THE NEW KOSOVO POWER PLANT: AT WHAT GENERATION CAPACITY WILL THE BENEFITS OUTWEIGH THE COSTS?

by

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ABSTRACT

The following research will examine the generation capacities at which the benefits of the new lignite-based Power Plant in Kosovo will outweigh the costs.

Given that almost all of the EU countries are investing in renewable energy sources, the government insists on building a large coal-based power plant in Kosovo. The reason behind is that Kosovo has the fifth largest lignite deposits in the world. As this is a truly complex situation, the following pages will look at an analysis of the current energy stance, increasing demand, the need for new generation capacities, as well as externalities that come along, including the effects on the environment and socio-economic matters. The paper will consider a Cost-Benefit approach, as a way that may best weigh positive and negative aspects of, perhaps, the most important project in Kosovo. It then will continue to provide a policy recommendation after having analyzed the possible scenarios.

At this point in time, the whole project is very ambiguous for the taxpayers. On one hand, the government says it wants to build a 2,100 MWh capacity power plant, but on the other hand, it claims that after the recent economic crisis, it is facing difficulties attracting potential investors for such a large investment, and therefore is considering to reduce the installed capacities to 1,000 MWh or even 600 MWh. Furthermore, there are voices among environmentalists and the civil society who say that gigantic power plants with capacities of 2,100 MWh will be devastating for the society.

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LIST OF ABBREVIATIONS

EAR	European Agency for Reconstruction
ECTSEE	Energy Community Treaty of South East Europe
EE	Energy Efficiency
ERO	Energy Regulatory Office
ESTAP	Energy Sector Technical Assistance Project
HPP	Hydro Power Plant
ICMM	Independent Commission for Mines and Minerals
INDEP	Institute for Development Policy
KEDS	Kosovo Electricity Distribution and Supply
KEK	Kosovo Energy Corporation
KOSOVO C 2100	Kosova e Re Power Plant, or KRPP (New Kosovo Power Plant)
KOSTT	Kosovo Transmission System and Market Operator
KRPP	Kosova e Re Power Plant (New Kosovo Power Plant)
MED	Ministry of Economic Development
NATO	North Atlantic Treaty Organization
PRG	Partial Risk Guarantee
S&P	Standard & Poor's

CHAPTER 1 - INTRODUCTION

On February 17, 2008, Kosovo unilaterally declared independence from Serbia, after NATO forces entered to liberate the country in 1999. The economy was devastating, but gradually recovering up to date. Until the end of May 2013, while this thesis is being written, 98 countries of the United Nations organization – a number that is continually rising, have recognized Kosovo as an independent Republic; among those countries, 22 are of the European Union ("Who Recognized Kosova," 2013). Nevertheless, there are still many countries that did not recognize its independence where most importantly, its first neighbor, Serbia, claims it will never do so ("Serbia Will Never Recognize Kosovo's Independence," 2013).

The most severe problems Kosovo's economy faces are poverty, unemployment, and missing economic opportunities. According to the European Commission's Kosovo 2011 Progress Report, among the main barriers encountered by businesses in Kosovo remains the lack of a reliable supply of electricity ("Kosovo 2011 Progress Report," 2011, p.43).

Currently, lignite-based energy comprises 97% of the total generating energy capacity in Kosovo. There are two existing power plants, Kosovo A and Kosovo B, both lignite-based. Kosovo A consists of five units, from which, only three are operational, the decommission of which is forecasted to be carried out in 2017. The three operational units that were constructed during 1970 and 1975 were originally designed to produce in total 350 MWh. Kosovo B, on the other hand, was constructed in 1983 and 1984 with two units, which originally were designed to produce 340 MWh each. (Beér, Mielczarski, & Taylor, 2012, p.3). Additionally, there are also two hydropower turbines of hydro power plant (HPP) Ujmani with total installed capacity of 35 MW; a few small HPPs with total installed capacity of 11.68

MW. Because of the ageing of the plants, the overall available power generation capacity in Kosovo is slightly over 900 MW ("Thematic Roundtable 6," 2012, p.13).

Taking into account the ever-rising demand for electricity, the government of Kosovo seeks to build a new lignite-based power plant that will primarily satisfy local demand, but may also export to other countries, as well. The project for a new lignite-based power plant was initiated in 2005 by the two coalition forces at the time. It started with a proposal of 2,100 MWh new generation capacities, where in 2006 four international consortiums were prequalified. In 2008, the government changed, which caused the energy project to be postponed. When the new government was formed with different coalition partners, the new power plant project was reconsidered, but planned capacities were downgraded to 1,000 MWh. In 2009, after the Copenhagen Conference on World Climate, the government of Kosovo reviewed the project again and proposed a further decrease in capacities – that is, a total of 600 MWh (Sinani & Demi, 2011, p.17). Members of the civil society, environmentalists, and the financial crisis have largely contributed to the downgrading of the capacities (Shllaku & Beqiri, 2007, p.65). "[t]he history of international credit flows shows that when international markets are down, emerging markets with less developed domestic sources of long-term credit can suffer disproportionately as international lenders retreat back to their own domestic market (Farquharson, Mästle, Yescombe, & Encinas, 2011, p.1)." The process is currently at halt, but negotiations with potential investors are ongoing.

Since nothing has been decided yet, and there is still no specific study about how much can Kosovo "afford", the freedom to analyze different scenarios is still available. The question that needs answer is at what generation capacities will the benefits of the new power plant outweigh the costs, including all possible

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externalities that come along? This thesis will consider four scenarios – that is, new generation capacities of 600 MWh, 1,800 MWh, 2,100 MWh, but also the possibility of only importing from abroad. This will help analyze the situation and offer a policy proposal that may best fit the circumstances in the country. The reason why the option of 1,800 MWh will be analyzed is that the March 2013 "Study about Electricity Supply in Kosovo" by Vattenfall Europe PowerConsult GmbH suggests that 1,800 MWh would be the "Best Optimized Strategy" (Diebels, Tillmann, Filenberg, & Pallaska, 2013, p.87-88). Whether that is the case or not remains to be seen in the pages ahead.

The rest of this chapter will discuss the institutional set up, macroeconomic conditions of the country, and the methodology applied; the second chapter elaborates on the literature review and the fierce discussions that continue to this day (one of the reasons why planned capacities might change); chapter three discusses the limitations and milestones; chapter four continues with the analysis; concluding with policy recommendations in chapter five.

1.1 Institutional Set-Up

Kosovo's institutions of the energy sector comprises of government institutions, regulatory institutions, and a number of energy enterprises. Institutions include (1) The Ministry of Economic Development (MED), responsible for policies and strategies for the overall economic development, including policies for country energy balances, energy efficiency, and renewable energy sources. (2) The Energy Regulatory Office (ERO), responsible for tariff adoptions, provision of authorizations for the development of new generation capacities, monitoring of energy markets, and adoption of energy sector regulations; (3) and the Independent Commission for Mines and Minerals (ICMM), responsible for issuing exploitation licenses for minerals

including lignite. The energy enterprises, on the other hand, are (4) the Kosovo Energy Corporation (KEK), which owns and operates the power generation and distribution; (5) the Kosovo Transmission System and Market Operator (KOSTT), responsible for planning, operating, maintaining and developing the transmission network and the interconnections with neighboring power systems. KOSTT is also accountable for the functioning and operation of the wholesale electricity market in Kosovo; and (6) the Kosovo Electricity Distribution and Supply (KEDS), responsible for power distribution and supply ("Task Force on European Integration," 2012, p.10).

1.2 Country Macroeconomic Conditions

Kosovo is a relatively small country (around 11,000 square km), which in 2008 declared independence from Serbia. With a population of around 1.73 million, according to the World Bank, GDP per capita is estimated to be 2,610 EUR. Although it is one of the poorest countries in Europe, poverty has been declining. 34% of the population lives below the poverty line, whereas 12% live in extreme poverty. The unemployment rate is 45.4%, whereas the labor participation rate is 48.1%. The economic growth of Kosovo has been relatively stable since the end of the Kosovo-Serbia conflict in 1999. This development is attributed partly to large investments (part of reconstruction in the form of foreign aid) and an increase in private consumption and investment. During the world crisis, the Kosovo economy did not face the consequences, as did some of its counterparts in the South-East Europe. Growth increased from 2.9% in 2009 to 5% in 2011.

Kosovo's budget experienced a surplus of 7.1% of GDP in 2007 (because of conservative policies on recurrent spending), while in 2008 it found itself in balance. However, in 2009, the budget deficit was 0.8% of GDP, increasing to 2.6% in 2010 ("Kosovo Country Fiduciary Assessment," 2012, p.1-3). Furthermore, energy

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demand per capita in Kosovo is still low compared to regional and world standards. The following World Bank graph gives a comparison.

Graph 1 - Electric Power Consumption 2009
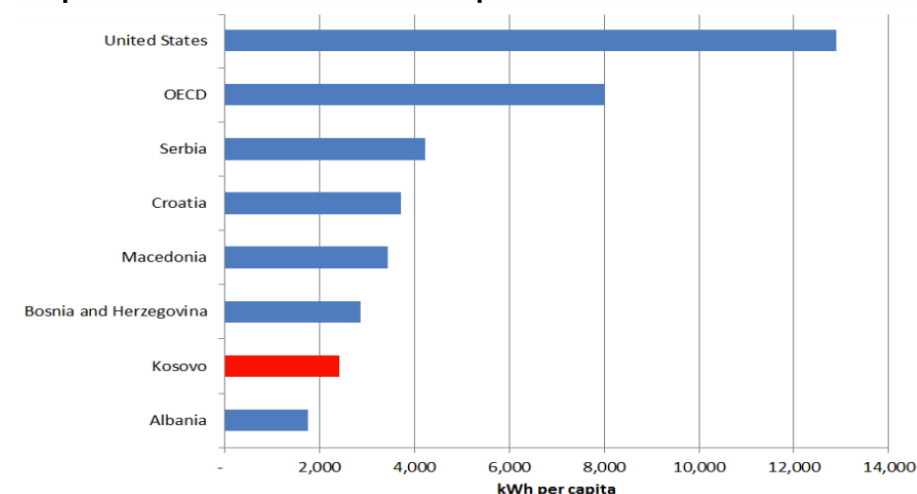
Source: World Bank Group Support to Kosovo's Energy Sector, 2012, p.3

1.3 Methodology

The proposed policy will consider some Cost-Benefit factors as a method to answer the research question. Considering the nature of the issue, which is more technically oriented, the underlying assumption is that Cost-Benefit would best apply and is the easiest method to answer the question at hand. Because many analysis and tests about KRPP (Kosova e Re Power Plant) have not been conducted yet, it will only make it more difficult to come up with a nonbiased answer – that is, whether it is worth investing or not, and at what capacities. In fact, the roots of the problem are very complicated and politically affected so that much more research will be needed to analyze the entire situation in more specificity.

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CHAPTER 2 - LITERATURE REVIEW AND DISCUSSION

2.1 The Economics of the Project

On both sides, economists and environmental experts, there are opinions as to whether Kosovo should emphasize economic or environmental goals. It seems that achieving both, economic development through the energy sector (meaning large energy exports), and protect the environment from emitted gasses, is almost an impossible mission, or rather say, a difficult job. One thing is sure: Kosovo is rich in natural resources, lignite being the most important source of economic development. According to Kosovo's Independent Commission for Mines and Minerals, the country possesses from 10 to 15 billion tonnes of lignite, considered being the world's fifth largest deposit. Nevertheless, Kosovo uses 8 million tonnes per year to fulfill its needs. Because of its calorific content and high moisture, the lignite is very close to the surface, and therefore, easy and not so expensive to mine ("Lignite," 2012).

A deep transformation and reconstruction of the energy sector has started in the 1990's in many countries of the South Eastern Europe. As part of the transition period from the communist system to a market capitalist system, reforms have been undertaken in different parts of the economy, especially in the electricity sector. Restructuring is taking place in the privatization of state-owned enterprises; the unbundling of the monopolistic elements from the potentially competitive ones; the establishment of competitive wholesale and retail markets and the application of performance-based regulatory mechanisms. The current electricity market in Kosovo is recovering from the 1999 conflict. It is moving through a transition from a vertical monopoly system to a market driven competitive environment with a well defined

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development goals as agreed in the Energy Community Treaty of South East Europe (ECTSEE) (Avdiu and Hamiti 2011, p.1).

Once again, the energy sector is of high importance to Kosovo's economy. Suffering with problems of outdated lignite-based power plants and a constant increase in the demand for energy consumption, the government of Kosovo is still trying to address the question of new generation capacities.

The following graph, taken from the World Bank, shows the gap in peak demand for electricity in Kosovo, and the capacity the existing power plants can produce. With a constantly increasing demand, a solution to the problem needs to be found. Currently, this gap is being counterbalanced by imports ("World Bank Group Support to Kosovo's Energy Sector", 2012, p.11).

Graph 2 - Generation Capacity Required to Meet Peak Demand (MW)
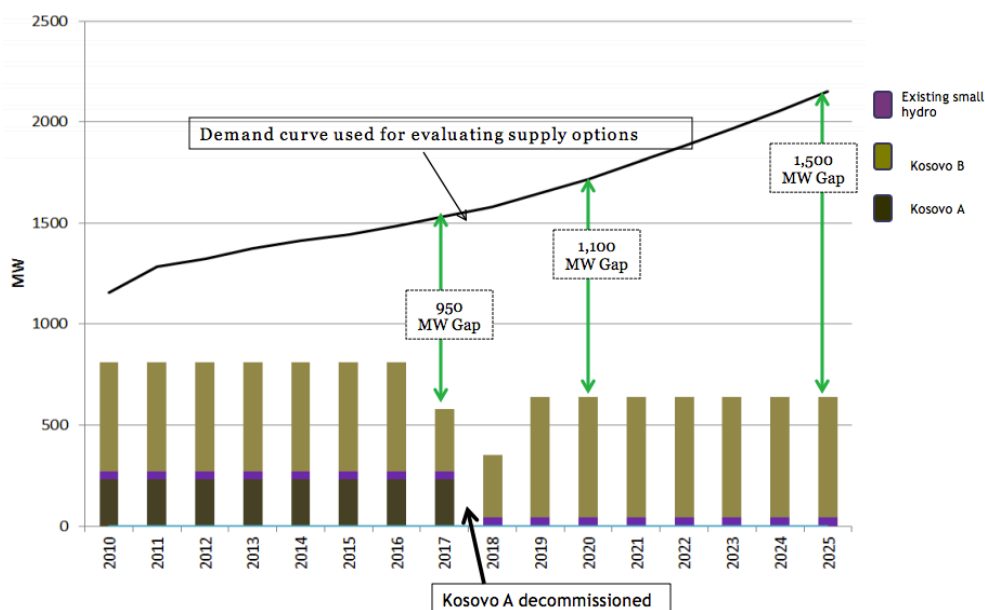
Source: World Bank Group Support to Kosovo's Energy Sector, 2012, p.11

For the Kosova e Re Power Plant, the Minister of Economic Development points out some uncertainties. He said to a local newspaper in mid-September 2012 that the ownership has not been decided yet. He also added that advisers are in

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continuous communication with parties to see whether they are still interested, or the government should announce a new bidding tender (Whitford, 2012, p.11).

Because of the difficulties to attract potential investors at 2,100 MWh, the Ministry of Economic Development is considering to reduce the installed capacity of the plant to 2 times 300 MWh, in total adding up to 600 MWh (Haxhiu, 2012, p.20). To prove that things are not consistent, the current Energy Strategy of the Republic of Kosovo 2009-2018 (2009, p.4) proposes to begin with 1,000 MWh and potentially add new capacities in the future.

On the other hand, in 2005, the parliament passed an electricity law that is fully in line with EU laws. This allows for unbundling of the vertically integrated Kosovo Energy Corporation into components like generation, transmission, and distribution. Furthermore, in 2005, the government established an independent Transmission System Operator called KOSTT, where the supply is still controlled from KEK. On October 17, 2012, the distribution component of KEK has been sold to the consortium Limak & Çalik ("Nënshkruhet Kontrata Për Shitjen E KEK-ut," 2012, par.1), but the case is still disputable due to the former accumulated debt and will be assessed by the court ("KEK e Çalik-Limak Energy Në Gjyq Për 18 Milionë Euro," 2013, par.1).

The fairly well managed and independent KOSTT has, in the last decade, invested in repairing, modernizing, and expanding the grid, where transmission losses came down from 3.31% in 2009 to 2.06% in 2011 ("Energy Regulatory Office: Annual Report 2011," 2011, p.24). In addition to the transmission losses, distribution losses are even higher.

In 2005, the government of Kosovo established the independent regulator – the Energy Regulatory Office (ERO). Given the present political and economic

situation in Kosovo, one could argue about the independence of the regulator, but in the last few years ERO has taken some hard tariff decisions. According to the Energy Regulatory Office (2011, p.24) annual report for 2011, losses in distribution are 38.15%. From that, 16.78% were technical losses because of the ageing of the grid, 21.3% is attributed to nonpayment of bills as well as theft. Around 5% of the non-paid bills are political – that is, the Serbs that live in the northern part of the country, for which the government of Kosovo has no control over.

Given the state of the generation division during the 1990's, because of the political tensions, the sector was completely neglected and under-maintained. However, in the post-conflict of 1999, the country could manage to bring back the capacity at work, although not at full capacity. In 2000, for example, the gross electricity output was 1.9 TWh, in 2005 it reached 4 TWh, and in 2011 over 5 TWh (Whitford, 2012, p.9).

Table 1 - Electricity Sales to Customers 2008-2017 (GWh)

Kosovo: Electricity sales to customers - 2008-2017 (GWh)										
	2008	2009	2010	2011	2012[a]	2013[a]	2014[a]	2015[a]	2016[a]	2017[a]
Type of customer										
Transmission	473	544	701	679	744	622	622	622	622	622
Industrial	216	227	227	244	245	285	295	304	311	319
Commercial	481	536	580	637	637	673	697	718	741	764
Household	1,667	1,769	1,873	1,988	2,121	2,198	2,297	2,378	2,461	2,520
Total	2,837	3,076	3,381	3,478	3,747	3,778	3,911	4,022	4,135	4,225

[a]KEK forecast

Source: KEK presentation, September 2012

Source: Whitford, 2012, p.9

2.2 Legal Framework

"In 2005 the Kosovo Assembly adopted an Energy Strategy for the years 2005–2015. This strategy was reviewed in 2009, and the Kosovo government sent for Assembly approval an updated Energy Strategy for 2009–2018. Following months of discussion in the Kosovo Assembly, the Energy Strategy for 2009–2018 was approved by the parliament on April 1, 2010. (Sinani & Demi, 2011, p.15)."

Based on different studies and analyses, the Energy Strategy of the Republic of Kosovo 2009-2018 pays special attention to the compliance with the EU Acquis, where the main goals of the strategy include the security of supply, promotion of investments in the sector, preserving of environment, and further development of the energy market. One of the principal objectives that derive from those goals is also the 20-20-20 program. Based on the development of the demand, to achieve the 20-20-20 goals, Kosovo needs to attain a 10MW bio mass, 250MW wind, 1MW solar, and 150MW small hydro power plants (Diebels, Tillmann, Filenberg, & Pallaska, 2013, p.40) in order to reach the 20% share of renewable energy in 2020 ("Energy Strategy of the Republic of Kosovo 2009-2018," 2009, p.60).

The requirements, known as the 20-20-20 targets include:

- A 20% reduction in EU greenhouse gas emissions from 1990 levels;

- Raising the share of EU energy consumption produced from renewable resources to 20%;

- A 20% improvement in the EU's energy efficiency ("The EU Climate and Energy Package," 2012, par.1).

At a press conference in September 2012, the Minister of Economic Development of Kosovo – Mr. Besim Beqaj, said that the investor for the Kosova e Re Power Plant will be chosen in 2013; the construction will start in 2014, whereas the completion of the project is foreseen to end in 2018 (Whitford, 2012, p.11). However, this may be postponed even further, given that no decision was taken so far, considering also the fact that the Minister of Economic Development was discharged on May 16, 2013 as part of a government reorganization ("Beqaj, Ministër i Financave, Fadil Ismajli në MZHE," 2013, par.1).

The following graph from the World Bank shows how the energy supply will meet consumer demand until 2025 if the government decides to build a 600 MWh power plant, instead of a 2,100 MWh as initially idealized.

Graph 3 - Thermal and Renewable Energy Alternative
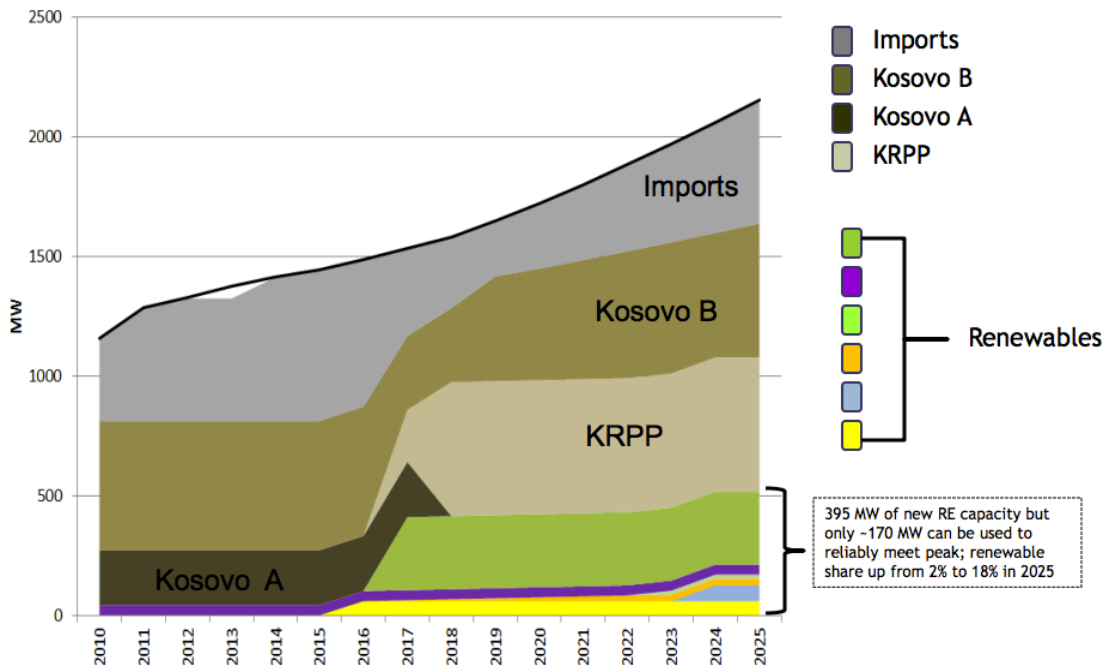
Source: World Bank Group Support to Kosovo's Energy Sector, 2012, p.18

2.3 The Environmental Aspect of the Project

In addition to the economic problems, the environment is of a particular importance where the dust from the existing power plants is obvious and clearly visible on car-roofs every morning, no matter how far one lives from the power plants. Nevertheless, that is the only natural wealth Kosovo has – the 10 billion tons of lignite (Bytyci, 2007, par.8). For many years now, the existing coal-based power plants Kosova A and B have been contributing to the damage of the environment. According to *A Modern Tale: Kosovo C 2100,* a book written by Luan Shllaku (the Head of Kosovo Foundation for Open Society) and Ekrem Beqiri, major pollutants of the environment in Kosovo are the existing power plants, whereas an even worse situation is that particular area where the plants sit. The authors emphasize that

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many citizens who live in Kastriot, Ferizaj, Pristina, and Hani i Elezit suffer from respiratory illnesses (2007, p.56). This claim has also been supported by Arben Salihu from the Institute for War & Peace Reporting, who talked to local inhabitants of Dardhishte and asked about their health. One of the inhabitants Valon Mexhuani, said that his uncle died from a respiratory disease, and blames KEK for the pollution – claiming to be the major contributor to the death of his uncle (Salihu, 2005, par.7). This is not the only case that people are afraid to live in the vicinity of the power plants. Salihu also explains how inhabitants have started to flee the areas, and move to cities – as this is the only choice left for them (Salihu, 2005, par.8). "A report by Kosovo's ministry of environment in May 2003 said that Kosova A emitted around 2.5 tons of dust per hour, which exceeds the European standard by some 74 times (Salihu, 2005, par.3)" – a difficult situation, not only for people living in those villages, but also for the rest of Kosovo. A study conducted by the European Agency for Reconstruction found the following:

> "In 1999 the air quality in Pristina was amongst the worst in Europe. EU assistance was rapidly mobilized by the Agency to reduce the environmental impact of the coal-fired plants and improve the management of public energy companies. In Kosovo B power station just outside Pristina, the electro-static filter system was refurbished, thereby drastically reducing pollution. However, disposing of the ash discharged from the plant remains a challenge: the ash poses a health hazard and pollutes both air and ground water ("Rebuilding the Energy Sector in Kosovo," 2007, p.3)."

According to Kosovalive journalist Krasniqi, Kosovo C 2100 (meaning 2,100 MWh) will only enhance conflicts between economic, social, demographic, agriculture, and environment goals (Krasniqi, 2008).

Though environmental issues are a concern, as many other developing countries, Kosovo has an emerging need for economic development, and the major source of natural resources that Kosovo possesses are reserves of lignite. For the government, this is a perfect opportunity to build a new coal-based power plant,

called Kosovo C – 2100, that will enable Kosovo not only to provide its citizens with energy, but also "become a key player in the market of the South East Europe ("Tender on Kosovo C by the End of the Year," 2007, par.5)." Regarding the economic issue, the authors of *A Modern Tale: Kosovo C 2100,* state, "Kosovo is a country of immense mineral wealth. Reserves of lignite, in particular, are considered sufficient to provide the country with energy for several hundred years (Shllaku & Beqiri, 2007, p.11)." On the other hand, the authors claim that the location is not adequate and that the Ministry of Economic Development (former Ministry of Energy and Mining) did not conduct necessary analysis about the consequences Kosovo C 2100 may have on the environment, social life, and sustainability (Shllaku & Beqiri, 2007, p.11). "The exploitation of Kosovo's lignite reserves must proceed rationally. Beyond being a finite source of energy, the use of lignite can lead to significant structural changes in the landscape, damaging living conditions and triggering socio-economic conflicts. As a country of only 10,904km^2, Kosovo must develop a clear strategic vision for its economic, spatial, and social future. This is the only way to guarantee the country's sustainable economic development (Shllaku & Beqiri, 2007, p.11)."

There are many negative environmental impacts of coal power plants. According to a study conducted by Oman Janez, Boris Dejanovic, and Matija Tuma from the University of Ljubljana, it is obvious that coal-based power plants are major contributors to pollution, especially if the mine is located near the plant (2002).

> "The intensive mining and firing of coal at a single location can harm the environment, both in the vicinity and in the surrounding areas. The problems are caused by the emission of solid particles, sulphur oxides, nitrogen oxides, carbon monoxide, carbon dioxide, and trace elements, as well as by the pollution of the surrounding waters and the degradation of the land due to the deposition of ash and slag. The consequences of coal mining can also be seen in the sinking of the ground above the mine (Oman et al, 2002, p.617)."

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According to Mr. Luan Shllaku, the author of *A Modern Tale: Kosovo C 2100,* on a phone interview in late November 2012 said that if we were to take KRPP (or Kosovo C 2100) and construct it somewhere on an island where there's nothing around it in a diameter of 500 km – than it really would comply with EU standards, because the air would not be loaded and that part of SO_2 and CO_2 emitted will not exceed the limits allowed, although they still contribute negatively to our health, global warming, extinction of species, etc (Personal Communication, 2012). According to studies that have been developed in other countries, even lignite-based power plants can be constructed in such a way that it will reduce the emissions of harmful gasses.

> "No techniques exist for burning coal without creating carbon dioxide; the best we can do is capture it and store the gas. There are three clean coal technologies available for separating out carbon dioxide to make it available for capture: the so-called integrated gasification combined cycle method, which turns coal into a synthetic gas (syngas) that can be used either as a fuel to generate electricity or for a variety of other purposes; post-combustion removal of carbon dioxide using scrubbers; and what is known as the oxy-fuel method, which removes nitrogen at the beginning of the coal-burning process. The last method captures a higher percentage of the CO_2 than the other two- 95% or more compared with just over 90% (Olijnyk, 2007, par.8)."

This tells us that techniques are not able to stop gas emissions completely; however, there are ways how it could be reduced, and eventually use the waste for other purposes.

Another study conducted by the Edison Electric Institute gives us more hope about the pollution problem. It states that the environmental impacts from coal-based plants will eventually come to an end; technology is advancing, and probably in the future it would at least reduce emissions in the atmosphere (McMahon & Richard, 2005). It explains how:

> "Integrated gasification combined-cycle (IGCC) technology, for example, could be commercially constructed in quantities in the near future. IGCC is projected to be able to remove more than 99 percent of SO_2, NO_X and

particulate matter, and 95 percent of mercury. It can also capture CO_2 more economically than conventional coal technology, aid the technology's higher operating efficiencies can lower CO_2 emissions even further (McMahon & Richard, 2005, p.55)."

This is how the current situation in Kosovo is. The World Bank reports that the general environmental degradation from all activities in the country (including vehicle pollution) is estimated to cost 220.8 million EUR per year (Berg, Woerden, & Naber, 2013, p.10). Nevertheless, in April 2013, KEK announced that it will manage to reduce pollution drastically. New electrostatic precipitators have been placed on two units of Kosova A and one more will be placed in the days ahead. According to KEK, from the summer of 2013, Kosova A units will operate in conditions "fifteen times more environmentally friendly than earlier ("KEK Reduced to a Minimum the Pollution Level," 2013, par.1).

"Besides the precipitators, KEK is also working on the hydraulic ash transportation system from power plant Kosova A to the Mirash mine. The 8.7 million EUR project (1 million EUR were financed by the World Bank and the rest from KEK), will be completed by the end of this year… [a]s a result of the transition from open conveyer belts system to the hydraulic system, the pollution will be zero ("KEK Reduced to a Minimum the Pollution Level," 2013, par.2)."

Economic development is critical for a newly established country, and in order to do so, the government insists to invest in new generation capacities, regardless of the green-experts' idea that the new power plant (KRPP) will have negative environmental impacts. The information missing in this regard is that no in-depth analysis about the externalities of KRPP has been conducted; thus, the exact implications are unexplained and unable to be measured. Furthermore, no detailed information is available about the type of power plant it will be, including mechanisms to protect the environment such as filters, and other protective tools. This Thesis Research will be exploring the issue of determining what new capacities will be more beneficial than costly; 600 MWh, 1,800 MWh, 2,100 MWh, or rely on imports.

CHAPTER 3: LIMITATIONS & MILESTONES

With contemporary technologies, the increasing demand for energy might perhaps be smaller if we take into account the gain in energy efficiency. The medium term Kosovo Action Plan for Energy Efficiency 2010-2012 foresees a reduction in energy consumption of 9% by 2018 ("Kosovo Energy Efficiency Action Plan 2010-2018," 2011, p.20). However, since most of the residential buildings use electricity for heating, it is very difficult to calculate the gain in efficiency, provided that currently there is no concrete plan to switch from electricity heating to other forms. This is one of the limitations that, if taken into account, would perhaps change the demand forecast and therefore, the need for particular new capacities.

Other limitations of the project are political factors, which this research will not take into account. Finally, limitations of the research are the inability to currently monetize and evaluate the following costs and benefits that have not been studied thoroughly in the past. They should serve as milestones that after having studied these factors, we would be able to examine the exact costs and benefits.

3.1 Costs

3.1.1 Relocation of Citizens

Relocation of citizens involves much more than only physical construction of houses and land construction. It should be looked more carefully to determine how much their location is valuable. It should focus on how much citizens of that area value their presence in that particular location, and examine the extent to which citizens will sacrifice economically if they were to relocate somewhere else. Many of those who live in the villages around the area of KRPP work agricultural land. Nonetheless, the population density on the power plant location is approximately 600

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inhabitants per km^2 and lies only 5 km away from the outskirts of the capital, Pristina (Shllaku & Beqiri, 2007, p.29). Shllaku and Beqiri (2007, p.29) made a comparison of two large lignite producers, Germany and Greece, and found that the population density at KRPP is between 3 to 12 times higher than that near lignite plants in Germany (Aachen complex) and Greece (Megalopolis).

3.1.2 Air Pollution

Air pollution is another of those costs to the society, especially to those 24 villages in the first-affected area. Pollution contributes greatly to respiratory diseases, and that should be monetized according to the number of incoming patients into hospitals. Costs are associated with curing of those diseases, but they are also associated with the costs of drugs. The World Bank has conducted a comprehensive environmental degradation study, but only lignite pollution alone is not evaluated.

3.1.3 Water Pollution

Frankly speaking, every power plant releases, except other chemicals, the worst and most dangerous pollutant – dust. Dust particles not only pollute the air we breathe, but on a great scale it pollutes also the waters in Kosovo (rivers and lakes). The polluted waters need to be filtered so that the population can have access to drinking water. There are costs and limited capacities associated in filtering the waters. Once the power plant capacity is decided, the regional water supply Prishtina should evaluate their costs in filtering the water and costs of not being able to use the water for other applications.

3.1.4 Soil Pollution

Another major impact KRPP will have is on the agricultural soil, where in total, around 8,000 ha of land will be affected (Shllaku & Beqiri, 2007, p.41). That area

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could not be used for agricultural reasons anymore – an enormous loss on agricultural land. The costs of this loss could be determined by the profit villagers now earn in that area by involving in agriculture, and the profit they will make after KRPP starts operations. Speaking to the national television RTK, a farmer from Kastriot says that agriculture has become useless in this region. After learning the origin of the products, potential buyers immediately change their minds. "The buyers, he said, consider these and other local products to be contaminated, hazardous to human health, and consequently unfit for consumption (Shllaku & Beqiri, 2007, p. 41)."

3.2 Benefits

3.2.1 Stable Electricity Supply

The greatest benefit for Kosovar citizens will be a stable and continuous supply of electricity. That will lead to more investments, and more investments will lead to the foundation of more jobs. According to the European Commission's Kosovo 2011 Progress Report, one of the main barriers faced by businesses in Kosovo is the lack of reliable electricity supply (2011, p.43). According to Sinani and Demi (2011, p.8), "many planned investments in Kosovo never materialize, and existing industry is at risk", where power cuts lead to damage of equipment and production interference. However, with KRPP in function, this problem should be solved. Electricity supply will also help reduce costs of running and maintaining power generators, whereas business profits should increase.

3.2.2 Revenue

At this stage, it is really difficult to quantify a real number of profits from the power plant while the entire ownership of the plant has not been decided yet. If it is a

complete foreign investment, the profit will be gathered only from taxes, land lease, and transfer fees. Royalty fees, maintenance services, and salaries shall not be considered revenue for Kosovo's budget; rather they are profits for the investor, or private companies. On the other hand, if KRPP is Kosovo owned, the revenues will change. Moreover, no data exist that show how much will businesses boost their revenues after having stable electricity supply. Further research is required to estimate the real benefits of the project.

CHAPTER 4: ANALYSIS

4.1 Kosovo Power Network

Besides the transmission within the country, Kosovo has interconnection lines with neighbouring Montenegro (440 kV line), Macedonia (400 kV line), Albania (220 kV line), and Serbia (400 kV line), that allow either transit, export, or import of electricity (Kammen, Mozafari, & Prull, 2012, p.9). For a detailed map of the transmission system of Kosovo, see Appendix A. As discussed earlier in the paper, due to the aging of the grid, distribution and transmission losses occur.

According to the Energy Regulatory Office, in 2010 transmission losses were brought down to 2.38% from 3.31% in 2009, whereas total distribution losses dropped to 41.22% in 2010 from 42.8% in 2009 ("Statement of Security of Supply for Kosovo," 2011, p.8-9). The Energy Sector Technical Assistance Project (ESTAP) of May 2002, which in itself encompasses the Power Distribution Master Plan for 2000-2015, addressed the progress of a mid and long-term development of the energy sector in Kosovo. The plan has not been followed strategically, however, during the past ten years the developments and maintenance issues of the Kosovo Distribution System have been responded based on situations on the field. Since the ESTAP report is out of date and conditions in the field are changing, the recommendations provided in the Power Distribution Master Plan are reviewed and updated accordingly. So far, many projects to resolve transmission constraints have either been implemented or approved for implementation.

The KEK Network Development Plan 2010-2014 (2013, p.8) will address the issues in the following order[1]:

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[1] A detailed strategy for 2010-2014 that will meet the above objectives can be found on the KEK Network Development Plan 2010-2014.

1. Ensure reliability and quality of electric supply, and support load growth

2. Rehabilitate and modernize metering capability

3. Comply with operations and performance standards

4. Reduce technical losses

5. Reduce commercial losses

KEK is undertaking these projects using its own budged and budget expectations for future years. However, because there is no strategic plan yet and that KEK is currently working to develop an updated Power Distribution Master Plan, projects will be reviewed on yearly basis and priorities will be assigned based on the situation in the field.

From 2010 until 2012, KEK has invested EUR 28,630,000, whereas for 2013 and 2014, KEK is projecting to invest another EUR 67,100,000 to improve the grid and reduce losses on its network ("KEK Network Development Plan 2010-2014," 2013, p.21-22)[2]. Since the Power Distribution Master Plan is still in progress, Mr. Naim Bejtullahu, Deputy Executive Director at Transmission, System, and Market Operator confirmed that improvement projects would continue until 2018 with estimated average yearly cost of 20 million EUR. After the completion of the projects, Mr. Bejtullahu expects that losses would go down to approximately 6% in distribution, and 1.5% in transmission, arguing further that it is unrealistic to expect higher reductions in losses (Personal Communication, 2013). The following graph shows a World Bank projection of the fall in energy demand if the price of energy increases yearly by 4.2%; technical losses go down to 8%; and commercial losses are reduced to 5%. By 2025, the World Bank predicts a roughly 25% decrease in energy demand.

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[2] Please note that for some reason costs are cleared in the online version of the document, but I do posses a confidential copy of the same document with indicative total costs only.

Graph 4 - Energy Generation Required to Meet Demand with EE
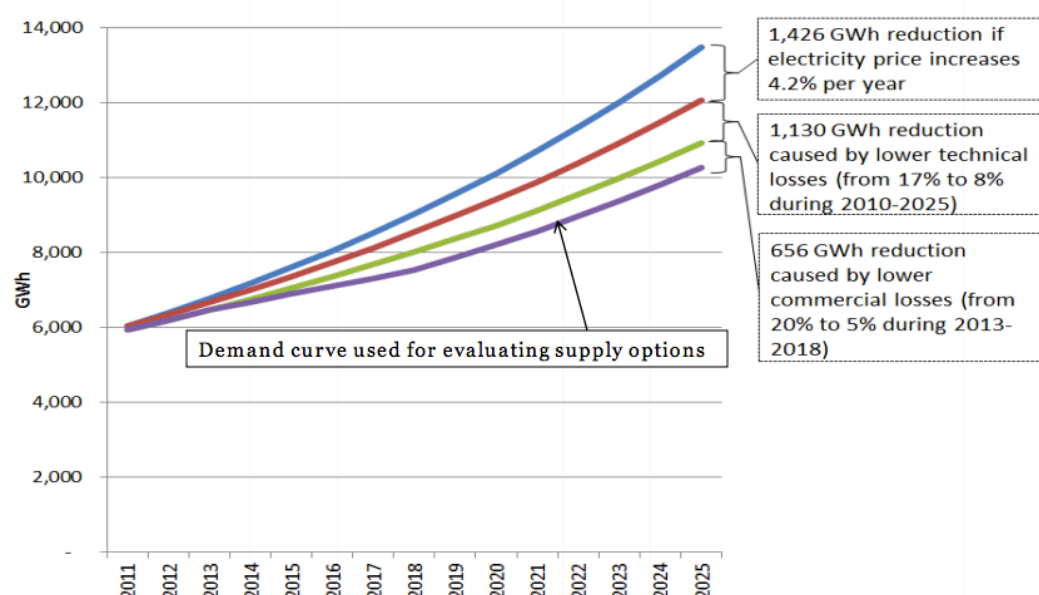
Source: World Bank Group Support to Kosovo's Energy Sector, 2012, p.10

4.2 Energy Imports

Due to excess demand and a shortage in domestic generation capacities, during 2002-2011 Kosovo has on average imported 16% (or 665.3 GWh) of energy per year from neighboring countries to meet peak demand. In 2012, the average energy price in Kosovo was 30.00 EUR/MWh - roughly the cost of production, whereas the average import price was 70.00 EUR/MWh ("Aplikimi Tarifor per Vitin 2012," 2012, p.6). One of the reasons the imported energy is relatively expensive, a trend that may increase in the future, is the significant lack of generation capacities and available electricity in the region ("Thematic Roundtable 6: Environment, Energy, Transport, and Regional Development," 2012, p.14)." During the interview with the Deputy Executive Director of KOSTT, Mr. Bejtullahu explains other reasons why import prices are high:

- There is no transparency in interconnection price setting, which leads to artificially created monopolies and thus, a higher import price.
- The regional energy market is still a closed one.

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Although Kosovo is part of the common electricity market called Energy Community Treaty of South East Europe (ECTSEE), KOSTT still does not participate in the regional mechanisms to plan and remunerate electricity transit because of differences over the country's status ("Thematic Roundtable 6: Environment, Energy, Transport, and Regional Development," 2012, p.12). According to Mr. Bejtullahu, import prices may change if Kosovo builds new generation capacities, and if the market becomes liberalized in the future (Personal Communication, 2013). In 2008, for example, the import prices were covered with government subsidies, which peaked at 5% of government expenditures ("World Bank Group Support to Kosovo's Energy Sector," 2012, p.5). Given that KEK cannot constantly rely on government subsidies if it continues to import, the price of energy should increase to cover the costs, which will further deteriorate (although low GDP per capita of 2,650 EUR ("Economic Indicators," 2013)) the disposable income of its citizens. Moreover, knowing that the demand is forecasted to increase even further while assuming that no new capacities are built, the share of energy imports will have to go up.

On the other hand, we observe relatively low domestic energy prices. According to the Institute for Advanced Studies – GAP, there are several factors that were taken into account when setting the domestic price:

- The old technology that is still being used. The technology has been depreciated to that point that it does not introduce additional costs for energy production.

- A number of grants and foreign investment aids. During 2007-2012, different municipalities of Kosovo have invested around 800,000 EUR in the distribution network. The government of Kosovo has also invested around 22.4 million EUR in the transmission network. On the other hand, between

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1999 and 2007, the EU has contributed with around 400 million EUR in a variety of energy projects.

- Large amounts of government subsidies. Between 2009 and 2011 KEK received around 146 million EUR from the government. However, in the last period, the government's aim is to reduce this amount because of budget deficits and financial unsustainability.

- Lack of investments in the reduction of environmental externalities. The large cost of air filters and other investments have not been an incentive for KEK to invest; therefore, the cost of production is lower.

- Cheap labor force in comparison to other countries. Average monthly wage in Kosovo is 310 EUR; in Bosnia and Hercegovina 622 EUR; in Macedonia 461 EUR; in Montenegro 715 EUR; in Croatia 1,054 EUR ("Çmimi I Energjisë Elektrike: Trendet E Ndryshimit Dhe Ndikimi Ekonomik," 2013, p.5-6).

As a consequence, the above factors have largely contributed to keeping the domestic energy production at current prices. As an example, in the European Energy Exchange market, on April 24, 2013 the price per MWh fluctuated between 18.47 EUR and 64.42 EUR throughout the same day ("Hour Contracts - Spot Hourly Auction," 2013). This is much lower than the average price Kosovo pays for imported energy, but this situation is likely to change only after the regional market is liberalized.

4.3 Energy Efficiency

The first Kosovo Mid-term Energy Efficiency Action Plan 2010-2018 foresees savings in energy of 9% by the end of 2018, where the following graphs show that efficiency should be reached by 1% per year. ("Kosovo Energy Efficiency Action Plan 2010-2018," p.20)

Graph 5 - Short & Long-term Target of EE in % | **Graph 6 - Total Energy Demand & Energy Savings**
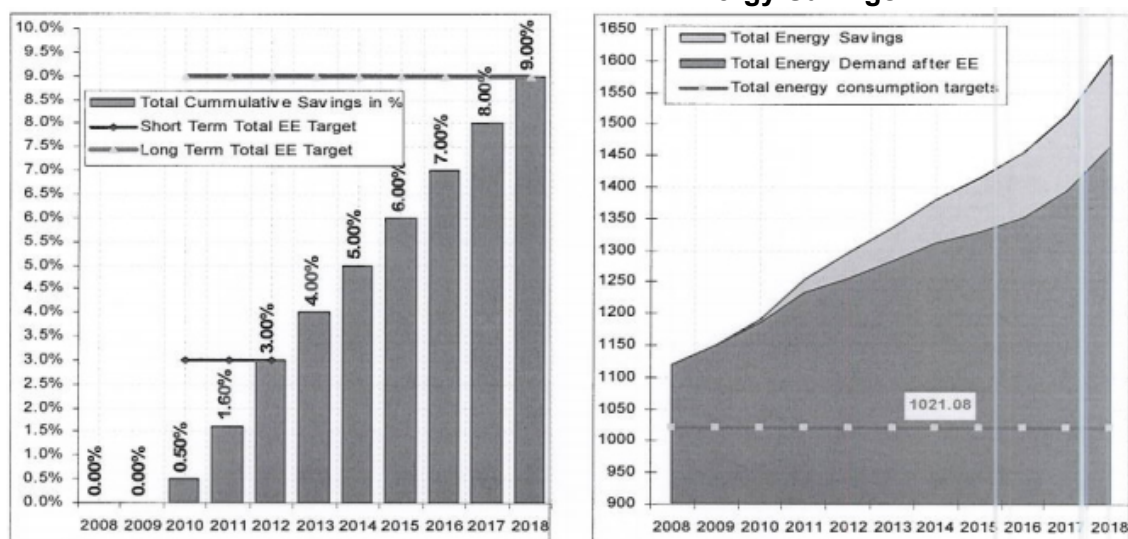
However, this Action Plan is not sufficient to analyze the energy demand for 40-50 years from now. Furthermore, analysts doubt the credibility of this Action Plan's enforcement.

> "The Institute for Development Policy (INDEP) has monitored the implementation of the Law on Energy Efficiency. From the analysis of the documents and the data, it results that all the official documents attempt to fulfill the requests that stem from the European Union Directive (EU) 2006/032 on Energy Efficiency. Their implementation is a completely different thing, where due to the lack of the policy creation cycle the law is not being fully implemented (Abazi et al., 2012, p.5)."

A large contribution to that might also have the inability to produce alternative energy at low-cost. The average yearly wind speed in most of the Kosovo territory at 80 meters height is 5.3 m/s (*Wind Resource Assessment – Final Report*, 2010, p.25). However, based on Evaluation of Global Wind Power by Cristina L. Archer and Mark Z. Jacobson (2005, p.1) for a country to be suitable for low-cost wind power generation, the wind speed should be at least 6.9 m/s at 80 m height.

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4.4 The Cost of Capital (WACC)

The cost of capital is essential in order to determine whether a project will be profitable for the investor, be it a private investor or the government. Given that in Kosovo, the economic and political situation is relatively unstable, the cost of capital is higher than in most European countries.

In 2011, the Energy Regulatory Office has calculated and presented the pre-tax Weighted Average Cost of Capital (WACC) for the energy sector, taking into account the following parameters into the formula:

$$WACC = \frac{(1-g)*rE}{(1-t)+g*rD}$$

Based on the above formula, the Energy Regulatory Office presents the pre-tax WACC for the energy sector to be 11.5% ("Indicative Values of WACC," 2011). For detailed calculations of WACC please see Appendix B.

4.5 Financial Analysis

In order to determine whether the project is worth investing in or not, the following calculations of the Net Present Value (NPV) of the future cash flows as well as the Internal Rate of Return (IRR) will help in making a better and educated decision.

The most recent study finalized on March 31, 2013, conducted by Vattenfall Europe PowerConsult GmbH named Study about Security of Electricity Supply in Kosovo (Diebels et al, 2013), is considered the most serious study that has been developed so far for the energy sector in Kosovo. According to the Deputy Director of the Transmission System and Market Operator (KOSTT) Mr. Naim Bejtullahu, the study is reliable and can be used for analytical purposes. Mr. Bejtullahu confirms that the study uses estimates, where the exact figures would only be known after the bids

have been accepted and opened for review (Personal Communication, 2013). Therefore, the following calculations are based on the information extracted from this study as well as from the Financial and Economic Analysis of the New TPP, conducted by the European Agency for Reconstruction. Please note, however, that some of the information is confidential, given that the Vattenfall Appendices have not been made public. Nevertheless, I do hold a copy of these Appendices, which will help me conduct the necessary calculations.

To calculate the demand for electricity, one of the methods Vattenfall has used is based on forecasted GDP growth for High, Medium, and Low Growth scenarios.

Table 2 – Forecasted Growth Scenarios

Scenarios/ Year	2007	2008	2009	2010	2011	2012	2013	2014
Base Scenario	6.3%	6.9%	2.9%	3.9%	5.3%	4.4%	4.9%	5.6%
Low Scenario	6.3%	6.9%	2.9%	3.9%	5.3%	4.4%	3.9%	3.8%
High Scenario	6.3%	6.9%	2.9%	3.9%	5.3%	4.4%	5.7%	7.4%
Scenarios/ Year	2015	2016	2017	2018	2019	2020	2025	2030
Base Scenario	5.8%	4.5%	6.5%	5.9%	5.5%	5.1%	5.6%	6.2%
Low Scenario	3.8%	2.0%	3.4%	2.5%	2.0%	1.4%	2.8%	2.5%
High Scenario	7.8%	7.5%	8.5%	7.7%	7.1%	6.6%	7.0%	8.0%

Source: Diebels et al, 2013

Based on forecasts of three GDP-growth-scenarios (High growth, Medium growth, Low growth), Vattenfall in consultation with KOSTT experts have forecasted the energy demand for the following four time periods. Given that, realistically, High growth is difficult to be achieved and low growth would be very pessimistic, this research consistently uses the Medium growth scenario for all calculations.

Table 3 - Forecasted Energy Demand

Scenario	Real peak demand 2010 [MW]	Result 2015 [MW]	Result 2020 [MW]	Result 2025 [MW]	Result 2030 [MW]
High	1,158	1,297	1,510	1,747	2,010
Medium	1,158	1,218	1,411	1,627	1,869
Low	1,158	1,138	1,311	1,506	1,727

Source: Diebels et al, 2013

To determine what capacities are most beneficial for the economy of Kosovo as well as for the investor, the following scenarios are assessed. The first considers an implementation of a 600 MWh lignite-based power plant; the second considers a 1,800 MWh power plant and the third a 2,100 MWh power plant. Please note that in order to find out which option is best, the following analysis considers only the new capacities and disregards old-existing ones.

Given that the Vattenfall report provides a bundle of cost-estimates of the existing power plants as well (and does not provide an exact breakdown of the build-up of costs), the only way how to find out the operating costs of the new plants is to weigh them according to their respective capacities of production with the help of other supporting documents. Please refer to Appendix C for Vattenfall's operating cost-estimates for the 1,800 MWh plant or, as they call it, the *Best Optimized Strategy* (Diebels et al, 2013, p.87-88). According to the Financial and Economic Analysis of the New TPP, the capital investment for building one MWh of lignite-based power plant is estimated to be 1,182,000 EUR (*Financial and Economic Analysis of the New TPP*, 2006, p.6). Please see Appendix D for a breakdown of costs in EUR per kW of power plant.

Most importantly, since the exact costs will be known after the bids have been accepted, the Energy Task Manager of the Project Implementation Unit Kosova e Re

Power Plant (KRPP) Mr. Sabri Limari, on a meeting on April 15, 2013, confirmed that around 30% of the plant expenditures should be estimated as mining costs, whereas the number of employees – one person per MW (Personal Communication, 2013). Based on the WACC and a gearing of 50%, only half of the funds should be acquired as debt, with an interest rate of 9.3%. For calculation purposes, the interest rate is compounded monthly, and both, the principal and interest costs will start to deleverage five years after the investment occurs (to allow a grace period of five years), assuming that the new plant will start generating revenues five years later. Since average annual inflation rate in Kosovo is 2.8% ("Kosovo Inflation Rate," 2013), all the costs (Cash Outflow), except the environment fee, have been yearly adjusted upwards for 2.8%. The environment fee is a 2010 calculation of the World Bank that results in 220.8 million EUR (midpoint) per year as a cost to the environmental degradation (Berg et al., 2013, p.10).

Table 1 - Overall Environmental Degradation in Kosovo

Pollution or contamination\ estimate	Annual cost (€ million)			% of 2010 GDP		
	Low	Mid	High	Low	Mid	High
Outdoor air	37.2	95.6	157.8	0.89	2.28	3.76
Lead	41.7	67.9	94.0	1.00	1.62	2.24
Solid waste	19.0	25.1	31.3	0.45	0.60	0.75
Forests	16.7	18.1	19.5	0.40	0.43	0.40
Water, sanitation, and hygiene	8.0	11.3	14.6	0.19	0.27	0.35
Water from heavy metals	0.4	2.8	5.2	0.01	0.07	0.12
Total	**123.0**	**220.8**	**322.5**	**2.9**	**5.3**	**7.7**

Source: Berg et al., 2013, p.10

Provided that there is no detailed study that measures the environment degradation only from lignite-power plants, I will use these numbers to estimate the impact of the forthcoming plant.

The following table summarizes the efficiency of the new power plants with regards to gas emissions. Only CO_2 emissions will be higher compared to the 2010

emissions by the old power plants (Diebels et al., 2013). For a detailed comparison of emissions see Appendix E.

Table 5 - Estimated Environment Pollution from New Power Plants

Gas	2020 (600 MWh)	2025 (1,200 MWh)	2030 (1,800 MWh)
CO_2	54% less than in 2010	8% less than in 2010	37% **more** than in 2010
SO_2	87% less than in 2010	75% less than in 2010	62% less than in 2010
NO_X	90% less than in 2010	80% less than in 2010	69% less than in 2010

Source: Diebels, et al., 2013

Therefore, to calculate the environmental degradation, based on the above table and because of other un-forecasted implications, I have used an estimation of 70% of the 2010 costs as indicated by the World Bank that may be attributed to the new power plants only, given that *state-of-the-art* units are required to be built with the Energy Strategy of the Republic of Kosovo 2009-2018 (2009, p.11). In order to account for environment externalities, the costs are internalized in the calculations.

On the revenues side (Cash Inflow), 7,000 operating hours (Diebels et al, 2013, p.117) per year are multiplied with the price of energy (which is yearly adjusted for inflation), times an 85% load factor (*Financial and Economic Analysis for the New TPP*, 2006, p.2) of the generating capacities.

Example: $7{,}000\ hours * 51.07\ price\ per\ MW * (85\% * 600\ MW)$ for a 600 MWh plant.

600 MWh

The first calculations are based on the construction of a 600 MWh power plant (2 times 300 MWh), planned to start operation in 2020 and decommissioned in 2060. For detailed calculations, see Appendix F.

Investment costs:	EUR 709,200,000.00
30% of the plant cost for mining:	EUR 212,760,000.00
Interest Rate (cost of debt):	9.3%
Return on Equity:	13.7%
Loan:	EUR 460,980,000.00
Equity:	EUR 460,980,000.00

After calculating the cash flow, the result shows:

Internal Rate of Return (IRR): 89.36%
Net Present Value (NPV): EUR 344,225,844.93

1,800 MWh

The second calculations are based on the construction of a 1,800 MWh power plant, planned to be implemented in three phases. Phase one, includes the construction of two plants with 300 MWh capacity each, the operation of which is foreseen to start in 2020. The second phase includes another plant of 600 MWh capacity with operation-start in 2025, whereas the last phase, of the last plant of 600 MWh is predicted to start operation in 2030. For detailed calculations, see Appendix G.

Investment costs: EUR 1,418,400,000.00
30% of the plant cost for mining: EUR 425,520,000.00
Interest Rate (cost of debt): 9.3%
Return on Equity: 13.7%
Loan: EUR 921,960,000.00
Equity: EUR 921,960,000.00

After calculating the cash flow, the result shows:

Internal Rate of Return (IRR): 39.23%
Net Present Value (NPV): EUR 867,157,752.53

2,100 MWh

The final calculations are based on the construction of a 2,100 MWh power plant, planned to be implemented in three phases. Phase one, includes the construction of two plants with 300 MWh capacity each, the operation of which is foreseen to start in 2020. The second phase includes another plant of 900 MWh capacity with operation-start in 2025, whereas the last phase, of the last plant of 600

MWh is predicted to start operation in 2030. For detailed calculations, see Appendix H.

After calculating the cash flow, the result shows:

Investment costs:	EUR 2,482,200,000.00
30% of the plant cost for mining:	EUR 744,660,000.00
Interest Rate (cost of debt):	9.3%
Return on Equity:	13.7%
Loan:	EUR 1,613,430,000.00
Equity:	EUR 1,613,430,000.00

After calculating the cash flow, the result shows that:

Internal Rate of Return (IRR):	34.81%
Net Present Value (NPV):	EUR 1,010,793,311.30

From the above information we can conclude that the Internal Rate of Return is highest for 600 MWh and diminishing with additional capacities, where the largest plant has the lowest IRR.

4.6 Economic Analysis

From the above results, we expect the government of Kosovo to directly increase the revenues collected from the profit tax as well as from the VAT.

Table 6 - Government Revenues from New Power Plants

Government Revenues			
	600 MWh	**1,800 MWh**	**2,100 MWh**
Profit Tax/EUR	635,998,863.29	2,564,286,957.14	3,129,591,773.80
VAT/EUR	1,930,903,780.14	6,815,477,162.48	7,967,334,327.77
Total/EUR	2,566,902,643.43	9,379,764,119.62	11,096,926,101.57
Average per Year/EUR	64,172,566.09	187,595,282.39	221,938,522.03

The above numbers show only the direct benefits the government will obtain from the operation of the power plants; however, there are other additional costs and benefits that currently could not be monetized. Therefore, revenues may change with both, particular installed capacities, and after all necessary studies have been performed.

CHAPTER 5: CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Conclusion

The energy sector in Kosovo was underinvested and under maintained during the last twenty years. During the same time, the demand for electricity has always been higher than domestic generation capacities. Due to the aging of the grid, distribution and technical losses were relatively high, but in a declining trend. Knowing that the import prices of energy have been substantially higher than domestic prices, KEK relied on the government to subsidize the price difference. When the government was unable to finance the energy import, citizens sat in the dark for hours with power cuts across the entire Kosovo. Not only that, according to the European Commission's Kosovo 2011 Progress Report, one of the main barriers businesses face in Kosovo is the lack of stable electricity supply. Therefore, in order to attract investments, stable electricity supply seems to be among the main prerequisites.

It is unquestionable that Kosovo's primary energy resource is lignite and that the institutions should make use of it. The government started proposing a 2,100 MWh power plant, but reconsidered this decision by modifying the installed capacities, first to 1,000 MWh, and now is even considering reducing it to 600 MWh. The main reasons for this modification are the latest economic crisis, where investors were no longer interested to invest such large funds in a large power plant, and environmentalists and members of the civil society, who were against environmental degradation that would come with large power plants. Given that the cost of capital in Kosovo is high, larger projects with high costs seem to have a lower Internal Rate of Return; perhaps that may be one of the reasons why potential investors lost interest in a large plant. After analyzing the main components of the

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project, by also keeping in mind the limitations presented in chapter 3, the next subsection will present the policy recommendation that may best fit the circumstances in the country.

5.2 Policy Recommendation

At the first glance, ceteris paribus, all three options, 600 MWh, 1,800 MWh, and 2,100 MWh, seem profitable and beneficial for the investor and for the economy as a whole. However, since a number of external factors are not accounted for, the costs do not reflect the real cost of the plants. It may increase substantially if we take into account every single element.

After learning that there is a large discrepancy between the domestic and the imported energy price, new generation capacities are essential for the country. The proposal is to begin with a 600 MWh lignite-based power plant, and based on the situation in the field, review the need for additional capacities, but in no way start with larger capacities, because of current uncertainties. The internal rate of return (IRR) is highest with 600 MWh – that is 89.36%, and it diminishes with additional capacities. For 1,800 MWh it is 39.23%, and for 2,100 MWh it is 34.81%. If we were to consider every direct cost involved, the IRR would diminish even further, maybe up to the point where the cost of capital becomes higher than the Internal Rate of Return. Financially, it makes perfect sense to build large power plants, where the government will potentially collect much more revenues through VAT and profit tax, but economically, the entire population may have to pay much more for externalities that have not been accounted for. Given that no feasibility study has been conducted about the amount of investments that may start flowing in after KRPP starts operating, it is difficult to evaluate how much will the economy benefit in this regard.

It is true that with a 600 MWh plant the domestic supply will fall short of the demand, considering also that all existing units of Kosovo A will be decommissioned by 2017, and that there will be a need for energy import. If the market is liberalized, the prices in the region will become competitive. According to ERO's Renewable Energy Policy and Market Developments in Kosovo report, this is expected to happen as of 2015 (Avdiu and Hamiti, 2011, p.2). Kosovo is part of the Energy Community Treaty of South East Europe, but little progress has been made towards creating an internal energy market and overall implementation of the treaty (*Electricity Balancing Models in the Energy Community*, 2011, p.16). ECTSEE's "institutional framework for electricity trading is expected to expand the region's generation-mix, diversify loads and fuel options and improve overall economic efficiency through improved utilization of existing resources and the introduction of competition (Bajs et al, 2013, p.1)." Although there are no legal barriers for new generators and suppliers, the market in Kosovo still operates as a single buyer model (Avdiu and Hamiti, 2011, p.1). Nonetheless, after some years, if we observe that generation capacities in the region are declining or maybe stagnating, we can still consider installing additional new generation capacities. Furthermore, with the full implementation and enforcement of the ECTSEE, Kosovo may also import energy from EU countries, for example, from Hungary using the interconnection lines through Serbia, something that in the past was very expensive, given that Serbia "applied a special tax for the import, export, or transit through its transmission network", says Economic Analyst Ibrahim Rexhepi (Karadaku, 2012, par.11). Now, what would be the best way to accelerate this investment?

Due to a shortage of public funds, in many countries, lately we can observe an increasing trend among governments to engage the private sector in public

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project investments. The Kosovo budget for 2013 is 1.58 billion EUR (Bytyci, 2012, par.5), or roughly more than half of the least costly option of the power plant (600 MWh). The banking sector in Kosovo is not large enough (Brajshori, 2013, par.2) to finance any large investment such as the Kosova e Re Power Plant; therefore, external funds should be acquired. One of the options for the Kosovo government to proceed with the project is the Build Operate and Transfer (BOT) approach – an outsource option of public projects to the private sector. BOT allows the private sector to design, finance, construct, and operate the plant (Menheere & Pollalis, 1996, p.5), in this case for forty years concessionary period, after which it should be transferred to the government. According to Menheere and Pollais, "BOT can be seen as a developing technique for infrastructure projects by using private initiative and funding (1996, p.5)." After the concessionary period is over, the government may refurbish the plant and extend its life for another seven to ten more years, just like is the case with Kosovo A power plant that was built in 1970 and is expected to be decommissioned in 2017.

Furthermore, the government is suggested to provide the land and the legal infrastructure, and the public should have decision-making power. Additionally, the government of Kosovo should provide Partial Risk Guarantee, which will cover the risk of "changes in law, expropriation and nationalization, and failure to issue licenses, approvals, and consents in a timely manner ("Partial Risk Guarantees," 2013)", as well as a commitment that future taxes will not increase.

To account for environmental externalities, the forthcoming operator should be required to pay an environment fee in the form of taxes, which should represent the real cost of the damage the power plants will cause. The amount of this fee,

however, will be decided only after thorough analyses about the impacts of the power plant have been conducted.

There are at least two more additional factors that should be taken into account. Firstly, no matter whether it is the government or the private sector that is investing, this large loan might have an effect on the credit rating of the country. The only agency that conducted the credit rating for Kosovo is Standard and Poor's (S&P) for the first time in 2012. On an interview conducted on April 29, 2013, the Head of Economic and Public Policy department at the Ministry of Finance, Mrs. Valmira Rexhebeqaj, said that S&P had visited Kosovo last year (2012) and that she is their direct contact person. S&P have conducted the rating, but the Minister of Finance resigned on January 17, 2013 to become the new Central Bank Governor. Currently there is no Minister of Finance (the deputy is acting Minister); therefore, S&P do not want to publish the report/rating before the new Minister is assigned. Moreover, Mrs. Rexhebeqaj, would also agree that this loan might affect the rating, especially the external score, but by how much, this is still not clear until we receive the S&P report.

Secondly, it is believed that large investments may crowd out other investments. "However, the mechanism or mechanisms through which such crowding out occurs, if it does, are still being debated and there is no unanimity (Gupta, 1992, par.2)." According to the Ricardian Equivalence, under certain circumstances, "the effect of government expenditures on aggregate demand is insensitive to whether such expenditures are financed by taxes or by debt (Gupta, 1992, par.2)." The assumption here is that there is no difference between debt or tax financing because economic agents foresee that taxes may increase in the future if expenditures are financed through debt, and therefore, frame their expectations

accordingly (Gupta, 1992, par.2). Additionally, the chief economist at the International Monetary Fund - Mr. Olivier Jean Blanchard points out that crowding out may happen at full employment. "If labor supply is inelastic, output is fixed and any increase in aggregate demand must be offset by an increase in interest rates, leaving output unchanged (Blanchard, 2012, p.2.)." Since the unemployment rate in Kosovo is over 45%, this will not likely cause any problem in this regard. Finally, crowding out is not likely to happen if the project is financed through external investors and sources, rather than through fiscal spending.

Finally, if Kosovo potentially joins the EU, it should establish some prerequisites that will allow its smooth integration to its institutional structures, among them being the adoption of the 20-20-20 rule. To achieve this rule, the country either has to increase the share of renewables to 20% of total energy production, or reduce the share of lignite burning if things are not working particularly well as in Kosovo's case, where the wind speed is low to be able to generate wind energy at low-cost.

As a final conclusion, the new power plant project should be executed with initial 600 MWh installed capacity, and the option for additional generating capacities should be left open, based on the needs and changing circumstances in the future.

APPENDIX A – Map of the Transmission System of Kosovo
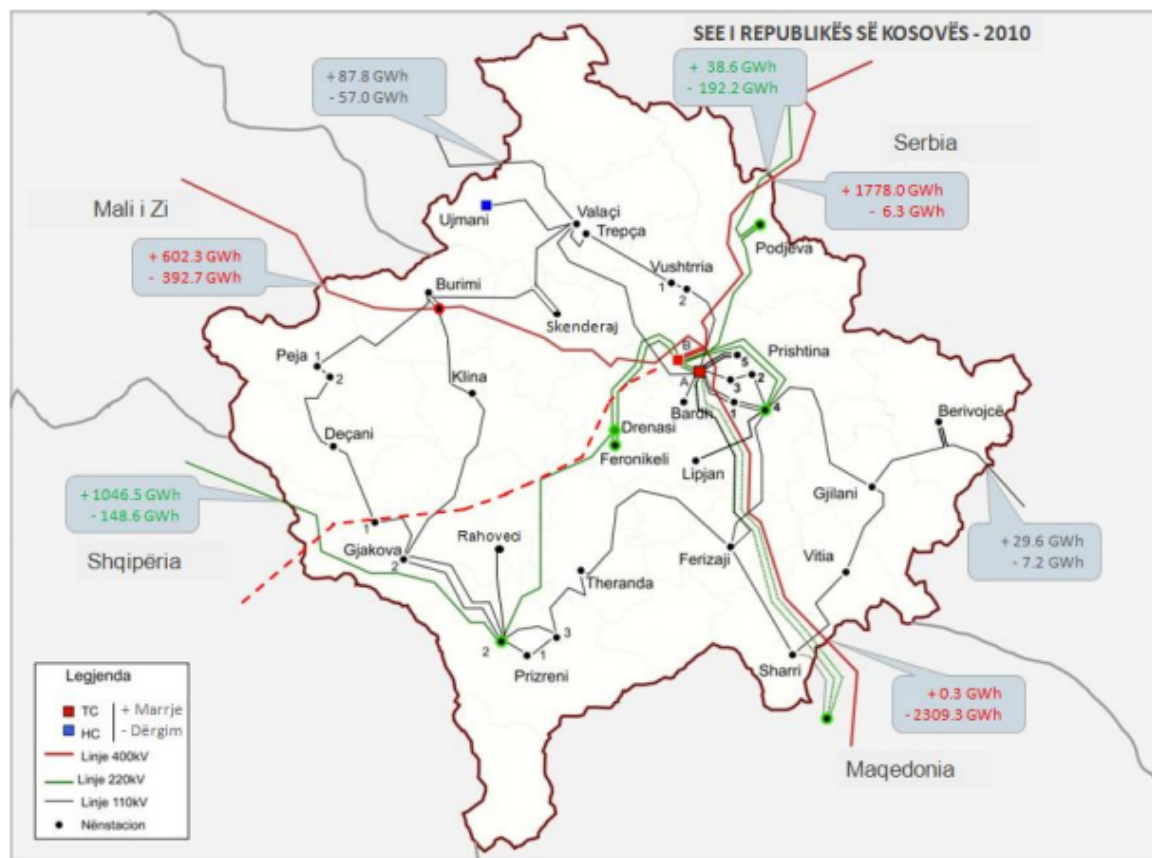
Source: KOSTT

APPENDIX B – WACC Calculations

$$WACC = \frac{(1-g) * rE}{(1-t) + g * rD}$$

where

WACC   is the Weighted Average Cost of Capital

g   is the gearing ($\frac{debt}{debt+equity\ ratio}$)

rE   is the real cost of equity (13.7 %)

rD   is the real cost of debt (9.3 %)

t   is the Kosovo Corporate Income Tax (10%)

The pricing rules specify that the gearing value is to be proposed by the licensee with the final value to be determined by the Regulator. According to ERO, the values would be expected to be around 50%.

From this, the real cost of debt is calculated:

rD = Rf + DRP

where

rD   is the real cost of debt

Rf   is the risk free rate

DRP   is the debt risk premium for the borrower

ERO estimates a risk free rate of 5.5% and a debt risk premium rate of 2%-2.5%. The cost of equity, using a simplified Capital Asset Pricing Model (CAPM):

$$re = Rf + \beta * ERP$$

Based on the above calculations, the Energy Regulatory Office presents the pre-tax WACC for the energy sector to be 11.5% ("Indicative Values of WACC," 2011).

APPENDIX C – Cost Estimates for Best Optimized Strategy

Annex 05-01 - Balance Matrix Kosovo.xls   MGS-Ko3

Year		2015	2020	2025	2030
Peak Demand	MW	1218	1411	1627	1869
Primary Reserve Power	MW	5	6	6	8
Secondary Reserve Power 2,5%	MW	30	35	41	47
Minute Reserve incl. Border-Crossing-MR	MW	310	310	600	600
Available Generation Power	**MW**	**1528**	**1721**	**2227**	**2469**
Reserve Power 10%	MW	153	172	223	247
Necessary Generation Power	**MW**	**1680**	**1893**	**2449**	**2716**
Therefrom					
Oil	MW	0	0	0	0
Gas	MW	0	0	0	0
Nuclear	MW	0	0	0	0
Water >10MW	MW	40	40	40	40
Lignite	MW	1015	1220	1820	1820
Installed Conventional Generation Power	**MW**	**1055**	**1260**	**1860**	**1860**
Bio mass	MW	6	16	18	20
Wind	MW	60	140	170	200
Water < 10MW	MW	60	141	146	150
Solar	MW	1,4	3	113	200
Installed Renewable Generation Power	**MW**	**127,4**	**300**	**447**	**570**
Import / Export	**MW**	**625**	**633**	**589**	**856**

Produced Energy					
Coal	TWh	5,25	5,95	7,23	8,60
	h	5175	4875	3975	4725
Gas	TWh	0,00	0,00	0,00	0,00
	h	2000	2000	2000	2000
Oil	TWh	0,000	0,000	0,000	0,000
	h	100	100	100	100
Water < 10MW	TWh	0,26	0,62	0,64	0,66
	h	4400	4400	4400	4400
Water > 10MW	TWh	0,18	0,18	0,18	0,18
	h	4400	4400	4400	4400
Wind	TWh	0,11	0,25	0,31	0,36
	h	1800	1800	1800	1800
Solar	TWh	0,00	0,00	0,12	0,22
	h	1100	1100	1100	1100
Biomass	TWh	0,03	0,08	0,09	0,10
	h	5000	5000	5000	5000
Import/ Export Winter Peak	TWh	0,25	0,25	0,24	0,34
	h	400	400	400	400
Total	**TWh**	**6,08**	**7,33**	**8,81**	**10,46**
		4995	5198	5415	5596
Export/ Coal	TWh	1,04	1,62	4,05	2,68
	h	1025	1325	2225	1475

	Year		2015	2020	2025	2030
Oil	Investment costs	M€	0	0	0	0
	Fuel Costs	M€	0,00	0,00	0,00	0,00
	Depreciation	M€	0	0	0	0
	Interests	M€	0	0	0	0
	Employees	M€	0	0	0	0
	Miscellaneous	M€	0	0	0	0
Gas	Investment costs	M€	0	0	0	0
	Fuel Costs	M€	0,00	0,00	0,00	0,00
	Depreciation	M€	0	0	0	0
	Interests	M€	0	0	0	0
	Employees	M€	0	0	0	0
	Miscellaneous	M€	0	0	0	0
Water>10MW	Investment costs	M€	120	120	120	120
	Depreciation	M€	2,4	2,4	2,4	2,4
	Interests	M€	6	6	6	6
	Employees	M€	0,08	0,08	0,08	0,08
	Miscellaneous	M€	0,08	0,08	0,08	0,08
Lignite	Investment costs	M€	1.523	1.830	2.730	2.730
	Fuel Costs	M€	125,86	151,28	225,68	225,68
	Depreciation	M€	40,6	48,8	72,8	72,8
	Interests	M€	76,125	91,5	136,5	136,5
	Employees	M€	10,15	12,2	18,2	18,2
	Miscellaneous	M€	10,15	12,2	18,2	18,2
RES In-feed tariff	Bio mass	M€	2,40	6,40	7,20	8,00
	Wind	M€	9,72	22,68	27,54	32,40
	Water < 10MW	M€	22,44	52,73	54,60	56,10
	Solar	M€	0,46	0,99	37,29	66,00
	Total Production Costs per Year	M€	306	407	607	642
	Export	M€	0,00	0,00	0,00	0,00
	Import	M€	25,02	25,31	23,57	34,22
	Total Energy Costs per Year	M€	331	433	630	677

Costs per produced MWh incl. Export	€/MWh	43,03	45,52	47,17	48,88

Costs per MWh incl. Import/ Export	€/MWh	46,54	48,35	49,01	51,49

The above calculations are Vattenfall's Best Optimized Strategy, which proposes to install 2x300 MWh in 2015, 600 MWh in 2020, and 600 MWh in 2025. Based on the above table, all three estimated scenario-calculations have been performed – that is, 600 MWh, 1,800 MWh, and 2,100 MWh.

APPENDIX D – Cost Breakdown for MW of Power Plant

	300 CFB
Boiler plant	120,0
Turbine plant	60,0
Black start	15,0
Fuel yard, ash	30,0
Cooling towers	15,0
Piping	12,0
Electrical systems	20,0
Instruments & DCS	14,0
Water treatment	5,0
Other	5,0
Civil work	25,0
Infrastructure	
Office, maintenance shop	5,0
Access roads	1,5
Water supply	1,0
Power lines	2,0
Ash	3,0
Subtotal	333,5
CM & engineering	16,0
Development costs	5,0
Grand total	354,5
EUR/kW	1182

Source: Financial and Economic Analysis for the New TPP, 2006, p.6

APPENDIX E – Comparison of Emissions
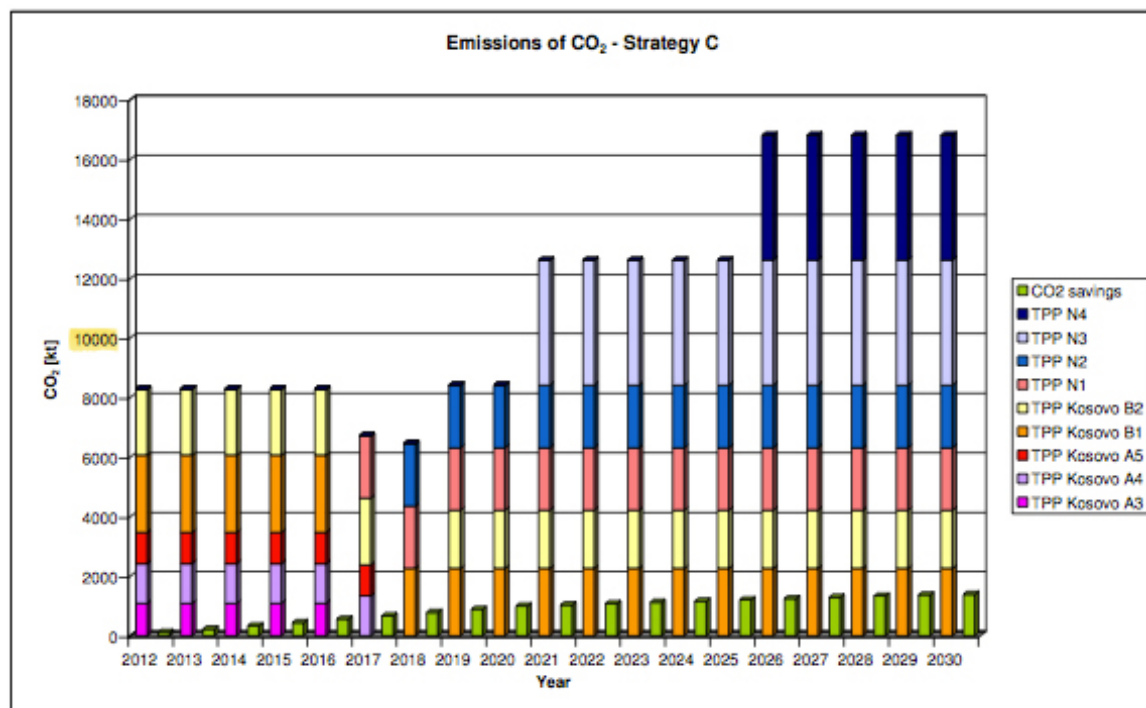
Source: Diebels et al, 2013
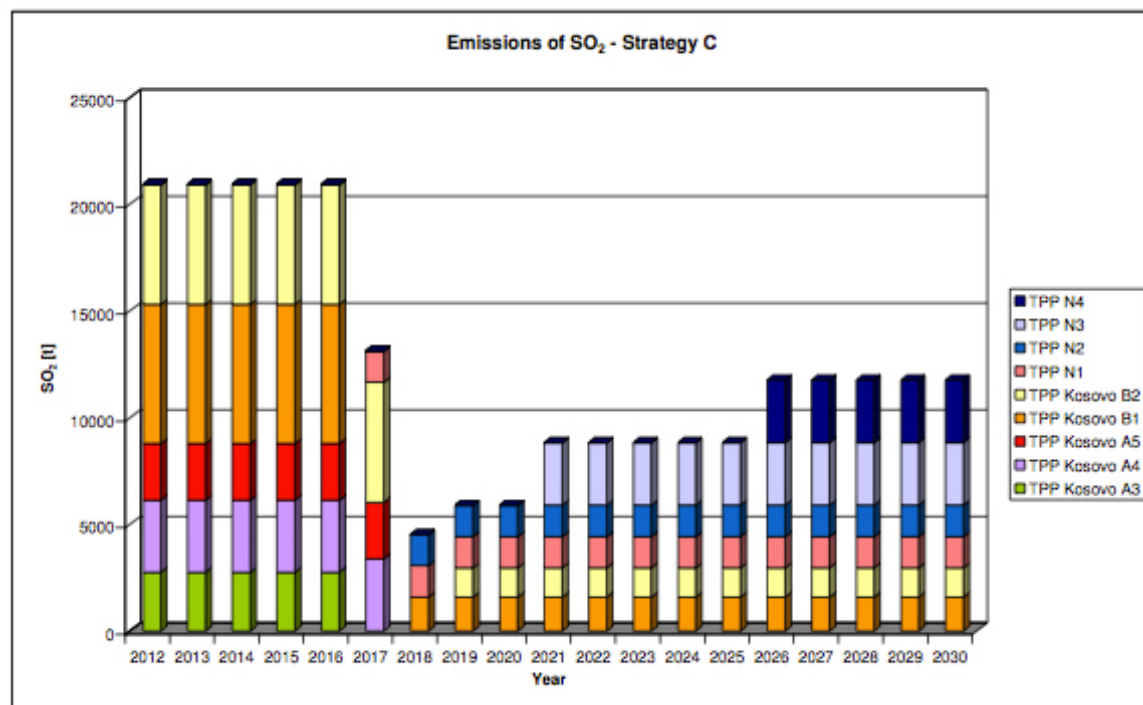
Source: Diebels et al, 2013
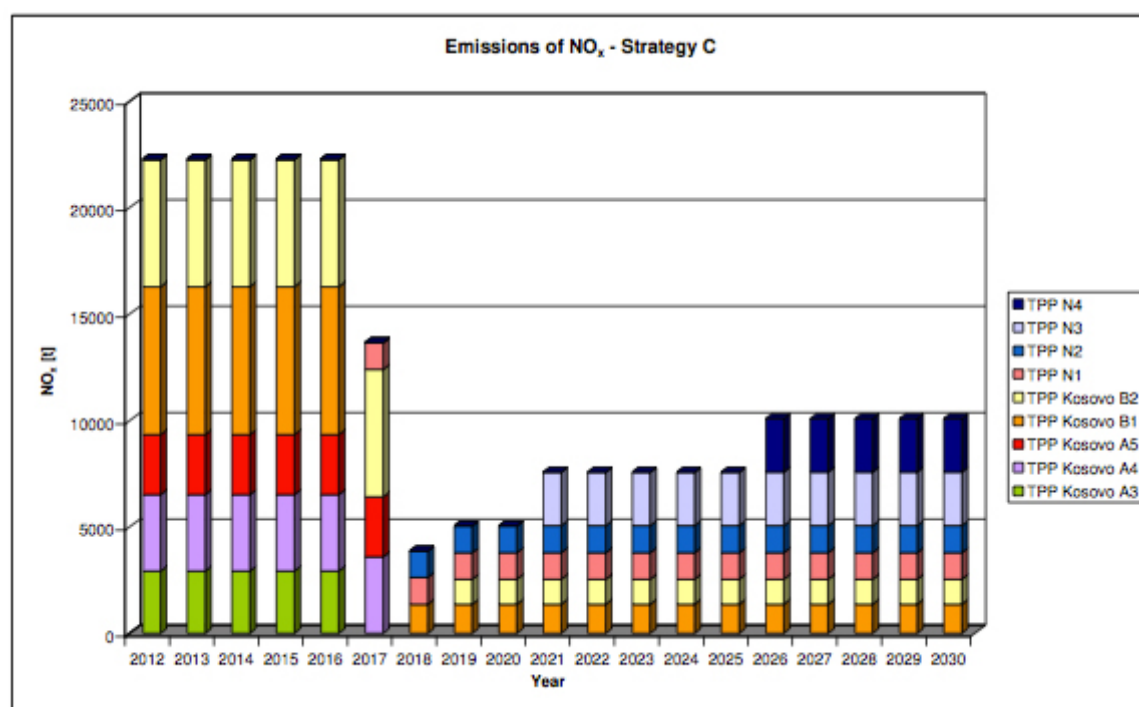
Source: Diebels et al, 2013

APPENDIX F – Calculations in EUR for 600 MWh Power Plant

	Cash Outflow									Cash Inflow				
Year	Investment Cost	Mining (30% of plant value)	Fuel Cost	Employee Cost	Misc	Interest	Principal	Environment Fee	Total Outflow	Total Energy Produce	Price per MWh	Equity Investment	Cash Inflow From Loan	Total Inflow
2015	709,200,000	212,760,000	-	406,667	406,667	-	-	-	922,773,333	-	-	460,980,000	460,980,000	921,960,000
2016	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2017	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2018	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2019	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2020	-	-	15,128,000	1,220,000	1,220,000	68,008,054	2,891,056	80,272,500	168,739,610	3,570,000	51.07	-	-	182,319,900
2021	-	-	15,557,635	1,254,648	1,254,648	67,727,424	3,171,686	80,272,500	169,238,541	3,570,000	52.52	-	-	187,497,785
2022		-	15,999,472	1,290,280	1,290,280	67,419,553	3,479,557	80,272,500	169,751,642	3,570,000	54.01	-	-	192,822,722
2023		-	16,453,857	1,326,924	1,326,924	67,081,798	3,817,312	80,272,500	170,279,315	3,570,000	55.55	-	-	198,298,888
2024	-	-	16,921,147	1,364,609	1,364,609	66,711,258	4,187,852	80,272,500	170,821,974	3,570,000	57.12	-	-	203,930,576
2025	-	-	17,401,707	1,403,363	1,403,363	66,304,750	4,594,360	80,272,500	171,380,044	3,570,000	58.75	-	-	209,722,204
2026	-	-	17,895,916	1,443,219	1,443,219	65,858,784	5,040,326	80,272,500	171,953,964	3,570,000	60.41	-	-	215,678,315
2027	-	-	18,404,160	1,484,206	1,484,206	65,369,528	5,529,583	80,272,500	172,544,183	3,570,000	62.13	-	-	221,803,579
2028	-	-	18,926,838	1,526,358	1,526,358	64,785,766	6,113,344	80,272,500	173,151,164	3,570,000	63.89	-	-	228,102,801
2029	-	-	19,464,360	1,569,706	1,569,706	64,192,354	6,706,756	80,272,500	173,775,383	3,570,000	65.71	-	-	234,580,920
2030	-	-	20,017,148	1,614,286	1,614,286	63,541,340	7,357,770	80,272,500	174,417,330	3,570,000	67.58	-	-	241,243,018
2031	-	-	20,585,635	1,660,132	1,660,132	62,827,134	8,071,976	80,272,500	175,077,508	3,570,000	69.49	-	-	248,094,320
2032	-	-	21,170,267	1,707,280	1,707,280	62,043,600	8,855,510	80,272,500	175,756,436	3,570,000	71.47	-	-	255,140,199
2033	-	-	21,771,502	1,755,766	1,755,766	61,184,011	9,715,099	80,272,500	176,454,645	3,570,000	73.50	-	-	262,386,180
2034	-	-	22,389,813	1,805,630	1,805,630	60,240,982	10,658,128	80,272,500	177,172,683	3,570,000	75.58	-	-	269,837,948
2035	-	-	23,025,684	1,856,910	1,856,910	59,206,415	11,692,695	80,272,500	177,911,114	3,570,000	77.73	-	-	277,501,346
2036	-	-	23,679,613	1,909,646	1,909,646	58,071,425	12,827,685	80,272,500	178,670,516	3,570,000	79.94	-	-	285,382,384

| | Cash Outflow | | | | | | | | | Cash Inflow | | | | |
Year	Investment Cost	Mining (30% of plant value)	Fuel Cost	Employee Cost	Misc	Interest	Principal	Environment Fee	Total Outflow	Total Energy Produce	Price per MWh	Equity Investment	Cash Inflow From Loan	Total Inflow
2037	-	-	24,352,114	1,963,880	1,963,880	56,826,263	14,072,847	80,272,500	179,451,485	3,570,000	82.21	-	-	293,487,244
2038	-	-	25,043,714	2,019,654	2,019,654	55,460,235	15,438,875	80,272,500	180,254,633	3,570,000	84.54	-	-	301,822,281
2039	-	-	25,754,956	2,077,013	2,077,013	53,961,609	16,937,501	80,272,500	181,080,591	3,570,000	86.95	-	-	310,394,034
2040	-	-	26,486,396	2,136,000	2,136,000	52,317,514	18,581,596	80,272,500	181,930,006	3,570,000	89.41	-	-	319,209,225
2041	-	-	27,238,610	2,196,662	2,196,662	50,513,829	20,385,281	80,272,500	182,803,544	3,570,000	91.95	-	-	328,274,767
2042	-	-	28,012,187	2,259,047	2,259,047	48,535,064	22,364,046	80,272,500	183,701,891	3,570,000	94.57	-	-	337,597,770
2043	-	-	28,807,733	2,323,204	2,323,204	46,364,223	24,534,887	80,272,500	184,625,751	3,570,000	97.25	-	-	347,185,547
2044	-	-	29,625,872	2,389,183	2,389,183	43,982,662	26,916,448	80,272,500	185,575,849	3,570,000	100.01	-	-	357,045,616
2045	-	-	30,467,247	2,457,036	2,457,036	41,369,928	29,529,183	80,272,500	186,552,929	3,570,000	102.85	-	-	367,185,712
2046	-	-	31,332,517	2,526,816	2,526,816	38,503,579	32,395,531	80,272,500	187,557,759	3,570,000	105.77	-	-	377,613,786
2047	-	-	32,222,360	2,598,577	2,598,577	35,358,998	35,540,112	80,272,500	188,591,125	3,570,000	108.78	-	-	388,338,018
2048	-	-	33,137,475	2,672,377	2,672,377	31,909,179	38,989,931	80,272,500	189,653,840	3,570,000	111.87	-	-	399,366,817
2049	-	-	34,078,580	2,748,273	2,748,273	28,124,491	42,774,619	80,272,500	190,746,735	3,570,000	115.04	-	-	410,708,835
2050	-	-	35,046,411	2,826,324	2,826,324	23,972,430	46,926,680	80,272,500	191,870,668	3,570,000	118.31	-	-	422,372,966
2051	-	-	36,041,730	2,906,591	2,906,591	19,417,335	51,481,775	80,272,500	193,026,522	3,570,000	121.67	-	-	434,368,358
2052	-	-	37,065,315	2,989,138	2,989,138	14,420,084	56,479,026	80,272,500	194,215,201	3,570,000	125.13	-	-	446,704,419
2053	-	-	38,117,970	3,074,030	3,074,030	8,937,759	61,961,351	80,272,500	195,437,639	3,570,000	128.68	-	-	459,390,825
2054	-	-	39,200,520	3,161,332	3,161,332	-	-	80,272,500	125,795,684	3,570,000	132.34	-	-	472,437,524
2055	-	-	40,313,815	3,251,114	3,251,114	-	-	80,272,500	127,088,543	3,570,000	136.09	-	-	485,854,750
2056	-	-	41,458,727	3,343,446	3,343,446	-	-	80,272,500	128,418,118	3,570,000	139.96	-	-	499,653,025
2057	-	-	42,636,155	3,438,400	3,438,400	-	-	80,272,500	129,785,454	3,570,000	143.93	-	-	513,843,171
2058	-	-	43,847,022	3,536,050	3,536,050	-	-	80,272,500	131,191,622	3,570,000	148.02	-	-	528,436,317
2059	-	-	45,092,277	3,636,474	3,636,474	-	-	80,272,500	132,637,725	3,570,000	152.23	-	-	543,443,908

Year	Profit Before Tax	NPV	VAT Paid	VAT Collected	Difference in VAT	Profit Tax	Net Profit/Loss
2015	(813,333)	(813,333)	147,578,667	147,513,600	(65,067)	-	(813,333)
2016	(813,333)	(729,447)	65,067	-	(65,067)	-	(813,333)
2017	(813,333)	(654,212)	65,067	-	(65,067)	-	(813,333)
2018	(813,333)	(586,738)	65,067	-	(65,067)	-	(813,333)
2019	(813,333)	(526,222)	65,067	-	(65,067)	-	(813,333)
2020	13,580,290	7,880,154	2,615,680	29,171,184	26,555,504	1,358,029	12,222,261
2021	18,259,244	9,502,406	2,689,965	29,999,646	27,309,680	1,825,924	16,433,320
2022	23,071,080	10,768,218	2,766,360	30,851,636	28,085,275	2,307,108	20,763,972
2023	28,019,573	11,729,043	2,844,925	31,727,822	28,882,897	2,801,957	25,217,615
2024	33,108,602	12,429,883	2,925,721	32,628,892	29,703,171	3,310,860	29,797,742
2025	38,342,160	12,910,049	3,008,811	33,555,553	30,546,741	3,834,216	34,507,944
2026	43,724,351	13,203,827	3,094,262	34,508,530	31,414,269	4,372,435	39,351,916
2027	49,259,397	13,341,070	3,182,139	35,488,573	32,306,434	4,925,940	44,333,457
2028	54,951,637	13,347,728	3,272,511	36,496,448	33,223,937	5,495,164	49,456,473
2029	60,805,537	13,246,312	3,365,451	37,532,947	34,167,497	6,080,554	54,724,984
2030	66,825,688	13,056,309	3,461,029	38,598,883	35,137,854	6,682,569	60,143,120
2031	73,016,812	12,794,549	3,559,323	39,695,091	36,135,769	7,301,681	65,715,130
2032	79,383,763	12,475,528	3,660,407	40,822,432	37,162,024	7,938,376	71,445,387
2033	85,931,535	12,111,696	3,764,363	41,981,789	38,217,426	8,593,154	77,338,382
2034	92,665,265	11,713,711	3,871,271	43,174,072	39,302,801	9,266,526	83,398,738
2035	99,590,232	11,290,662	3,981,215	44,400,215	40,419,000	9,959,023	89,631,209
2036	106,711,868	10,850,269	4,094,282	45,661,181	41,566,900	10,671,187	96,040,681

Year	Profit Before Tax	NPV	VAT Paid	VAT Collected	Difference in VAT	Profit Tax	Net Profit/Loss
2037	114,035,759	10,399,057	4,210,559	46,957,959	42,747,400	11,403,576	102,632,183
2038	121,567,648	9,942,511	4,330,139	48,291,565	43,961,426	12,156,765	109,410,884
2039	129,313,443	9,485,208	4,453,115	49,663,045	45,209,931	12,931,344	116,382,099
2040	137,279,219	9,030,943	4,579,583	51,073,476	46,493,893	13,727,922	123,551,297
2041	145,471,222	8,582,831	4,709,644	52,523,963	47,814,319	14,547,122	130,924,100
2042	153,895,879	8,143,396	4,843,397	54,015,643	49,172,246	15,389,588	138,506,291
2043	162,559,795	7,714,661	4,980,950	55,549,687	50,568,738	16,255,980	146,303,816
2044	171,469,767	7,298,211	5,122,409	57,127,299	52,004,890	17,146,977	154,322,791
2045	180,632,783	6,895,258	5,267,885	58,749,714	53,481,829	18,063,278	162,569,504
2046	190,056,027	6,506,700	5,417,493	60,418,206	55,000,713	19,005,603	171,050,425
2047	199,746,892	6,133,160	5,571,350	62,134,083	56,562,733	19,974,689	179,772,203
2048	209,712,978	5,775,036	5,729,576	63,898,691	58,169,114	20,971,298	188,741,680
2049	219,962,100	5,432,533	5,892,296	65,713,414	59,821,117	21,996,210	197,965,890
2050	230,502,297	5,105,695	6,059,638	67,579,675	61,520,037	23,050,230	207,452,068
2051	241,341,836	4,794,434	6,231,731	69,498,937	63,267,206	24,134,184	217,207,653
2052	252,489,218	4,498,552	6,408,712	71,472,707	65,063,995	25,248,922	227,240,296
2053	263,953,186	4,217,761	6,590,720	73,502,532	66,911,812	26,395,319	237,557,867
2054	346,641,840	4,967,766	6,777,896	75,590,004	68,812,108	34,664,184	311,977,656
2055	358,766,207	4,611,231	6,970,389	77,736,760	70,766,371	35,876,621	322,889,586
2056	371,234,906	4,279,364	7,168,348	79,944,484	72,776,136	37,123,491	334,111,416
2057	384,057,717	3,970,563	7,371,929	82,214,907	74,842,979	38,405,772	345,651,945
2058	397,244,695	3,683,315	7,581,291	84,549,811	76,968,519	39,724,469	357,520,225
2059	410,806,183	3,416,196	7,796,600	86,951,025	79,154,425	41,080,618	369,725,565

Total NPV   344,225,845 EUR
Total VAT revenue   1,930,903,780 EUR
Total Profit Tax   635,998,863 EUR
Internal Rate of Return (IRR)   **89.36%**

APPENDIX G – Calculations in EUR for 1,800 MWh Power Plant

Year	Investment Cost	Mining (30% of plant value)	Fuel Cost	Employee Cost	Misc	Interest	Principal	Environment Fee	Total Costs	Total Energy Produced in MW	Price per MWh	Equity Investment	Cash inflow from Loan	Total Inflow
						Cash Outflow				**Cash Inflow**				
2015	709,200,000	212,760,000	-	406,667	406,667	-	-	-	922,773,333	-	-	460,980,000	460,980,000	921,960,000
2016	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2017	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2018	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2019	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2020	709,200,000	212,760,000	15,128,000	1,220,000	1,220,000	110,831,926	4,018,832	80,272,500	1,134,651,258	3,570,000	51.07	460,980,000	460,980,000	1,104,279,900
2021	-	-	15,557,635	1,254,648	1,254,648	110,441,825	4,408,933	80,272,500	213,190,189	3,570,000	52.52		-	187,497,785
2022	-	-	15,999,472	1,290,280	1,290,280	110,013,857	4,836,901	80,272,500	213,703,290	3,570,000	54.01		-	192,822,722
2023	-	-	16,453,857	1,326,924	1,326,924	109,544,347	5,306,411	80,272,500	214,230,963	3,570,000	55.55		-	198,298,888
2024	-	-	16,921,147	1,364,609	1,364,609	109,029,263	5,821,495	80,272,500	214,773,622	3,570,000	57.12		-	203,930,576
2025	709,200,000	212,760,000	34,803,414	2,806,727	2,806,727	151,288,052	7,514,353	160,545,000	1,281,724,274	7,140,000	58.75	460,980,000	460,980,000	1,341,404,409
2026	-	-	35,791,831	2,886,438	2,886,438	150,558,647	8,243,759	160,545,000	360,912,113	7,140,000	60.41		-	431,356,630
2027	-	-	36,808,319	2,968,413	2,968,413	149,758,439	9,043,967	160,545,000	362,092,550	7,140,000	62.13		-	443,607,158
2028	-	-	37,853,676	3,052,716	3,052,716	148,833,542	9,968,864	160,545,000	363,306,513	7,140,000	63.89		-	456,205,601
2029	-	-	38,928,720	3,139,413	3,139,413	147,865,881	10,936,525	160,545,000	364,554,951	7,140,000	65.71		-	469,161,841
2030	-	-	60,051,443	4,842,858	4,842,858	146,804,290	11,998,115	240,817,500	469,357,066	10,710,000	67.58		-	723,729,055
2031	-	-	61,756,904	4,980,396	4,980,396	145,639,653	13,162,752	240,817,500	471,337,601	10,710,000	69.49		-	744,282,960
2032	-	-	63,510,800	5,121,839	5,121,839	144,361,967	14,440,439	240,817,500	473,374,383	10,710,000	71.47		-	765,420,596
2033	-	-	65,314,507	5,267,299	5,267,299	142,960,257	15,842,148	240,817,500	475,469,011	10,710,000	73.50		-	787,158,541
2034	-	-	67,169,439	5,416,890	5,416,890	141,422,486	17,379,919	240,817,500	477,623,125	10,710,000	75.58		-	809,513,844
2035	-	-	69,077,051	5,570,730	5,570,730	139,735,446	19,066,959	240,817,500	479,838,417	10,710,000	77.73		-	832,504,037
2036	-	-	71,038,839	5,728,939	5,728,939	137,884,648	20,917,757	240,817,500	482,116,622	10,710,000	79.94		-	856,147,152
2037	-	-	73,056,343	5,891,641	5,891,641	135,854,196	22,948,209	240,817,500	484,459,529	10,710,000	82.21		-	880,461,731
2038	-	-	75,131,143	6,058,963	6,058,963	133,626,652	25,175,754	240,817,500	486,868,974	10,710,000	84.54		-	905,466,844
2039	-	-	77,264,867	6,231,038	6,231,038	131,182,883	27,619,523	240,817,500	489,346,848	10,710,000	86.95		-	931,182,102
2040	-	-	79,459,189	6,407,999	6,407,999	128,501,902	30,300,504	240,817,500	491,895,093	10,710,000	89.41		-	957,627,674
2041	-	-	81,715,830	6,589,986	6,589,986	125,560,682	33,241,723	240,817,500	494,515,708	10,710,000	91.95		-	984,824,300
2042	-	-	84,036,560	6,777,142	6,777,142	122,333,963	36,468,442	240,817,500	497,210,749	10,710,000	94.57		-	1,012,793,310
2043	-	-	86,423,198	6,969,613	6,969,613	118,794,032	40,008,373	240,817,500	499,982,329	10,710,000	97.25		-	1,041,556,640

Year	Cash Outflow									Cash Inflow				
	Investment Cost	Mining (30% of plant value)	Fuel Cost	Employee Cost	Misc	Interest	Principal	Environment Fee	Total Costs	Total Energy Produced in MW	Price per MWh	Equity Investment	Cash inflow from Loan	Total Inflow
2044	-	-	88,877,617	7,167,550	7,167,550	114,910,486	43,891,920	240,817,500	502,832,622	10,710,000	100.01	-	-	1,071,136,849
2045	-	-	91,401,741	7,371,108	7,371,108	110,649,970	48,152,436	240,817,500	505,763,863	10,710,000	102.85	-	-	1,101,557,135
2046	-	-	93,997,551	7,580,448	7,580,448	105,975,893	52,826,513	240,817,500	508,778,352	10,710,000	105.77	-	-	1,132,841,358
2047	-	-	96,667,081	7,795,732	7,795,732	100,848,111	57,954,294	240,817,500	511,878,451	10,710,000	108.78	-	-	1,165,014,053
2048	-	-	99,412,426	8,017,131	8,017,131	95,222,584	63,579,822	240,817,500	515,066,594	10,710,000	111.87	-	-	1,198,100,452
2049	-	-	102,235,739	8,244,818	8,244,818	89,050,996	69,751,409	240,817,500	518,345,280	10,710,000	115.04	-	-	1,232,126,504
2050	-	-	105,139,234	8,478,971	8,478,971	82,280,343	76,522,063	240,817,500	521,717,081	10,710,000	118.31	-	-	1,267,118,897
2051	-	-	108,125,189	8,719,773	8,719,773	74,852,473	83,949,932	240,817,500	525,184,641	10,710,000	121.67	-	-	1,303,105,074
2052	-	-	111,195,944	8,967,415	8,967,415	66,703,593	92,098,813	240,817,500	528,750,679	10,710,000	125.13	-	-	1,340,113,258
2053	-	-	114,353,909	9,222,089	9,222,089	57,763,714	101,038,692	240,817,500	532,417,993	10,710,000	128.68	-	-	1,378,172,474
2054	-	-	117,601,560	9,483,997	9,483,997	45,032,782	42,870,513	240,817,500	465,290,349	10,710,000	132.34	-	-	1,417,312,573
2055	-	-	120,941,444	9,753,342	9,753,342	40,871,413	47,031,883	240,817,500	469,168,924	10,710,000	136.09	-	-	1,457,564,250
2056	-	-	124,376,181	10,030,337	10,030,337	36,306,106	51,597,190	240,817,500	473,157,651	10,710,000	139.96	-	-	1,498,959,075
2057	-	-	127,908,465	10,315,199	10,315,199	31,297,652	56,605,643	240,817,500	477,259,658	10,710,000	143.93	-	-	1,541,529,512
2058	-	-	131,541,065	10,608,150	10,608,150	25,803,037	62,100,259	240,817,500	481,478,161	10,710,000	148.02	-	-	1,585,308,950
2059	-	-	135,276,831	10,909,422	10,909,422	19,859,808	68,100,061	240,817,500	485,873,043	10,710,000	152.23	-	-	1,630,331,725
2060	-	-	92,745,795	7,479,500	7,479,500	15,084,664	28,866,984	160,545,000	312,201,442	7,140,000	156.55	-	-	1,117,755,430
2061	-	-	95,379,776	7,691,917	7,691,917	12,282,594	31,669,054	160,545,000	315,260,259	7,140,000	160.99	-	-	1,149,499,685
2062	-	-	98,088,562	7,910,368	7,910,368	9,208,532	34,743,116	160,545,000	318,405,945	7,140,000	165.57	-	-	1,182,145,476
2063	-	-	100,874,277	8,135,022	8,135,022	5,836,075	38,115,573	160,545,000	321,640,969	7,140,000	170.27	-	-	1,215,718,407
2064	-	-	103,739,106	8,366,057	8,366,057	2,221,000	41,787,221	160,545,000	325,024,441	7,140,000	175.10	-	-	1,250,244,810
2065	-	-	53,342,648	4,301,826	4,301,826	-	-	80,272,500	142,218,801	3,570,000	180.08	-	-	642,875,881
2066	-	-	54,857,580	4,423,998	4,423,998	-	-	80,272,500	143,978,076	3,570,000	185.19	-	-	661,133,556
2067	-	-	56,415,535	4,549,640	4,549,640	-	-	80,272,500	145,787,315	3,570,000	190.45	-	-	679,909,749
2068	-	-	58,017,736	4,678,850	4,678,850	-	-	80,272,500	147,647,935	3,570,000	195.86	-	-	699,219,186
2069	-	-	59,665,448	4,811,729	4,811,729	-	-	80,272,500	149,561,398	3,570,000	201.42	-	-	719,077,011
2070	-	-	61,359,935	4,948,382	4,948,382	-	-	80,272,500	151,529,203	3,570,000	207.14	-	-	739,498,798

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Year	Profit BeforeTtax	NPV	VAT Paid	VAT Collected	Difference	Profit Tax	Net Profit/Loss
2015	(813,333)	(813,333)	147,578,667	147,513,600	(65,067)	-	(813,333)
2016	(813,333)	(729,447)	65,067	-	(65,067)	-	(813,333)
2017	(813,333)	(654,212)	65,067	-	(65,067)	-	(813,333)
2018	(813,333)	(586,738)	65,067	-	(65,067)	-	(813,333)
2019	(813,333)	(526,222)	65,067	-	(65,067)	-	(813,333)
2020	(30,371,358)	(17,623,407)	150,129,280	176,684,784	26,555,504	-	(30,371,358)
2021	(25,692,404)	(13,370,743)	2,689,965	29,999,646	27,309,680	-	(25,692,404)
2022	(20,880,568)	(9,745,816)	2,766,360	30,851,636	28,085,275	-	(20,880,568)
2023	(15,932,075)	(6,669,195)	2,844,925	31,727,822	28,882,897	-	(15,932,075)
2024	(10,843,046)	(4,070,779)	2,925,721	32,628,892	29,703,171	-	(10,843,046)
2025	59,680,135	20,094,681	153,531,223	214,624,705	61,093,483	5,968,013	53,712,121
2026	70,444,517	21,272,751	6,188,523	69,017,061	62,828,538	7,044,452	63,400,065
2027	81,514,608	22,076,846	6,364,277	70,977,145	64,612,868	8,151,461	73,363,147
2028	92,899,089	22,565,148	6,545,023	72,992,896	66,447,874	9,289,909	83,609,180
2029	104,606,889	22,788,311	6,730,901	75,065,894	68,334,993	10,460,689	94,146,200
2030	254,371,990	49,698,843	10,383,088	115,796,649	105,413,561	25,437,199	228,934,791
2031	272,945,359	47,827,517	10,677,968	119,085,274	108,407,306	27,294,536	245,650,824
2032	292,046,213	45,896,422	10,981,222	122,467,295	111,486,073	29,204,621	262,841,592
2033	311,689,531	43,931,355	11,293,089	125,945,367	114,652,278	31,168,953	280,520,578
2034	331,890,719	41,953,928	11,613,813	129,522,215	117,908,402	33,189,072	298,701,647
2035	352,665,620	39,982,116	11,943,645	133,200,646	121,257,001	35,266,562	317,399,058
2036	374,030,529	38,030,745	12,282,845	136,983,544	124,700,700	37,403,053	336,627,476
2037	396,002,202	36,111,915	12,631,677	140,873,877	128,242,200	39,600,220	356,401,982
2038	418,597,870	34,235,373	12,990,417	144,874,695	131,884,278	41,859,787	376,738,083
2039	441,835,254	32,408,845	13,359,345	148,989,136	135,629,792	44,183,525	397,651,729
2040	465,732,581	30,638,319	13,738,750	153,220,428	139,481,678	46,573,258	419,159,323
2041	490,308,592	28,928,303	14,128,931	157,571,888	143,442,957	49,030,859	441,277,732
2042	515,582,561	27,282,037	14,530,192	162,046,930	147,516,737	51,558,256	464,024,305
2043	541,574,311	25,701,695	14,942,850	166,649,062	151,706,213	54,157,431	487,416,880

Year	Profit Before Tax	NPV	VAT Paid	VAT Collected	Difference	Profit Tax	Net Profit/Loss
2044	568,304,227	24,188,544	15,367,227	171,381,896	156,014,669	56,830,423	511,473,804
2045	595,793,272	22,743,095	15,803,656	176,249,142	160,445,486	59,579,327	536,213,945
2046	624,063,006	21,365,229	16,252,480	181,254,617	165,002,138	62,406,301	561,656,706
2047	653,135,601	20,054,304	16,714,050	186,402,248	169,688,198	65,313,560	587,822,041
2048	683,033,857	18,809,256	17,188,729	191,696,072	174,507,343	68,303,386	614,730,472
2049	713,781,224	17,628,673	17,676,889	197,140,241	179,463,352	71,378,122	642,403,102
2050	745,401,816	16,510,875	18,178,913	202,739,024	184,560,111	74,540,182	670,861,635
2051	777,920,433	15,453,966	18,695,194	208,496,812	189,801,618	77,792,043	700,128,390
2052	811,362,579	14,455,892	19,226,137	214,418,121	195,191,984	81,136,258	730,226,321
2053	845,754,481	13,514,480	19,772,160	220,507,596	200,735,436	84,575,448	761,179,033
2054	952,022,224	13,643,546	20,333,689	226,770,012	206,436,323	95,202,222	856,820,002
2055	988,395,326	12,703,868	20,911,166	233,210,280	212,299,114	98,839,533	889,555,793
2056	1,025,801,424	11,824,798	21,505,043	239,833,452	218,328,409	102,580,142	923,221,281
2057	1,064,269,855	11,002,904	22,115,786	246,644,722	224,528,936	106,426,985	957,842,869
2058	1,103,830,789	10,234,891	22,743,874	253,649,432	230,905,558	110,383,079	993,447,710
2059	1,144,458,681	9,517,129	23,389,800	260,853,076	237,463,275	114,445,868	1,030,012,813
2060	805,553,988	6,007,940	16,036,047	178,840,869	162,804,822	80,555,399	724,998,589
2061	834,239,426	5,580,162	16,491,471	183,919,950	167,428,479	83,423,943	750,815,483
2062	863,739,530	5,181,602	16,959,829	189,143,276	172,183,447	86,373,953	777,365,577
2063	894,077,438	4,810,403	17,441,488	194,514,945	177,073,457	89,407,744	804,669,694
2064	925,220,369	4,464,540	17,936,826	200,039,170	182,102,343	92,522,037	832,698,332
2065	500,657,080	2,166,691	9,223,116	102,860,141	93,637,025	50,065,708	450,591,372
2066	517,155,480	2,007,257	9,485,052	105,781,369	96,296,317	51,715,548	465,439,932
2067	534,122,435	1,859,292	9,754,428	108,785,560	99,031,132	53,412,243	480,710,191
2068	551,571,251	1,722,002	10,031,454	111,875,070	101,843,616	55,157,125	496,414,126
2069	569,515,613	1,594,641	10,316,347	115,052,322	104,735,975	56,951,561	512,564,052
2070	587,969,596	1,476,313	10,609,331	118,319,808	107,710,476	58,796,960	529,172,636

Total NPV   867,157,752 EUR
Total VAT revenue   6,815,477,162 EUR
Total Profit Tax   2,674,956,957 EUR
Internal Rate of Return (IRR)   **39.23%**

APPENDIX H – Calculations in EUR for 2,100 MWh Power Plant

	Cash Outflow									Cash Inflow				
Year	Investment Cost	Mining (30% of plant value)	Fuel Cost	Employee Cost	Misc	Interest	Principal	Environment Fee	Total Costs	Total Energy Produced in MW	Price per MW	Equity Investment	Cash Inflow From Loan	Total per Year
2015	709,200,000	212,760,000	-	406,667	406,667	-	-	-	922,773,333	-	-	460,980,000	460,980,000	921,960,000
2016	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2017	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2018	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2019	-	-	-	406,667	406,667	-	-	-	813,333	-	-	-	-	-
2020	1,063,800,000	319,140,000	15,128,000	1,220,000	1,220,000	132,243,862	4,582,719	80,272,500	1,617,607,082	3,570,000	51.07	691,470,000	691,470,000	1,565,259,900
2021	-	-	15,557,635	1,254,648	1,254,648	131,799,025	5,027,556	80,272,500	235,166,013	3,570,000	52.52		-	187,497,785
2022	-	-	15,999,472	1,290,280	1,290,280	131,311,009	5,515,573	80,272,500	235,679,114	3,570,000	54.01	-	-	192,822,722
2023	-	-	16,453,857	1,326,924	1,326,924	130,775,621	6,050,960	80,272,500	236,206,787	3,570,000	55.55		-	198,298,888
2024	-	-	16,921,147	1,364,609	1,364,609	130,188,265	6,638,317	80,272,500	236,749,445	3,570,000	57.12	-	-	203,930,576
2025	709,200,000	212,760,000	43,504,268	3,508,409	3,508,409	172,367,767	8,410,462	200,681,250	1,353,940,565	8,925,000	58.75	460,980,000	460,980,000	1,446,265,511
2026	-	-	44,739,789	3,608,048	3,608,048	171,551,377	9,226,852	200,681,250	433,415,363	8,925,000	60.41		-	539,195,787
2027	-	-	46,010,399	3,710,516	3,710,516	170,655,742	10,122,487	200,681,250	434,890,911	8,925,000	62.13	-	-	554,508,948
2028	-	-	47,317,094	3,815,895	3,815,895	169,626,155	11,152,074	200,681,250	436,408,363	8,925,000	63.89	-	-	570,257,002
2029	-	-	48,660,900	3,924,266	3,924,266	168,543,642	12,234,588	200,681,250	437,968,912	8,925,000	65.71	-	-	586,452,301
2030	-	-	70,060,017	5,650,001	5,650,001	167,356,051	13,422,179	280,953,750	543,091,999	12,495,000	67.58	-	-	844,350,564
2031	-	-	72,049,722	5,810,461	5,810,461	166,053,182	14,725,047	280,953,750	545,402,624	12,495,000	69.49	-	-	868,330,120
2032	-	-	74,095,934	5,975,479	5,975,479	164,623,846	16,154,383	280,953,750	547,778,870	12,495,000	71.47	-	-	892,990,696
2033	-	-	76,200,258	6,145,182	6,145,182	163,055,767	17,722,462	280,953,750	550,222,602	12,495,000	73.50	-	-	918,351,632
2034	-	-	78,364,346	6,319,705	6,319,705	161,335,477	19,442,753	280,953,750	552,735,736	12,495,000	75.58	-	-	944,432,818
2035	-	-	80,589,893	6,499,185	6,499,185	159,448,201	21,330,028	280,953,750	555,320,242	12,495,000	77.73	-	-	971,254,710
2036	-	-	82,878,646	6,683,762	6,683,762	157,377,731	23,400,499	280,953,750	557,978,149	12,495,000	79.94	-	-	998,838,344
2037	-	-	85,232,400	6,873,581	6,873,581	155,106,283	25,671,946	280,953,750	560,711,540	12,495,000	82.21	-	-	1,027,205,353
2038	-	-	87,653,000	7,068,790	7,068,790	152,614,350	28,163,879	280,953,750	563,522,560	12,495,000	84.54	-	-	1,056,377,985
2039	-	-	90,142,345	7,269,544	7,269,544	149,880,529	30,897,700	280,953,750	566,413,412	12,495,000	86.95	-	-	1,086,379,120
2040	-	-	92,702,388	7,475,999	7,475,999	146,881,341	33,896,889	280,953,750	569,386,365	12,495,000	89.41	-	-	1,117,232,287

	Cash Outflow									Cash Inflow				
Year	Investment Cost	Mining (30% of plant value)	Fuel Cost	Employee Cost	Misc	Interest	Principal	Environment Fee	Total Costs	Total Energy Produced in MW	Price per MWh	Equity Investment	Cash Inflow From Loan	Total per Year
2041	-	-	95,335,135	7,688,317	7,688,317	143,591,026	37,187,204	280,953,750	572,443,750	12,495,000	91.95	-	-	1,148,961,683
2042	-	-	98,042,653	7,906,666	7,906,666	139,981,326	40,796,904	280,953,750	575,587,964	12,495,000	94.57	-	-	1,181,592,195
2043	-	-	100,827,065	8,131,215	8,131,215	136,021,238	44,756,991	280,953,750	578,821,474	12,495,000	97.25	-	-	1,215,149,414
2044	-	-	103,690,553	8,362,141	8,362,141	131,676,751	49,101,478	280,953,750	582,146,815	12,495,000	100.01	-	-	1,249,659,657
2045	-	-	106,635,365	8,599,626	8,599,626	126,910,552	53,867,677	280,953,750	585,566,597	12,495,000	102.85	-	-	1,285,149,991
2046	-	-	109,663,809	8,843,856	8,843,856	121,681,706	59,096,523	280,953,750	589,083,500	12,495,000	105.77	-	-	1,321,648,251
2047	-	-	112,778,261	9,095,021	9,095,021	115,945,305	64,832,925	280,953,750	592,700,283	12,495,000	108.78	-	-	1,359,183,061
2048	-	-	115,981,164	9,353,320	9,353,320	109,652,081	71,126,149	280,953,750	596,419,783	12,495,000	111.87	-	-	1,397,783,860
2049	-	-	119,275,029	9,618,954	9,618,954	102,747,983	78,030,246	280,953,750	600,244,916	12,495,000	115.04	-	-	1,437,480,922
2050	-	-	122,662,440	9,892,132	9,892,132	95,173,717	85,604,512	280,953,750	604,178,684	12,495,000	118.31	-	-	1,478,305,380
2051	-	-	126,146,053	10,173,069	10,173,069	86,864,229	93,914,000	280,953,750	608,224,170	12,495,000	121.67	-	-	1,520,289,253
2052	-	-	129,728,601	10,461,984	10,461,984	77,748,153	103,030,076	280,953,750	612,384,549	12,495,000	125.13	-	-	1,563,465,468
2053	-	-	133,412,893	10,759,104	10,759,104	67,747,195	113,031,035	280,953,750	616,663,081	12,495,000	128.68	-	-	1,607,867,887
2054	-	-	137,201,820	11,064,663	11,064,663	53,852,186	56,026,933	280,953,750	550,164,015	12,495,000	132.34	-	-	1,653,531,335
2055	-	-	141,098,351	11,378,899	11,378,899	48,413,745	61,465,375	280,953,750	554,689,019	12,495,000	136.09	-	-	1,700,491,625
2056	-	-	145,105,544	11,702,060	11,702,060	42,447,403	67,431,716	280,953,750	559,342,534	12,495,000	139.96	-	-	1,748,785,587
2057	-	-	149,226,542	12,034,399	12,034,399	35,901,918	73,977,201	280,953,750	564,128,208	12,495,000	143.93	-	-	1,798,451,098
2058	-	-	153,464,576	12,376,175	12,376,175	28,721,074	81,158,045	280,953,750	569,049,796	12,495,000	148.02	-	-	1,849,527,109
2059	-	-	157,822,970	12,727,659	12,727,659	20,927,937	88,993,671	280,953,750	574,153,646	12,495,000	152.23	-	-	1,902,053,679
2060	-	-	115,932,244	9,349,375	9,349,375	15,084,664	28,866,984	200,681,250	379,263,891	8,925,000	156.55	-	-	1,397,194,288
2061	-	-	82,808,746	9,614,897	9,614,897	12,282,594	31,669,054	200,681,250	346,671,437	8,925,000	160.99	-	-	1,436,874,606
2062	-	-	85,160,514	9,887,960	9,887,960	9,208,532	34,743,116	200,681,250	349,569,332	8,925,000	165.57	-	-	1,477,681,845
2063	-	-	87,579,073	10,168,778	10,168,778	5,836,075	38,115,573	200,681,250	352,549,526	8,925,000	170.27	-	-	1,519,648,009
2064	-	-	90,066,319	10,457,571	10,457,571	2,221,000	41,787,221	200,681,250	355,670,932	8,925,000	175.10	-	-	1,562,806,012
2065	-	-	37,049,681	4,301,826	4,301,826	15,084,664	28,866,984	80,272,500	169,877,482	3,570,000	180.08	-	-	642,875,881
2066	-	-	38,101,892	4,423,998	4,423,998	12,282,594	31,669,054	80,272,500	171,174,036	3,570,000	185.19	-	-	661,133,556
2067	-	-	39,183,985	4,549,640	4,549,640	9,208,532	34,743,116	80,272,500	172,507,413	3,570,000	190.45	-	-	679,909,749
2068	-	-	40,296,811	4,678,850	4,678,850	5,836,075	38,115,573	80,272,500	173,878,658	3,570,000	195.86	-	-	699,219,186
2069	-	-	41,441,240	4,811,729	4,811,729	2,221,000	41,787,221	80,272,500	175,345,419	3,570,000	201.42	-	-	719,077,011
2070	-	-	42,618,171	4,948,382	4,948,382	7,075,210	250,064	80,272,500	140,112,710	3,570,000	207.14	-	-	739,498,798

Year	Profit Before Tax	NPV	VAT Paid	VAT Collected	Difference	Profit Tax	Net Profit/Loss
2015	(813,333)	(813,333)	147,578,667	147,513,600	(65,067)	-	(813,333)
2016	(813,333)	(729,447)	65,067	-	(65,067)	-	(813,333)
2017	(813,333)	(654,212)	65,067	-	(65,067)	-	(813,333)
2018	(813,333)	(586,738)	65,067	-	(65,067)	-	(813,333)
2019	(813,333)	(526,222)	65,067	-	(65,067)	-	(813,333)
2020	(52,347,182)	(30,375,188)	223,886,080	250,441,584	26,555,504	-	(52,347,182)
2021	(47,668,228)	(24,807,317)	2,689,965	29,999,646	27,309,680	-	(47,668,228)
2022	(42,856,391)	(20,002,834)	2,766,360	30,851,636	28,085,275	-	(42,856,391)
2023	(37,907,899)	(15,868,314)	2,844,925	31,727,822	28,882,897	-	(37,907,899)
2024	(32,818,869)	(12,321,109)	2,925,721	32,628,892	29,703,171	-	(32,818,869)
2025	92,324,946	31,086,397	155,035,628	231,402,482	76,366,853	9,232,495	83,092,452
2026	105,780,424	31,943,446	7,735,654	86,271,326	78,535,672	10,578,042	95,202,381
2027	119,618,037	32,396,513	7,955,346	88,721,432	80,766,085	11,961,804	107,656,233
2028	133,848,639	32,511,775	8,181,278	91,241,120	83,059,842	13,384,864	120,463,775
2029	148,483,389	32,346,681	8,413,627	93,832,368	85,418,742	14,848,339	133,635,050
2030	301,258,565	58,859,476	12,113,603	135,096,090	122,982,487	30,125,856	271,132,708
2031	322,927,496	56,585,759	12,457,629	138,932,819	126,475,190	32,292,750	290,634,747
2032	345,211,826	54,251,646	12,811,426	142,878,511	130,067,085	34,521,183	310,690,643
2033	368,129,030	51,886,270	13,175,270	146,936,261	133,760,991	36,812,903	331,316,127
2034	391,697,082	49,513,982	13,549,448	151,109,251	137,559,803	39,169,708	352,527,374
2035	415,934,468	47,154,980	13,934,252	155,400,754	141,466,501	41,593,447	374,341,021
2036	440,860,195	44,825,864	14,329,985	159,814,135	145,484,150	44,086,019	396,774,175
2037	466,493,812	42,540,129	14,736,957	164,352,856	149,615,900	46,649,381	419,844,431
2038	492,855,425	40,308,589	15,155,486	169,020,478	153,864,991	49,285,542	443,569,882
2039	519,965,707	38,139,754	15,585,902	173,820,659	158,234,757	51,996,571	467,969,137
2040	547,845,922	36,040,163	16,028,542	178,757,166	162,728,624	54,784,592	493,061,329
2041	576,517,934	34,016,671	16,483,752	183,833,869	167,350,117	57,651,793	518,866,141
2042	606,004,231	32,065,698	16,951,891	189,054,751	172,102,860	60,600,423	545,403,808
2043	636,327,940	30,192,454	17,433,325	194,423,906	176,990,581	63,632,794	572,695,146
2044	667,512,842	28,411,128	17,928,431	199,945,545	182,017,114	66,751,284	600,761,557

Year	Profit Before Tax	NPV	VAT Paid	VAT Collected	Difference	Profit Tax	Net Profit/Loss
2045	699,583,394	26,705,055	18,437,599	205,623,999	187,186,400	69,958,339	629,625,055
2046	732,564,751	25,079,861	18,961,226	211,463,720	192,502,494	73,256,475	659,308,276
2047	766,482,778	23,534,590	19,499,725	217,469,290	197,969,565	76,648,278	689,834,500
2048	801,364,077	22,067,811	20,053,517	223,645,418	203,591,900	80,136,408	721,227,670
2049	837,236,005	20,677,708	20,623,037	229,996,947	209,373,910	83,723,601	753,512,405
2050	874,126,696	19,362,170	21,208,732	236,528,861	215,320,129	87,412,670	786,714,027
2051	912,065,083	18,118,849	21,811,060	243,246,280	221,435,221	91,206,508	820,858,574
2052	951,080,919	16,945,226	22,430,494	250,154,475	227,723,981	95,108,092	855,972,827
2053	991,204,805	15,838,660	23,067,520	257,258,862	234,191,342	99,120,481	892,084,325
2054	1,103,367,320	15,812,491	23,722,637	264,565,014	240,842,376	110,336,732	993,030,588
2055	1,145,802,606	14,727,028	24,396,360	272,078,660	247,682,300	114,580,261	1,031,222,345
2056	1,189,443,053	13,711,157	25,089,217	279,805,694	254,716,477	118,944,305	1,070,498,748
2057	1,234,322,889	12,760,990	25,801,750	287,752,176	261,950,425	123,432,289	1,110,890,600
2058	1,280,477,313	11,872,785	26,534,520	295,924,337	269,389,817	128,047,731	1,152,429,581
2059	1,327,900,033	11,042,597	27,288,101	304,328,589	277,040,488	132,790,003	1,195,110,029
2060	1,017,930,397	7,591,875	20,045,059	223,551,086	203,506,027	101,793,040	916,137,357
2061	1,090,203,168	7,292,283	14,787,783	229,899,937	215,112,154	109,020,317	981,182,852
2062	1,128,112,513	6,767,584	15,207,756	236,429,095	221,221,339	112,811,251	1,015,301,261
2063	1,167,098,482	6,279,338	15,639,656	243,143,681	227,504,025	116,709,848	1,050,388,634
2064	1,207,135,081	5,824,885	16,083,822	250,048,962	233,965,140	120,713,508	1,086,421,573
2065	472,998,400	2,046,993	6,616,241	102,860,141	96,243,900	47,299,840	425,698,560
2066	489,959,520	1,901,700	6,804,142	105,781,369	98,977,227	48,995,952	440,963,568
2067	507,402,336	1,766,279	6,997,380	108,785,560	101,788,180	50,740,234	456,662,103
2068	525,340,528	1,640,110	7,196,106	111,875,070	104,678,964	52,534,053	472,806,476
2069	543,731,592	1,522,445	7,400,475	115,052,322	107,651,847	54,373,159	489,358,433
2070	599,386,088	1,505,182	7,610,649	118,319,808	110,709,159	59,938,609	539,447,479

Total NPV   1,010,793,311 EUR
Total VAT revenue   7,967,334,327 EUR
Total Profit Tax   3,129,591,773 EUR
Internal Rate of Return (IRR)   **34.81%**

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