Czech University of Life Sciences Prague

Faculty of Economics and Management

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Diploma Thesis

Case Study of Selected Business plan Development in Renewable Energy

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Bc. Lukáš Málek, BSc

Economics and Management

Thesis title

Case Study of selected business pplan development in Renewable energy

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Objectives of thesis

The Aim of the thesis is to analyze, which type of energy (solar or wind) is better for real life business.

Methodology

The theoretical part of the Diploma thesis was written with detailed view of selected important parts in the field of renewable energy. Then was approached types of business and described how the business plan should be build.

The practical part was focused on developing the business plans so that it can be used in real life or business, by analyzing the business itself.

The thesis will contain descriptive and comparative methods, also logical inference methods.

The proposed extent of the thesis

60 – 80 pages

Keywords

Solar energy, Wind energy, Renewable energy, Business in renewable energy, Case Study.

Recommended information sources

BĚLOHLÁVEK, Alexander J. Ochrana přímých zahraničních investic v energetice. V Praze: C.H. Beck, 2011. Beckova edice právo a hospodářství. ISBN 978-80-7400-392-9.

MATUŠKA, Tomáš. Solární zařízení v příkladech. Praha: Grada, 2013. Stavitel. ISBN 978-80-247-3525-2.

QUASCHNING, Volker. Obnovitelné zdroje energií. Praha: Grada, 2010. Stavitel. ISBN 978-80-247-3250-3.

Expected date of thesis defence

2016/17 SS – FEM

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Declaration

I declare that I have worked on my diploma thesis titled "Case Study of Selected business plan development in Renewable Energy" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any third person.

In Prague on _____

Acknowledgement

I would like to thank doc. Ing. Mansoor Maitah, Ph.D. et Ph.D. and Ing. Oldřich Výlupek, MSc, Ph.D.for their support, supervision and assistance during the assessment of my diploma thesis.

Case Study of Selected Business plan Development in Renewable Energy

Případová studie vývoje vybraného byznys plánu v obnovitelných zdrojích

Summary

The diploma thesis deals with solar and wind energy especially in terms of business and also from the perspective to address potential investor within Czech Republic. Diploma thesis was written as a business plan, which includes two different projects with the focus business in solar and wind energy. In business plans was processed all basic information, like are all necessary information for planning of solar or wind project, understanding the possibilities of using solar or wind energy in Czech Republic according to localities through the authorization process, the there was also mentioned which technology is the best for the project from perspective of Author of this thesis. In business plans was also evaluated the economic return and effectivity of potential projects.

Business plans are also used to provide basic information how to do business and how to address potential investor, which is the main purpose of project creation. Also Author provide information about legislation of Czech Republic associated with the project and complete entire financial plan with all aspect which the potential investor should want to know.

Also there has been used analysis of competition and for helping to achieve the success of projects was elaborated SWOT and PEST analysis. The positives, negatives, opportunities and threats are discussed in SWOT analysis and in the PEST analysis could be found factors influencing the whole development of projects.

For the feeling of security during business is recommended to elaborate project analysis for risk reduction. The information obtained during different phases of the projects helps to get financial aspect about anticipated costs and profit.

Keywords: Solar energy, Wind energy, Renewable energy, Business in renewable energy, Case Study

Souhrn

Diplomová práce se zabývá solární a větrnou energií zejména z hlediska podnikání a také z pohledu možného oslovení potenciálního investora v rámci České republiky. Diplomová práce je napsána jako byznys plán, který obsahuje dva rozdílné projekty se zaměřením podnikání v solární a větrné energii. V byznys plánu byly zpracovány všechny základní informace, jako jsou všechny nezbytné informace pro plánování projektů, pochopení možností ohledně využití solární a větrné energie v České republice na základě lokalit přes daná povolovací řízení, také bylo zmíněno, kterou technologii je nejlepší použít pro daný projekt z pohledu autora této práce. V byznys plánu byla také hodnocena ekonomická návratnost a efektivita potenciálního projektu.

Byznys plán také slouží k poskytnutí základních informací jak podnikat a jak oslovit potencionálního investora, což je hlavní účel vytvoření projektů. Dále v diplomové práci naleznete legislativu České republiky spojenou s projektem a kompletní finanční plán se všemi aspekty, které potřebuje potenciální investor znát.

Dále zde můžete nalézt analýzu konkurence a pro dosažení plného úspěchu projektů byly zpracovány analýzy SWOT a PEST. V analýze SWOT naleznete všechny možné positiva, negativa, příležitosti, ale i hrozby daného projektu. V analýze PEST lze nalézt všechny faktory, které ovlivňují vývoj projektů.

Pro pocit bezpečného podnikání je doporučeno vypracovat analýzu projektu pro snížení rizika. Informace získané v průběhu různých fází projektu pomáhá mít představu nad finanční stránkou projektu, což znamená znát předpokládané náklady a profit projektu.

Klíčová slova: Sluneční energie, Větrná energie, Obnovitelné zdroje, Podnikání v obnovitelných zdrojích, Případová studie

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1 Introduction

I always want to make own business and with this are connected thoughts in what industry is good to do business. And there came the idea of why not to do business in the energy industry. Energy resources accompanied mankind since time immemorial. As development of technology continues are discovering new, better and more efficient way of producing energy, on which humanity is increasingly dependent. So it could be said that the energy will be needed always and this is one of the best reasons why to do this type of business.

One of the ways how to produce energy is possibility use of renewables. That means using of inexhaustible assets like wind, water, biomass, sun. There is no doubt that the use of these resources in itself offers great potential and efforts of humanity will be in the future, as much as possible, to break away from dependence on fossil fuels, whose reserves are not inexhaustible. And also due to that the renewables are clear sources of energy there is possibility do something good for our environment.

All above mentioned is the reason why I want and in same time choose to do business in the field of renewables.

In diploma thesis I will deal with creation of business plans for solar energy and wind energy, which has in my opinion, best potential at the territory of Czech Republic. The thesis will provide information about planning and realization of project, including economic evaluation of solar and wind energy.

The thesis was written for addressing of potential investor and this is why there you could find two separate projects with the aim to be able find optimum solution for real business.

2 Objectives and Methodology

2.1 Objectives

Diploma thesis has many aims. First aim is about providing basic information about renewable energies. Second aim is to teach readers how to build business plan. And last aim, which is also the main aim of this thesis, is to create business plan for the purpose of addressing potential investor and due to addressing of investor transfer this project into future realization.

2.2 Methodology

The diploma thesis is divided in to two parts; it means that is divided on theoretical and practical part.

Detailed view on selected important parts could be found in theoretical part of this diploma thesis. These important parts contain definitions and history of renewables like is energies from sun, water, wind and bio fuels. In the theoretical part are also described in detail economics aspects of solar and wind energy on which this thesis is focused. These aspects include for example solar radiation, price of collectors also it includes annual air flow and so on. In a nutshell all factors influencing electricity production and return of power plants.

In the practical part or in the results is inscribed how to create business plan and how to start business with the explanation what is needed for start this type of business. Also there is described legislation connected with the production of electricity from renewable sources, which correspond with the chapter what is needed to start this type of business.

Further thesis describes business plan development in renewables with possibility to do this business in real life. The development is divided on two specific business plans, specifically on the business plan in the field of solar energy and the second one is in the field of wind energy. The author of this thesis had to familiarize with the various laws in terms of entrepreneurship and also in terms of legislation renewables. The information about costs, revenues, profit and return of investment are clearly listed in the business plans.

Also there has been used analysis of competition and for helping to achieve the success of projects was elaborated SWOT and PEST analysis. The positives, negatives, opportunities and threats are discussed in SWOT analysis and in the PEST analysis could be found factors influencing the whole development of projects.

For the feeling of security during business is recommended to elaborate project analysis for risk reduction. The information obtained during different phases of the projects helps to get financial aspect about anticipated costs and profit.

3 Literature Review

3.1 Definitions

In the following chapter will be described definitions of all renewables.

3.1.1 Definition of Renewable Energy

It is type of energy, which is produced form natural processes and that are faster recovered then they are consumed.

Types of renewable energy are following:

- Solar
- Wind
- Geothermal
- Hydro
- Biomass (Certain forms)

Some of these types of renewable energy are also in category called variable renewables. More specifically is talking about solar, wind, wave and tidal energy. For variables renewables we consider those energies, which are based on sources that fluctuate during f given period. [24]

3.1.2 Definition of Solar Energy

Solar energy is a type of energy, which is provided by the sun. Solar energy is in form of solar radiation. This radiation can be transfer to electricity. [19]

Solar energy is one of most popular renewable energy in the world; it is clean, free and really widely available. [7]

For transforming solar radiation into electricity we use many devices. Below are listed devices for direct producing of energy.

We divided these devices into two groups:

- Thermal solar collectors

- Photovoltaic solar panels

Thermal collectors are made for producing of thermal energy, like water heating of pool or household. And the photovoltaic panels produce electric energy. [48]

3.1.3 Definition of Wind Energy

Wind energy is a just another type of solar energy. The wind is created in atmosphere due to heating of air and Earth surface, when the hot air goes up and cold air change with hot air. Thanks to this heating, changing hot and cold air, and also by rotation of Earth are caused air flows, which are used for collecting of wind energy. Not even rotation of Earth but also Earth terrain, bodies of water and vegetative cover caused intensity a direction of air flows. [56]

For generating of electricity from air flows serves wind turbines. Wind energy is converted into rotation mechanical power (collected in turbines) by aerodynamics forces which act on the rotator leafs of wind turbine. The mechanical power is source of electricity power through generator of turbine. [4]

3.1.4 Definition of Geothermal Energy

Geothermal energy is the oldest energy on the Earth. Geothermal energy is caused by thermal energy of earth's core, which arises from decay of radioactive substances and by effect of tidal forces. Eruptions of volcanoes and geysers, hot spring or steam sprains are proof of thermal energy. [3]

Advantages of geothermal energy are – small impacts on environment, independence on supply of fuels, almost automated operation and stable performance. And also there are disadvantages like uncertainty in geological conditions. [3]

Within European Union best conditions for planting geothermal energy has Island. [3]

3.1.5 Definition of Biomass

Biomass is substance of biological origin, like are animal biomass, organic products or wastes but also plant biomass grown in soil or water. In biomass is saved solar energy. [3]

Biomass is divided into two basic groups [54]:

- Biomass cultivated for energetic purposes
- Waste biomass

These two groups are further divided according to characteristic of biomass on [54]:

- Dry – can be burn directly
- Wet – liquid waste
- Special – for obtaining of energy substances

Table1: Advantages and disadvantages in area of biomass usage

Advantages	Disadvantages
Usage of waste	Weak efficiency of electricity production
Availability of technology for combustion	In some cases necessary to do fuel treatment
Equal Balance of Carbon Dioxide	Costs for certain treatments
Fuel treatments options	Costs for transportation
Constant availability of energy	Need to have storages
Possibility to use in households	Production is not emission-free

Source: own table, Biomass - oenergetice.cz, 2017

3.2 History of Renewable Energy

3.2.1 History of the use of Solar Energy in the Czech Republic

One the first solar collectors, which were use in Czech Republic occurred in 1997, at that time it was in Czechoslovakia. It was time when can be seen increase in researches of usage of non-fossil energy sources after oil crisis in 1973. After this situation, in eighties years, Czech Republic helps to start, by state aids, development of solar thermal technology of fuels and energy. For this purposes was establish government program for usage of solar energy and heat pumps. The program was focused on usage of solar energy in the field of national economy, like is preparing of hot water in agriculture and food industry, family houses and apartments, but also for sport facilities and public pools, even for schools, public facilities and others. [30]

In 1985, has appeared decline in interest of using solar energy and solar collectors. This decline was caused by low lifetime of produced collectors and also by bad economy of Czech Republic. It went too far that after 1989, due to privatization of state enterprises, there was decrease of active solar system by 60 percent of total systems. [30]

But for real boom in this area of renewables, within Czech Republic, can be consider year 2003. From this year were utilized government program and also were provided government subsidies through State Environmental Fund in the amount of 30 percent from total costs on solar system installation for both individuals and legal entities. In the 2005, was stabilized a business environment and this stabilization leads to attracting of investors. [55]

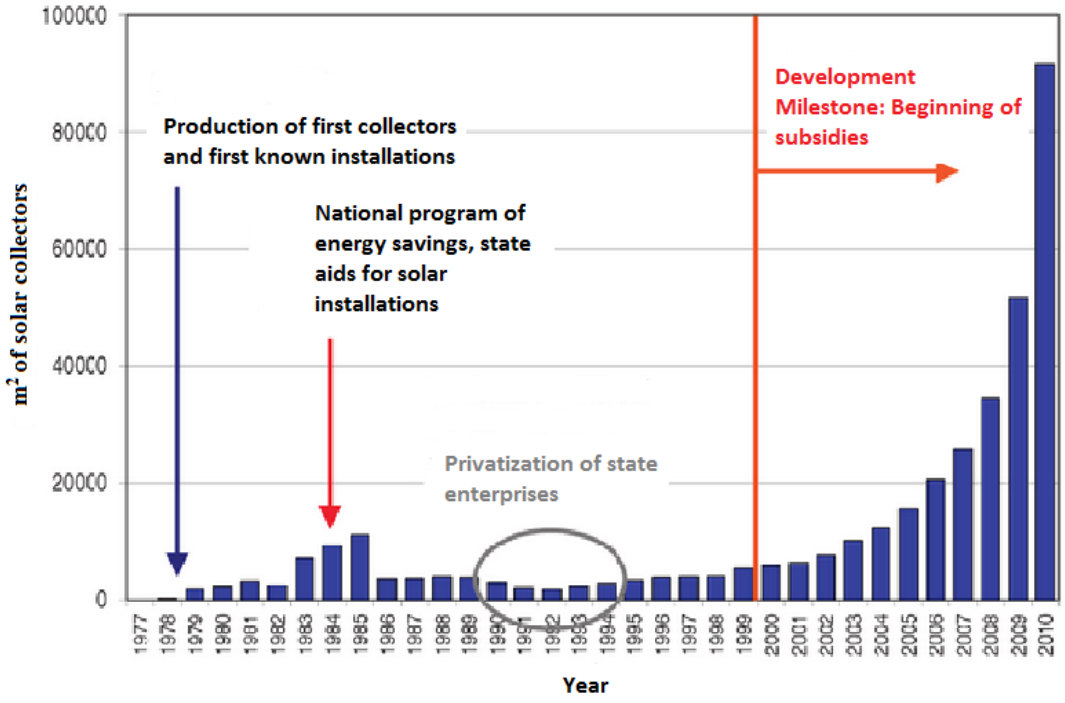
During the year 2006 was managed installation of solar systems which supply electric power to distribution network. [55]

In the year 2007 was establish six-year program of subsidies from the European Union and purchase prices are very high. [55]

But from 2013 appears a big drop in purchase prices and operating the solar systems are no longer so advantageous. [14]

Czech Republic committed to the European Union that the amount of electricity power from renewables must be 13% from total sum of electrical power produced in Czech Republic. This must be accomplished till the year 2020. [1]

Figure 1: Market development of solar collectors in the history of the Czech Republic



Source: Tomáš Matuška, Solar installations in examples, 2013

Table2: Historical breakdown of motivational tools for the years 2000 – 2006

Year	Motivational tool
2000	The announcement of the Sun to schools (State Environmental Fund)
2001	The introduction of discounted 5% VAT rate for photovoltaic systems and components
2002	The introduction of the obligation to purchase electricity from small resources, legislation of Energy Regulatory Office
2002	Determining the purchase price of electricity power from photovoltaic systems 6 CZK / kWh, pricing decisions Energy Regulatory Office
2003	Program to support the installation of photovoltaic systems connected to the distribution network
	The subsidy of 30% of investment costs for individuals to 2 kW
	The subsidy of 30% of investment costs for legal entities to 20 kW
2006	Determining the purchase price of electricity power from photovoltaic systems 13.20 CZK / kWh, pricing decisions Energy Regulatory Office

Source: Own table, RENEWABLE ENERGY SOURCES and the possibilities of their application in the Czech Republic, ČEZ Group, 2010

3.2.2 History of the use of Wind Energy in the Czech Republic

First historically documented information about using of wind energy is dated to 1277. In past the wind energy was used in windmills. The first declared windmill in Bohemia, Moravia and Silesia was in the garden of Strahov Monastery in Prague. If we talk about the biggest boom in wind milling industry at area of Czech Republic, it starts in Bohemia in forties years of nineteen century. Meanwhile in Moravia and Silesia this boom starts thirty years later, respectively in seventies of nineteen century. [55]

The next historic phase in the field of wind energy in Czech Republic may be considered the period of wind turbine powering water pumps. This phase is dated to first decade of twentieth century and starts thanks to the biggest Czech producer of turbines called Sigma enterprise. [55]

In the nineties of twentieth century, in the Czech Republic, may be seen expansion in producing of big wind power plants and also the phenome called Czech paradox. Czech paradox is particular dynamic development of wind energy; it means that in the Europe is possible to see exponential growth of newly installed wind power plants, but in Czech Republic exponential growth may be seen from 1990 – 1995 and then there was a big drop in producing and installing of new wind power plants, respectively abandoning from this type of electricity production. This whole situation was caused by indifference of state

authorities about the new emerging area of power production and also due to low purchasing price for wind energy. For these reasons Czech companies ceased to exist and Czech Republic lost her primacy in wind energy field. Last built wind power plant was in 1996. [55]

For the development of wing energy between years 1990 – 1995 is responsible assumption of businessmen that the purchase prices will increase and also that there will be government support trough regulations, subsidies, etc. But as was mentioned above the government doesn't care about this area. [55]

In the years 2002 – 2003 it began to build wind turbines again, to this renewed development helps Energy Regulatory Office, with new statements about wind energy. The Energy Regulatory Office determines the purchase prices and also provides support for development of new technologies. [55]

For interest, there is listed several historic wind power plants, which are still in operation [55]:

- Wind World – placed at Anteater in Hruby Jesenik, in operation from 1993
- Vestas – placed at Ostružná, Šumperk, in operation from 1994
- Enercon – placed at Jindřichovice pod Smrkem, in operation from 2003

3.3 Economic aspects of Solar Energy in Czech Republic

Solar energy seems to be a very lucrative source of energy, because is abstracted from the Sun and the Sun is a form of an inexhaustible source of energy with no negative effect on environment. Solar energy and its intensity are dependent on climate conditions of different parts of the earth's surface. Next advantage of solar energy is that it is possible to use it not just in areas with long sunlight but also in areas with high altitudes. [29]

Economic aspects are divided into:

- Intensity of Solar radiation
- Duration of Solar radiation
- Subsidies
- Price of collectors

3.3.1 Intensity of Solar radiation

The intensity of sunlight is calculated by the sum of energy content of incident solar radiation to $1m^2$ of all sunlight hours for the entire year. This value is specified for horizontal surface and this value varies according to the position of the region in the Czech Republic. [21] [53]

Figure 2: The intensity of solar radiation in Czech Republic (kW/h)

Source: European Commission, Joint Research Centre, PVGIS © European Union, 2001-2012[26]

On the figure 2 can be seen increase in intensity of solar radiation from north to south. There is obvious that there are other values in big cities than in wild or areas not affected by agglomeration. This changing of solar radiation intensity is caused by air pollution especially the amount of air emissions and increased incidence of dust and soot in cities. [21]

The intensity of solar radiation is also influenced mainly by season and its weather, but also with the position of the Sun on the sky. In bad weather, there is a significant part of the incident solar radiation is reflected or scattered by clouds, which is also one of the reasons a lower intensity of solar radiation in the winter months. [35]

In latitudes of the Czech Republic is counted with 75% of total annual sum of solar radiation for period between April and September. These better conditions in summer

season are affected mainly by longer and fewer cloudy days and also with a higher position of the Sun in the sky. [21]

It is indicated that the annual average of intensity of solar radiation is approximately 1081 kWh/m^2. But for real number is taken that total annual intensity of solar radiation on territory of the Czech Republic is between 1000 - 1250 kWh/m^2. Due to geographical position of Czech Republic solar radiation is generally available everywhere, thus there is no strictly need to choose some special right area for solar system. Solar system at Czech Republic territory with performance 1 kWh can produce roughly 900 – 1000 kWh of electric power yearly. [55]

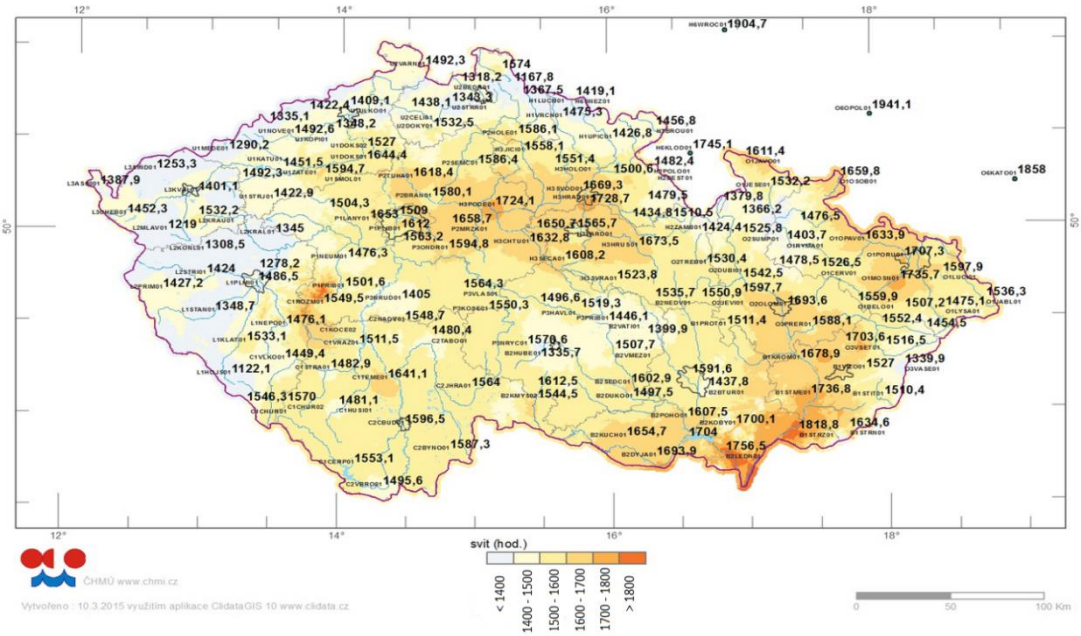
3.3.2 Duration of Solar radiation

The total duration of solar radiation for the period of last 10 years is approximately 1400 – 1700 hours for entire year. [37]

But based on the data from Czech Hydro Meteorological Institute and by own calculation from these data, was calculate that the average of total hours of solar radiation for the year 2015 is 1460 hours and the total number of hours for each region in the Czech Republic in 2015, is divided into 1300 – 1800 hours. [46]

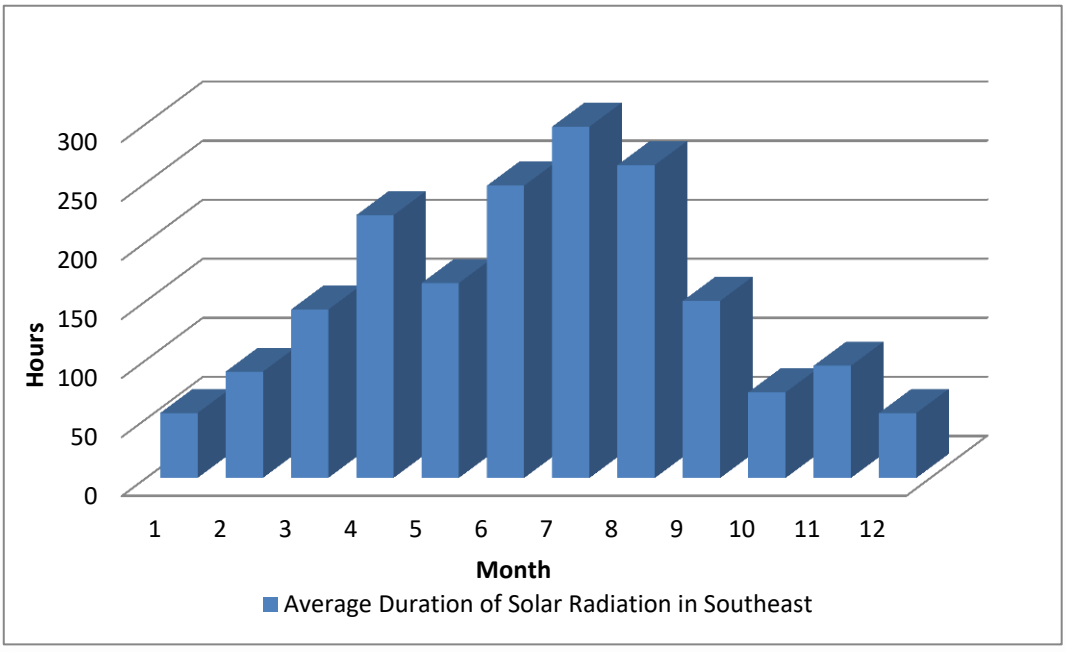
From the data provided on website of Czech Hydro Meteorological Institute, we can estimate that lowest values of duration of solar radiation is in northwest Bohemia, but average duration of solar radiation is increasing towards the southeast. From the figure 3 it is obvious that highest duration of solar radiation is on south Moravia.

Figure 3: The Duration of Solar radiation in Czech Republic, in 2015 (h/year)



Source: Czech Hydro Meteorological Institute, 2016

Figure 4: The Average Duration of Solar radiation in Southeast area, in 2015 (h/month)



Source: Czech Hydro Meteorological Institute, Own calculation and own graph, 2017

3.3.3 Subsidies

In this chapter subsidies will be divided into three parts. First part is government subsidies and second part will be focused on subsidies from the European Union, also last part is about domestic subsidies. It will be described how purchase prices changed, which options

of subsidies are possible to use and which subsidies were used, but they are no longer valid now.

3.3.3.1 Government subsidies

In solar energy are government subsidies divided into two groups. First group are green bonuses and second feed-in-tariff.

Feed-in-tariff is a minimal purchase price for electric power generated by renewables, stated by government. Government stated for this purposes Energy Regulatory Office, which takes all responsibilities focused on renewables. Energy Regulatory Office stated fixed feed-in-tariff by price decision issued for each year. These purchase prices are stated in Czech crowns for one kilowatt per hour or one megawatt per hour for electric power. The minimal Feed-in-tariff is guaranteed for 20 years and it is stated that purchase price will every year rises by 2% but maximally by 4%. Therefore, purchase prices for feed-in-tariff are differs according to time of commissioning and on the basis of system performance. According to time of commissioning is it because there is lowering of purchase prices every year. And according to the basis of solar system performance are divided into three groups with regard to their power supply – power supply to 30 kW, to power supplies between 30 – 100 kW and last group are power supplies over 100 kW. [55]

Next group us been told are the green bonuses, which are equally important as feed-in-tariff. The system of green bonuses works on principle of free market. Where, every producer of electric power from solar system must find own consumer. But is know that producing of electric power from solar radiation is unstable, due to this there are lower purchase prices from consumers. That is why the green bonuses were set. By green bonuses are regulated risks and is there situation, which leads to balancing of market price and thus the resulting price slightly higher than in the feed-in-tariff. The State favors entities which have their own initiative and use the free market and also finding of consumer by themselves. [55] [14]

In figure 5 may be seen the difference between Feed-in-tariff and Green bonuses. Also you can find there how the purchase price changes during of years. Before year 2006 there are no special subsidies from government, producer can only apply for donations on investment. Also there is clearly visible that when subsidies started they were huge, but

during years they rapidly decrease. Subsidies starts in 2006 with purchase price about 16,000 CZK for 1 MWh, but into the 2013 fell to 2,600 CZK per 1MWh.

Figure 5: The Purchase Prices for Solar Energy

	Supported type of energy	Date of commissioning		Installed power of system (kW)		Single-zone operation	
		From	To	From	To	Feed-in-tariff (CZK/MWh)	Green bonuses (CZK/MWh)
ř./sl.	a	b	c	d	e	l	m
501	Production of electricity using solar radiation	1.1.2006	31.12.2007	-	-	16 518	15 918
502		1.1.2008	31.12.2008	-	-	16 110	15 510
503		1.1.2009	31.12.2009	0	30	15 115	14 415
504		1.1.2009	31.12.2009	30	-	15 004	14 404
505		1.1.2010	31.12.2010	0	30	14 077	13 377
506		1.1.2010	31.12.2010	30	-	13 966	13 366
507		1.1.2011	31.12.2011	0	30	8 446	7 746
508		1.1.2011	31.12.2011	30	100	6 647	6 047
509		1.1.2011	31.12.2011	100	-	6 194	5 594
510		1.1.2012	31.12.2012	0	30	6 802	6 102
511		1.1.2013	30.6.2013	0	5	3 691	2 991
512		1.1.2013	30.6.2013	5	30	3 064	2 364
513		1.7.2013	31.12.2013	0	5	3 236	2 536
514		1.7.2013	31.12.2013	5	30	2 632	1 932

Source: Energy Regulatory Office, The Energy Regulatory Journal, Own improvements, 2016

There was also support from government relating to taxation. Until the year 2010 there was tax breaks or we can call it tax holidays. It means that producers of electric power from solar radiation were exempted on income tax for 6 years from commissioning of solar system. But from 2001 it was cancelled and all producers must pay income tax even if their solar systems are new. The value of income tax till 2010 was 19%, but from 2011 is value 26%. This action should lead to avoid raising prices for electricity. [23]

3.3.3.2 EU subsidies

The European Union established Operational Program Environment, which stated that in the years 2007 – 2013 subsidies will be for Czech Republic in amount of 5 billion Euros for renewables energy. Czech Ministry of Industry and Trade, therefore, established the Operational Program Enterprise and Innovations. This operational program established for Czech Republic, in years 2007 – 2013, is aims to promote and develop the business environment particularly in the small and medium-sized enterprises. It means that the Ministry of Industry and Trade helps, by this program, to draw financial support from EU

funds. The program is divided into three priority axes, when the renewables are on axis three with program called ECO-ENERGY. [49] [8] [34]

The program ECO-ENERGY was focused on greater use of renewable and alternative energy sources and their sustainable growth. The program was divided into three parts, always for a certain period of time one and each part corresponded to a single invitation. In the first invitation was possible to apply for subsidies in the amount of 0.5 million Czech crowns up to 100 million Czech crowns. Second invitation offers subsidies in the amount from 0.5 million Czech crowns up to 250 million Czech crowns and the third invitation offers same subsidies. [49] [8] [34]

Today is no longer possible to apply for EU subsidies in terms of business sites; subsidies from EU funds are intended only for homeowners. These subsidies are provided within program Green savings (Czech name – Zelená úsporám), and request for this type of subsidies can be done between years 2016 – 2021. The size of subsidy is from 35,000 to 100,000 Czech crowns, but maximum 50% of the total investment. [50]

3.3.3.3 Domestic subsidies

Domestic subsidies are support provided by certain cities of Czech Republic. This support is at the moment provided by 5 cities, which are Prague, Pilsen, Kladno, Litomerice and Nachod. [49]

The installation of solar heating systems, cities provides the following subsidies [49]:

- Prague - 4,000 CZK per m^2 of system, max. 50% of documented costs, but not exceeding 80 000 CZK
- Pilsen – 2,000 CZK per m^2 of system
- Kladno – 2,000 CZK per installed kilowatt of thermal system
- Litomerice - CZK 40,000 per project
- Nachod - 10,000 CZK for water heating system, 15,000 CZK for the system to support heating

The installation of solar systems for producing of electric power to distribution network, cities provides the following subsidies [49]:

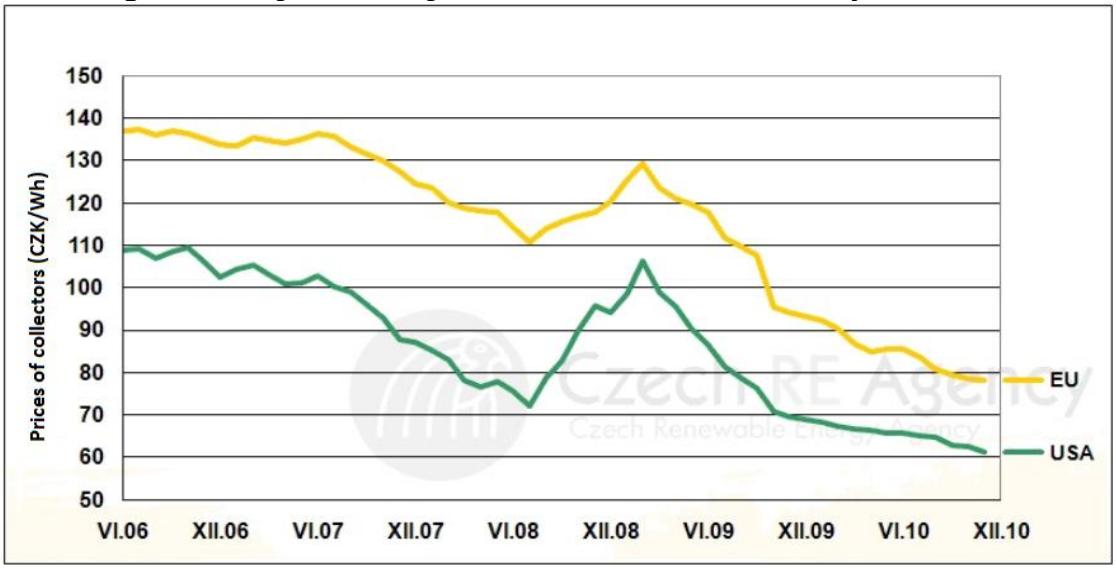
- Prague - 4,000 CZK per m^2 of system, but not exceeding 80,000 CZK
- Plzen - 20 CZK per Wh for system with an output of up to 5 kWh

3.3.4 Price of collectors

There is a trend that the price of collectors are falling annually on average by 20%; it happens when it rise the number of installed capacity of solar systems in the world, when the installed capacity of solar system will increase by twice, the price on market automatically drop. Prices of collectors after 2000 were around € 5 per one Wh. However, operational support of collectors slashed prices below 1 € per Wh. For the year 2016 prices decrease only by just 5% due stagnation of European markets, but still this decrease helps to producer have higher profits. [38] [52]

So we can say that the conditions for entrepreneurs in this area are ideal due to constant price falls of collectors and thus there is an opportunity to get connected solar power system for reasonable money.

Figure 6: The price development of solar collectors between years 2006 - 2010



Source: Czech Renewable Energy Agency, Photovoltaics - the development of investment costs, 2011

3.4 Economic aspects of Wind Energy in Czech Republic

Wind energy similarly s solar energy is one of inexhaustible power of energy and actually we can use it thanks to the sun. How the wind energy is made was told in definitions. As been previously told Wind Energy was used for windmills in past, but today is mostly used

for producing of electric power. To produce electric power are used wind power plants that are mounted with turbines. Most common types of turbines are turbines with three-bladed propeller. In these days are wind power plants are projected as a group of plants, which are called the wind farms. [37]

Wind energy has advantage against solar energy in the fact that wind blows all year round.

Similarly as in solar energy chapter we will separate economic aspects of wind energy in the Czech Republic and we will bring why should to do business in this area.

Economic aspects are divided into:

- Intensity of Air Flow
- Wind Potential
- Subsidies
- Price of Turbines

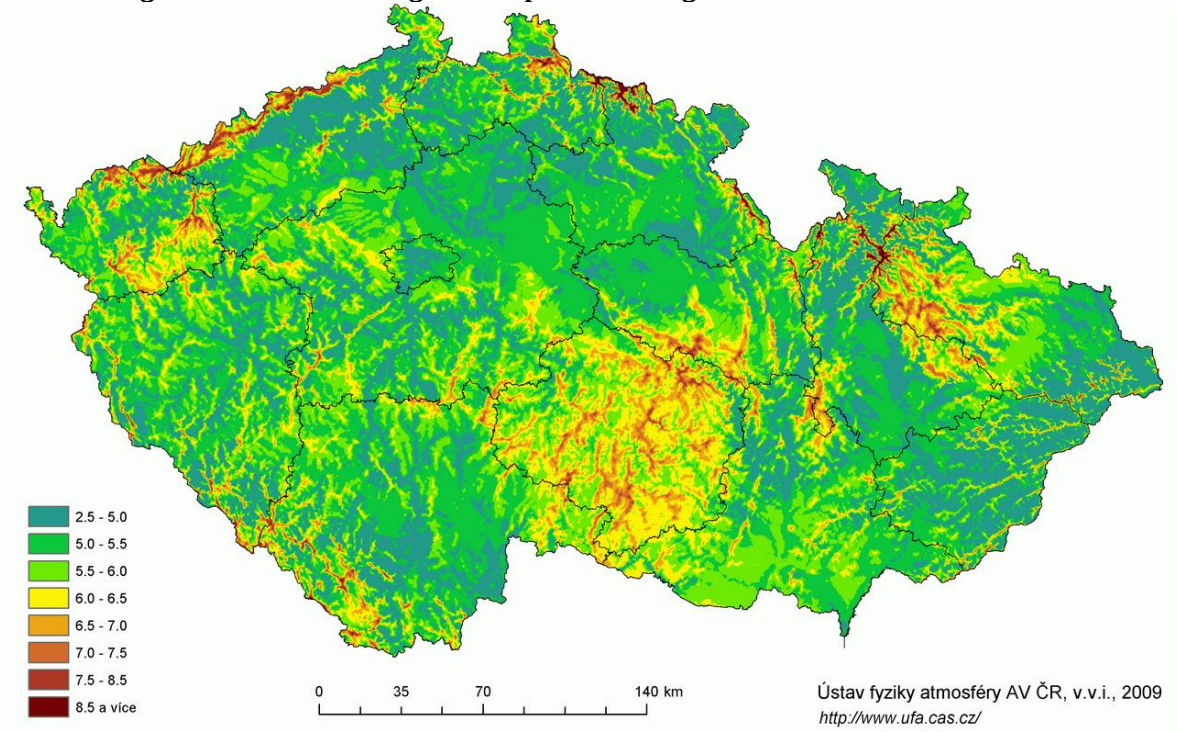
3.4.1 Intensity of Air Flow

The intensity of air flow is calculated from average of wind density, another important aspect is the speed of the wind, which is the most important and also by performance of wind power plants. In calculations is usually neglected influence of wind density and thus is not counted with it. For calculation of intensity of air flow on turbines are usually used turbines at a height of 40 meters or 80 meters. In nowadays are most used turbines at a height of 80 meters. The performance is expressed as power of one Watt per square meter. [55]

For wind energy in wind power plants is the most important variable wind speed, because wind energy increases with the cube of its speed. Location suitable for wind power should have an average wind speed of 5 meters per second. The minimal speed of wind for producing electric power in wind power plants is speed of 3.5 – 5 meters per second. All wind power plants are constructed to work with wind speed 15 meters per second to achieve maximum of their energy yield. If the wind speed is more than 15 m/sec. then the performance of turbine is artificially reduced. [31]

To compute wind speed was set computer program VAS and WasP, stated by Institute of Atmospheric Physics ASCR. The calculation of average annual wind speed is measured from a height of 10 meters to 140 meters above the surface. The annual average of wind speed in Czech Republic is 6 meters per second at a height of 100 meters. [55]

Figure 7: Field of average wind speed at a height of 100 m above the surface



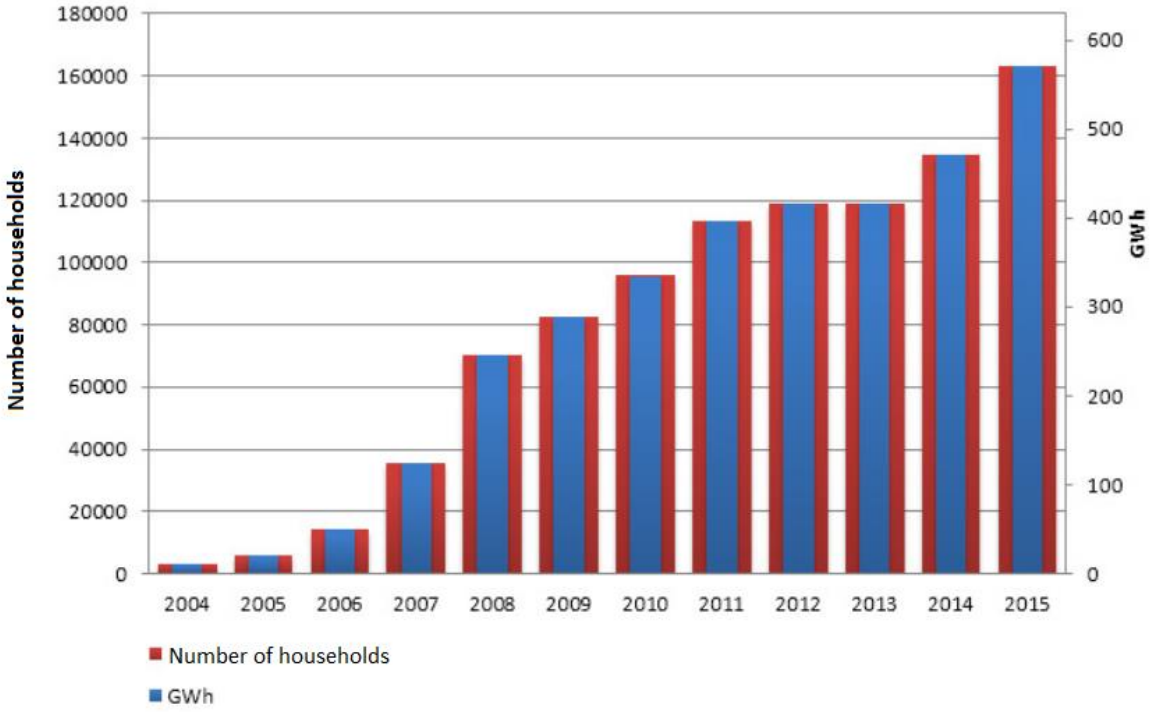
Source: Institute of Atmospheric Physics ASCR, 2009

On the figure 7 can be seen that intensity of air flow is highest at mountains, meanwhile in lowlands the intensity of air flow decreasing. Therefore, it is recommended to build wind power plants in the mountains in order to ensure the most power for electricity generation.

It is calculated that the one wind power plant, with performance 2MW, will produce on average 4,430 MWh of electric power per year, which is enough energy for 1,265 households. Based on the data from Czech Society for Wind Energy, was average monthly production for year 2015 approximately 47 646 MWh of electric power, which corresponds after conversion to have enough energy for approximately 13,605 households. Overall, the Czech Republic has 283 wind turbines, which produce together 572 GWh for year 2015. [5] [6]

It can be said that wind conditions in Czech Republic are very ideal for producing electric power from wind turbines and this type of business in the Czech Republic thrive, even though its full potential is not yet realized.

Figure 8: Production of wind power plants in the Czech Republic + electricity consumption from wind in relation to the number of households, in GWh



Source: Czech Society for Wind Energy, 2015

3.4.2 Wind Potential – Selection of suitable locations

One of the most important economic aspects from the perspective of an investor is right selection of suitable location. Thanks to right selection of locations can be computed the return on investment in wind power plants.

Wind potential or as is called selection of suitable location, related to previous chapter on intensity of air flow. The speed of wind is one criterion to select right location. Second criterion is wind density. [55]

Wind speed as was told before are measured by VAS and WAsP programs. It means that if it is found that selected location is suitable, it is appropriate to make an opinion from the closest weather stations measuring wind speeds at conversion due to altitude, terrain and

other data that affect the speed of the wind. This opinion is made as result of mathematic model given by program VAS and WasP. [55]

Based on the result of opinion are placed weather stations at chosen location, where stations continues to measure the fair value of the wind at the site location, which can be held up to one year from start of measuring. The opinion and measurement is very important especially for large projects. After measurement there is evaluation of results and also leads to accurate of financial budget for large projects. [55]

In terms of wind density is understand under this term performance, which is possible to get by 100% usage of kinetic energy of wind flowing through a unit area normal to the direction current flow direction. Wind density is calculated by function in figure 8.

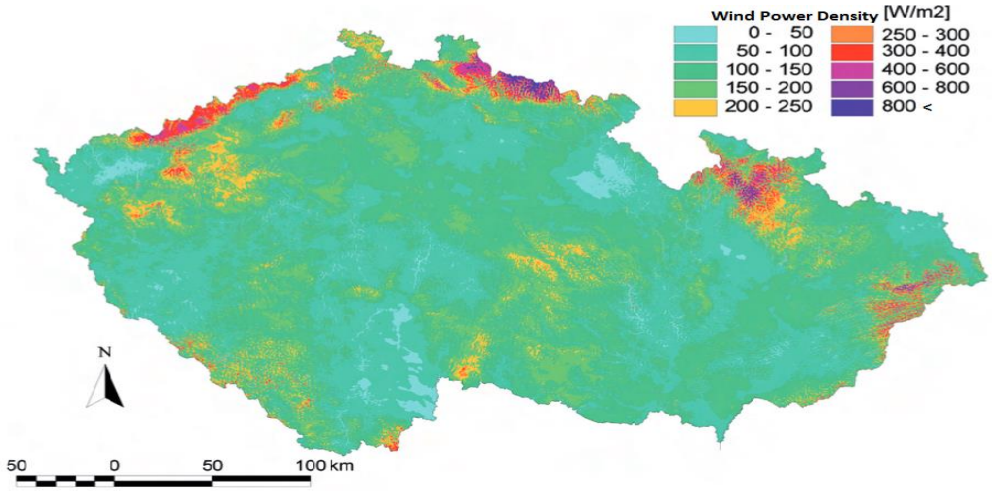
Figure 9: Function of wind power density

$$P = \frac{1}{2} \rho u^3$$

Source: RENEWABLE ENERGY SOURCES and the possibilities of their application in the Czech Republic, ČEZ Group, 2010

Wind power density value is determined as one Watt per square meter. Wind power dependence on the density of air is expressed in the real atmosphere by function of altitude and then by function of the non-periodic alternation of hot and cold air masses. Simply we can say that if we consider as a basis the performance of wind power plants at sea level, so performance will be at altitude of 500 m lower on output by 5%, at altitude of 800 m by 7% and at altitude of 1,200 m will be output lower by 11%. The power, which can be produce by wind turbines are determined by the performance curve, which is a basic indication of each type of wind power plants. [55]

Figure 10: Wind Power Density at I height of 40 meters at territory of Czech Republic, Data from VAS/WAsP



Source: RENEWABLE ENERGY SOURCES and the possibilities of their application in the Czech Republic, ČEZ Group, 2010

From above mentioned follows that the performance of wind power plants is dependent extremely sensitive to wind speed and without all information, which have been mentioned is construction of wind power plants very risky, so it is very important let the professionals handle the necessary documentation before construction for avoiding risks and also for successfully launching of this business.

3.4.3 Subsidies

Subsidies in this chapter are similarly divided as for solar energy. They are divided only into two groups which are almost same as subsidies in solar energy, but with small changes, which will be described below. Subsidies from European Union are exactly the same for wind and solar energy.

3.4.3.1 Government subsidies

In wind energy are government subsidies divided into two groups. First group are green bonuses and second feed-in-tariff.

Feed-in-tariff is a minimal purchase price for electric power generated by renewables, stated by government. Government stated for this purposes Energy Regulatory Office, which takes all responsibilities focused on renewables. Energy Regulatory Office stated fixed feed-in-tariff by price decision issued for each year. These purchase prices are stated in Czech crowns for one kilowatt per hour or one megawatt per hour for electric power.

The minimal Feed-in-tariff is guaranteed for 20 years and it is stated that purchase price will every year rises by 2% but maximally by 4%. Therefore, purchase prices for feed-in-tariff are differs according to time of commissioning and they are decreasing every year based on commissioning. [55] [14]

In this case subsidies are not divided according to types of power, which they have as it was in solar energy. But these types of power should be named for an overview. Wind power plants are divided into small, middle and big power plants. Small are with power from 10 kW to 60 kW, middle are with power from 60 kW to 750 kW and last group are big power plants with power from 750 kW to 6,400 kW. In figure 9 you can see categorization of wind power plants according to ČEZ group. [55]

Figure 11: Categorization of Wind Power Plants, according to ČEZ Group

Wind Power Plants								
Small			Middle			Big		
Propeller		Power up to (kW)	Propeller		Power up to (kW)	Propeller		Power up to (kW)
Diameter (m^2)	Surface (m^2)		Diameter (m^2)	Surface (m^2)		Diameter (m^2)	Surface (m^2)	
≤ 8	≤ 50	10	16,1–22	200,1–400	130	45,1–64	1600,1–3200	1500
8,1–11	50,1–100	25	22,1–32	400,1–800	310	64,1–90	3200,1–6400	3100
11,1–16	100,1–200	60	32,1–45	800,1–1600	750	90,1–128	6400,1–12800	6400

Source: RENEWABLE ENERGY SOURCES and the possibilities of their application in the Czech Republic, ČEZ Group, 2010

Next group us been told are the green bonuses, which are equally important as feed-in-tariff. The system of green bonuses works on principle of free market. Where, every producer of electric power from solar system must find own consumer. But is know that producing of electric power from wind power plants is unstable, due to this there are lower purchase prices from consumers. That is why the green bonuses were set. By green bonuses are regulated risks and is there situation, which leads to balancing of market price and thus the resulting price slightly higher than in the feed-in-tariff. The State favors entities which have their own initiative and use the free market and also finding of consumer by themselves. [55] [14]

In figure 10 may be seen the difference between Feed-in-tariff and Green bonuses. Also you can find there how the purchase price changes during of years. Also there is clearly visible that when subsidies for wind energy started they were not a huge as subsidies for solar energy. It is due to that from wind power plants could be produced more electric power than in from solar collectors, but there is still rapid decrease during years 2006 - 2017. Subsidies starts in 2006 with purchase price about 3,000 CZK for 1 MWh, but for

year 2017 were set to about 1,900 CZK per 1 MWh and in green bonuses even to 1,430 CZK per 1 MWh.

Figure 12: The Purchase Prices for Wind Energy

	Supported type of energy	Date of commissioning		Single-zone operation	
		From	To	Feed-in-tariff (CZK/MWh)	Green bonuses (CZK/MWh)
ř./sl.	a	b	c	j	k
403	Wind power plant	1.1.2006	31.12.2006	3 146	2 646
404		1.1.2007	31.12.2007	3 091	2 591
405		1.1.2008	31.12.2008	3 015	2 515
406		1.1.2009	31.12.2009	2 750	2 250
407		1.1.2010	31.12.2010	2 573	2 073
408		1.1.2011	31.12.2011	2 517	2 017
409		1.1.2012	31.12.2012	2 462	1 962
410		1.1.2013	31.12.2013	2 294	1 794
411		1.1.2014	31.12.2014	2 137	1 637
412		1.1.2015	31.12.2015	2 060	1 560
413		1.1.2016	31.12.2016	1 969	1 469
414		1.1.2017	31.12.2017	1 930	1 430

Source: Energy Regulatory Office, The Energy Regulatory Journal, Own improvements, 2016

For wind energy was there tax holidays, but they met same end as taxation in solar energy. Tax holidays are only for wind plant up to 30 kW, but with condition that produced energy must be all consumed in the place of production. [33]

3.4.3.2 EU subsidies

The European Union established Operational Program Environment, which stated that in the years 2007 – 2013 subsidies will be for Czech Republic in amount of 5 billion Euros for renewables energy. Czech Ministry of Industry and Trade, therefore, established the Operational Program Enterprise and Innovations. This operational program established for Czech Republic, in years 2007 – 2013, is aims to promote and develop the business environment particularly in the small and medium-sized enterprises. It means that the Ministry of Industry and Trade helps, by this program, to draw financial support from EU funds. The program is divided into three priority axes, when the renewables are on axis three with program called ECO-ENERGY. [8] [34] [49]

The program ECO-ENERGY was focused on greater use of renewable and alternative energy sources and their sustainable growth. The program was divided into three parts, always for a certain period of time one and each part corresponded to a single invitation. In the first invitation was possible to apply for subsidies in the amount of 0.5 million Czech crowns up to 100 million Czech crowns. Second invitation offers subsidies in the amount from 0.5 million Czech crowns up to 250 million Czech crowns and the third invitation offers same subsidies. [8] [34] [49]

Today is no longer possible to apply for EU subsidies in terms of business sites; subsidies from EU funds are intended only for homeowners. These subsidies are provided within program Green savings (Czech name – Zelená úsporám), and request for this type of subsidies can be done between years 2016 – 2021. The size of subsidy is from 35,000 to 100,000 Czech crowns, but maximum 50% of the total investment. [50]

3.4.4 Price of Wind Turbines

In the field of price and costs for wind turbines may be seen similar trend as in solar energy. The prices for wind turbines are constantly decreasing, but it still doesn't mean that construction of wind power plants is cheap affair. The construction of wind farms is worth millions CZK and the small wind turbines for household usage is investing several tens to hundreds of thousands of Czech crowns. [45]

The price of wind turbines is affected by several factors. Factors are following [45]:

- Size of wind turbines - the size and the possibility of installed capacity in kWh
- Technology
- Branch – Prices are different between well-known companies and Asian companies

If we want to have wind energy for doing business we also must compute with costs related to construction (like are excavating, cables, etc.) of wind farms and costs will going to millions Czech crowns.

It must be mentioned that into costs must be insert also energy for operation of wind turbines. With regard to the environmental impact, we must mention the so-called energy return. I t is important to say that wind power plants have one of the shortest energy return for ensuring of their lifecycle. This energy return is within a few months. It is known that

after 3-6 months of operation, wind turbines are able to produce energy required for its manufacture, installation, operation, maintenance and disassembly. [45]

3.5 The share of renewable energy in electricity consumption in the Czech Republic

The share of renewables in electricity consumption in the Czech Republic in last years is almost same. The share of renewables is only a few percentage units from total consumption of electricity, in 2007 was share about 5%, in 2012 it was 11.5%. The Czech Republic is committed to the European Union to have, until the year 2020, share in electricity consumption at point of 13%. This share of 13% from renewables was reached by Czech Republic in 2013 and from this date is approximately equal. [9]

From last published data is share of renewables in electricity consumption for year 2015 is 13.27%; year growth thus amounted to only a tenth of a percentage point. Gross electricity consumption, which includes electricity consumed in production, losses in networks and pumped storage hydropower plants in the Czech Republic last year amounted to 71 TWh. Total electricity consumption increase in 2015 by 2%. [9]

Czech state government has decided, based on the faster achievement in share of renewables to increase its stake in 2020 to 15.3% of total electricity consumption in the Czech Republic. [51]

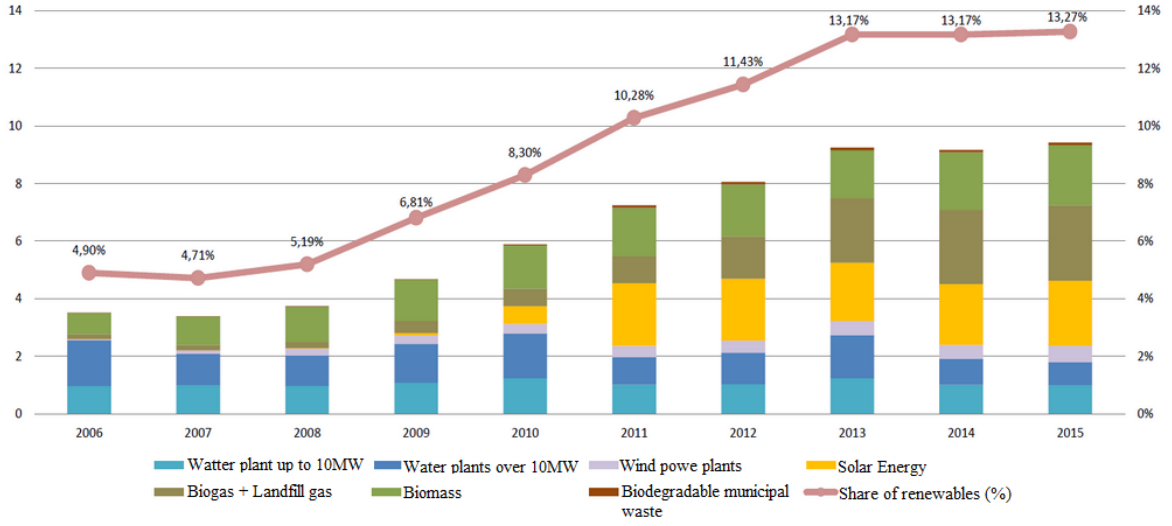
"Of all the groups, renewable energy that Energy Regulatory Office monitors, last year in the Czech Republic was made the most of electricity from biogas and landfill gas. Gross production of these resources, which also includes the electricity consumed in production, was totally 2.61 TWh. Followed by solar energy with 2.26 TWh and 2.09 TWh of biomass. Of these three segments rose against most of 2014, electricity production from the sun, by 6.6%." (ČTK, 2015) [9]

Figure 13: The share of Renewables in the Domestic Gross Electricity Consumption

YEAR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gross Consumption (TWh)	71,73	72,05	72,05	68,60	70,96	70,52	70,45	70,18	69,62	71,01
Share of Renewables (%)	4,90	4,71	5,19	6,81	8,30	10,28	11,43	13,17	13,17	13,27

Source: ČTK, 2016

Figure 14: Development of Gross Electricity Production from Renewables and its Share in Gross Domestic Consumption



Source: Energy Regulatory Office, 2016

The Czech Republic and its government started state program for decreasing of electricity consumption in fossil fuels and replacing of this consumption by renewables. Government plans to decrease the share of electricity consumption in gross domestic product at least by 1% every year. [33]

"The Ministry of Industry of the Czech Republic with the European Commission negotiated the third lowest goal from all EU countries; it now confirms that the goal was set too low. There is potential for development of renewables, but the Czech Republic to renewables accesses by style Brake – Gas, so rather Gas - brake, "says for Alliance for energy self-sufficiency Martin Sedlak. (Sedlák, Hlídacípes.org, 2016) [2]

But we must to take in consideration that consumption is not production. The Czech Republic does have consumption over 13% by renewables, but the real gross production of electricity from renewables is only 10.7% from total production of electricity and the share of energy from renewables in Czech Republic is only 9% from total electric production. [2]

3.6 Employment in Renewables

3.6.1 Employment in Renewables – Global

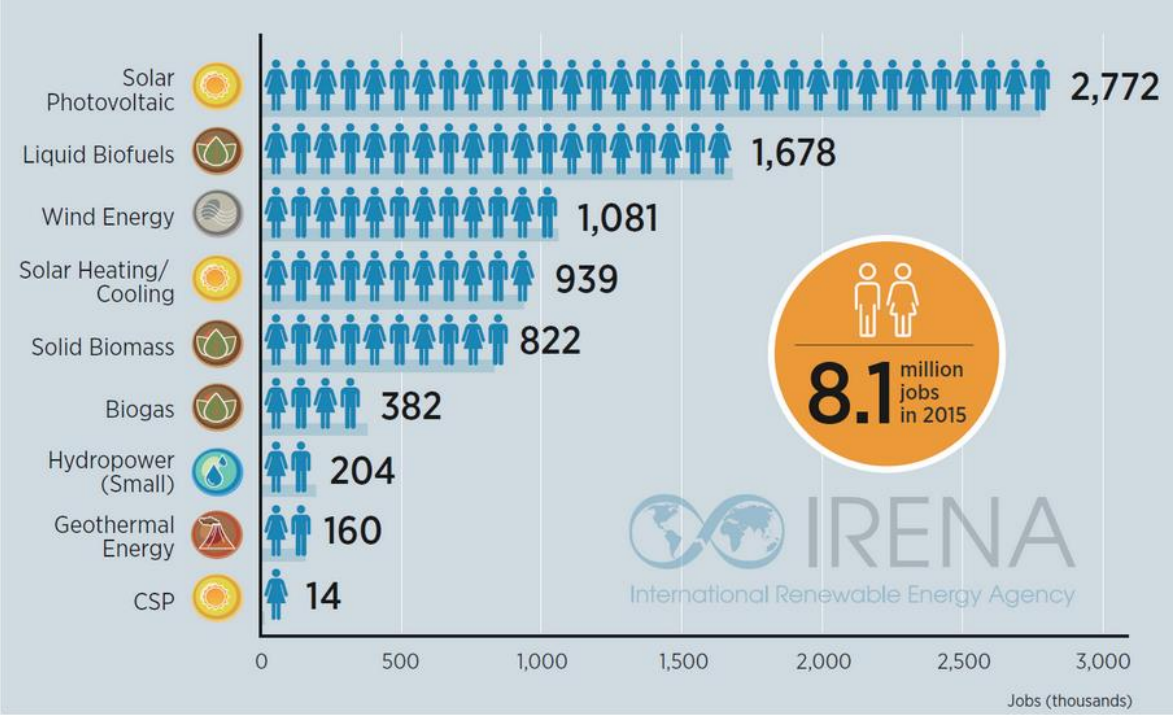
Based on the data from IRENA, which is International Renewable Energy Agency, the employment in renewables increased for the year 2015 by 5%. Totally renewables industry contains 8.1 million employees globally. This data consists of people working in manufacturing, installation and maintenance of these systems. IRENA study does not include data from large hydroelectric sources, as it struggled with a lack of relevant data. Estimated employment in the field of hydroelectric power reaches 1.3 million people. [25]

The greatest growth in employment for the year 2015 has been recorded in Asia and also in USA. The employment in the sector of renewables in USA is about 769,000 people, when we compared this number with the employment in oil industry where is 187,000 employees and in coal industry where is 68,000 employees, we can say that there is big trend and interest about to have job in renewables industry and that the renewable industry is quite huge in USA. The greatest growth in employment has been in wind energy and solar energy, this growth was bigger about 20%. Main reason for the employment growth is responsible decrease of costs in technologies. [25]

If we look on the European Union there is the fourth consecutive year drop in unemployment. The reason for it is the persisting crisis of Eurozone and also by absence of significant government subsidies. [25]

Most people are employed worldwide in the field of photovoltaics with number of 2.7 million employees, with annual growth of 11%. The biggest growth in 2015 was recorded in the USA and Japan. However, it remains that 60% of the workforce is in China. The second biggest employer is the area of biofuels, where the dominant part takes USA and Brazil. On the following figure you can see number of employees in each renewables area. [25]

Figure 15: Number of Employees According to Sector



Source: IRENA, Renewable energy and jobs – Annual Review, 2016

Also in the following figure is described employment in renewable energy divided by each industry broken down by countries.

Figure 16: Estimated Direct and Indirect Jobs in Renewable Energy Worldwide, by Industry (in Thousands)

	World	China	Brazil	United States	India	Japan	Bang-ladesh	European Union[i]		
								Germany	France	Rest of EU
Solar Photovoltaic	2,772	1,652	4	194	103	377	127	38	21	84
Liquid Biofuels	1,678	71	821[c]	277[f]	35	3		23	35	47
Wind Power	1,081	507	41	88	48	5	0.1	149	20	162
Solar Heating/ Cooling	939	743	41[d]	10	75	0.7		10	6	19
Solid Biomass[a,g]	822	241		152[e]	58			49	48	214
Biogas	382	209			85		9	48	4	14
Hydropower (Small)[b]	204	100	12	8	12		5	12	4	31
Geothermal energy[a]	160			35		2		17	31	55
CSP	14			4				0.7		5
Total	8,079[h]	3,523	918	769	416	388	141	355[j]	170	644[k]

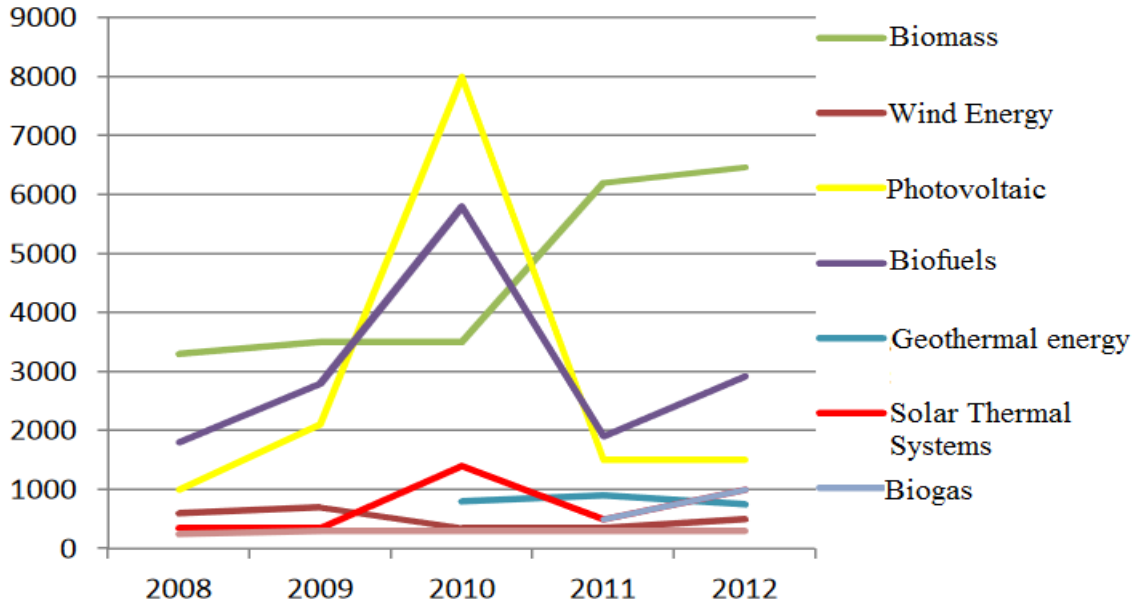
Source: IRENA, Renewable energy and jobs – Annual Review, 2016

3.6.2 Employment in Renewables – Czech Republic

The employment in Czech Republic in the area of renewables is not very big, it is caused by the size of Czech Republic, economic structure and also by physical and geographical conditions. In the year 2010 were huge drop in employment in renewables by 40% due to big reducing of purchase prices, but in the 2012 there was conversely growth and totally were employed 14,525 people, due to increase of job place in biomass sector. In the year 2014 took Czech Republic 17th place within employment of EU in renewables. [10]

Photovoltaic, biofuels and biomass are sectors with the largest number of employees. These three sectors employ 2/3 of all workers in renewables. These jobs are largely concentrated in rural areas, which help with economic and social stability. Regards to photovoltaic, the largest number of workers was in 2010 with 8,000 employees (due to solar boom), but as been told after reducing purchase prices there was huge drop to 1,500 employees. The smallest importance in terms of employment has the wind energy industry with 500 employees; it is expected that in 2030 there will be 2,426 employees in this sector. This little importance of wind sector employment is due to the small scale of this sector, difficult position for development due to low acceptance by the regional administration and the absence of major production capacities in the Czech Republic. In the following figure can be seen the development of employment in renewables sectors. [10]

Figure 17: Development of employment in renewables sectors, in Czech Republic



Source: Dvořák, Martinát, Renewables Energy and Employment in the Czech Republic, 2014

4 Results

4.1 Case Study – Business Plan

The subject of this case study is to make two business plans focused on renewables. So, it consist two parts – first part is about business in solar energy and second part is about business in wind energy. In the following chapters you will find all necessary information, which are for example how to set up business plan, what is need to be able start this type of business, legislative and of course at the end will be balance sheet for each business plan. All necessary details will be more described in separate steps as well as project and aims of project.

4.1.1 How to set up business plan

This chapter is short summary how to set up business plan for real use. There is described what needs to be done for proper preparation of business plan and what to keep during creation of business plan. How to set up business plan is described below in few steps, each step will be also little bit more described.

The creation of business plan is divided into seven steps, for success you need to follow these steps [13]:

a) Executive summary

   The executive summary describes to reader the aims and meaning of the planned project. There should also be what you asking for and it must be clearly stated.

b) Business description

   In the business description is briefly described industry and company; also you need to discuss present outlook as well as future possibilities. Then it is needed provide all information about market within industry and also related innovation, which can be benefit or negative for your business.

c) Market analysis

   Market analysis or as it is called market strategies are outputs after market research. In another words it is operation, which leads to the knowledge of the market for

right selection of products, which should be placed at market. It is fully understanding of consumer needs.

d) Analysis of competition

The main purpose of this analysis is to know strengths and weakness of your competitors within your market; also your advantages against competition and of course to be able ensure barriers against competition to prevent their entering on your market.

e) Development plan

This part provide to investors all necessary information about your product, how it will be designed, how it will be produced and his development, also it is include marketing of product and in the end the budget for ensuring all stages of placing product on the market.

f) Management plan

This step describes how the whole business will work. There is talked about logistic, future responsibilities of each work groups and all related costs.

g) Financial factors

It means the creation of balance sheet. All finance requirements should be put on the end of business plan.

4.1.2 How to start to do business

Firstly, before you will do all steps necessary for doing business in solar energy or wind energy, you need to have business license called unqualified notifiable trade or you need to establish Ltd., which is limited liability company.

When we talking about unqualified notifiable trade license, it must be mentioned that the for this type of business are related points 47 and 80 from annex number four of unqualified notifiable trade of Trade licensing Act. These points mean following [27]:

- Point 47 - Brokering services

- Point 80 - Production, trade and services not elsewhere classified

Trade licenses are further divided into Professionals trade business licenses, Craft Trade, Concession Trade and as I mentioned above Unqualified Trade. Craft and Concession Trades are subcategories of Professional Trade.

If we take limited company there is no division into subcategories or segments as in trade license, but to be able establish Ltd in the Czech Republic you need to have professional experiences like are for example if we talking about Building company Ltd, you need to graduate from the school with a focus on the construction industry or somebody must guarantee for you. Previously Ltd companies guarantee with capital, which was deposited during establishment of Ltd, but in nowadays companies guarantee with their entire actual capital.

Also there is dividing into formal entities. If you do the business based on Trade license you will be physical entity and while are you doing business under Ltd there is formed legal entity.

For the purposes of business in the solar or wind energy it is enough to have Trade license, respectively unqualified notifiable trade license. It is why that in Ltd you need more documentations, establishment took more time and etc. But if you establish unqualified notifiable trade you are able to start your business, with hyperbole, same day as you established you trade license. It is due to that trade license is published at Trade Licensing Office and it takes just a few minutes. Of course it highly depends on where you apply for license, I applied for license in Beroun and it takes for me 10 minutes and after it I was ready to do business. The second advantage of choosing Trade license is that there is no needed to keep accountancy and you can use lump sum expenses, which are up to 60% of your total costs. Of course while the time will move there is high expectation that it will be better to keep accountancy for real subtraction of costs for the calculation of the tax base.

Nowadays is it possible to buy already established Ltd, called “ready-made” company, and do not process all requirements, which are needed for establishment.

All each steps how to apply for Trade licenses and Ltd will be described in details in chapters below.

4.1.2.1 Trade Business License establishment steps

- Visiting of Trade Licensing Office at your place of residence for applying and reporting of Trade license
- Declaration of all conditions by submission of documents
- Process a payment of fee – 1,000 CZK
- Filling of registration form
- There is also possibility to apply for health and social insurance and also for income taxes in same time at Trade Licensing Office; if you do not register for it you must do it separately in each certain Office.

4.1.2.2 Ltd establishment steps

Steps are [12]:

- Get knowledge about legislation
- Elaboration of documents
- Make a draft of social contract at notary office
- Insertion of capital stock
- Submission of necessary documents
- Declaration of Trade business license
- Application into business register
- Releasing bank account
- Registration at Tax Authority
- Acquirement of official note from Trade Registry

For the situation that you will hire employees into Ltd you must to do more than there is listed, but at this case study there is no counting with employees.

4.1.2.3 Conditions for establishment of Trade Business License

Conditions are [28]:

- Over 18 years old
- Be fully legally competent
- No criminal record
- Pay a fee of 1,000 CZK

4.1.2.4 Conditions for establishment of Ltd

Conditions are [11] [22]:

- Over 18 years old
- Be fully legally competent
- No criminal record
- Deposit capital stock, from 1.1.2014 starts deposit of minimal capital stock at 1 CZK but it is not limited by maximum amount of deposit, It is recommended to deposit a capital in the amount of actual future needs
- Founder or founders should be physical or legal entities
- Number of founders is between 1 to 50
- At a time of registration is needed to deposit at least 30% of capital stock, if there is only one founder capital stock must be paid with the amount of 100% from selected capital stock at the time of Ltd registration
- The rest 70% of deposit amount must be paid within 5 years from the date of registration
- Make a draft of social contract at notary office, in case of more founders it must be signed together
- Choose statutory bodies of the company
- No occurrence of insolvency process
- Meet the conditions to operate a Trade Business License
- To have chosen company name
- To have determined headquarters of company

4.1.2.5 The necessary documents for starting a business

For allowing emergence of business are needed certain types of documents, following two chapters will describe them.

4.1.2.5.1 The necessary documents for establishment of Trade Business License

Documents [27]:

- Two identity cards – e.g. ID card, Driver license or Passport
- Single registration form

- Statement from judicial record
- Certification of professional competence

4.1.2.5.2 The necessary documents for establishment of Ltd

Documents [47]:

- Bank document about establishment of account and deposit
- Sworn statement of company executives about full legal capacity, fulfilment of trade business license operations, and about meeting the criteria of paragraph 38I of Civil Code
- Sworn statement of representative
- Certification of professional competence
- Document about registration into business register
- Declaration of trade business license
- Specimen signature of representative
- Confirmation of administrative fee payment
- Declaration of deposit administrator
- Registration document of legal entity at Tax Authority
- Agreement of the property owner with the location of company headquarters
- Social contract or Memorandum
- Statement from the cadaster
- Statement from judicial record
- Certificate of Incorporation
- Statement from Trade Registry

4.1.3 Legislation

Business in renewable energy is also limited by much legislation as other businesses. These legislations are valid for all renewables, but there are also occurring improvements of laws according to type of renewable energy. The following two chapters will describe separately most important legislations, which affect this type of business most, within Czech Republic and European Union. Also there will be mentioned others legislations but only marginally.

4.1.3.1 Legislation of Czech Republic

The Czech Government Resolution no. 211, dated on 10th of March 2004, approved the default legal document, which is called State Energy Policy. State Energy Policy document is a basic part of the economic policy of Czech Republic; there are rooted main visions and goals of energy sector in the Czech Republic until 2030. The Ministry of Industry and Trade, which elaborate this document, plans to make a permanent growth in the share of renewables in total energy production in the Czech Republic within the framework of the objectives, which were set out in the State Energy Policy.

Below are described legislations, which regulate or restrict business in renewables.

4.1.3.1.1 Act no. 165/2012 Coll.

This is Act on supported energy sources and amending certain laws. By supported energy sources are meant renewable energy sources. Main purpose of this Act is primarily to support use of those resources in order to protect the climate and the environment and ensuring increasing the share of renewables in total primary energy sources to achieve the stated objectives. [15]

This Act does not stand by itself, but consists other Acts that are modified is some parts but they are still valid. It is talked about few most important Acts like are Act no. 180/2005 Coll., Act no. 406/2000 Coll., Act no. 458/2000 Coll. etc. They are listed below with descriptions.

4.1.3.1.2 Act no. 180/2005 Coll.

Act on the support of electricity from renewable energy sources and amending certain acts as amended.

This Act regulates the manner of support for the electricity production from renewable sources. The purpose is to protect the climate and the environment, promote the use of renewable energy sources, to ensure a permanent increase in the share of renewables in primary energy sources and contribute to economical use of natural resources and the sustainable development of society. This support is related to the production of electricity from renewable sources produced in facilities on the territory of Czech Republic, that using

renewables sources and is defined according to type of renewable energy according to the size of the installed capacity of facilities and also for example according to parameters of biomass. Support also extends to the production of electricity from mine gas of closed mines. [32]

The Act regulates the rights and obligations of entities on the market with electricity from renewable sources, the conditions for support, purchase and recording of electricity production from renewable sources, determining the level of purchase prices for electricity from renewable sources separately for individual types of renewable sources and green bonuses, determines the way of periodic evaluation of the share of electricity from renewable energy sources to gross electricity consumption for the previous calendar year and the calculation of expected impacts of support on the overall price of electricity for end consumers in the coming calendar year. The act also determines the implementation of controls through the State Energy Inspectorate and the amount of fines for administrative offenses. [32]

4.1.3.1.3 Act no. 458/2000 Coll.

Act on business conditions and the performance of state administration in the energy sectors and amending certain Acts (Energy Act), as amended

This Act regulates the conditions for production, transmission and distribution of electricity and gas and also trading in these commodities as well as the conditions for the production and distribution of thermal energy. Doing a business in energy sectors requires, according to Energy Act, to be granted by license for business entity; license is issued by Energy Regulatory Office. The Act also defines the conditions of the market with electricity and gas, also defines the rights and obligations of the participants – manufacturers and operators of transmission, transportation and distribution networks and also for consumers. [40]

4.1.3.1.4 Act no. 406/2000 Coll.

Act on energy economy, as amended.

This Act establishes certain precaution for more efficient use of energy and also establishes obligations of physics and legal entities in energy economy, setting the rules for the

creation of the State Energy Policy, Regional Energy Policy of the National Program for efficient energy use of secondary renewable sources. [39]

4.1.3.1.5 Decree no. 475/2005 Coll.

This Decree implements certain provisions of the Act on support for the usage of renewable energy sources.

The decree establishes the terms and details of selecting the method of support for electricity produced from renewable sources, the terms announcement of the intention to offer electricity produced from renewable sources to the mandatory purchase and the technical and economic parameters. [41]

4.1.3.1.6 Decree no. 541/2005 Coll.

Decree no. 541/2005 Coll. is decree on the electricity market rules, pricing policies for the activities of electricity market operator and execution of certain other provisions of the Energy Act.

The decree lays down the electricity market rules, pricing policies for the activities of the electricity market operator, the methods of accounting and payments of pricing policies for individual electricity market participants, rules of creation, allocation and use of typical electricity supply and the conditions for the supply of electricity suppliers of last resort. [42]

4.1.3.1.7 Decree no. 296/2015 Coll.

Decree no. 296/2015 Coll. is decree on technical and economic parameters.

The decree of technical-economic parameters for determining the purchase prices for electricity and green bonuses for warmth, establishing lifetime of electricity and heat facilities, which use renewable energy sources. [43]

4.1.3.1.8 Decree no. 9/2016 Coll.

Decree no. 9/2016 is registration decree.

This is decree on registration procedures for support of the market operator and the implementation of certain other provisions of the Act on supported energy sources. [44]

4.1.3.2 Legislation of European Union

Each national Act and Decree of certain countries is edited and narrower to European Directives. Acts and Decrees are edited according to requirements of the European Union. Some of European Directives will be described below.

4.1.3.2.1 European Directive no. 2012/27/EU

It is Directive of European Parliament and European Council dated from October 2012.

European Directive on energy efficiency, on amending Directives no. 2009/125/EC and no. 2010/30/EU and also subsequently repealing Directives no. 2004/8/EC and no. 2006/32/EC. [17]

This European directive regulates following Czech Acts [17]:

- Act no. 165/2012 Coll. on supported energy sources
- Act no. 458/2000 Coll. Energy Act
- Act. no 406/2000 Coll. on energy economy

4.1.3.2.2 European Directive no. 2009/28/EC

Directive of the European Parliament and Council Directive no. 2009/28/EC from 23 April 2009 on the supporting of the use of energy from renewable sources and amending and subsequently repealing Directives no. 2001/77/EC and no. 2003/30/EC (Text with EEA relevance) [16]

By this Directive is stated how much will be share of electricity from renewable energy for each country within European Union.

This European directive regulates following Czech Acts [16]:

- Act no. 165/2012 Coll. on supported energy sources
- Act. no 406/2000 Coll. on energy economy

4.1.4 Project

This business plan should be built for real use in real life. So, for this purpose is Author of this thesis is used as business man himself. The Author wants to set his own business and

that why he started thinks to what area of business to choose. There is plenty of areas that can be choose, but Author of this thesis wants to do also something good for environment and make profit of course. Author thinks that nowadays is needed to care about our environment and Earth. Anyway, thank to these situation Author got idea to do business in renewable energy. The idea was that energy will be needed at all times especially electricity and electricity could be produced from renewable energy sources and by this help to our environment. The Author chose two types of renewable energy, which are solar energy and wind energy. These two types of energy were chosen because they are both inexhaustible sources of energy. Solar energy is one of most popular renewable energy in the world; it is clean, free and really widely available and for the wind energy is it same. In simple terms you use natural resources to create own profit, with sources they are free, it just costs the technology and as soon as there will be return of cost for technology you will earn practically money without costs. So, Author thinks that is really smart to do business with something what is free and make you money.

There will be two business plans, first will be focused on solar energy, concretely on to own solar farm and second will be focused on wind energy it means to own and built wind farm. And after all to make conclusion, which type of farm is better for business in renewables, it means, which brings more profit and quicker return of costs.

In each business plan will be described technology, which going to be used, also each business plan will have own description of competition, balance sheet, description of project phases, etc.

4.1.4.1 Aims of project

As was said before, main aim of this project is to transfer chosen business plan for possible real usage in real life. Next aim of project is to address potential investor for the possibility of financing the project. There are two possibilities of project financing, which are taken under consideration. The first option takes into consideration that the potential investor will finance the project with the entire amount and profit will be divided as follows 70% of profit to the Author and 30% of profit to the investor. Of course after deduction of annual costs and construction costs budgeted each year after the counting period of return; it mean that if will be calculated that period of return will be 10 years, the construction costs will

be budgeted for ten years with a proportionate amount each year. In this way of financing must be clear for investor that it is investment not loan, so investor must take risk that the loss can occur sometimes. Another way of financing is to take a loan from investor or bank. It is calculated that the interest on loan will be 10% from money provided. The investment will be paid annually until the entire investment with interest would be paid.

In the balance sheet will be calculated with the return of investment without interest. It means that it will be based on the option one that the profit will be divided into Author of project and investor by 70% and 30% of profit. There can happen that Author will pay off investor someday. Down are broken steps how to process all steps of project.

Recommended preparation of project:

1) Project goal
2) Future agreement with the regional supplier about networking
3) Project documentation
4) Building permit procedures
5) Energy audit
6) Application for government support if there is any
7) Choosing of technology
8) Connection to distribution network
9) License application at Energy Regulatory Office to be able legally produce electricity
10) Request for final approval
11) Trial run
12) Commissioning

Due that in past were government subsidies available for renewable energy the one of the steps in preparation of the project was application for subsidies and payment of subsidies after commissioning.

Steps how to attract investor:

1) Set financial plan
2) Competition analysis

3) Show advantages
4) Market analysis
5) To get idea about provided service
6) Draw balance sheet with costs, profit and return

Target group will be distributors and suppliers of electricity within Czech Republic. There is also possibility to have target group of people who wants to distribute electricity, form the Author's energy farm, directly to their house.

4.1.4.2 Technical description of the project

The whole project will be divided into two separate projects onto solar energy and wind energy. Each part has three assumption or two phases, which are description of technology used and balance sheet with all necessary details and last part are SWOT and PEST analysis.

4.1.4.3 Competition analysis

In solar energy is competition quite big. There are plenty of companies and physic entities who do business in this field of business. It is due to that in past there was really good conditions to start this type of business, these conditions are meant as the support from government. By this support we understand subsidies as are feed-in-tariff and green bonuses these subsidies were set too much generously, they were at the start of supporting set to 15,000 CZK per MWh. But they went rapidly down during time and nowadays for the new solar system there are no any subsidies. It is due to that the conditions for producing solar energy are, according to opinion of government, very good. That is why the Author of this project will make business plan for solar energy in form of buying existing solar energy. The Greatest competitors are ČEZ Group, FVE Czech Novum, Photon Park and Photon Forest, SPL. These companies are five biggest companies in solar energy field.

Meanwhile in the solar energy there is high competition in wind energy is it different. In the Czech Republic is small amount of wind farms, so it is good situation to start this type of business in this field. In sum it can be said that only one company own some wind farms in Czech Republic. The owner of wind farms is ČEZ Group, biggest distributor and

supplier of electricity in Czech Republic. ČEZ Group also buys electricity produced from renewables from small distributors of electricity. They must buy this electricity due to decree of government. So the Author of this project recommend to focus on wind energy, due to small competition and also there are still provided subsidies from government, which are set as been mention before.

4.1.4.4 Solar Energy

In this chapter will be described two variants. First variant will calculate with situation of building new solar energy system and second variant is about to buy existing solar energy system for producing and selling electricity do distribution network. Buyer of electricity will be ČEZ Group.

But variant no. 1 will not be considered as a right way of doing business, it is due to that nowadays is really small chance to get license for joining distribution network and also for new solar systems there are no subsidies in for of feed-in-tariff or green bonuses.

4.1.4.4.1 Technology

For variant no. 1 was chosen cooperation with company AEKO s.r.o., for their offered prices and quality of products.

Technology:

Locality: Blatnice pod Svatým Antonínkem, district Hodonín

Installed Power output: 600 kWp

Type of panels: Renesola poly

Size of Land: 600m^2

Switches: GoodWE GW-15K-DT

Total costs: See chapter Balance Sheet

Annual costs for maintenance: See chapter Balance Sheet

Variant no. 2 takes in consideration of buying existing solar energy system. This system was built in 2010, and stands in Czech Krumlov. The Author chose this old system from one reason, the solar system built in 2010 has sill relative high subsidies in form of feed-in-tariff. The feed-in-tariff for solar energy in 2010 was 13,966 CZK per MWh and there is regulation from Energy Regulatory Office that this purchase price will be valid for 20 years and every two years will increase by 2%. Of course after 20 years will be set new purchase price according to actual situation in solar energy.

The existing solar energy system will be bought from company Energie s.r.o. , locality of system is in Czech Krumlov. Down is broken technology used and description.

Technology:

Locality: Czech Krumlov

Installed Power output: 110 kWp

Type of panels: Regulus KPS10 ALP

Size of Land: 600m^2

Switches: Fronius IG 400 and Fornius IG 500

Total costs in 2010: 7,954,300 CZK

Annual costs for maintenance: 120,000 CZK

In the variant no. 2 is planned with idea that after ending guaranteed purchase price will be entire solar system sold to investor.

4.1.4.4.2 Balance Sheet

In the balance sheet you will find all needed things like are fixed or variable costs, revenues, return of investment and of course profit. These outputs will be done for both variants.

4.1.4.4.2.1 Costs

Fixed costs for realization of project:

Variant no. 1:

- Photovoltaic panels 2,440 pcs – 7,805,860 CZK
- Switches 60 pcs – 1,830,000 CZK
- Cables, Switchboards – 1,179,480 CZK
- Supporting structure – 1,690,500 CZK
- The project, administration, inspection, licensing – 63,334 CZK
- Labor and Transport – 202 500 CZK
- Digging and necessary networking a part of the land – 500 000 CZK
- Land 6618 m^2 (Meadow suitable for solar power plant) – 390 462 CZK

Total fixed costs: 13,662,136 CZK

Variant no. 2:

It was negotiate with the owner of existing solar system about purchase price of his solar system. In past were total cost almost 8 million Czech crowns, but nowadays the prices of collectors are not too high as before so the solar system has lower value, anyway together with investor was offered to owner of solar system 15 million Czech crowns for selling existing solar system. The owner agreed with proposed offer, one of the reasons is that this is his extra business which is putted on side of his activities and he doesn't have much time on it, another reason is that the owner will use offered money for expanding of his actual business.

In this situation the fixed cost is just only 15 million CZK for the payment of the entire solar system.

Total fixed costs: 15,000,000 CZK

Operating costs:

Variant no. 1:

In the variant no. 1 is calculated that the operating costs will be approximately 1% from the total costs used on realization of project.

- Operating costs in amount of 1% – 136,621.36 CZK

Variant no. 2:

Operating costs are calculated like annual costs.

- Electricity consumption for camera system and lighting – 62,500 CZK
- Maintenance of land – 39 000 CZK
- Connection to ARC – 11 000 CZK
- Snow clearance of collectors – 60 000 CZK

Total operating costs: 172,500 CZK

4.1.4.4.2.2 Revenue

Variant no.1:

For the variant no.1 must be set purchase price. For new solar energy plants there are no subsidies as was told before. It means that the author must negotiate purchase price with the distributor of electricity. Today are purchase prices between 0.9 CZK/kWh – 4 CZK/kWh. So for the calculation of revenue will be take in consideration average purchase price in amount of 2.5 CZK/kWh. This price is close to last purchase prices from subsidies, that is why author chose this value.

Conditions of calculation:

- Annual reduction of electricity produced due to aging of solar panels in amount of 1% from previous electricity production
- There is no rule about increasing of purchase prices as was due to subsidies, but it can happen that new purchase could be negotiate so it is calculated at least with 1% of increase in purchase price.

The amount of kWh produced monthly is calculated as follows:

Produced kWh = Hours of solar radiation per month * Installed power output in kWp

Table 3: Electricity production per month in kWh, based on data of solar radiation from 2015

Month	Electricity production in kWh
January	29,400
February	39,000

March	66,000
April	126,000
May	90,000
June	135,000
July	156,000
August	150,000
September	84,000
October	36,000
November	45,000
December	28,800
Total production	**850,200**

Source: own calculation

In the following table could be found revenues for 20 years of operation of solar power plant. Revenue is calculated for the lifetime of solar panels, it is usually 20 years, but it is given by producer of solar panels. It could be seen that the electricity production has downward trend by 1% every year it is due to aging of solar panels and as mentioned before the purchase price was negotiate to have annual increase in value by 1%.

Table 4: The revenue of solar power plant for variant no.1

Year of commissioning	Electricity production in MWh	Purchase price for 1 MWh	Revenue
1.	850.2	2,500 CZK	2,125,500 CZK
2.	841.698	2,525 CZK	2,125,287.45 CZK
3.	833.281	2,550.25 CZK	2,125,074.87 CZK
4.	824.948	2,575.753 CZK	2,124,862.29 CZK
5.	816.699	2,601.510 CZK	2,124,650.62 CZK
6.	808.532	2,627.525 CZK	2,124,438.04 CZK
7.	800.446	2,653.800 CZK	2,124,223.60 CZK
8.	792.442	2,680.339 CZK	2,124,013.20 CZK
9.	784.517	2,707.142 CZK	2,123,798.92 CZK
10.	776.672	2,734.213 CZK	2,123,586.68 CZK
11.	768.905	2,761.555 CZK	2,123,373.45 CZK
12.	761.217	2,789.171 CZK	2,123,164.38 CZK
13.	753.604	2,817.063 CZK	2,122,949.95 CZK
14.	746.068	2,845.233 CZK	2,122,737.30 CZK
15.	738.608	2,873.686 CZK	2,122,527.47 CZK
16.	731.222	2,902.422 CZK	2,122,309.02 CZK
17.	723.909	2,931.447 CZK	2,122,100.87 CZK
18.	716.670	2,960.761 CZK	2,121,888.59 CZK
19.	709.504	2,990.369 CZK	2,121,678.77 CZK
20.	702.409	3,020.272 CZK	2,121,466.24 CZK
Total	----------	----------	42,469,631.71 CZK

Source: own calculation

The total revenue for 20 year is 42,469,631.71 CZK it seems very perspective if we will compare this result with investment to solar power plant.

Variant no.2:

In this variant is calculated with the feed-in-tariff of the year 2010 due to that the commissioning of this solar power plant was in 2010. The first 7 years was solar power plant used by previous owner, so there are calculated only years of production under ownership of author. This means that the remaining number of years for which revenues will be calculated is 13 years, it is due to that the lifetime of the solar panels is 20 years, and guaranteed purchase prices are also 20 years.

Conditions of calculation:

- Annual increase of purchase prices by 2%,it was set by Energy Regulatory Office
- Annual reduction of electricity produced due to aging of solar panels in amount of 1% from previous electricity production
- Used feed-in-tariff from 2010

Electricity production of solar power plant for variant no.2:

Table 5: Electricity production per month in kWh, based on data of solar radiation from 2015

Month	Electricity production in kWh
January	5,390
February	7,150
March	12,100
April	23,100
May	16,500
June	24,750
July	28,600
August	27,500
September	15,400
October	6,600
November	8,250
December	5,280
Total production	**180,620**

Source: own calculation

For the calculation of revenues started the feed-in-tariff first year of commissioning in 2010 at 13,966 CZK per 1 MWh and the beginning of the eighth year (where is planned to start with operation under Author ownership) is feed-in-tariff 16,042 CZK per 1 MWh as you can see in the following table. These calculations of revenues are based on data regarding solar radiation, given in 2015, and annual production of electricity during the counting of a production cut of 1% per annum. The results of revenues are shown only for the next 13 years, which is the time of ownership of solar power plant by author of this project.

Table 6: The revenue of solar power plant for variant no.2

Year of commissioning	Electricity production in MWh	Purchase price for 1 MWh	Revenue
8.	168.35	16,042.56 CZK	2,700,764.98 CZK
9.	166.67	16,363.41 CZK	2,727,289.55 CZK
10.	164.99	16,690.68 CZK	2,753,795.30 CZK
11.	163.35	17,024.49 CZK	2,780,950.44 CZK
12.	161.72	17,364.98 CZK	2,808,264.57 CZK
13.	160.10	17,712.28 CZK	2,835,736.03 CZK
14.	158.50	18,066.53 CZK	2,863,545.00 CZK
15.	156.92	18,427.86 CZK	2,891,699.80 CZK
16.	155.35	18,796.42 CZK	2,920,023.85 CZK
17.	153.80	19,172.35 CZK	2,948,707.43 CZK
18.	152.26	19,555.80 CZK	2,977,566.11 CZK
19.	150.73	19,946.92 CZK	3,006,599.25 CZK

20.	149.23	20,345.86 CZK	3,036,212.69 CZK
Total	----------	----------	37,251,155 CZK

Source: own calculation

The total revenue for 13 year is 37,251,155 CZK, this is also lucrative result and due to that there is no possibility to be connected into distribution network we must take variant no.2 as final for our business.

4.1.4.4.2.3 Net Profit

Variant no.1:

Net profit will be calculated as annual net profit for each year after deducting annual operation costs. After it will be known net profit for each year could be deducted investment. This all together will give net profit for 20 years and there will be seen how is this variant profitable. Net profit is it why that there is no calculated with income tax.

Annual operating costs are 136,621.36 CZK

Table 7: Calculation of Net Profit for the variant no.1

Year of commissioning	Revenue	Operating Costs	Net Profit (revenue-operating costs)
1.	2,125,500 CZK	136,621,36 CZK	1,988,878.64 CZK
2.	2,125,287.45 CZK	136,621,36 CZK	1,988,666.09 CZK
3.	2,125,074.87 CZK	136,621,36 CZK	1,988,453.51 CZK
4.	2,124,862.29 CZK	136,621,36 CZK	1,988,240.93 CZK
5.	2,124,650.62 CZK	136,621,36 CZK	1,988,029.26 CZK
6.	2,124,438.04 CZK	136,621,36 CZK	1,987,816.68 CZK
7.	2,124,223.60 CZK	136,621,36 CZK	1,987,602.24 CZK
8.	2,124,013.20 CZK	136,621,36 CZK	1,987,391.84 CZK
9.	2,123,798.92 CZK	136,621,36 CZK	1,987,177.56 CZK
10.	2,123,586.68 CZK	136,621,36 CZK	1,986,965.32 CZK
11.	2,123,373.45 CZK	136,621,36 CZK	1,986,752.09 CZK
12.	2,123,164.38 CZK	136,621,36 CZK	1,986,543.02 CZK
13.	2,122,949.95 CZK	136,621,36 CZK	1,986,328.59 CZK
14.	2,122,737.30 CZK	136,621,36 CZK	1,986,115.94 CZK
15.	2,122,527.47 CZK	136,621,36 CZK	1,985,906.11 CZK
16.	2,122,309.02 CZK	136,621,36 CZK	1,985,687.66 CZK
17.	2,122,100.87 CZK	136,621,36 CZK	1,985,479.51 CZK
18.	2,121,888.59 CZK	136,621,36 CZK	1,985,267.23 CZK
19.	2,121,678.77 CZK	136,621,36 CZK	1,985,057.41 CZK
20.	2,121,466.24 CZK	136,621,36 CZK	1,984,844.88 CZK
Total	42,469,631.71 CZK	----------	39,737,204.51 CZK

Source: own calculation

Total profit after 20 years of commissioning:

Total profit after 20 years is calculated from total net profit minus the entire investment.

39,737,204.51 CZK - 13,662,136 CZK = 26,075,068.51 CZK

The total profit, which we will get for the whole lifecycle of solar power plant, is 26,075,068.51 CZK; this profit is not after deducting income taxes.

Variant no.2:

The calculation of net profit for each year is same as in variant no.1 but with the difference that there is calculation for the rest of lifetime which gives 13 years.

Annual operating costs are 172,500 CZK.

Table 8: Calculation of Net Profit for the variant no.2

Year of commissioning	Revenue	Operating Costs	Net Profit (revenue-operating costs)
8.	2,700,764.98 CZK	172,500 CZK	2,528,264.98 CZK
9.	2,727,289.55 CZK	172,500 CZK	2,554,789.55 CZK
10.	2,753,795.30 CZK	172,500 CZK	2,581,295.30 CZK
11.	2,780,950.44 CZK	172,500 CZK	2,608,450.44 CZK
12.	2,808,264.57 CZK	172,500 CZK	2,635,764.57 CZK
13.	2,835,736.03 CZK	172,500 CZK	2,663,236.03 CZK
14.	2,863,545.00 CZK	172,500 CZK	2,691,045.00 CZK
15.	2,891,699.80 CZK	172,500 CZK	2,719,199.80 CZK
16.	2,920,023.85 CZK	172,500 CZK	2,747,523.85 CZK
17.	2,948,707.43 CZK	172,500 CZK	2,776,207.43 CZK
18.	2,977,566.11 CZK	172,500 CZK	2,805,066.11 CZK
19.	3,006,599.25 CZK	172,500 CZK	2,834,099.25 CZK
20.	3,036,212.69 CZK	172,500 CZK	2,863,712.69 CZK
Total	37,251,155 CZK	----------	35,008,655 CZK

Source: own calculation

Total profit after 13 years of commissioning:

Total profit after 13 years is calculated from total net profit minus the entire investment.

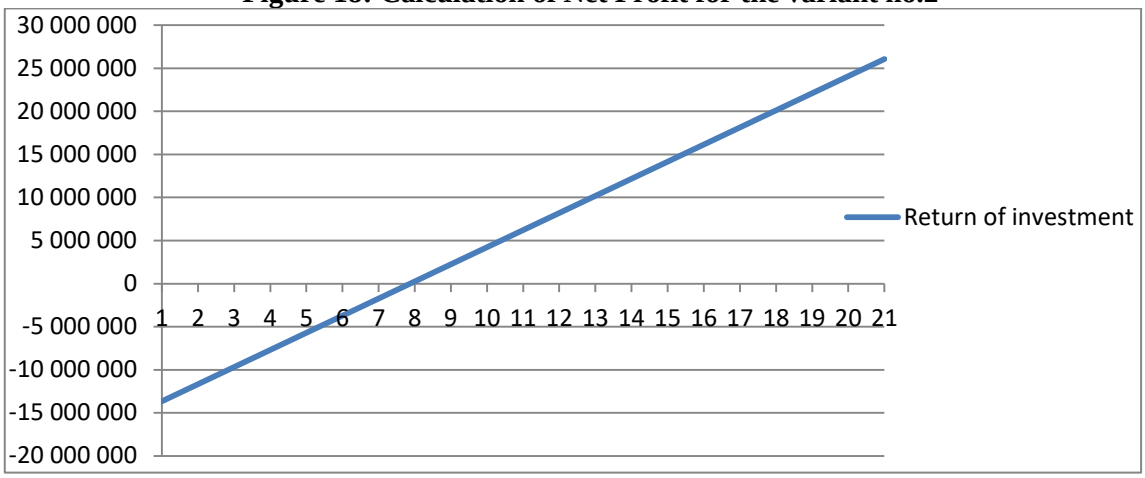
35,008,655 CZK – 15,000,000 CZK = 25,008,655 CZK

The total profit, which we will get for the whole lifecycle of solar power plant, is 25,008,655 CZK; this profit is not after deducting income taxes.

4.1.4.4.2.4 Return of investment

Variant no.1:

Figure 18: Calculation of Net Profit for the variant no.2

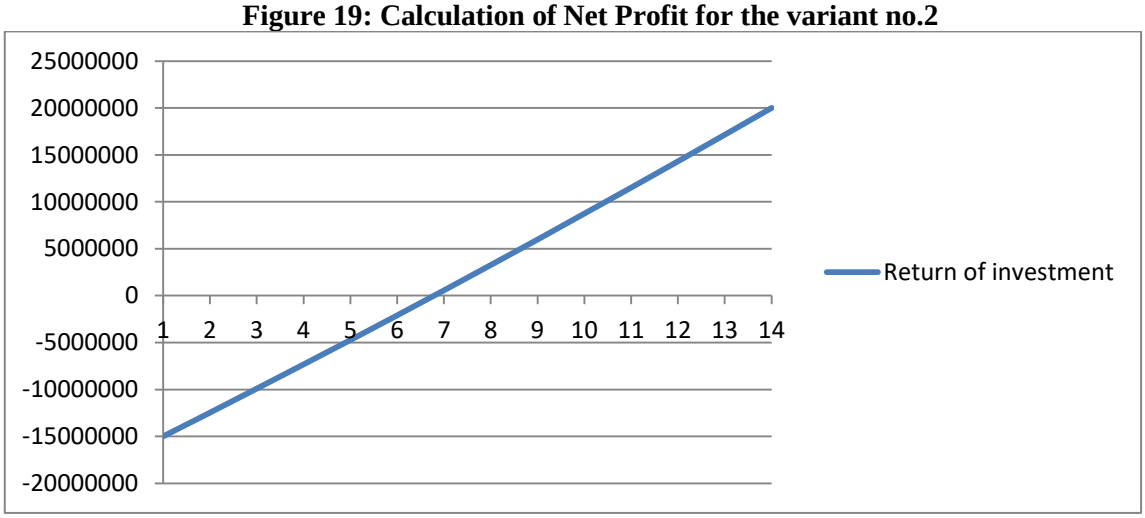


Source: own calculation

For project variant no. 1 is return of investment, as could be seen in the graph no.1, is approximately 8 years since commissioning of solar power plant. In the graph is mentioned 21 years it is due to that in the commissioning of power plant will start in the 2018 so the first revenue is accounted in 2019, the whole operation of solar power plant will end in 2038.

Variant no.2:

Figure 19: Calculation of Net Profit for the variant no.2



Source: own calculation

For project variant no. 2 is return of investment, as could be seen in the graph no.2, is approximately 7 years since commissioning of solar power plant. In the graph is mentioned

21 years it is due to that in the commissioning of power plant will start in the 2018 so the first revenue is accounted in 2019, the whole operation of solar power plant will end in 2031.

4.1.4.4.3 SWOT Analysis

Strengths:

- Inexhaustible source of energy
- Renewable source of energy
- Clear source of energy
- Does not pollute nature
- High lifetime of solar collectors and equipment
- Low operating costs
- Relative quick return of investment

Weaknesses:

- Climate dependence
- Dependence on right selection of location
- Complicated legislation
- For new solar power plants are not subsidies
- High initial investment

Opportunities:

- Save the environment due to clear source of energy
- High profit during the whole lifetime of solar power plant

Threats:

- Climate dependence
- Possibility to not get license for electricity production
- Almost no possibility to join in distribution network

4.1.4.4.4 PEST Analysis

Political-legislative factors:

- Limited by granting license for electricity production
- Lower VAT rate
- It is controlled by legislations and decrees

Economic factors:

- No subsidies for new solar power plants
- Possibility to buy already existing solar power plants, where subsidies are available
- Finding of right electricity distributor
- High revenues
- Return of investment

Socio-cultural factors:

- People may not agree with the placement of solar power plant
- Increasing of electricity production and land due to people or distributors needs
- Consideration that the environment is not polluted from the viewpoint of the citizens from village where should be solar power plant

Technological factors:

- New technologies in field of solar collectors
- Aging of solar power plants
- Without government support

4.1.4.5 Wind Energy

This chapter will have just one variant. After considering all options, author of this project decided for wind energy to build a small wind power plant or as can be called small wind farm. It is due to that for the chosen technology is wind speed acceleration is from 2 m/s and this technology is in height of 40 meters, so there is no needed to have turbines in the height of 100 meters and also have high wind speed. Also the investment will not be huge as in the case of turbines that are currently in the height of 100 m.

4.1.4.5.1 Technology

As a technology for small wind farm author chose turbines from company Cronimo. This technology was chosen for low initial costs of wind turbines and also that the acceleration of turbines starts from 2 m/s, so if practically there is no wind turbines can still produce some electricity. And also due to this low acceleration could be small wind farm built everywhere, because this technology is built for producing energy in the height of 40 meters. Author of the project chose land with the highest annual average of air flow at the height of 40 meters.

Technology:

Locality: Malá Úpa, district Trutnov

Installed Power output: 600 kW

Type of turbines: CRWT2KWAB 2 kW off-grid

Size of Land: 10 000 m^2

Total costs: See chapter Balance Sheet

Annual costs for maintenance: See chapter Balance Sheet

4.1.4.5.2 Balance Sheet

4.1.4.5.2.1 Costs

Fixed costs for realization of project:

- Wind turbines 300 pcs – 13,497,000 CZK
- Cables, Switchboards, Transformers –4,000,000 CZK
- The project, administration, inspection, licensing – 495,940 CZK
- Transport, construction and labor – 3,000,000 CZK
- Land 10 000 m^2 (Meadow suitable for wind turbines) – 2,241,960 CZK

Total fixed costs: 23,234,900 CZK

Operating costs:

It is calculated that annual operating costs will be approximately 2% from total fixed costs.

- Operating costs in amount of 2% – 420,178 CZK

4.1.4.5.2.2 Revenue

In this variant is calculated with the feed-in-tariff of the year 2017 due to that the commissioning of this small wind farm will be in 2018. Feed-in-tariff is 1,930 CZK per 1 MWh. The whole revenue will be calculated for 20 years, which is the lifetime of wind turbines. Also there are guaranteed purchase price of feed-in-tariff for 20 years with annual increase by 2 – 4%, set by Energy Regulatory Office. It will be calculated with increase by 2% of purchase prices, due to have the worst possible case of scenario that we will not be surprised over the years of business. The difference between solar panels and wind turbines is that the wind turbines do not lose their electricity production due to aging.

Conditions of calculation:

- Annual increase of purchase prices by 2%
- Used feed-in-tariff from 2017

Electricity production of wind farm:

The electricity production is calculated from average output power of all installed wind turbines, which is 300kW annually at wind speed 6 m/s. Multiplied by the total number of hours per year, total number of hours per year is given by 365 days multiplied by 24 hours. Total number of hours per year is 8,760 hours. It is due to that the wind is flowing whole year.

Electricity production = 300 kW * 8,760 h = 2,628,000 kWh

Table 9: The revenue of wind farm

Year of commissioning	Electricity production in MWh	Purchase price for 1 MWh	Revenue
1.	2,628	1,930 CZK	5,072,040 CZK
2.	2,628	1,968.60 CZK	5,173,480.80 CZK
3.	2,628	2,007.97 CZK	5,276,945.16 CZK
4.	2,628	2,048.13 CZK	5,382,485.64 CZK
5.	2,628	2,089.09 CZK	5,490,128.52 CZK

6.	2,628	2,130.87	CZK	5,599,926.36	CZK
7.	2,628	2,173.49	CZK	5,711,931.72	CZK
8.	2,628	2,216.96	CZK	5,826,170.88	CZK
9.	2,628	2,261.30	CZK	5,942,696.40	CZK
10.	2,628	2,306.53	CZK	6,061,560.84	CZK
11.	2,628	2,352.66	CZK	6,182,790.48	CZK
12.	2,628	2,399.71	CZK	6,306,437.88	CZK
13.	2,628	2,447.70	CZK	6,432,555.60	CZK
14.	2,628	2,496.65	CZK	6,561,196.20	CZK
15.	2,628	2,546.58	CZK	6,692,412.24	CZK
16.	2,628	2,597.51	CZK	6,826,256.28	CZK
17.	2,628	2,649.46	CZK	6,962,780.88	CZK
18.	2,628	2,702.45	CZK	7,102,038.60	CZK
19.	2,628	2,756.45	CZK	7,243,950.60	CZK
20.	2,628	2,811.58	CZK	7,388,832.24	CZK
Total	----------	----------		123,236,617.3	CZK

Source: own calculation

4.1.4.5.2.3 Net profit

Net profit will be calculated as annual net profit for each year after deducting annual operation costs. After it will be known net profit for each year could be deducted investment. This all together will give net profit for 20 years and there will be seen how is this variant profitable. Net profit is it why that there is no calculated with income tax.

Annual operating costs are 420,178 CZK

Table 10: Calculation of Net Profit for the wind energy

Year of commissioning	Revenue		Operating Costs		Net Profit (revenue-operating costs)	
1.	5,072,040	CZK	420,178	CZK	4,651,862	CZK
2.	5,173,480.80	CZK	420,178	CZK	4,753,302.80	CZK
3.	5,276,945.16	CZK	420,178	CZK	4,856,767.16	CZK
4.	5,382,485.64	CZK	420,178	CZK	4,962,307.64	CZK
5.	5,490,128.52	CZK	420,178	CZK	5,069,950.52	CZK
6.	5,599,926.36	CZK	420,178	CZK	5,179,748.36	CZK
7.	5,711,931.72	CZK	420,178	CZK	5,291,753.72	CZK
8.	5,826,170.88	CZK	420,178	CZK	5,405,992.88	CZK
9.	5,942,696.40	CZK	420,178	CZK	5,522,518.40	CZK
10.	6,061,560.84	CZK	420,178	CZK	5,614,382.84	CZK
11.	6,182,790.48	CZK	420,178	CZK	5,762,612.48	CZK
12.	6,306,437.88	CZK	420,178	CZK	5,886,259.88	CZK
13.	6,432,555.60	CZK	420,178	CZK	6,012,377.60	CZK
14.	6,561,196.20	CZK	420,178	CZK	6,141,018.20	CZK
15.	6,692,412.24	CZK	420,178	CZK	6,272,234.24	CZK

16.	6,826,256.28 CZK	420,178 CZK	6,406,078.28 CZK
17.	6,962,780.88 CZK	420,178 CZK	6,542,602.88 CZK
18.	7,102,038.60 CZK	420,178 CZK	6,681,860.60 CZK
19.	7,243,950.60 CZK	420,178 CZK	6,823,772.60 CZK
20.	7,388,832.24 CZK	420,178 CZK	6,968,654.24 CZK
Total	123,236,617.3 CZK	----------	114,806,057.3 CZK

Source: own calculation

Total profit after 20 years of commissioning:

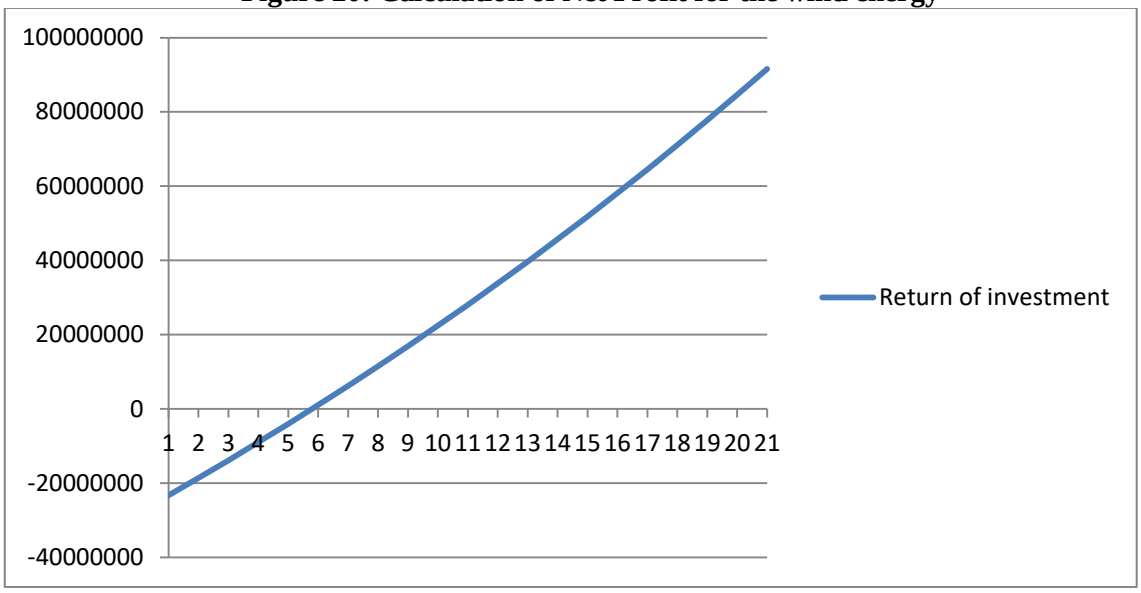
Total profit after 20 years is calculated from total net profit minus the entire investment.

114,806,057.3 CZK – 23,234,900 CZK = 91,571,157.3 CZK

The total profit, which we will get for the whole lifecycle of wind farm, is 91,571,220.70 CZK; this profit is not after deducting income taxes.

4.1.4.5.2.4 Return of investment

Figure 20: Calculation of Net Profit for the wind energy



Source: own calculation

For the project variant of wind farm is return of investment, as could be seen in the graph no.3, is approximately 6 years since commissioning of wind farm. So there is really quick return, better than in variants of solar power plants. In the graph is mentioned 21 years it is due to that in the commissioning of wind farm will start in the 2018 so the first revenue is accounted in 2019, the whole operation of wind farm will end in 2038.

4.1.4.5.3 SWOT Analysis

Strengths:

- Inexhaustible source of energy
- Renewable source of energy
- Clear source of energy
- Does not pollute nature
- High lifetime of wind turbines
- Guaranteed purchase prices for 20 years
- Reducing emissions of CO2 and other emissions generated by the production of electricity
- Reducing fossil fuels consumption and dependence on imports
- Quick assembly and disassembly of wind turbines
- Low operating costs
- Electricity production even at night
- Unattended turbines
- Almost no maintenance

Weaknesses:

- Climate dependence
- Dependence on right selection of location
- Complicated legislation
- Noise
- High initial investment
- Disturbance of landscape
- Stroboscopic effect

Opportunities:

- Save the environment due to clear source of energy
- High profit during the whole lifetime of solar power plant
- Reducing of costs for wind turbines

- During commissioning possibility to extend wind farm

Threats:

- Climate dependence
- Possibility to not get license for electricity production
- Threats to birds
- It is not clear what will be the purchase price after 20 years

4.1.4.5.4 PEST Analysis

Political-legislative factors:

- Limited by granting license for electricity production
- It is controlled by legislations and decrees
- Subsidies in form of feed-in-tariff or green bonus
- Frequent changes in legislation

Economic factors:

- 20 years lifetime of wind turbines
- The amount of electricity produced
- Operating costs
- Return of investment
- High revenues

Socio-cultural factors:

- People may not agree with the placement of wind turbines
- Consideration that the environment is not polluted from the viewpoint of the citizens from village where should be solar power plant

Technological factors:

- New technologies in field of wind turbines
- Decrease in prices for technology
- Government support

5 Conclusion

Renewable energy sources are currently very hot discussed topic and it is for many reasons. It is due to that now is taken into consideration that renewables will be in future really important sources of energy, which helps to solve ecological problems and also simultaneously increase energy self-sufficiency of each state. The idea of renewable energy gives the impression of options to cheaply obtain energy from sources that are accessible to all free of charge and are not subject to any restrictions or inflation.

Without doubt the greatest portion in the development of energy production from renewable sources in the Czech Republic was due to the European Union, which interferes with energy policy of all Member States through indicative targets for the share of energy from renewable energy sources to gross electricity consumption. Czech Republic was able to meet the targets set by the European Union, which set the share of energy consumption from renewables for Czech Republic to 13% from total gross electricity consumption. Czech Republic reached this condition in 2013. Reaching of energy consumption from renewables at 13% was due to boom in building of solar power plants, which was caused by generous subsidies. After subsidy fiasco with solar power plants, whose construction is currently suspended, it is only a matter of time when the Czech Republic will begin at a larger scale to build wind power plants.

The diploma thesis deals with solar and wind energy especially in terms of business and also from the perspective to address potential investor within Czech Republic. For this purpose was diploma thesis written as a business plan, which includes two different projects with focusing on, as mentioned before, business in solar and wind energy. In business plans was processed all basic information, like are all necessary information for planning of solar or wind project, understanding the possibilities of using solar or wind energy in Czech Republic according to localities through the authorization process, the there was also mentioned which technology is the best for the project from perspective of Author of this thesis. In business plans was also evaluated the economic return and effectivity of potential projects.

Business plans are also used to provide basic information how to do business and how to address potential investor.

Author of thesis expected that the business in solar energy will be much better than in wind energy. But as it turned out, during the writing a thesis, that the business in wind energy is really much better than in solar energy. And why is it so? Firstly it is due to that nowadays is not possibility to join distribution network with newly built solar power plant and second reason are results in profit after 20 years of commissioning. Meanwhile in solar energy, if we take in consideration to buy already existing solar power plant are initial costs 15 million Czech crowns and profit is 25,008,655 CZK after 13 years of commissioning (previous owner used solar power plant for 7 years and lifecycle is 20 years) and the result of return on investment is approximately 7 years. For potential realization of project in real business must be bought existing solar power plant due to no subsidies and no possibility to join network. So, in wind energy are although initial costs almost once way more expensive than in solar energy but even profit is several times higher than in solar energy. Initial costs for wind farm are 23,234,900 CZK and the profit after 20 years of commissioning is 91,571,157.3 CZK. The wind farm has also a faster return on investment which is less than 6 years.

From above mentioned we can conclude one single result and it is that the build and do business in the field of wind energy is very profitable, really preferable than solar energy and the Author of this project should address the potential investor by project on wind energy.

Also there has been used analysis of competition and for helping to achieve the success of projects was elaborated SWOT and PEST analysis.

For the feeling of security during business is recommended to elaborate project analysis for risk reduction. The information obtained during different phases of the projects helps to get financial aspect about anticipated costs and profit.

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