Chapter 1. Introduction

Africa is a continent that possesses a vast amount of various types of natural resources. Consequently, many countries in Africa export their natural resources. Here, the natural resources include important energy sources such as oil and natural gas. For example, Nigeria is a large oil exporter and, as of the end of 2011, it is estimated that Nigeria possessed about 37.2billion barrels amount of proven oil reserves. Also, it is estimated that around 767,000 barrels per day (bbl/d) of crude was exported to the United States, which made Nigeria the 4th largest foreign oil supplier to the United States in 2011. Furthermore, Nigeria's oil sector is estimated to account for 95 percent of its export revenue and 40 percent of government revenue (EIA Country Analysis Nigeria). There are also other large oil producer/exporters in Africa such as Algeria and Libya. Despite the fact that oil and other natural resources play a major role in African countries' economies, their heavy reliance on natural resource export often relates them to the term 'resource curse'. In fact, the term 'curse' frequently occurs when discussing the development in African countries. For example, there are terms such as 'resource curse', 'oil curse', and 'aid curse'. Unfortunately, these terms are no longer new in Africa, and many studies, such as Alicante & Misol (2009) and Moyo (2010), accentuate that such 'curses' exist in many African countries.

In recent years, many countries have been changing their policies to promote the use of renewable energy, accordingly the number of countries promoting renewable energy policies have doubled during the period of 2005-2011 (REN21, 2012, p.49). This trend has also been in African countries. For example, Algeria aims to have 40 percent of final energy share from renewable energy by 2030 (REN21, 2012, p. 105). When it comes to the issue of renewable energy, though other African countries are also in focus, North African countries have been receiving large attention due to their great potential for solar energy, as well as for wind energy, from the Sahara desert. Organizations, such as DESERTEC and Desertec Industrial Initiative (DII), have been paying a great deal of attention to the region, and they project that electricity generated via renewable energy in Middle East and North Africa (MENA) regions can be exported to Europe, which is projected to be 15 percent of the total European electricity consumption (DESERTEC Foundation: Global Mission EU-MENA). It is currently already possible to see the development of solar energy and other renewable energies in the MENA region. For example, DII and the Moroccan Agency for Solar Energy (MASEN) signed a Memorandum of Understanding in Morocco regarding a large cooperative solar project in Morocco in May 2011. The aim of the first reference project by DII is to demonstrate the export feasibility of electricity generated by solar energy in the deserts to Europe by utilizing the existing

line between Spain and Morocco (Dii newsletter, July 2011). Here, the potential for North African countries to become renewable energy exporters should be a matter of concern for them, as well as other African countries. As many of them are already suffering from the resource curse, the introduction of renewable energy may lead to a new curse of renewable. In other words, although positive effects may be obtained from the introduction of renewable energy in North Africa and other African countries, special attention should be paid to the possible negative effects, in this case renewable energy becoming a 'new curse'. Therefore, the aim of this thesis is to project the potential for the five North African countries (Algeria, Egypt, Libya, Morocco, and Tunisia) to suffer from a 'renewable energy curse' in the future.

When projecting the possibility of renewable energy in becoming a new curse, one is faced with a number of difficulties. Though the world total renewable electricity net generation[1] and renewable promoting polices have been increasing, renewable energy is still at its beginning stage. Also, projecting the potential for renewable energy to become a new curse for the entire African continent is problematic as it will make the subject too broad. Therefore, in order to narrow down this broad subject, this thesis will focus on solar energy in North Africa, as this is the region that has been in focus due to its ideal location, to project whether North Africa may suffer from a possible 'solar energy curse' in the future. Due to the fact that renewable energy is at its beginning stage, it is likely that there may be a lack of concrete data and information in projecting a solar energy curse. In this case, therefore, data and literature on the current resource curse will be employed in order to project the possibility of the solar energy curse in North Africa. Accordingly, Chapter 2 will illustrate details and case studies of the resource curse in order to provide the basic knowledge on what this curse is about. It will also briefly look at 'aid curse', as it is often argued that the impacts of the 'aid curse' are similar to that of the resource curse. The aim in analyzing the aid curse is to show that the curse is not only related to abundance of natural resources but can be formed by different sources.

Chapter 3 will look at the recent growing focus on renewable energy through an illustration of changes in policies towards renewable energy and its growing capacity in the world. As renewable energy in North Arica is gaining special focus, Chapter 3 also discusses the changes and growth of renewable energy in the region and explains why North Africa is the focus of attention especially when it comes to solar energy.

After providing a general outline of the resource curse in Africa and more specifically the current status of solar energy in North Africa, the literature on the resource curse will be reviewed in or order to identify the main cause(s) of the resource curse. The primary aim of identifying the main

[1] See figure 2.

cause(s) of the resource curse is so that it may be utilized as the boundary-line(s) in order to project which North African countries could potentially suffer from a solar energy curse. More specifically, as will be discussed in Chapter 4, the enormous size of resource rents and poor institutional quality, and the combination of these two, will be chosen as the boundary-lines to project whether solar energy could potentially become a new curse in North Africa in the future.

Accordingly, these chosen boundary-lines will be tested in Chapter 5 to see whether they are suitable for projecting the solar energy curse. For the rent size boundary-line, or Gross Domestic Product (GDP) growth comparison method in chapter 5, Sachs & Warner's (1997) theory, which states that a country is considered to be suffering from the resource curse if it has a high share of resource exports in GDP and, during that time, experiences poor economic growth rate compared to similar countries or an average region value, is tested with a number of 'filters', such as energy exporters/importers separation, income level, and development status, among the MENA countries in order to see whether it can be used as the boundary-line. Though the GDP growth comparison method improves after adding filters such as development status, it is not entirely suitable to be used as the boundary-line. In other words, different method in rent comparison will be used.

For the institutional quality boundary-line, the Worldwide Governance Indicators (WGI), which is used in Iimi's (2006) study on Botswana, will be used to test the institutional quality comparison method. The reason for choosing WGI to compare the institutional quality is that, according to UNDP (2007, p.56), the Governance Matters V 1996-2005 (Kaufmann et al, 2006), which is based on WGI, is considered as the most quoted and used governance indicator source in media, academia and among international organizations. Furthermore, the WGI contains six aggregate governance indicators which are Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. The fact that the WGI presents the governance quality in six dimensions is particularly advantageous because institutional quality is a broad term which is problematic when viewed as a single unit[2]. Also, the WGI uses margins of error which is necessary in comparing institutional quality. Further explanation regarding the use of margin of error will be illustrated in section 6.2.1. The institutional quality comparison method is tested with a number of filters such as energy exporter/importer separation and development status, among the MENA countries.

Here, especially regarding institutional quality, one should not ignore the recent political transformations, which have been correctively referred to as the Arab Spring Movement, when

[2] According to Stevens & Dietsche (2008, p.59), when measuring institutional quality, governance indicators are often used as proxies. Therefore, throughout this thesis, governance and institutions will be perceived as one factor. Thus, this candidate will be referred to as 'institutional quality'.

dealing with the Northern African region and also the other Arab Worlds. The period 2010-2011 is perceived as a crucial turning point for the North African countries because they were going through various changes, for example, regime changes in Tunisia and Egypt. It is unwise to regard the current visible consequences of recent events in the region as the final consequences of the Arab Spring. For example, though there has been a regime change in Tunisia, the ruling elites and state structures created by Zine El Abidine Ben Ali have yet to be eradicated. In other words, it is uncertain how the Northern African region is to be transformed in the future.

It is crucial to be aware of the possible impacts of the Arab Spring and the role it will have in shaping the future of the North African countries' institutional quality. A projection of future institutional quality in itself without the inclusion of the Arab Spring is already a difficult task. Here, this political uncertainty in the region makes is even more difficult to project the institutional quality of the region which is considered as an important element in measuring the possible solar energy curse in the future. In this case, the best way to 'project' the institutional quality of the Northern African countries is to analyze past and most recently available changes in their institutional quality. As will be discussed later, the combination of the poor institutional quality and the enormous rent size is considered as the main cause of the resource curse. Therefore, if a country's most recent institutional quality is poor and continues to remain poor in the future, under the circumstance that solar electricity exports will create an enormous additional rent, then the country will be considered to have the potential to suffer from a solar energy curse.

Chapter 6, 7 will apply the chosen boundary-lines to project the potential for the North African countries to suffer from a solar energy curse. The institutional quality of the five North African countries will be compared to the five resource cursed boundary-countries and the five resource curse avoided/escaped boundary-countries in order to see where they stand. Institutional quality date from 2011, which is the most recent data, from WGI will be used to compare the institutional quality. The confidence level of 95 percent will be applied, and all six aggregate governance indicators will be compared.

For the rent size comparison, as the GDP growth comparison method is not found to be sufficient, it is decided to compare the oil and natural gas rent size to the projected solar energy rent size. For the oil and natural gas rent size, the average oil, natural gas, and oil and natural gas rent sizes of the MENA countries (1993-2009) are calculated based on data from the World Development Indicator (WDI). For the projected solar energy rent size, it is decided to focus on parabolic trough technology as it dominates the concentrated solar thermal power (CSP) market. However, as the solar energy is in its initial stage in North Africa, the solar energy rent size is projected based on data from other countries, such as Germany and Spain, which have more experiences with renewable energy. The

rent size is based on the formula; Feed in Tariff (FiT) = Levelized Cost of Electricity (LCOE) + Rent. The projected solar rent size is in two major forms which are X US$pense/kilowatt per hour (kWh) and US$Xbillion/year(y). The comparison will be made in different forms as well because the projected solar energy rent in X US$pense/kWh form allows one to calculate individual North African countries' projected solar energy rent size by using data from Trieb et al. (2012), and the projected solar energy in US$Xbillion/y form allows one to compare the total sum of oil and natural rent size and the total average oil and natural rent size. It must be mentioned that, the projected solar energy rent size is based on studies, such as DLR (2006) and Trieb et al. (2012), which only, or mainly, focus on the electricity export via CSP form North Africa and MENA respectively, to Europe via direct connection. Therefore, the sole reliance on this data may over/underestimate the CSP and its capacity, additional projection is made based on the study from Zickfeld et al. (2012) which projects that wind power is to dominate Europe and MENA (EUMENA) renewable energy in 2050. The projection of the CSP rent size, and CSP and wind power rent size will be calculated.

Chapter 8 will discuss the solar energy curse in a different perspective. More specifically, this chapter will hypothesize a situation where solar energy is introduced successfully in North Africa, becoming the substitute energy source for natural gas in meeting the domestic electricity demand, and see the possible impact on the current resource curse in North African countries under the assumption that the poor institutional quality will remain in the future.

Finally, Chapter 9 will gather the results obtained in chapter 6, 7, and 8. The main discussion here will concern whether solar energy has the potential to become a new curse or not, and the importance of a comprehensive understanding of the resource curse.