in the countries of the former CCCP, which have been heavily relying on the industrial sector for decades. From countries such as China (893) and India (1023) we can expect an increase of their index number, because of the expanding middle class. It will create easier access to the modern day lifestyle, thus increasing the overall emissions. The World's average is 412 and most of the countries in the first group are well over a double of that.

When we are looking at second group (550 – 849), we can find there the countries characterized as the emerging economies of North Africa and other countries rich from oil reserves located at the Arabian Peninsula. In the middle group (300 – 499) meet various economies, the United States of America (301), the world's largest economy, through Latin American countries and several of the younger members of the European Union, through Latin American countries and several of the younger members of the European Union.

In the fourth category (150 – 299) collide two different worlds – the developed with the developing. Canada, Germany, Australia or the United Kingdom meet the countries of Africa, such as Namibia, Tanzania and Nigeria and also the more developed countries of South America – Brazil, Colombia or Chile. The cleanest states, according to our CO₂/GNI index, are again an interesting mixture of developed and developing countries – on the one side Sweden, Norway or France, on the other Chad, Zambia and Mali.

As an explanation for these findings we will help ourselves with the Environmental Kuznets Curve pattern (Picture 5). The EKC hypothesis is telling us that with an increasing income per capita, the environmental degradation first rises, but then decreases as the income keeps rising. Thus forming a wide upside-down U shape on the x/y axis. This hypothesis can be clarified by the fact that the lowest income countries (Mali, Chad,...) have not started their transformation and thus do not emit many emissions, whereas the countries with the highest income per capita (Sweden, Norway,...) have already passed their industrialization phase and have started focusing on other economic sectors, but also started using cleaner and more expensive technologies, such as the renewable sources of energy. These are often being referred to as the Composition and Technique Effects. The Composition Effects is when the composition of the output changes over the course of economic development (agriculture → heavy industry → light manufacturing and services). The Technique Effect occurs when the changing techniques of production are accompanying economic growth and

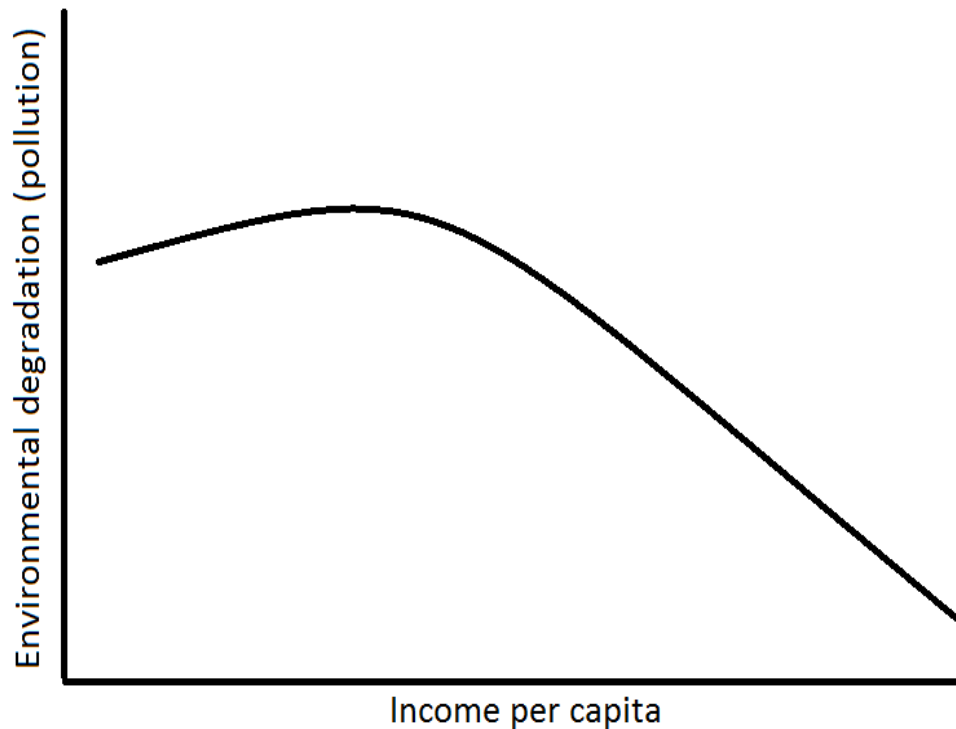
the technological improvements are reducing the emission-intensity of the production of goods and services (WTO, 2014)



Picture 5 Environmental Kuznets Curve

Source: ERE (2010), made by the author

If we look at the biggest polluters, the countries in the middle of the EKC pattern and on top of our CO₂/GNI index, we see mostly the emerging Asian economies. We can find a close parallel between this and the Rostow's *Stages of Economic Growth* where these countries are undergoing economic development at a rapid rate, resulting in levels of massive air pollution. As it happened in last century, we will see shifts in the behaviors and policies of various countries all over the world. Some of them will become more industrialized and will increase their CO₂ emissions and some will join the most developed countries in the efforts of mitigating their emissions. Therefore we can expect that the EKC pattern will change its shape from the inverted "U" to an "L" (Picture 6), where even the poorest countries will have higher emissions and the threshold level, when the curve starts heading downwards, will move to the left as a result of more countries having lower numbers of their CO₂/GNI index.



Picture 6 Predicted Future Environmental Kuznets Curve

Source: made by the author

There are many studies examining the EKC hypothesis. In general, an EKC relationship is not sufficiently supported in the case of CO₂ emissions. The relationship is rather positive-monotonic which implies that economic growth is not expected to control CO₂ emissions. Besides that, this pattern is mostly seen only in the developed countries (Thomas, 2011). The studies of the EKC hypothesis have provided contradicting outcomes over the years. A large part of them indicates that the process of economic growth is not reducing the CO₂ emissions after time. They also state that an increase in CO₂ emissions is related with economic growth through energy consumption (Kaika and Zervas, 2013) and other various factors like energy prices, structural and technology changes, institutions or population growth. All of these seem to affect the effect of economic growth on the environment and vice versa (Thomas, 2011). Therefore an assumption that the CO₂ emission levels are influenced only by the national income and its growth, as the EKC suggests, would be improper.

6.2 Paris 2015 and the Developing Countries

It has been almost two decades since the signature of the Kyoto Protocol and thus the world leaders have agreed upon the fact that there is need for a new global guideline concerning the environment. The convention dedicated to this goal was held in Paris as the *2015 United Nations Climate Change Conference*, also known as the COP 21 or CMP 11.

The conference took part from the 30 November to 12 December 2015 and its key result was an agreement to set a goal of limiting global warming to less than 2 °C compared to pre-industrial levels. At the end, this goal was set even higher, when in the adopted version of the Paris Agreement, the parties will also *pursue efforts* to limit the temperature increase to 1.5 °C (CNN, 2015), which was a top priority for developing countries highly vulnerable to climate impacts.

However, compared to the Kyoto Protocol, what is actually changing for the developing countries in the Paris Agreement? Well, the first and the most important change is that the new treaty ends the strict differentiation between developed and developing countries that characterized earlier efforts, replacing it with a common framework that commits all countries to put forward their best efforts and to strengthen them in the years ahead. This includes, for the first time, requirements that all parties report regularly on their emissions and implementation efforts, and undergo international review by an independent body.

The core mitigation commitments are common to all parties, but there is some differentiation in the expectations set: developed countries “should” undertake absolute economy-wide reduction targets, while developing countries “are encouraged” to move toward economy outcome with legal force under the Convention applicable to all Parties,” to apply from 2020, but provided no further substantive guidance (Center for Climate and Energy Solutions, 2015).

Also, the Paris Agreement and the accompanying COP decision:

- Reaffirm the binding obligations of developed countries under the UNFCCC to support the efforts of developing countries, while for the first time encouraging voluntary contributions by developing countries too;
- Extend the current goal of mobilizing \$100 billion a year in support by 2020 through 2025, with a new, higher goal to be set for the period after 2025;
- Call for a new mechanism, similar to the Clean Development Mechanism under the Kyoto Protocol, enabling emission reductions in one country to be counted toward another country’s “nationally determined contributions” (NDCs). (Center for Climate and Energy Solutions, 2015)
- In a victory for small island countries and other countries highly vulnerable to climate impacts, the agreement includes a free-standing provision extending the Warsaw International Mechanism for Loss and Damage. The mechanism is charged with developing approaches to help vulnerable countries cope with unavoidable impacts, including extreme weather events and slow-onset events such as sea-level rise.

7. Conclusion

The aim of this thesis was to bring more light on the issue of the close relation between developing countries and the ongoing climate change. We have explained the basic systems of how the international leaders have been tackling the emission mitigation in the last couple of years and what outcomes it has brought.

Climate change is happening without any doubts and only a person with their eyes closed and ignoring all the scientific evidence can say otherwise. We are having year by year new record temperatures, the sea levels are rising, the carbon dioxide concentration is unheard of and all this is caused by human actions. Even though a majority of these problems is caused by the already developed industrial nations, developing countries will have to suffer the biggest consequences, as the agricultural sector will be the most affected one.

The countries which have the lowest resources to somehow influence the climate change are falling into the group of *The Least Developed Countries* (LDCs). It is absolutely crucial that we quickly focus on finding possibilities for a sustainable development of these countries by providing them with development aid to help them in dealing with this unenviable situation which is ahead of them. As an indication of this can be taken the Paris Agreement of 2015, which besides other points, also involves a pledge of developed countries to mobilize resources in support for developing countries.

In general, the environment is not a topic people care about that much. In order to put the environmental issues on a higher place in the hierarchy of public interests, we must properly explain the basic principles of it. When people will understand what an enhanced greenhouse effect is and how is it influencing our future, they will pay more attention to it. But global warming will not be an unfortunate thing to everyone on Earth. There are countries that might actually profit from it. By opening new sea routes, or improved agricultural productivity, the climate change will positively affect some countries of the Global North, therefore no LDCs

There have been many approaches taken regarding how to tackle ongoing problems with the environment. Starting in Stockholm 1972, throughout the Montreal Protocol in 1987, until the Kyoto Protocol of 1997, there have been several conferences with binding proposals. But what is the point of having them, if the biggest polluters never agree to their terms?

The Kyoto Protocol was revolutionary by creating new ways of how to fight the global warming. The Emission Trading and the Clean Development Mechanism have not been a flawless solution for the mitigation of greenhouse gases as once presented, but any new and novel approach requires further refinement. Even though they brought the possibility of lowering the emissions for the developed countries while keeping their steady economic growth and managed to have installed new and

greener technologies to the developing world, in some cases they also brought the outrage of local people or even an increase in the global emission levels.

The offset solutions have a potential roll in buying time to adjust the more industrialized and rich countries' economies to the needs of low carbon economy. It is definitely not a long-term solution in terms of bringing down emissions because it ultimately allows countries to buy their way out of trouble. Market based solutions have been the primary tool on how to combat the climate change for almost two decades and yet, the emissions continue to rise. It is clear the World needs to do more, and urgently.

In the thesis we have also looked on the correlation between the national income of countries and their CO₂ emissions. Our quantitative research has shown us that with the rising income per capita there is also a rise in emissions, but after reaching a certain threshold level the emissions start to lower because of the Composition and Technique Effects and thus the transformation of economy and usage of more expensive renewable sources of energy. We believe that in the future the trend will change the shape of the Environmental Kuznets Curve pattern from an inverted U to an L, after the LDCs commence their industrialization and in the meantime, the countries around the threshold level will switch to renewable sources of energy and their CO₂/GNI ration will begin to drop.

As an idea for the next paper could be research focused on the involvement of developing countries in the fight against climate change based on the recent Paris Agreement. The Agreement limits their privileges of not needing to contribute to the mitigation of greenhouse gases as the Kyoto Protocol and makes them also the part of the global warming problem.

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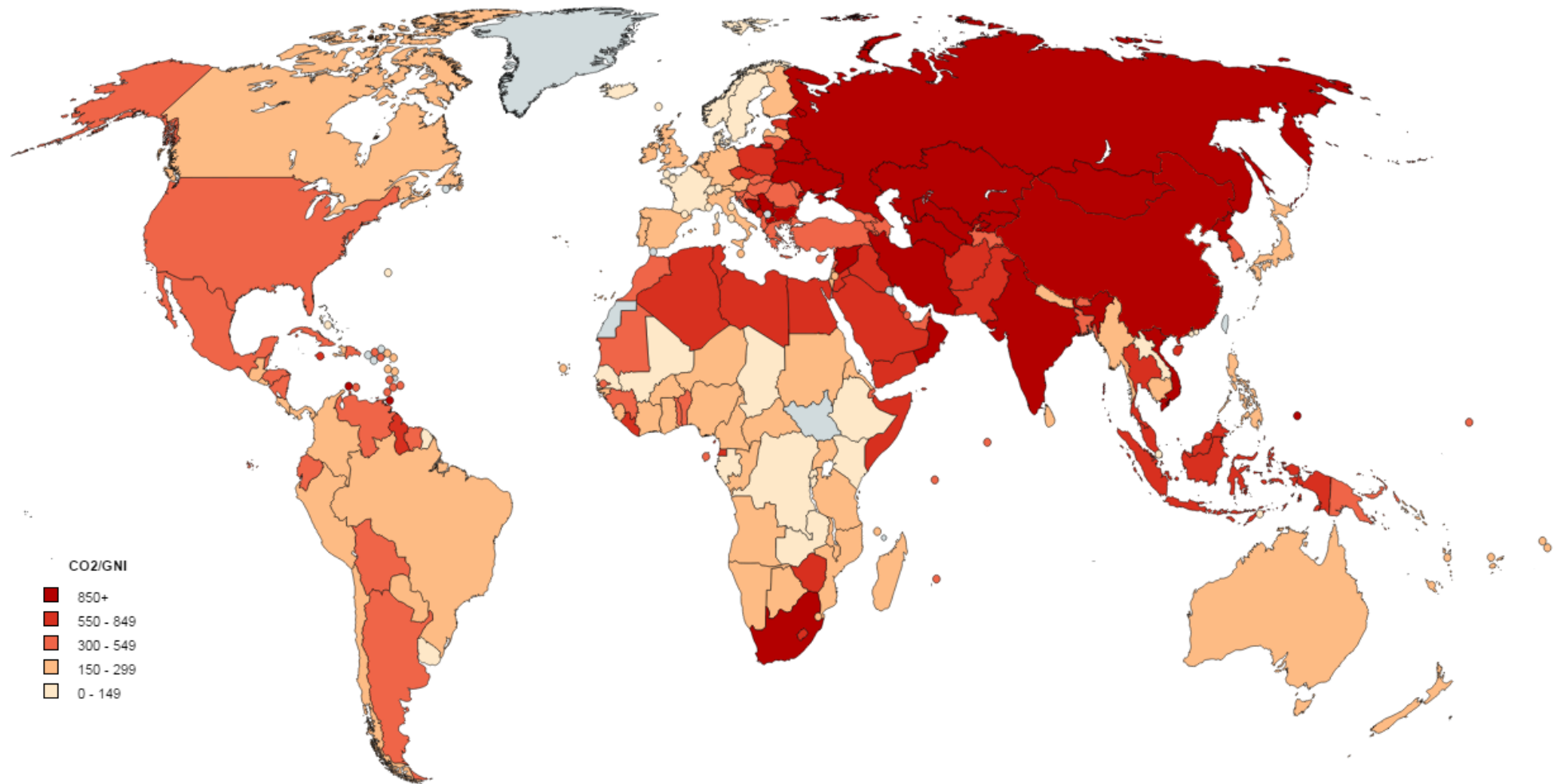
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Appendix 1: List of the Least Developed Countries

Afghanistan	Madagascar
Angola	Malawi
Bangladesh	Mali
Benin	Mauritania
Bhutan	Mozambique
Burkina Faso	Myanmar
Burundi	Nepal
Cambodia	Niger
Central African Republic	Rwanda
Chad	Sao Tome and Principe
Comoros	Senegal
Dem. Rep of Congo	Sierra Leone
Djibouti	Solomon Islands
Equatorial Guinea	Somalia
Eritrea	South Sudan
Ethiopia	Sudan
Gambia	Timor-Leste
Guinea	Togo
Guinea-Bissau	Tuvalu
Haiti	Uganda
Kiribati	United Rep. of Tanzania
Lao People's Dem. Republic	Vanuatu
Lesotho	Yemen
Liberia	Zambia

Source: The United Nations, 2014

Appendix 2: CO2/GNI Map of the World



Source: World Bank (2016), made by the author