Corvinus University of Budapest
Faculty of Business Administration
Department of Finance

Profitable Growth for Vestas?
Valuation of the Largest Wind Turbine Manufacturer

Nándor Hajdu
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Thesis Supervisor: Árpád Pál
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1. INTRODUCTION

Although the renewable energy sector has always been standing close to my heart, my keen interest in wind energy dates back to 2013, when I started an exchange semester in Vienna. During my first trip to the Austrian capital, I noticed that the highway is surrounded by several wind farms along both sides of the border. Unconsciously staring out of the window of the coach, I found these machines simply fascinating. Some were still, some were moving slower, others faster. Some were rotating clockwise, others counter-clockwise. They seemed like autonomous giants working all the time and generating clean electricity without consuming any fuel and emitting any pollutant. The realization that these wind turbines allow a clean and pollution-free way of power generation immediately captured my mind and sparked my interest. Upon my return to Budapest, I took a deep dive into renewable energy and wind power sector.

In the past decades, worldwide energy demand has been steadily growing due to the growth in worldwide population, rising incomes and consumption as well as the accelerating pace of urbanization. Nowadays electricity generation is the world’s single-largest source of energy demand. Although energy intensity of large economies has been decreasing, global electricity demand grew gradually in the past twenty years. The growing electricity demand is expected to continue in the long term.

In meeting this ever increasing demand, renewable sources such as wind, solar, biomass and hydro energy play crucial role. According to forecasts, renewable sources are expected to supply at least one third of the global electricity in 2035.

Wind energy is today the most mature and cost competitive renewable technology. It not only offers huge potential for tackling the challenge of growing demand but also forms an important part of the global energy mix as carbon emission, nuclear and energy security concerns rise. Wind turbine makers, one of the most significant players in the wind sector, play a crucial role in exploiting the full potential of wind power and bringing wind on par with fossil fuels and nuclear power.

Although cumulative wind installations have been growing all over the world, unclear renewable energy targets resulted in volatile annual installations. Due to an impressive historical growth and high growth prospects, new market players entered the wind turbine manufacturer industry.
The emergence of industrial conglomerates and Asian manufacturers has lead to overcapacity and intense price war and therefore deteriorated the profitability of incumbent pure-play manufacturers, such as Vestas. Hence, in these days it is not obvious whether wind turbine manufacturers are good investments or not.

In my thesis I am going to put myself in the position of a financial analyst and investigate the market leader wind turbine manufacturer, Vestas Wind Systems. With my analysis and corporate valuation I intend to estimate the fair share price of the firm. On 30th September 2014, Vestas shares were traded on EUR 30.95. Does this price reflect the growth and profitability prospects of the firm? What recommendation can be given for an investor: buy, hold or perhaps sell? By the end of this thesis I will be able to give a sound answer for this question and decide whether Vestas shares are fairly priced or not.

My thesis follows a funnel-structure: after a broader global energy perspective, renewable sources and wind energy overview, the wind turbine manufacturing industry is going to be analyzed in detail, before turning the spotlight to company analysis and valuation.

The thesis is structured into three main parts. The first part, chapters 2-4, takes a bird’s eye view on the trends of the broader energy sector, electricity generation, renewable energy as well as the entire wind energy sector. This part highlights the growth prospects that will play a central role in the latter chapters. In the second part, in chapter 5, the wind turbine manufacturing industry is examined with a focus on pure-play manufacturers. In the third part, in chapters 6-7, the largest wind turbine manufacturer is investigated in detail: products and services, company history, management and shareholders, strategy, and financial performance. After the strategic and financial analysis of the firm, an enterprise valuation is conducted using two valuation methods: discounted cash flow and relative valuation.
2. GLOBAL ENERGY AND ELECTRICITY TRENDS

2.1. The Basics

As Jim Yong Kim, the president of World Bank put it: “Energy is a critical part of boosting prosperity and eradicating poverty”. (World Bank, 2012) Like no other commodity, energy touches every aspect of modern life, providing tremendous benefits to individuals and businesses around the world. We use energy for various purposes including home, work, and travel, and we also use it indirectly in ways we may not think about: by purchasing goods that take energy to be manufactured, packaged and shipped, by making use of hospitals, schools and public services, or simply by using the internet. (ExxonMobil, 2014)

Energy sources can be classified into two groups: renewable and non-renewable. Renewables come from sources that can be easily replenished, while non-renewables come from sources that we are continuously using up and cannot recreate. (Energy Information Administration, 2014b) Solar, wind, geothermal, hydropower and bioenergy belong to the group of renewable energy sources, while non-renewable energy sources include oil, gas, coal, and nuclear. (International Energy Agency, 2014a)

A common classification of energy is by end-use sectors. When we measure primary energy demand or primary energy consumption, we usually disaggregate total numbers into five segments: (1) power generation, (2) industry, (3) transport, (4) buildings, and (5) other. In the next chapter, energy and electricity consumption trends and outlooks are going to be investigated.

2.2. Energy Consumption

Total primary energy demand has been rising for decades (Figure 1). The primary energy demand increased by almost 50% since 1990, from 8,815 million tons of oil equivalent (Mtoe), up to 13,056 Mtoe in 2012, which means a 1.8% compound annual growth rate (CAGR).

Asia experienced the highest growth in energy consumption and today the continent is responsible for half of global energy consumption. North America and Europe is ranked second and third respectively, however, both regions have faced a less significant growth compared to Asia.
Interestingly, energy demand has been growing in spite of global energy efficiency improvements. According to the International Energy Agency (IEA), “energy efficiency is a way of managing and restraining the growth in energy consumption. Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input”. (International Energy Agency, 2014d)

Between 2001 and 2011, global gross domestic product grew faster than primary energy demand. This indicates a decrease in energy intensity, which – according to the Eurostat glossary – measures the energy efficiency of an economy. By definition, a country’s energy intensity is the energy consumption per unit of gross domestic product. (Eurostat, 2014)

Figure 2 shows the decline in energy intensity in the European Union (EU-28), United States, and China. Increased energy efficiency and the structural changes in the economies have reduced energy intensity. Compared to 2001, the EU-28, U.S. and China had an energy intensity of 84%, 86% and 92%, respectively, in 2011.
Energy outlooks project permanent growth in energy consumption for the future decades. Today, one of the global megatrends is the increasing energy demand driven by three factors: population growth, rising incomes and urbanisation. With the assumed expansion of the global economy of almost 140%, and an increase of 1.7 billion in the world’s population, the energy demand will continuously rise. (International Energy Agency, 2013) In addition to this, due to the accelerating pace of urbanisation, the world’s urban population is expected to increase by approximately 72% by 2050. This process will demand rising investment in urban infrastructure, putting further strains on vital resources, such as energy. (PwC, 2014a)

What is the forecasted increase in global energy consumption? In order to answer this question I synthesise energy outlooks from four different entities1. As Figure 3 illustrates, what all the four forecasts have in common is that they anticipate a gradual growth in global energy demand. While global energy consumption was approximately 13,000 Mtoe in 2012, it is expected to climb up to 15,000-19,500 Mtoe by 2035, depending on the forecasting entity or scenario. This indicates a future CAGR of 0.5-1.8%.

---

1 British Petrol, ExxonMobil, International Energy Agency (IEA) and U.S. Energy Information Administration (EIA)
Among the four energy end use sectors, the power sector is the most significant: it will represent over half of the increase in global total primary energy demand. (International Energy Agency, 2014c) Accordingly, in the following chapter electricity trends are going to be analyzed in more detail.

### 2.3. Electricity Consumption

Today, power or electricity generation is the world’s single-largest source of energy demand. (ExxonMobil, 2014) We have to differentiate between electricity consumption and electricity production. Electricity production is self-explaining – it is defined as the volume of electricity generated or produced. Electricity consumption, or electricity demand, is calculated as the total gross electricity produced less own use in the production of electricity, less transmission and distribution losses. (International Energy Agency, 2013) Thus, electricity consumption is always below electricity production.

Electricity production and electricity consumption have been growing for decades (Figure 4). Global electricity consumption increased by 92% between 1990 and 2012, which indicates a compound annual growth rate of 3.0%. Global electricity production expanded from 11,847 TWh in 1990 to 22,619 TWh in 2012.
In 2011, China overtook the United States to become the world’s largest electricity consumer. (International Energy Agency, 2013) Accordingly, the biggest worldwide electricity consumer is currently Asia, accounting for approximately half of the global electricity consumption. North America, the second largest electricity consumer region, experienced a growth of roughly 40% between 1990 and 2012, despite a small downturn caused by the global economic crisis. In Europe, which is currently ranked third globally, electricity consumption also increased, with an average growth rate of 1.3% per year. The three other regions, Latin America & Caribbean, Africa & Middle East, and the Pacific region faced gradual growth in electricity demand, however, together they account for less than 15% of the global consumption.

According to IEA, the global demand for electricity is set to continue to grow faster than for any other form of energy. By 2040, the largest source of energy demand will be for fuels used to generate power, to make electricity. (International Energy Agency, 2013) As Figure 5 shows, according to IEA and ExxonMobil forecasts, global electricity consumption will almost double by 2035 – growing from 19,462 terawatt hours (TWh) in 2012, to 28,000-35,000 TWh in 2040. This indicates a future CAGR of 1.7-2.7%.
Not surprisingly and in accordance with the historical trends discussed above, the bulk of growth in electricity consumption will arise in non-OECD countries. The forecasted incremental global electricity demand will be attributable mainly to China (38%) and India (13%). (International Energy Agency, 2013)

### 2.4. Ways and Costs of Power Generation

Electricity is generated in so-called power plants. A power plant is a facility designed to produce electric energy from another form of energy. (EON, 2014b)

There are several types of power plants. One category is the conventional power plant, that is, fossil-fuel, nuclear, and hydro power plants. Firstly, fossil-fuel (thermal) power plants are perhaps the most conventional method of generating electrical energy. Simply speaking, these plants convert heat energy into electricity by burning various fuels (coal, oil, natural gas). With the burning process high temperature steam is obtained that enters the turbine and rotates the turbine blades. Secondly, nuclear power plants work similar to thermal power plants, however, radioactive elements (e.g. uranium) are used as the primary fuel. These radioactive fuels undergo a fission reaction within the nuclear reactors, heat up the water and produce high temperature steam. Thirdly, hydro power plants convert the kinetic energy into electrical energy by utilizing flowing water to drive the turbine which runs the generator. (ABB.com, 2014)

In addition to the conventional power plants, there are alternative methods of power generation: solar, wind, geothermal, and tidal.
Today, the term Levelized Cost of Energy (LCoE) is generally used as the “yardstick for comparing energy sources”. (Global Wind Energy Council, 2014a, p.6) The method of LCoE is a net present value based approach that makes it possible to compare power plants of different generation and cost structures with each other. (Fraunhofer Institute, 2013)

Figure 6 shows the LCoE for various energy sources in Germany. For onshore wind, LCoE is roughly EUR 0.05-0.10 per kWh, which indicates that wind is not only the cheapest renewable source, but also can compete successfully with traditional fossil fuels such as coal and natural gas.

For market players, the falling cost of renewable sources has dark sides too. Due to the relatively low costs of renewable power generation, these sources account for an ever greater share of production, which helps pushing wholesale electricity prices down. This, however, is causing a disaster for utility companies whose gas plants are shouldered aside by solar and wind. In Germany, for instance, excess supply coupled with depressed demand resulted in a 50% decrease in wholesale electricity prices between 2008 and 2013. (Economist, 2013)

Nonetheless, the LCoE concept takes only part of the overall picture into account. A perhaps more realistic cost-benefit calculation has been developed by Siemens, which is called the Society’s Cost of Energy (SCoE). The innovative concept takes into consideration several cost effects: costs of hidden subsidies, grid development (transmission) costs, variability costs, social impact, employment and geopolitical effects. (Global Wind Energy Council, 2014a)

According to a forecast for the United Kingdom for 2025, wind onshore and wind offshore will be the most competitive electricity sources in the country – when judged with the social
cost of energy concept. Additionally, gas fired power plants remain the most competitive back up technology. (Global Wind Energy Council, 2014a) Figure 7 illustrates the way from LCoE to SCoE for various sources.

**Figure 7: Forecasted LCoE and SCoE of Different Energy Sources in the UK by 2025**

<table>
<thead>
<tr>
<th>EUR/kWh</th>
<th>Coal</th>
<th>Natural Gas</th>
<th>Nuclear</th>
<th>Photovoltaics</th>
<th>Wind Onshore</th>
<th>Wind Offshore</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LCoE</strong></td>
<td>0.12</td>
<td>0.08</td>
<td>0.08</td>
<td>0.11</td>
<td>0.06</td>
<td>0.10</td>
</tr>
<tr>
<td>+ Subsidies + Transmission + Variability</td>
<td>0.12</td>
<td>0.09</td>
<td>0.13</td>
<td>0.13</td>
<td>0.07</td>
<td>0.11</td>
</tr>
<tr>
<td>+ Social Impact + Employment Effect + Geopolitical Impact</td>
<td>0.11</td>
<td>0.10</td>
<td>0.10</td>
<td>0.08</td>
<td>0.06</td>
<td>0.06</td>
</tr>
</tbody>
</table>

(Source: (Global Wind Energy Council, 2014a)

To sum up, energy demand is set to grow gradually. Power or electricity generation is today the largest source of energy demand, and is expected to grow by an annual 2-3%. When it comes to power generation, various types of power plants are available: not only conventional fossil fuel plants, but also alternative methods of power generation that operate with renewable energy sources.

In the next chapters, the focus will move on to the renewable energy market, its global trends, forecasts as well as its status in a global and regional setting.

### 3. RENEWABLE ENERGY

#### 3.1. The Basics

“If we assume that the course of human civilization will continue for at least another thousand years, then we will eventually arrive at a 100% renewable energy future” (Global Wind Energy Council, 2014a, p.55) This citation from the latest annual report of the Global Wind Energy Council illustrates the current prospects of renewable energy sources. The world economy needs ever-increasing amounts of energy to sustain economic growth, raise living standards, and reduce poverty. But today's trends in energy use are not sustainable. As the
world's population grows and economies become more industrialized, non-renewable energy sources will become scarcer and more costly. (World Bank, 2014)

According to the International Energy Agency (IEA), renewable energy is “energy that is derived from natural processes that are replenished at a higher rate than they are consumed”. (International Energy Agency, 2014a) Common sources of renewable energy include solar, wind, geothermal, hydro, and biomass. These renewable sources hold the promise of an infinite source of power without the risk of exhausting natural resources, contributing to climate change, or worrying about the availability of fossil fuels. (McKinsey Global Institute, 2014)

3.2. Global Perspective

“The introduction of subsidy programs for renewable energy technologies and setting long-term goals in energy policy created a stable investment climate in many states.” (Fraunhofer Institute, 2013, p.8) The latest outlook of the International Energy Agency anticipates that the share of renewable sources in total power generation will rise from 19% in 2011 to 31% in 2035, as they are expected to supply nearly half of the growth in global electricity generation. Although fossil fuels will continue to dominate the electricity generation sector, their share in power generation is expected to decline. (International Energy Agency, 2014c)

Figure 8 below illustrates these outlooks. The share of fossil fuels, – coal, oil, and gas – will decline from 68% in 2011 to 57% in 2035. Regarding the nuclear energy sources, they are expected to remain stable with a share of 12-13% by 2035. Renewable sources, on the other hand, will gain additional share in electricity generation, and are expected to supply 31% of the global electricity.

Figure 8: Current and Forecasted Share of Electricity Generation by Source

(Source: (International Energy Agency, 2014c))
Additionally, according to the forecasts cited above, renewable energy sources will not only overtake gas as the second-largest source of power generation, but also approach coal as the leading source by 2035. (International Energy Agency, 2014c)

As it is shown on Figure 8, the World Energy Outlook includes projections for the various renewable sources as well. Considering the mix of renewable sources in electricity production, the share of hydro sources is expected to remain constant with 15-16% by 2035. On the other hand, all the other renewable sources will increase their share. Amongst these, solar and wind will become the most significant: the share of solar will increase from 0.2% to 3% while the share of wind will increase from the current 1.6% to 7%.

Other recognized research firms also support these projections. According to McKinsey Global Institute (MGI), the business and economics research arm of the top-tier consulting firm McKinsey & Co., the share of wind and solar in global electricity generation is expected to rise up to 16% by 2025, assuming continued cost declines in technology and policy support for meeting the global environmental target of carbon dioxide. (McKinsey Global Institute, 2014)

### 3.3. Regulations

The renewable energy industry is a highly regulated sector where government policies and national targets play a crucial role. Today, renewable energy sources require governmental support in order to compete successfully with conventional sources. The reason for that is simple: carbon emissions and other environmental impacts are not taken into account for conventional sources. (Global Wind Energy Council, 2014a) In this chapter energy regulations and national targets will be examined in the three largest electricity markets: European Union, United States and China.

#### 3.3.1. European Union

In the European Union, the use of renewable energy sources is seen as a key element in energy policy: it enables the reduction of dependence on fuel imported from non-EU countries and emissions from fossil fuel sources as well as to decouple energy costs from oil prices. (European Commission, 2009b) In 2009, the European Parliament and the European Council issued a directive on the promotion of the use of energy from renewable sources. This directive – Directive 2009/28/EC – established accounting criteria for the 2020 targets on renewable energy sources. (European Commission, 2009a)
These targets, known as "20-20-20" targets, set three key objectives for 2020: (1) reducing greenhouse gas emissions (GHG) by 20% from 1990 levels; (2) raising the share of EU energy consumption produced from renewable resources to 20%; and (3) improving the EU’s energy efficiency by 20%. (European Commission, 2014a)

With the aforementioned legislations, a rapid expansion of renewable electricity generation, particularly wind and solar, has occurred in recent years. (International Energy Agency, 2014a) Currently, almost one fourth (23.5%) of the electricity in the EU comes from renewable sources, rising from 14.3% in 2004. Although, low rates of power demand growth and a difficult economic situation raise doubts about the timelines of future investments (International Energy Agency, 2014a), in October 2014 the European Union set new targets for 2030: reducing GHG emissions by at least 40%, increasing the share of renewable energy and energy efficiency at least 27%. (European Commission, 2014b) The new policy spurs continued renewable energy equipment demand for producers, yet at a slower pace than the industry expected. (Evans, 2014a)

Germany  Germany is one of the flagship countries in renewable energy: by 2025, the country aims to produce 40% of its electricity from renewable sources, rising to at least 80% by 2050. (Karnitschnig, 2014)

In April 2000 the German Renewable Energy Act (Erneuerbare Energien Gesetz, EEG) went into effect, which discriminates carbon-neutral renewable energy sources and provides a stable investment environment by setting feed-in tariffs (FITs) for renewables. The core concept behind the feed-in tariff is relatively simple: power generators receive a set rate for each kilowatt-hour of renewable power they produce. Although the rate paid depends on the technology and location, once connected to the grid it remains stable for twenty years. Additionally, renewable power generators are prioritized in a way that grid operators are obliged to expand their grid capacity to provide immediate grid connection to renewable power generators. This, together with the feed-in tariffs, creates financial certainty and a firm risk environment. (German Wind Energy Association, 2014)

In regular intervals, the feed-in tariff decreases for newly connected systems in order to exert cost pressure on generators and manufacturers as well as to incentivize technology innovations. With the decreasing feed-in tariff system renewable sources are becoming more competitive compared to traditional sources. (German Wind Energy Association, 2014) However, from a consumer perspective, the EEG and feed-in tariffs have negative impact on electricity bills since the German government passes the subsidy cost on to consumers in the
form of a surcharge. (Karnitschnig, 2014) For a household of three, the average EEG surcharge (EEG-Umlage) was 5.3 EUR cents per kWh in 2013, representing more than 18% of the total unit price (Figure 9).

**Figure 9: Average Electricity Price for a German Household of Three (2013)**

<table>
<thead>
<tr>
<th>EUR cent / kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production, transportation and distribution; 14.4</td>
</tr>
<tr>
<td>Concession charge; 1.8</td>
</tr>
<tr>
<td>Value-added tax; 4.6</td>
</tr>
<tr>
<td>EEG charge; 5.3</td>
</tr>
<tr>
<td>Other; 2.8</td>
</tr>
</tbody>
</table>

(Source: (Bundesverband der Energie- und Wasserwirtschaft, 2013))

The feed-in tariff is not sustainable on the long run. In the beginning of 2014 the European Union adopted a new state aid guidance which is expected to facilitate a shift from feed-in tariff systems to a more market-based scheme. Overall, this might lead to reduced support for renewable sources across a number of European countries, including Germany. (Vestas, 2014a)

**3.3.2. United States of America**

In the United States of America, Energy Policy Acts (EPAct) are designed to provide a regulatory framework for the energy sector. The latest EPAct was signed into law by President Bush in 2005, and addressed energy production topics, including energy efficiency, renewable energy, electricity, and energy tax incentives. (United States Environmental Protection Agency, 2005) The EPAct set renewable energy goals on a federal level: at least 3% of all electricity consumption had to be derived from renewable sources by 2009, 5% by 2012, and 7.5% after 2013. (International Institute for Sustainable Laboratories, 2005)

The American Renewable Energy and Efficiency Act is a bill introduced by Senator Edward J. Markey in 2013. Although thirty U.S. states already have renewable electricity targets, the United States itself has no clean energy target in place. Although the EPAct set a 7.5% target for the years after 2013, it did not include any progressivity requirement. The American Renewable Energy and Efficiency Act obliges utility companies selling more than one million MWh of electricity to meet a given percentage of their supply with electricity produced from renewable sources. The required renewable share begins at 6% in 2015 and gradually rises to
25% in 2025. With this national Renewable Energy Standard (RES), the United States intends to ensure that it is not lagging behind the other 118 nations that already have clean energy targets in place. (Markey, 2013)

An important element of the U.S. energy legislations is the Production Tax Credit (PTC). It gives financial support for the development of renewable energy facilities by providing a per-kilowatt-hour tax credit for electricity generated by qualified energy resources. Originally enacted in 1992, the PTC has been renewed and expanded numerous times. Currently, the legislation provides 1.1-2.3 US cent/kWh tax credit for the first ten years of the facility's operation (for wind resources the PTC is 2.3 US cent/kWh). (Energy.gov, 2014)

3.3.3. China

In China, where combustion of coal accounts for approximately 80% of total electricity production, renewables are considered to be essential alternatives to conventional fossil sources. The government of the People’s Republic of China is strongly committed to increasing the share of renewable sources. In 2005, the Renewable Energy Law was put into force. With the passage of this law the state gave priority to the exploitation of renewable energy and set medium-to-long term objectives for the total volumes of renewables. (National People's Congress of the People's Republic of China, 2005)

The Renewable Energy Law requires operators to purchase resources from renewable energy generators that legally obtained an administrative license. Furthermore, national funds were established to boost renewable energy development by providing financial incentives, discounted lending and tax benefits for renewable energy projects. The National Development and Reform Commission (NDRC) set the grid price of electricity from renewable sources and adjusts it from time to time. (Renewable Energy World, 2005)

The charge and fee sharing system is similar to the one in Germany: “the excess between the expenses that power grid enterprises purchase renewable power (feed-in tariff) and the expenses incurred in the purchase of average power price generated with conventional energy shall be shared in the selling price”. (National People's Congress of the People's Republic of China, 2005, p.8) In other words, the additional cost of renewable power generation is spread across individual and industrial customers on the given grid.

In 2010, a government agency called National Energy Commission (NEC) was set up to coordinate the country’s energy policy. NEC is responsible for planning, strategy formulation, ensuring energy security and coordinating international cooperation. According to industrial
experts, “the establishment of the National Energy Commission shows that the government has raised energy issues to an unprecedented level”. (Zhihong, 2010)

To sum up, subsidy programs and national targets have been set up in large power consumer regions. The targets and subsidy schemes are, however, slightly different.

Today, wind energy is primarily used to generate electricity. (Energy Information Administration, 2014c) According to energy outlooks, within renewable energy sources, the share of wind will experience a steady increase – not only globally but also on regional levels. But what is wind energy exactly? Why is it preferred over fossil fuels and other renewable sources? How wind power capacity developed in the past? The following chapter is going to, among other things, provide answers to these questions.

4. WIND ENERGY

In these days wind energy is one of the most mature and cost competitive renewable technologies. It forms an important part of the global energy mix as carbon emission, nuclear and energy security concerns rise. (Global Wind Energy Council, 2014a) In this chapter I am going to give an overview about the utilization of wind for power generation, its pros and cons, capacity developments as well as introduce the types of market players.

4.1. The Basics

Wind is caused by the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface and the rotation of the earth. (Wind Energy Development EIS, 2014) The term wind energy, or wind power, refers to the process by which the wind is used to generate mechanical power or electricity. Humans started using wind energy centuries ago with windmills that pumped water, ground grain and did other types of work. Today’s wind turbine is a highly evolved version of a windmill. (American Wind Energy Association, 2014)

By definition, a wind turbine is a machine that transforms the kinetic energy of the wind into mechanical or electrical energy. This mechanical power can be used for specific tasks (e.g. grinding grain, pumping water) or a generator can convert this mechanical power into electricity. (European Wind Energy Association, 2014b)

Wind turbines consist of a foundation, a tower, a nacelle and a rotor. The foundation prevents the turbine from falling over, while the tower holds the rotor and a nacelle (or box). The
nacelle contains large primary components such as the main axle, gearbox, generator, transformer and control system. The rotor is made of the blades and the hub, which holds them in position as they turn. Most commercial wind turbines have three rotor blades, and the length of the blades can be more than 60 metres. (European Wind Energy Association, 2014b)

Wind turbines are often grouped together into a single wind power plant, also known as a wind farm, and generate bulk electrical power. Electricity from these turbines is fed into a utility grid and distributed to consumers. (Wind Energy Development EIS, 2014)

4.2. Competitive Advantages and Disadvantages

(+) Cost competitiveness Wind energy is considered to be cost competitive and today, in many markets, its most compelling selling point is the relatively low cost. Wind is already competing successfully against heavily subsidized incumbents in a growing number of markets around the world as the technology and its implementation steadily improve. (Global Wind Energy Council, 2014a)

With feed-in tariffs and other types of governmental support and due to improvements in efficiency and declines in prices, wind is becoming cost-competitive with conventional energy sources. Figure 10 shows the LCoE development of wind energy in the United States: in the last five years, the levelized cost of electricity generated from wind dropped from 0.14 USD to 0.06 USD, indicating a 58% five-year decrease. (Lazard, 2014)

Figure 10: LCoE of Wind in the United States (2009-2014)

It has to be kept in mind that governmental support for investments in wind power drive the expansion and cost reduction of the sector. This support is usually provided through incentive schemes or grants to the owners of wind power plants (operators). Primarily, the support
manifests itself through tax incentives and subsidising tariffs on electricity generated by wind turbines. (Vestas, 2014a)

**(+) Energy security** Volatile fuel prices, recent events in Ukraine and elsewhere in the world, as well as the importance of a stable and abundant supply of energy point to wind energy’s contribution to energy security. In the European Union, where 53% of the energy consumed is imported, an EU energy security strategy has been released, emphasising the switch to alternative energy sources. (European Commission, 2014b)

**(+ Economic benefits** Wind energy helps the economy. Approximately 670,000 people were employed directly or indirectly in the global wind energy industry in 2012. According to Global Wind Energy Council, by 2030 the wind energy sector could generate 2.5-3 million jobs globally (Global Wind Energy Council, 2014c) and thus address unemployment issues.

Nevertheless, wind power has disadvantages too. Conventional fossil-fuelled power stations offer dispatchable electricity available on demand since the chemical energy in coal and gas can be stored in relatively huge quantities. In the case of fossil fuels, grid management is generally a simple task, but when it comes to wind energy, grid management becomes more difficult. (World Economic Forum, 2014)

**(-) Intermittence** Clean energy sources, in particular wind and solar, can be highly intermittent: instead of producing electricity when residential, commercial and industrial consumers want it, they generate uncontrollable quantities only when favourable weather conditions allow. (World Economic Forum, 2014)

**(-) Storage difficulties** Another significant barrier is connected to the intermittence and to the fact that electricity cannot be directly stored, so grid managers must constantly ensure that overall demand from customers is exactly matched by an equal amount of power fed into the grid by generating stations. (World Economic Forum, 2014) Due to intermittence and storage difficulties, there were days when spot electricity prices turned to negative. For instance, on a bright and breezy Sunday in Germany this year, power generating companies had to pay grid managers to take their electricity due to the peak of wind and solar power. (Economist, 2013)

Nevertheless, today there are signs that a range of new technologies are getting closer to cracking the challenge of energy storage. The most novel option being explored is the so-called carbon-dioxide-methanation, where surplus energy is used to split water into hydrogen
and oxygen, with the hydrogen being reacted with waste carbon dioxide to form methane for later combustion – to generate electricity. Although the efficiency of these options are relatively low, electricity storage will undoubtedly have high economic potential in the future as the pace of technological development in this field is nowadays moving more rapidly than ever before. (World Economic Forum, 2014)

(-) Impact on animals and natural habitats Wind farms often harm birds, bats and natural habitats. Although wind turbine blades appear to be moving slowly, the blade tip is indeed very fast so birds are sometimes killed by collisions with wind turbines. Additionally, natural habitats can be lost or fragmented when they are cleared to establish wind farms and power facilities. (World Bank, 2009)

(-) Noise and health effects Although wind energy enjoys considerable public support, some are concerned about the noise emitted from wind turbines and its health effects. Nevertheless, the improved design of wind turbines has drastically reduced the noise of mechanical components and an American-Canadian expert panel review concluded that “sound from wind turbines does not pose a risk of hearing loss or any other adverse health effect in humans”. (Canadian Wind Energy Association, 2009, p.10)

4.3. Types of Wind Turbines

So far onshore wind energy has been examined in more detail but there is another type of wind energy that has similar or even more potential – this is the so-called offshore wind energy. According to Global Wind Energy Council, the enormous potential of offshore wind is shown by two illustrative facts: offshore wind could meet Europe’s energy demand seven times over, and the United States’ energy demand four times over. (Global Wind Energy Council, 2014b) The European Wind Energy Association refers to offshore wind as a “rapidly growing industry with huge potential and massive developer interest”. (European Wind Energy Association, 2014c)

Offshore wind is a relatively new technology. Most probably the technological costs will decrease and the technology will advance further enabling offshore wind energy to be more efficient and competitive in the near term. Offshore wind energy has three key benefits in comparison to onshore wind. Firstly, wind resources offshore are generally much greater than in onshore, thus makes it possible to generate more energy with fewer turbines. Secondly, offshore wind is suitable for large scale development close to major demand centres, avoiding the need for long transmission lines since most of the world’s large cities are located near a
coastline. Thirdly, in case of densely populated coastal regions with high property values, offshore wind installations make sense as onshore developments would otherwise trigger public opposition. (Global Wind Energy Council, 2014b)

Although the offshore wind energy is considered to be the “future of energy”, there are some significant obstacles that have to be taken into account. From a global perspective, regulatory uncertainty is the main non-technological barrier threatening deep offshore wind deployment. (European Wind Energy Association, 2014d) From a European Union perspective, a major obstacle is the absence of electrical transmission systems at sea, and the Member States’ lack of experience with integrated spatial planning in the marine environment. Additionally, offshore projects are usually bigger than onshore ones. The electricity produced at sea is much more difficult to distribute on land and therefore it is necessary to extend the grid and the interconnection capacity. (Europa.eu, 2014)

After learning the basics of wind energy and getting a better understanding of its advantages and disadvantages, we can now move on to statistics and take a look at the development of global and regional wind energy installations.

4.4. Global Perspective

The Global Wind Energy Council (GWEC) publishes an annual report on the status of global wind industry that provides a comprehensive overview of the sector at the moment in time. According to this report, for the first time in more than 20 years, the annual global market for wind energy dropped in 2013. In other words, new installations were lower than in 2012. Although more than 35 GW of new wind power was brought online, this was a sharp decline compared to 2012, when global installations reached 45 GW (Figure 11). The drop was mainly attributable to the U.S. market that shrank dramatically, from 13 GW in 2012 to just 1 GW in 2013. (Global Wind Energy Council, 2014a)

Figure 11: Global Annual Installed Wind Capacity (1996-2013)

(Source: (Global Wind Energy Council, 2014a))
In general, the decrease or elimination of government support schemes has a negative impact on the wind turbine market. In recent years, government support schemes have been under pressure due to the pressing need for cutting budgets. Therefore, disruptions in government support have occurred and uncertainties evolved. (Vestas, 2014a) Nevertheless, the global cumulative installations stood at 318 GW at the end of 2013, which is approximately 20-times the capacity of 2000.

4.5. Regional Perspective

By taking a look at the geographical regions (Figure 12) it becomes clear that Europe and Asia are responsible for the majority of cumulative wind installations. The two continents, with 38.2% and 36.4% respectively, account for three quarters of the total global installed capacity. (Global Wind Energy Council, 2014a)

![Figure 12: Cumulative and New Installed Capacity in Different Regions (2013)](source)

North America is ranked third with 70.8 GW, representing 22.3% of the global cumulative installed capacity. The three other regions – Latin America & Caribbean, Africa & Middle East and the Pacific Region – are insignificant in terms of cumulative installed capacity, accounting for roughly 3%.

Besides analyzing the cumulative capacity, Figure 12 also enables us to investigate the new annual installations. Interestingly, new installations in Asia lead global markets with 18.2 GW, while Europe was in the second place with 12.0 GW. (Global Wind Energy Council, 2014a)
In the past years, annual installations were fluctuating driven by the unstable regulative environment. While new installations in the EU were relatively stable, in China and especially in the United States the annual market showed high level of fluctuations.

4.5.1. European Union

Today, a total of 121 GW wind power capacity is installed in Europe, out of which 117 GW is installed in the European Union. During 2013, 12 GW of wind power capacity was installed across Europe, with the European Union accounting for the majority of the total figure (11.2 GW). The 2013 European figures reflect orders made before the wave of political uncertainty that has swept across the continent since 2011. (Global Wind Energy Council, 2014a)

Analysing the last year growth we can see that onshore wind energy market dropped by 12%, from 10.9 GW to 9.6 GW. Offshore installations, however, grew by a promising 34%, from 1.2 GW up to 1.6 GW (Figure 13).

Figure 13: Annual Installations in the European Union (2001-2013)

In addition to the European Union, North America and China are the dominant markets for wind energy. This is perfectly shown by country-level statistics: China, USA, Germany, Spain, India, and the UK are ranked top six and account for more than 75% of global cumulative capacity. Nevertheless, annual installations in the US and China show huge variations and therefore must be investigated in more detail.

4.5.2. United States of America

In the United States, the Production Tax Credit is a major driver of wind power development. The PTC has been extended in one- and two-year intervals since its inception, and has been allowed to expire on several occasions: in 2002, 2004 and 2013 (Figure 14). Due to the
expiration, annual installations dropped notably in 2013, however, a new extension drives strong installations in 2014 and 2015. (American Wind Energy Association, 2014)

**Figure 14: Annual Installations in the United States (2001-2013)**

![Annual Installations in the United States (2001-2013)](source)

### 4.5.3. China

Since 2009, China is the largest overall market for new wind installations. After the skyrocketing of installations between 2001 and 2010, annual installations dropped in 2011-2012. In last year, approximately 16 GW was installed, representing 51.6% of global annual capacity (Figure 15). Due to the strong growth, Chinese manufacturers have started to emerge in recent years. Today they not only dominate the home market but also gaining foothold in Europe and America.

**Figure 15: Annual Installations in China (2001-2013)**

![Annual Installations in China (2001-2013)](source)

The other Asian giant, India, saw new wind energy installations of 1.7 GW in 2013, which pace of growth kept the Indian wind power market firmly in the top five rankings globally. (Global Wind Energy Council, 2014a)

In addition to the European Union, United States and China wind power is reaching critical mass in a number of Latin American countries too. The region has begun developing substantial wind power capacity in order to support energy security and diversify energy supply: it installed 1.2 GW new capacity in 2013, out of which four countries (Brazil, Chile,
Argentina, Uruguay) accounted for the vast majority, 1.16 GW. (Global Wind Energy Council, 2014a)

To sum up, wind energy is one of the most mature and cost competitive renewable technology. The levelized cost of wind energy has been continuously falling, putting onshore wind in a competitive position among other power generation sources. Although wind energy is facing several challenges (e.g. intermittence, grid, storage, noise and health effects), global cumulative wind power installations have been growing significantly. The European Union, North-America and Asia are the dominant regions, accounting for more than 95% of worldwide cumulative installations.

4.6. Market Players in the Wind Energy Sector

The wind energy market is a global market: global companies dominate in every business segment. We can differentiate between three types of market players: (1) wind turbine manufacturers, (2) wind farm developers, and (3) wind power operators. Figure 16 gives an overview of these players, their activities and involvement in the entire process (from manufacturing to operation) as well as illustrates some companies as examples.

**Figure 16: Wind Energy Sector Market Players**

<table>
<thead>
<tr>
<th>Wind turbine manufacturers</th>
<th>Wind farm developers</th>
<th>Wind power operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing and assembling of wind turbines</td>
<td>Planning, development and realisation of wind farms</td>
<td>Generation, distribution and sales of electricity</td>
</tr>
<tr>
<td>Vestas, Siemens, Suzlon, Goldwind</td>
<td>TEST WIND, RES</td>
<td>E.ON, Vattenfall, RWE, DONG</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Project Development</td>
<td>Maturation</td>
</tr>
<tr>
<td>Construction</td>
<td>Installation</td>
<td>Operation and Maintenance</td>
</tr>
</tbody>
</table>

(Based on: (Deloitte, 2011) & (Deloitte, 2014))

In order to gain a better understanding of the wind power sector, the three types of players are going to be investigated in brief:

(1) Global wind turbine manufacturers such as Vestas, Gamesa, Goldwind as well as industrial conglomerates (Siemens, General Electric) produce wind turbines and offer maintenance services after installation. Generally they also provide turnkey solutions, that is, they take part in the project development, construction and installation processes.
(2) Wind farm developers (e.g. PNE Wind and Renewable Energy Systems) are primarily responsible for the development process, from the initial development through construction to installation. They do not operate wind farms, instead they sell those to utility companies after installation.

(3) Finally, wind power operator giants such as E.ON, EDP, EDF, RWE and GDF SUEZ take care of the operations of installed wind turbines and the distribution of electricity, although most of the time they are the initiators of project development and also participate in the development and installation process. Perhaps surprisingly, more and more petrochemical company invests in wind energy and operates wind farms. British Petrol, for example, is the owner and operator of wind power facilities with a capacity of 2,600 MW in the US. (British Petrol, 2014b)

In the following part of my thesis I put myself into the position of an analyst giving recommendations to investors who want to ride the wave of wind energy and consider buying shares of the market leader in wind turbine manufacturer, the Danish company Vestas. In order to judge whether Vestas shares are fair priced or not, I am going to conduct a fundamental analysis: an analysis of the determinants of firm value, such as prospects for earnings, in an attempt to find mispriced stocks and enterprises. (Brealey et al., 2007) & (Bodie et al., 2010) Before turning the spotlight on Vestas, the wider wind turbine manufacturing sector is going to be investigated, with an emphasis on growth, profitability and competitive dynamics.

5. WIND TURBINE MANUFACTURING MARKET ANALYSIS

5.1. Growth

The traditional power utility business model is under pressure – in parts of the world, power generation from gas and nuclear no longer makes economic sense for utilities. (PwC, 2014b) Consequently, utility companies are raising the share of renewables in their energy mix. For instance, E.ON is today among the top ten wind power operators worldwide. In the medium term, the company is committed to make further large-scale investments and to expand onshore and offshore installed wind capacity. (E.ON, 2014) The global growth in electricity demand and the aforementioned shift towards renewable sources implies a high growth rate for the wind turbine manufacturing sector.
In terms of total sales, the global wind turbines industry grew by a compound annual growth rate of 5% between 2009 and 2013. According to MarketLine analysis, the global revenue of wind turbine manufacturers is expected to be approximately EUR 87 million, representing a 53% increase compared to 2013. Accordingly, the compound annual growth rate of the industry value is predicted to be 8% for the period of 2014-2018 (Figure 17). (MarketLine, 2014)

![Figure 17: Annual Revenue of the Global Wind Turbine Industry (2009-2018)](chart)

(Source: (MarketLine, 2014, p.12))

Nevertheless, high growth rate does not necessary indicate that investors should make investments in that given industry without any other considerations. Warren Buffett’s letter to shareholders underlines this by emphasising the role of competitive dynamics and profit margins: “in the past, it required no brilliance for people to foresee the fabulous growth that awaited such industries as autos, aircraft and television sets. But the future then also included competitive dynamics that would decimate almost all of the companies entering those industries. […] Just because Charlie and I can clearly see dramatic growth ahead for an industry does not mean we can judge what its profit margins and returns on capital will be as a host of competitors’ battle for supremacy. At Berkshire we will stick to businesses whose profit picture for decades to come seems reasonably predictable. Even then, we will make plenty of mistakes.” (Buffett, 2010, p.4)

5.2. Revenue and Profitability

The wind turbine manufacturing industry comprises of pure-play companies and industrial conglomerates. Generally, wind energy equipment manufacturers operate on a global level. Since governments very often require local production to qualify for state-backed financing or subsidies, the biggest manufacturers have production facilities around the world. Chinese

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2 Charlie Munger, Vice Chairman at Berkshire Hathaway, is the right-hand man and investment partner of Warren Buffett (Forbes.com, 2014)
producers have been the exception, mainly targeting the domestic market and only recently selling externally. In terms of product mix, some companies are focusing exclusively on onshore wind such as Enercon and Nordex and some on gearless turbines. (Morales, 2013a)

In the period between 2004 and 2008, the revenue of the largest pure-play wind turbine manufacturers increased gradually (Figure 18). With the hit of global financial crisis in 2008 European manufacturers (Vestas, Gamesa, Nordex) and Indian manufacturer Suzlon experienced a sharp decline in sales. On the other hand, Chinese manufacturers’ revenue (Goldwind, Sinovel, MingYang) continued to grow up until 2010, before starting to drop in 2011.

From 2008-2009 the industry has been facing challenging times. The crisis of turbine manufacturers was mainly attributable to overcapacity and price war: “the industry was causing its own demise by building more factories everywhere and continuously competing on price.” (Evans, 2014c)

**Figure 18: Revenue of the Largest Pure-Play Wind Turbine Manufacturers (2004-2013)**

![Revenue Chart](chart.png)

The crisis can be paralleled to what happened in the solar panel industry between 2011 and 2013, when prices fell dramatically due to massive overcapacity, cutback in subsidies and increased competition from manufacturers arising from China. (Church, 2011) With the intensifying price war in the sector, panel manufacturer giants filed bankruptcy such as Evergreen Solar Inc., Solyndra (USA), Solar Millennium, Conergy (Germany) and several Chinese manufacturers. After a consolidation, the number of players dropped and solar companies started to return to profitability.
A similar trajectory is expected in the wind turbine manufacturing industry. A breakdown of some market players, an anticipatory consolidation, and an increase in prices is vital since negative EBIT margins (Figure 19) are not sustainable on the long term.

**Figure 19: EBIT of the Largest Pure-Play Wind Turbine Manufacturers (2004-2013)**

Accordingly, form 2013 wind turbine makers changed attitude and abandoned the pursuit of growth at all costs. Companies cut at least 9,000 jobs and closed their less efficient manufacturing plants. As Juergen Zeschky, CEO of Nordex, points out: “wind turbine manufacturers are now doing their homework and becoming more efficient, optimizing their processes and achieving further cost reductions“. (Morales, 2013a) Most of the manufacturers are now in the middle of cost cutting programs that are beginning to show positive profitability. As a result of these steps, the large turbine makers’ EBIT grew notably in 2013.

Plant closures by the biggest manufacturers have significantly reduced potential turbine supply. Consequently, the stabilization of volumes and a lower supply now enables to boost prices. (Morales, 2013a)

In addition to sales and EBIT, it is worth investigate the return on invested capital (ROIC), which is the return the company earns on each unit of currency invested in business. (Koller et al., 2010) As Figure 20 illustrates, ROIC\(^3\) started to decrease with the escalating price war and intensifying competition from industrial conglomerates and Chinese manufacturers.

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\(^3\) ROIC does not compute if (1) the year-on-year average invested capital is negative or (2) the effective tax rate is not available (Bloomberg)
Historical revenue and profitability development gives only a superficial impression of the sector and therefore a more detailed industry analysis has to be conducted in order to understand competitive dynamics.

5.3. Five Forces Analysis

In this chapter I am going to conduct an in-depth industry analysis by using Michael Porter’s classical Five Forces Model, which determines industry attractiveness by investigating competitive dynamics.

(1) Bargaining Power of Buyers  Buyers of wind turbines are fragmented and usually include large power operator companies, state utilities, and private power producers. Customers’ switching costs are high as they are usually locked into a contract for a longer period once they commit themselves to a turbine manufacturer. (MarketLine, 2014) Generally, buyers choose a particular turbine manufacturer and they stick to it for a long term as long term (at least five-year) servicing is bundled with the turbines sold.

(2) Bargaining Power of Suppliers  Current market conditions and fierce competition within the wind industry increases the need for wind turbine manufacturers to rely more on suppliers to deliver outstanding quality, innovation and flexibility. (Vestas, 2014e) Manufacturers are limiting turbine platforms and cutting costs by increasing the commonality of components across turbine models. (Evans, 2014c) The growing commonality of components and the commodity raw material (steel) indicate a moderate bargaining power of suppliers.

(3) Threat of New Entrants  Potential new entrants face several entry barriers. Firstly, new entrants must possess a turbine design that meets the market requirements in terms of efficiency and reliability. Secondly, significant amount of capital is required for the initial
capital expenditures and manufacturing costs. Thirdly, engineering, manufacturing and construction expertise are also inevitable due to product complexity and often harsh construction sites (e.g. mountains, offshore). Nevertheless, the high industry growth rate fuelled by national energy targets and governmental subsidies attract new entrants, especially industrial conglomerates who possess expertise and available capital. Additionally, Chinese manufacturers are also entering the market since their ability to offer low prices and grow in parallel with their expanding home wind energy market.

(4) Threat of Substitutes  From a practical perspective, substitutes include not only other renewable energy sources but also conventional fossil fuels and nuclear energy. Nonetheless, threat of substitutes is moderate for two reasons: (1) fossil fuels are cost competitive but energy policies point to the decrease of carbon emissions, and (2) among renewable sources, wind has the lowest levelized cost of energy.

(5) Industry Rivalry  Three types of companies compete on the wind turbine manufacturing market: pure-play wind turbine manufacturers (e.g. Vestas, Gamesa, Nordex, Goldwind), industrial conglomerates (e.g. GE, Siemens, American Superconductor) and large private manufacturers (e.g. Bard, Enercon). The top ten companies held a total market share of 69.5% in 2013. Accordingly, the value of the Herfindahl-Hirschman index is approximately 600, which indicates a low market concentration. Industry rivalry is intense, especially in terms of price: manufacturers offer similar quality and therefore try to compete on price driving a drop in profitability.

To sum up, the wind turbine manufacturing industry has been highly attractive. The emergence of new entrants, primarily industrial manufacturers and manufacturers from China, increased the level of competition. But who are the current competitors? The next chapter answers this question by introducing the ten largest wind turbine manufacturers.

5.4. Competitor analysis

In the 1980s, when the utility-scale use of wind power began, the market was dominated by Danish, German and U.S. companies. In the past decade, however, the industry has gone through a period of consolidation and in these days many industrial conglomerates participate alongside pure-play companies. Recently, due to strong domestic growth, new market entrants have also emerged from China, helping it to become the largest wind energy market worldwide. (Evans, 2014d)
Figure 21 shows the top ten wind turbine manufacturers based on market share. In 2013, the Danish Vestas was the market leader in wind turbine manufacturing with 13.1% market share.

**Figure 21: Market Share of Wind Turbine Manufacturers (2013)**

(Source: (BTM Consult, 2013))

Nevertheless, there are other significant wind turbine manufacturers who are going to be introduced in brief in the following lines.

**Goldwind Science & Technology Ltd.** is a wind turbine manufacturer headquartered in China. The company has more than 19 GW installed capacity and is a market leader in China, with approximately 20% market share. Although the core market of Goldwind is China, since its listing on the Hong Kong Stock Exchange in 2010, the company expanded across six continents and gained foothold in Europe and America. (Goldwind, 2014)

**Enercon**, founded in 1984, is a private company based in Aurich, Germany. The company has a cumulative installed capacity of 34 GW and owns production plants in various European countries as well as in Canada, and Brazil. In Germany, Enercon is the market leader with an impressive market share of 49.6% in 2013. (Enercon, 2014)

**Siemens Wind Power**, a subsidiary of the German conglomerate Siemens, is an manufacturer of onshore and offshore wind turbines. The company installed the world’s first offshore wind power plant in Denmark in 1991, and today it is a market leader in offshore wind: 4 GW out of the cumulative 7 GW installed offshore capacity has a Siemens label. (Evans, 2014b)

**GE Wind** is a branch of GE Energy, a subsidiary of the world’s largest company, General Electric (GE). GE’s entry into the wind power sector dates back to 2002, when the company won the bankruptcy auction for the Enron Wind Corporation’s wind turbine manufacturing assets. (The New York Times, 2002) As one of the leading wind turbine supplier, the
company offers wind turbines with capacities ranging from 1.5 to 4.1 MW as well as support services. (GE Wind, 2014)

**Gamesa Corporación Tecnológica** is a Spanish manufacturer with global production centres in Spain and China, and local production capacity in India, US, and Brazil. Although the company is headquartered in Zamudio, Spain, 88% of sales stemmed from outside the home country in 2013. (Gamesa, 2014)

**Suzlon Group** is a wind turbine manufacturer headquartered in Pune, India. The Group involves three companies: Suzlon Energy Ltd., SE Forge, and Senvion SE AG. With the acquisition of Senvion SE (formerly Repower Systems SE) in 2009, Suzlon gained a strong foothold in Germany and acquired know-how of offshore wind power. (Senvion, 2012) By the end of 2013, the company had a cumulative installed capacity of 24 GW and had wind turbines in 31 countries. (Suzlon, 2014)

**Goudian United Power** is a subsidiary of the stated owned enterprise China Goudian Corporation. The company is headquartered in Beijing, China, and it manufactures and sells wind turbine generators and wind turbines. (China Goudian Corporation, 2014)

**MingYang Wind Power Ltd.** is a non-state owned wind turbine manufacturer based in China. The company was founded in 2006, and since 2010 it is listed on the New York Stock Exchange. MingYang cooperates with Aerodyne Energiesysteme GmbH, a leading wind turbine design firm based in Germany. (MingYang, 2014)

**Nordex SE**, a developer and manufacturer of wind turbines, is headquartered in Rostock, Germany. The company is listed on the Frankfurt Stock Exchange since 2001, and has roughly 11 GW installed capacity in 34 countries all over the world. Although Nordex wind turbines are manufactures in Rostock, the company is represented with offices and subsidiaries in 19 countries. (Nordex, 2014)

To sum up, wind turbine manufacturers operate in a sector with high growth rates. In spite of impressive growth, the industry has been facing challenges recently. The competition is relatively high given the number of Chinese manufacturers: an intense price war drives the falling prices of wind turbines.

In the final chapters of my thesis I conduct a fundamental analysis as well as value the company with the method of discounted cash flow analysis and relative valuation. During the
analysis of Vestas the following areas are going to be covered: products and services, company history, management and shareholders, revenue streams and financial ratios.

6. ANALYSIS OF VESTAS

Vestas Wind Systems A/S is a global energy company dedicated exclusively to wind energy. (Vestas, 2014a) The company is headquartered in Aarhus, Denmark and since 1998 it is listed on NASDAQ OMX Copenhagen. Vestas not only develops, manufactures, and markets wind turbines but also installs the turbines and offers follow-up and maintenance services of the installations. It has manufacturing facilities in several countries across Europe, Asia, North and South America, and operates a worldwide sales and service network. (Vestas, 2014e)

6.1. Strategic Analysis

6.1.1. Products and Services

The firm’s products and services portfolio is split into three areas: turbines, operations & maintenance, and options & solutions. Firstly, turbines are classified into two segments: 2MW platform and 3MW platform, however both platforms include turbines with different rotor diameters and for a broad range of wind and site conditions. (Vestas, 2014e)

Secondly, operation & maintenance services are offered under the umbrella of Active Output Management (AOM) and VestasOnline services. With AOM the company provides continuous service and ensures the highest possible output, while VestasOnline services offer an online dashboard in order to support monitoring, planning and forecasting. (Vestas, 2014e)

Thirdly, options & solutions include project planning support (e.g. siting, electrical design), various turbine options for specific needs (e.g. de-icing system, aviation marking), construction and installation, as well as plant optimisation. (Vestas, 2014e)

By the end of third quarter 2014, the company installed more than 52,000 wind turbines. These turbines have a total capacity of 62 GW, which is approximately 20% of the cumulative global installations. The size of these turbines range from 1.8-3.3 MW, although Vestas has already developed an 8 MW turbine dedicated for offshore locations. (Vestas, 2014e)

The company came a long way to install 62 GW. The period between 2009 and 2013 was particularly challenging and hallmarked by numerous changes for Vestas. In the next chapter
the past five years will be analyzed in more detail in order to gain a better understanding of Vestas’ present and outlook for the future.

6.1.2. Five-Year Company History

Back in 2009, Vestas defined financial targets for its “Number 1 in Modern Energy” strategy. With the Triple15 target, the company aimed to achieve an EBIT margin of 15 percent and revenue of EUR 15 billion by no later than 2015. (Vestas, 2010) In a pursuit of meeting these targets, the year 2010 was hallmarked by the motto “in the region for the region”: the firm further globalised its production by transferring part of the manufacturing from Europe to USA and China. Previously, the company manufactured wind turbines in Europe and transported them to other regions such as North America and Asia. (Vestas, 2011)

By 2011, 80-90% of Vestas turbines were typically manufactured regionally. (Vestas, 2012) The globalised production has resulted in substantially lower transportation costs, shorter distances to customers and markets, while simultaneously reducing the environmental impact. Furthermore, globalised production allowed Vestas to cut the amount of money tied up in inventories during transport and enabled the replacement of lorry with the cheaper way of rail transportation. (Vestas, 2011) In addition to this, with a global footprint Vestas has become more robust towards exchange rate fluctuations. (Vestas, 2012)

Although the globalised production strategy enabled the company to exploit its global operations, increase customer proximity and reduce costs, 2011 was a tough year for Vestas: the company had to abandon its previously set Triple15 targets, and the share price dropped by roughly 65%. As a result, approaching the end of 2011, the company embarked on a new journey and started to establish a new operating business model and a new organisation. (Vestas, 2013) These restructurings determine the current strategy and operations of the company.

Until 2011, Vestas handled most of its production in-house, including the manufacturing of components such as control systems, blades, towers, and nacelle constructions. Many of the company’s suppliers have grown with the business of Vestas and today they are able to deliver quality in time. Relying highly on suppliers allows Vestas to manufacture to order and reduce inventories. With local and international suppliers delivering a greater share of wind turbine components, Vestas has a relatively lower need for investment. This gives grounds to a leaner Vestas with a smaller employee base. (Vestas, 2012)
In the previous years, the company succeeded in implementing a number of initiatives that made the company better prepared for the future. The restructuring of the group included a new organisation announced in January 2012: the former 16-member Vestas Government was replaced by an enlarged, 6-member Executive Management, allowing greater focus on every part of the value chain and a stronger performance management. (Vestas, 2012)

Vestas has become a light and flexible organisation with a new operating business model that is scalable to volatile and specific demand. Furthermore, the product range was simplified: instead of investing heavily in new technologies, the emphasis moved to the development of existing platforms (2MW and 3MW) and proven technological solutions. (Vestas, 2013)

In addition to the globalised production strategy, in 2010 Vestas changed its accounting policy for revenue recognition. In years before 2010, revenue and earnings on the contracts were recognised at the rate of completion of work. With the new policy effective from 1st of January 2010, “revenue from contracts on which Vestas delivers as well as installs wind turbines is recognised at the time of delivery of the finally installed wind turbines to the customers”. (Vestas, 2011, p.15) Consequently, revenue and earnings are not recognised in the financial statements until the risk of the installed wind turbines has been transferred to the customer. In other words, revenues are now recognised at a later time than under the previous policy. (Vestas, 2014a)

Since the turnaround, Vestas has focused on three key areas: cost reduction, investments reduction, and capital efficiency improvement. (Vestas, 2012) These areas are going to be examined in more detail in the financial analysis chapter.

By the end of 2013, the turnaround has been completed successfully. With the new strategy, Vestas strengthened its ability to manage business risk by becoming more scalable, flexible, and lean. (Vestas, 2013) The company is now in a better shape: costs have been reduced, manufacturing capacity has been aligned with demand, and profitability increased significantly. (Vestas, 2014a)

In addition to the completion of turnaround, the agreement to form a joint venture with Mitsubishi Heavy Industries Ltd. was an important milestone in 2013. The combination of MHI’s presence in global power markets and Vestas’ technological capabilities holds the promise of large synergies for the cooperation dedicated to offshore wind power. (Vestas, 2014a)
6.1.3. Management and Incentives

Vestas has a two-tier management system: the Board of Directors and the Executive Management. The Board of Directors consists of twelve members: eight external members with broad international experience, and four employee representatives. (Vestas, 2014a) The Executive Management is responsible for the day-to-day management of the company and has eight members who represent the key disciplines of the company (Figure 22).

Figure 22: Vestas Organisational Structure

Currently the company has a Swedish president and chief executive officer, Mr. Anders Runevad who was appointed on 1st September 2013, after two unprofitable years. (Morales, 2013b) Mr. Runevad gained a masters degree in electrical engineering and an MBA from the University of Lund (Sweden). Before his appointment to CEO at Vestas, he worked 25 years for the Swedish telecommunication equipment manufacturer Ericsson where he had various jobs in the US, Singapore, Sweden and Brazil and therefore has an extensive international experience. (Milne, 2013)

The remuneration policy for members of the Board of Directors and Executive Management reflects the interest of the company’s shareholders by promoting performance and aiming at attracting and retaining talented executives. Members of the Executive Management receive a remuneration package that consists of four elements: (1) fixed salary, (2) cash bonus, (3) share-based incentives, and (4) personal benefits. Executive Management is incentivised in multiple ways: they participate in an annual performance-based bonus scheme that is based on the achievement of a number of parameters, including financial key performance indicators like EBIT and cash flow. Additionally, they are also eligible for participation in a share-based long-term incentive programme. (Vestas, 2013) As of October 2014, Mr. Runevad holds 5,000 shares, while the total Executive Management holds 28,902 shares of the company. This is approximately 0.13% of shares outstanding (Table 1).
Table 1: Shares held by Vestas Executive Management

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Number of shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anders Runevadd</td>
<td>Group President &amp; CEO</td>
<td>5,000</td>
</tr>
<tr>
<td>Marika Fredriksson</td>
<td>Executive Vice President &amp; CFO</td>
<td>5,500</td>
</tr>
<tr>
<td>Anders Vedel</td>
<td>Executive Vice President &amp; CTO</td>
<td>3,800</td>
</tr>
<tr>
<td>Jean-Marc Lechéne</td>
<td>Executive Vice President &amp; COO</td>
<td>2,000</td>
</tr>
<tr>
<td>Juan Araluce</td>
<td>Executive Vice President &amp; CSO</td>
<td>12,602</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td></td>
<td><strong>28,902</strong></td>
</tr>
</tbody>
</table>

(Source: (Vestas, 2014e))

The performance-based remuneration linked to financial KPIs as well as the share-based incentive programme ensures the commitment of Executive Management to the proposed financial targets.

6.1.4. Corporate Strategy

Vestas has a sound corporate strategy: “Profitable Growth for Vestas”. The company’s mission is to deliver best-in-class wind energy solutions and set the pace in the industry to the benefit of the customers and the planet. The strategic vision of the company is to be the undisputed Global Wind Leader: “being the market leader in volume, having best-in-class margins and the strongest brand in the industry while bringing wind on par with coal and gas”. (Vestas, 2014d) In order to reach the strategic ambition and vision, Vestas set four strategic goals (Vestas, 2014e):

1. Reducing the levelized cost of energy faster than the market average
2. Achieving operational excellence in all fields of the business
3. Capturing the full market potential of the service business and to grow the service business by more than 30% in the mid-term
4. Growing profitably in mature and emerging markets and in the mid-term to grow faster than the market

6.1.5. Shareholders

As of 30 September 2014 Vestas has 224,074,513 shares. According to the Bloomberg classification, the majority of these shares (89.8%) are held by investment advisors, while governments and corporations hold 7.8 and 2.2%, respectively. In terms of volumes held, the biggest shareholder was Blackrock (4.9%), an independent global investment manager firm.
6.2. Financial Analysis

After a strategic analysis, the company is now going to be analyzed from a financial perspective: revenues, profitability, liquidity and leverage will be starring in the next chapters. In general, a historical financial analysis of five years is considered sufficient to identify trends occurring in a given business. (Hitchner, 2011) In the case of Vestas, however, a longer period is considered (2008 and 2014 first nine months) in order to examine years before wind turbine industry crisis evolve from 2009-2010.

6.2.1. Revenue Streams

The revenue of Vestas derives from two sources: (1) sales of turbines, and (2) services of turbines. Figure 23 shows the revenue distribution of the company across geographical regions between 2008 and 2014 first nine months. Revenue has show high volatility: substantial year-on-year changes indicate relatively unstable market environment that is exposed to governmental regulations.

Figure 23: Vestas Revenue (2008-2014M9)

When it comes to the service business, Vestas is in a favourable position as the company has a global cumulative installed capacity of more than 60 GW. This is significantly higher than the one the closest competitor has and therefore provides a unique platform from which the service business can be grown. (Vestas, 2014a)

The service business is characterised by a stable and evenly distributed revenue stream over the course of the calendar year. Additionally, in the service business the EBIT margin\(^4\) is significantly higher than in the turbine sales business. With the growing service revenues

\(^4\) before allocation of Group costs
(Figure 24), Vestas has become a two-legged operation standing firmly on two revenue streams: selling wind turbines and servicing wind power plants. (Vestas, 2013)

**Figure 24: Vestas Service Revenue and EBIT Margin (2008-2014M9)**

![Graph showing Vestas Service Revenue and EBIT Margin (2008-2014M9)](source)

By focusing on the servicing and maintenance, Vestas is becoming less exposed to the financial and seasonal fluctuations of the wind turbine manufacturing industry. (Vestas, 2012) Additionally, it requires in-depth knowledge about the wind turbines’ performance, wind conditions and grid types, therefore can be a source of competitive advantage for an experienced firm such as Vestas. Last but not least, it ties up only a relatively low amount of capital. (Vestas, 2014d)

### 6.2.2. Costs and Capital Expenditures

The turnaround had three focus points: cost reduction, investments reduction, and capital efficiency improvement. Did the company succeed to improve in these dimensions?

By the fourth quarter of 2013 Vestas reduced its annualised fixed capacity costs by EUR 484 million compared to 2011Q4. The primary reason for cost reductions was the cutback of workforce in the period of 2010-2013, when the company laid off 7,755 employees (Figure 25). In the first nine months of 2014, however, the company increased the number of employees by 3,827, mainly driven by the ramp up at the factories in the United States. (Vestas, 2014c)
Secondly, the firm reduced net investments in PP&E from EUR 606 million in 2009 down to EUR 73 million in 2013 (Figure 26). The decrease was attributable to the cutback of heavy investments made in plants, equipment, and new wind turbine platforms. From 2013 Vestas has become a streamlined company: instead of producing all components itself the firm outsourced part of the production to trusted business partners.

Thirdly, capital efficiency considerations played an important role during the turnaround. Non-core activities were divested or outsourced: Vestas reduced its number of factories from 31 to 19. Divestments and closures were mainly carried out in Europe: the company sold its tower factory in Denmark, and six machining units in Denmark, Germany, Norway, Sweden and China. (Vestas, 2014a) Vestas’s tower factory in Denmark was sold to Chinese manufacturer Titan Wind Energy (Quilter, 2012), while other plants started to share manufacturing capacity with third parties: the Vestas tower factory in Pueblo, Colorado (US) increased its activity in order to supply both the parent company (Vestas) and third parties. (Vestas, 2013)

Currently, the company has production sites in eight countries including the United States, Spain, Denmark, China, Brazil, Germany, Italy and India (Figure 27).
6.2.3. Profitability Ratios

Since the turnaround initiated at the end of 2011, Vestas’ gross margin has improved significantly. By definition, gross margin is the gross profit/loss as a percentage of revenues. The gross margin increased by 6.2% points in the past years: from 11.0% in 2012, up to 17.2% in the first nine months of 2014. (Vestas, 2013)

EBIT margin has also increased in the period between 2011 and 2014. The turnaround strategy triggered a positive development, from 0.7% in 2011 the EBIT margin jumped to 6.9% in the first nine months of 2014. However, it has be bear in mind that the Group’s EBIT margin is a compound average, representing two substantially different business lines. While the service’s EBIT margin\(^5\) climbed up to 22% in 2013, the turbine sales business line showed highly fluctuating margin (negative values in 2010-2011 were followed by 6% in the first nine months of 2014).

Finally, return on invested capital\(^6\), which stood above 30% in the golden years, has also increased due to the turnaround. Since 2011 it grew from -1.3% to an impressive 25.7% in the first nine months of 2014. In the coming years, Vestas aims to continuously generate a

---

\(^5\) before allocation of Group costs

\(^6\) Vestas defines ROIC as follows: “operating profit/loss after tax (effective tax rate) as a percentage of average property, plant and equipment and intangible assets, inventories and receivables less non-interest bearing debt including provisions” (Vestas, 2014a, p.51)
double-digit ROIC by increasing earnings and keeping investment and net working capital requirements low. (Vestas, 2014a)

Figure 28 gives an overview of the development of gross margin, EBIT margin and ROIC. The figure perfectly illustrates the successful years of 2007-2009, the downturn evolved afterwards as well as the rise experienced in 2013-2014M9.

![Figure 28: Vestas Gross Margin, EBIT Margin and ROIC (2004-2014M9)](Source: Vestas Annual Reports (2008-2014Q3))

6.2.4. Activity Ratios

The majority of Vestas’ inventories consist of wind turbines that have been installed but not yet handed over to the customers. In the past years, the company was committed to the reduction of its inventories and thereby release capital. (Vestas, 2011) Consequently, the inventory turnover improved dramatically: from 173 days in 2010 it dropped to 100 days in 2013. As for the receivables, although receivable turnover climbed up from 33 days in 2010 to 41 days in 2011, a strict collection management decreased it to 37 days in 2013. Finally, payable turnover also took a turn to the better: from 59 and 98 days in 2010 and 2011, respectively, it dropped to 49 days in 2013. In summary, all the three common types of activity ratios advanced, indicating a successful execution of the turnaround strategy.

6.2.5. Liquidity Ratios

The most commonly known liquidity ratio, the current ratio, remained relatively flat between 2010 and 2013. Nevertheless, it fluctuated between 1.15 and 1.25, which shows the company’s ability to pay its obligations. The other commonly used liquidity ratios (acid-test and cash ratio) increased, indicating the drop in inventories attributable to the management’s dedicated efforts to reduce net working capital.
6.2.6. Leverage Ratios

One leverage ratio Vestas regularly reports is the solvency ratio, which is the equity at year-end divided by total assets. The solvency ratio improved notably, from 23.3% at the end of 2012, up to 30.8% at 30 September 2014.

Another leverage ratio is gearing (debt-to-equity), which shows the interest-bearing liabilities at year-end as a percentage of the equity at year end. Similar to the solvency ratio, gearing has shown positive developments: from 108% at the end of 2012, it dropped to 28.6% by 30 September 2014.

The key message of Chapter 6 is that the two-year turnaround has been implemented successfully and Vestas is now in good shape: cost decreased significantly, which drove an improvement of all types of financial ratios, including profitability. Streamlining has made the company flexible and well-positioned for the future. Closure of unnecessary manufacturing plants released capital, while keeping a number of plants still guarantees proximity to key markets: Europe, Americas and Asia. Drop in inventories and investments in fixed assets has lead to a decreasing invested capital and therefore a higher ROIC.

Additionally, Vestas has developed a strategy emphasising the importance of growth, operational excellence, LCoE reduction as well as the focus on service business. The positioning of the firm fits well to these strategic cornerstones: diversified manufacturing and revenues across various geographical segments, increasing margins as well as an unrivalled cumulative installed capacity (>60GW) indicate a promising future for the Danish wind turbine manufacturer. As HSBC clean-energy analyst Sean McLoughlin emphasises: “now there is a clear long term value in Vestas shares since the company is ideally positioned to benefit from global wind demand growth”. (Morales, 2013b)

Does share price reflect these promising prospects? What recommendation should be given for an investor: buy, hold or perhaps sell? In the next chapter, the company is going to be valued with two corporate valuation approaches in order to answer these questions.
7. VALUATION OF VESTAS

Value is the “defining dimension of measurement in a market economy”. (Koller et al., 2010, p.3) In a market economy, a company’s ability to create value for its shareholders and the amount of value it creates are the primary measures by which the company and its management is judged. (Brealey et al., 2007) The guiding principle of value creation is that companies create value by investing capital to generate cash flows at rates of return exceeding the cost of capital. The combination of sustainable growth and return on invested capital relative to its cost are the key factors what drive value. (Koller et al., 2010)

In this chapter, theory and practice are going to be covered side by side. After giving an overview of theoretical approaches, the particular valuation method is applied for the target company, Vestas.

7.1. Overview of Valuation Methods

According to Aswath Damodaran, Professor of Finance at the Stern School of Business at New York University, there are three approaches to enterprise valuation: (1) discounted cash flow, (2) relative valuation, and (3) contingent claim valuation. Firstly, the discounted cash flow (DCF) valuation determines the value of an asset by calculating the present value of the expected future cash flows. Secondly, the relative valuation estimates the value of an asset by looking at the pricing of comparable assets relative to a common variable such as earnings, sales, cash flow, or book value. Thirdly, the contingent claim valuation uses option pricing models to measure the value of assets that share option characteristics. Some of these assets are financial assets (e.g. warrants), while some of these are based on real assets (e.g. projects, oil reserves) – the latter are usually called real options. (Damodaran, 2012)

Figure 29: Three Approaches to Valuation

1. Discounted Cash Flow Valuation
   The value of an asset is derived from cash flows that are discounted at a risk adjusted discount rate

2. Relative Valuation
   The value of an asset is based on the pricing of similar assets

3. Contingent Claim Valuation
   The asset with the characteristics of an option is valued using an option pricing model

(Based on: (Damodaran, 2012))

Figure 29 gives a brief overview on the aforementioned approaches. In the next chapters Vestas is going to be valued with discounted cash flow and relative valuation methods.
7.2. DCF Method

Discounted cash flow (DCF) valuation is a fundamental valuation methodology broadly used by financial experts: “almost every sophisticated equity valuation model used by investment banks today is a discounted cash flow model”. (Viebig et al., 2008, p.9)

It is built on the principle that the value of a company can be derived from the present value of its projected free cash flow. The valuation implied for a company by DCF valuation is also known as intrinsic value, as opposed to market value, which is the value ascribed by the market at a given point of time. (Rosenbaum & Pearl, 2009)

There are various subtypes of DCF valuation: free cash flow to firm (FCFF), free cash flow to equity (FCFE), economic value added (EVA) and adjusted present value (APV) belong to the most common ones. It has to be emphasised that these methods are identical in output: they result in the same enterprise value. In the next chapters the FCFF and EVA methods will be applied for calculating the enterprise value of Vestas’ and the fair value of its shares.

In order to estimate free cash flow to a firm (FCFF), we first calculate cash flows based on revenue, earnings, taxes, invested capital and growth. In the next step, these cash flows are discounted with a discount rate called the weighted average cost of capital (WACC), which is the function of cost of equity, cost of debt, and the financial leverage of the firm. Finally, to get the total enterprise value, we add the terminal value that has a perpetuity-type formula: cash flow of the terminal year in the numerator and WACC minus stable growth rate (g) in the denominator (Figure 30). These steps are going to be conducted for Vestas in the next chapters.

**Figure 30: Components of FCFF Valuation**

\[
Enterprise\ Value = \sum_{t=1}^{t=n} \frac{FCFF_t}{(1 + WACC)^t} + \frac{FCFF_{t+1}}{(WACC_{t+1} - g_t)}
\]

(Based on: (Damodaran, 2012))
7.2.1. Growth

“Growth is the key input in every valuation”. (Koller et al., 2010) The growth rate used to forecast revenues and earnings is a critical element in valuation, especially for high-growth firms such as wind turbine manufacturers. There are three ways of estimating growth for any firm: (1) historical growth rate, (2) analysts’ estimates, and (3) the fundamental determinants. (Damodaran, 2012)

(1) Historical growth  Although historical growth is not always a good indicator of the future, it does convey information that can be valuable while making estimates for the future. (Damodaran, 2012) Between 2009 and 2013, Vestas revenues grew by an annual 4.6% on average. However, if we took the period between 2008 and 2013 into account, the revenue CAGR would be 0.6%. This shows the weakness of relying on the historical growth rate: depending on the period observed, there may be huge deviations in growth rate. Additionally, it hides important structural changes in sales and hinders the separation of Vestas’ two distinct revenue streams (turbine sales and servicing revenues).

(3) Analyst estimates of growth  Analysts’ estimates are thought to be better than historical growth rates for a very simple reason: analysts not only consider firm-specific information that has been made public since the last earnings report, but also count on macroeconomic information that may have an impact on future growth. Additionally, they may leverage on information revealed by competitor firms on future prospects, as well as private information about the firm. (Damodaran, 2012)

(3) Fundamental determinants of growth  The third way of estimating growth is to investigate the operating details of the firm, and so make growth estimate endogenous i.e., tie it closely to the actions a business takes to create and sustain growth. Accordingly, we can dig into quantitative element (e.g. return on capital, reinvestment rate, margins, etc.), however, we have to take into account that growth is determined by a number of subjective factors (e.g. quality of management, strength of marketing, strategic vision, etc.). (Damodaran, 2012)

In the following discounted cash flow valuation of Vestas, the emphasis will be put on the fundamental determinants of growth. The two distinct revenue streams (turbines, services) will be estimated separately, given their different growth prospects and margins. Additionally, global annual installation forecasts, strategic priorities and management qualities will be taken into consideration.
While the logics of the aforementioned approaches to growth estimates are different, there are some common messages that can be derived from these approaches. The first is that growth and reinvestment are linked – firms that desire to grow at high rates over long periods have to reinvest to create that growth. (Viebig et al., 2008) The second is that the quality of growth can vary widely across firms, and the best measure of growth is the return on investment, the return on invested capital, which is the return the company earns on each unit of currency invested in business. (Koller et al., 2010) Since the entire valuation is based on assumptions, projected financial statements (income statement, balance sheet and cash flow forecast) have to be dealt with in detail.

7.2.2. Projected Income Statement

According to the latest Annual Report, Vestas has three financial priorities: EBIT margin, free cash flow, and revenue. In the next chapters, these priorities, the successful turnaround as well as industry trends are going to be taken into account in order to precisely forecast the firm’s income statement, balance sheet and cash flow.

Revenue

Vestas’ two business lines substantially differ in growth prospects and profitability, thus they must be forecasted separately. Turbine sales are driven by three factors: annual installations, market share of Vestas and average selling price. Relying on these inputs, a bottom-up revenue forecast is created.

As for the annual installations, I rely on the outlooks of the Global Wind Energy Council. By estimating Vestas’ future market shares for the three separate regions, annual installed capacities are calculated. The average selling price of order intakes has been falling gradually. Lower turbine prices, while pressuring margins, improve the competitiveness of wind compared to fossil fuel sources, spurring new wind equipment demand. In the projections I assume a selling price decreasing with 2% annually. Finally, turbine revenues derive as annual installations multiplied by turbine unit price (Table 2).
As for the service business, Vestas has the largest installed capacity of wind turbines worldwide, which provides a strong platform for renewals of expiring service agreements. The company aims to improve the current service renewal rate (75%) while simultaneously recapture a part of the 15 GW Vestas turbine capacity that are currently not under Vestas service. (Vestas, 2014a)

In the case of services, a slightly different revenue estimation approach is used. Historically, Vestas’ service contracts comprised 75-77% of the company’s cumulative installations. This rate is applied on forecast cumulative installations in order to estimate GW under service. In the period between 2010 and 2013, the unit price of servicing was EUR 0.020-0.022m per MW – this price is projected and adjusted with a yearly 2% HICP assumption. Accordingly, revenues from services will almost double between 2014 and 2020 (Table 3).

### Table 2: Projected Turbine Sales (2014-2020)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Installed Capacity (GW)</td>
<td>47.3</td>
<td>51.0</td>
<td>55.7</td>
<td>60.2</td>
<td>64.0</td>
<td>70.8</td>
<td>78.3</td>
</tr>
<tr>
<td>Europe &amp; Africa</td>
<td>13.0</td>
<td>14.5</td>
<td>16.5</td>
<td>18.0</td>
<td>19.0</td>
<td>21.0</td>
<td>23.2</td>
</tr>
<tr>
<td>Americas</td>
<td>13.0</td>
<td>13.0</td>
<td>14.7</td>
<td>16.5</td>
<td>18.0</td>
<td>19.9</td>
<td>22.0</td>
</tr>
<tr>
<td>Asia &amp; Pacific</td>
<td>21.3</td>
<td>23.5</td>
<td>24.5</td>
<td>25.7</td>
<td>27.0</td>
<td>29.9</td>
<td>33.0</td>
</tr>
<tr>
<td>Vestas Market Share</td>
<td>12.0%</td>
<td>11.8%</td>
<td>11.8%</td>
<td>11.7%</td>
<td>11.5%</td>
<td>11.3%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Europe &amp; Africa</td>
<td>25.0%</td>
<td>25.0%</td>
<td>25.0%</td>
<td>25.0%</td>
<td>25.0%</td>
<td>25.0%</td>
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</tr>
<tr>
<td>Americas</td>
<td>12.0%</td>
<td>11.5%</td>
<td>11.0%</td>
<td>10.5%</td>
<td>10.0%</td>
<td>9.5%</td>
<td>9.0%</td>
</tr>
<tr>
<td>Asia &amp; Pacific</td>
<td>4.0%</td>
<td>3.8%</td>
<td>3.5%</td>
<td>3.3%</td>
<td>3.0%</td>
<td>2.8%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Vestas Annual Installed Cap. (GW)</td>
<td>5.7</td>
<td>6.0</td>
<td>6.6</td>
<td>7.1</td>
<td>7.4</td>
<td>8.0</td>
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<tr>
<td>Europe &amp; Africa</td>
<td>3.3</td>
<td>3.6</td>
<td>4.1</td>
<td>4.5</td>
<td>4.8</td>
<td>5.3</td>
<td>5.8</td>
</tr>
<tr>
<td>Americas</td>
<td>1.6</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.8</td>
<td>1.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Asia &amp; Pacific</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Turbine Unit Price (EURm / MW)</td>
<td>951.0</td>
<td>930.1</td>
<td>909.5</td>
<td>889.5</td>
<td>869.8</td>
<td>850.6</td>
<td>831.9</td>
</tr>
<tr>
<td>Revenue (Turbine, EURm)</td>
<td>5,385</td>
<td>5,581</td>
<td>6,002</td>
<td>6,286</td>
<td>6,402</td>
<td>6,776</td>
<td>7,169</td>
</tr>
</tbody>
</table>

### Table 3: Projected Service Revenue (2014-2020)

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vestas Cumulative Installed Cap. (GW)</td>
<td>65.9</td>
<td>71.9</td>
<td>78.5</td>
<td>85.6</td>
<td>92.9</td>
<td>100.9</td>
<td>109.5</td>
</tr>
<tr>
<td>Service contracts</td>
<td>77%</td>
<td>78%</td>
<td>79%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>Service contracts (GW)</td>
<td>50.7</td>
<td>56.1</td>
<td>62.0</td>
<td>68.5</td>
<td>74.3</td>
<td>80.7</td>
<td>87.6</td>
</tr>
<tr>
<td>Service unit price (EURm / MW)</td>
<td>0.021</td>
<td>0.022</td>
<td>0.022</td>
<td>0.022</td>
<td>0.023</td>
<td>0.023</td>
<td>0.024</td>
</tr>
<tr>
<td>Revenue (Service, EURm)</td>
<td>1,073</td>
<td>1,210</td>
<td>1,365</td>
<td>1,537</td>
<td>1,702</td>
<td>1,885</td>
<td>2,087</td>
</tr>
</tbody>
</table>

Cost of Sales, Distribution and Administrative Expenses

Cost of sales comprises the expenses incurred to achieve revenue for the year and includes the following items: raw materials, consumables, direct labour costs and indirect expenses such as salaries, rental expenses and depreciation of production facilities. (Vestas, 2014a) The gross
margin expresses the percentage that remains after deducting cost of sales from revenues. Since 2011, gross margin grew notably, from 12.4% in 2011 up to 17.2% in the first nine months of 2014. For the projection period, cost of sales is estimated separately for the two business lines, assuming a gross margin of 18% for service and 16% for turbine sales.

Research and development (R&D) costs comprise development costs that are not capitalised as well as amortisation of and impairment losses on capitalised development costs. In the previous years, Vestas re-focused its R&D function: existing product platforms are today prioritized over research. Distribution expenses comprise expenses incurred for the sale and distribution of products as well as expenses related to employees and depreciation. Administrative expenses comprise expenses incurred for management and administration of the Vestas Group, including expenses for administrative staff, management, office premises, office expenses and depreciation. (Vestas, 2014a)

R&D expenses are projected as a percentage of turbine revenues (3%) and reflect the efficiency improvements experienced in the period between 2011 and 2014. Distribution and administrative expenses are considered to be fix costs and therefore I calculate with historical averages (EUR 150m and EUR 300m) growing annually with 2% HICP.

**Depreciation, Amortization and Capital Expenditures**

The effects of capital expenditures (CAPEX) and depreciation are found on both the income statement and the balance sheet. (Allman, 2010) In the past two years, depreciation and amortization accounted for roughly 20% of Vestas’ non-current assets. Depreciation and amortization is calculated on a straight-line basis over the useful life of the assets that is: 20-40 years for buildings, 3-10 years for plant and machinery, and 3-5 years for other non-current assets including intangibles. (Vestas, 2014d) Accordingly, 5%, 20% and 25 depreciation rates are applied in depreciation and amortization calculation.

Capital expenditures will be increased in parallel with revenues since the expectations on sales and change in invested capital must be consistent: “a company can usually only grow its revenues if it invests in PP&E and in net working capital”. (Viebig et al., 2008, p.99)

**Earnings Before Interest and Taxes (EBIT)**

The service business line had an EBIT margin\(^7\) of 18-22% in the examined historical period, and service is one of the primary strategic focus points of the company. Hence, an EBIT

---

\(^7\) before allocation of group costs
margin of 20% is used in the forecasts. In the turbine sales business EBIT margin fluctuated between -3% and 6% in the past years. Nevertheless, in the first nine months of 2014 it has shown a remarkable improvement, climbing up to 6%. This was driven by successful cost reductions and the establishment of the offshore joint venture which resulted in lower R&D. For the projection period the turbine EBIT margin derive as turbine revenue minus turbine cost of ales minus group costs (R&D, distribution, administrative) and will rose from 3.7% in 2014 up to 6% in 2020.

**Financial Income and Financial Expenses**

Financial income and expenses comprise interest, exchange gains and losses and impairment losses on securities, debt and foreign currency transactions, as well as amortisation of financial assets and liabilities. (Vestas, 2014a) In 2014 financial income comprised mainly of interest income (EUR 4m), while financial expenses comprised of interest expenses (EUR 85m) and other financial expenses (EUR 39m). In the forecast period I assume no financial income and expense will arise except for the interest expenses associated with corporate bond (maturing in March 2015).

**Corporation Tax**

In Denmark, the corporation tax rate is currently 25%. Vestas’ subsidiaries, however, pay corporate tax in the countries in which they operate and therefore the effective tax rate differs from the Danish corporation tax rate. Previous years’ effective tax rates showed huge deviations: from 35% in 2010 it dropped to -128% due to special items attributable to the turnaround. In the first nine months of 2014, effective tax rate was 25%, consequently, this rate is used in the projections.

**Dividend**

The intention of the Board of Directors is to recommend a dividend of 25-30% of the net result of the coming year. However, pay-out of dividends will “always take into consideration the company’s plans for growth and liquidity requirements”. (Vestas, 2014d, p.12) In the projections for 2014-2020, I calculate with a dividend payout ratio of 30%.

Figure 31 illustrates the historical and projected development of revenue, cost of sales and earnings before interest and taxes.
Figure 31: Projected Revenue, Cost of Sales and EBIT

7.2.3. Projected Balance Sheet

Due to the turnaround and restructuring, the size of Vestas’ balance sheet decreased significantly, from EUR 7,066m at the end of 2010 to EUR 5,640m at the end of 2013. At the end of the third quarter 2014, however, total book value stood at EUR 7,038m driven by the strong growth in sales. Nevertheless the structure of the balance sheet is completely different compared to 2010: non-current assets and non-current liabilities dropped dramatically, while current assets and current liabilities increased. This fact illustrates that Vestas has been made scalable and flexible in the recent years.

Intangible Assets

Intangible assets comprise of four items: (1) goodwill, (2) completed development projects, (3) software, and (4) development projects in progress. Intangible assets have decreased significantly since 2010. Development projects (completed and in progress) are measured at costs comprise of salaries, amortisation and other expenses attributable to the development activities. Due to the fact that a joint venture for R&D intensive offshore wind was established, completed development projects and development projects in progress are expected to remain moderate. The current EUR 215m goodwill, which is not amortised, is assumed to be constant in the projected period. Software includes acquired software licences and internally developed software, and is amortised on a straight-line basis over five years. (Vestas, 2014a) Software is expected to increase in parallel with revenues due to Vestas’ strategic focus on the service business line, which includes operation and maintenance software and online services offered for turbine operators (e.g. AOM).
Property, Plant and Equipment

A decrease in property, plant and equipment was driven by the reclassification of offshore assets to assets held for sale, the closures of almost half of the production plants as well as by lower investments than depreciation and amortisation.

As corporate valuation books emphasise, “revenue growth assumptions must be consistent with forecast capital expenditures”. (Viebig et al., 2008, p.105) Due to the successful turnaround, the utilization of manufacturing capacities is high. Thus, in order to be able to generate higher revenues, the company has to invest in PP&E in parallel with sales growth.

Other Non-Current Assets

With effect of 1st April 2014, Vestas transferred its offshore activities related to the development of the V164-8.0 MW turbine to its subsidiary Vestas Offshore A/S while Mitsubishi Heavy Industries Ltd. injected an amount of EUR 100m. The transaction resulted in a joint venture with equal ownership between Vestas and MHI. (Vestas, 2014c) The balance sheet item investments in joint ventures reflect this investment and will be projected constant (EUR 179m). Investments in associates and JVs are consolidated and therefore part of invested capital. Other receivables (prepayments, supplier claims, VAT and insurance) and deferred tax are projected as a fix share of revenues.

Current Assets

Vestas’ dedicated effort for the optimisation of the supply chain (“make-to-order” principle) as well as an increased use of standard components keeps the level of inventories low. (Vestas, 2014a) In the forecasted period, trade receivables and inventories are forecasted based on their current turnover days with the following formulas:

\[
\text{Trade receivables} = \frac{(\text{Rec. turnover in days}) \times \text{Rev}}{365}
\]

\[
\text{Inventory} = \frac{(\text{Inv. turnover in days}) \times \text{Cost of sales}}{365}
\]

Construction contracts in progress, other receivables and corporation tax are projected as a fix share of revenues.

Cash at bank and in hand is classified into two groups: (1) cash at bank and in hand with disposal restrictions, and (2) without disposal restrictions. Cash at bank and in hand with disposal restrictions are “included in day-to-day cash management” (Vestas, 2014a, p.79) and therefore part of the operating assets. Cash without disposal restrictions, however, are considered as excess cash and therefore will be included in non-operating assets.
As part of the turnaround and site simplification project, the company is selling several facilities: these are classified as (current and non-current) assets held for sale, and comprise EUR 103m. This item will be considered as a non-operating asset as it comprises unused office facilities (measurement basis is fair value less cost to sell).

**Equity**

In the period between 2010 and 2013, Vestas’ equity diminished due to the negative net income. At 30th September 2014, equity amounted to EUR 2,165m, an increase of EUR 940m compared to one year before. This positive change was driven by two factors: positive net income in the first nine months of 2014 (Vestas, 2014d) and a capital increase conducted in February 2014, when share capital grew by EUR 3m and retained earnings by EUR 439m. (Vestas, 2014b) For the projected period, a constant share capital of EUR 30m will be assumed.

**Liabilities**

Provisions are made for all costs associated with wind turbine repairs within the warranty period (2-5 years) as well as to cover anticipated expenses in connection with service contracts. From the last years’ annual reports it is clear that utilised provisions for a given year was roughly the same as provisions made for the year. Hence, I assume a stable EUR 200 million provision – both current and non-current.

In March 2010 Vestas issued euro-denominated corporate bonds with a nominal value of EUR 600m, at a rate of 4.625% and an effective interest rate of 4.8%. In 2014 non-current liabilities dropped significantly due to the fact that the corporate bonds become due within twelve months. In parallel, they have been classified as current financial debt. These bonds will mature on 23 March 2015. (Vestas, 2014a)

Regarding the other current liabilities, prepayments from customers comprise prepayments received for wind turbines ordered but not yet delivered and therefore can be forecasted as a fix share of revenues. Trade payables will be projected based on the improved payable turnover of 50 days in 2013 and calculated as follows:

\[
\text{Trade payables} = \frac{(\text{Payable turnover in days}) \times \text{Rev}}{365}
\]

Other liabilities (staff costs, duties and other payables) are projected based on their historical share of revenue (7%).
7.2.4. Projected Free Cash Flow

Vestas expects to be able to finance its own growth and thus, the free cash flow is expected to be positive each financial year. (Vestas, 2014a) Free cash flow is defined as cash flows from operations which a company can distribute to its providers of capital after investing in capital. (Viebig et al., 2008)

Free cash flow is calculated as the difference between NOPLAT (net operating profit less adjusted taxes) and the change in invested capital ($\Delta IC$). Based on the projected revenues, cost of sales and other expenses, earnings before interest and tax (EBIT) is calculated. Multiplying the EBIT with $(1 – \text{tax rate})$ gives the NOPLAT for the projected period.

Revenues, EBIT and NOPLAT are forecasted to grow gradually in the period between 2014 and 2020. In the discounted cash flow model, however, expectations on sales must be always consistent with expected changes in invested capital. (Viebig et al., 2008) Therefore, invested capital is expected to increase (Table 4).

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>(+) Inventories</td>
<td>1,554</td>
<td>1,634</td>
<td>1,772</td>
<td>1,882</td>
<td>1,949</td>
<td>2,082</td>
<td>2,225</td>
</tr>
<tr>
<td>(+) Trade receivables</td>
<td>672</td>
<td>707</td>
<td>767</td>
<td>814</td>
<td>844</td>
<td>902</td>
<td>964</td>
</tr>
<tr>
<td>(+) Construction contracts in progress</td>
<td>52</td>
<td>54</td>
<td>59</td>
<td>63</td>
<td>65</td>
<td>69</td>
<td>74</td>
</tr>
<tr>
<td>(+) Other receivables</td>
<td>387</td>
<td>407</td>
<td>442</td>
<td>469</td>
<td>486</td>
<td>520</td>
<td>555</td>
</tr>
<tr>
<td>(+) Corporation tax</td>
<td>58</td>
<td>61</td>
<td>66</td>
<td>70</td>
<td>73</td>
<td>78</td>
<td>83</td>
</tr>
<tr>
<td>(+) Cash (operating)</td>
<td>65</td>
<td>68</td>
<td>74</td>
<td>78</td>
<td>81</td>
<td>87</td>
<td>93</td>
</tr>
<tr>
<td>Current Assets</td>
<td>2,789</td>
<td>2,932</td>
<td>3,180</td>
<td>3,377</td>
<td>3,497</td>
<td>3,737</td>
<td>3,994</td>
</tr>
<tr>
<td>(+) Trade payables</td>
<td>973</td>
<td>1,005</td>
<td>1,070</td>
<td>1,115</td>
<td>1,132</td>
<td>1,187</td>
<td>1,268</td>
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<tr>
<td>(-) Prepayments from customers</td>
<td>1,679</td>
<td>1,766</td>
<td>1,915</td>
<td>2,034</td>
<td>2,107</td>
<td>2,252</td>
<td>2,407</td>
</tr>
<tr>
<td>(-) Construction costs in progress</td>
<td>32</td>
<td>34</td>
<td>37</td>
<td>39</td>
<td>41</td>
<td>43</td>
<td>46</td>
</tr>
<tr>
<td>(-) Other current liabilities</td>
<td>452</td>
<td>475</td>
<td>516</td>
<td>548</td>
<td>567</td>
<td>606</td>
<td>648</td>
</tr>
<tr>
<td>(-) Corporation tax</td>
<td>65</td>
<td>68</td>
<td>74</td>
<td>78</td>
<td>81</td>
<td>87</td>
<td>93</td>
</tr>
<tr>
<td>(-) Provisions</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>Current Liabilities</td>
<td>3,401</td>
<td>3,548</td>
<td>3,811</td>
<td>4,013</td>
<td>4,128</td>
<td>4,375</td>
<td>4,661</td>
</tr>
<tr>
<td>Net working capital</td>
<td>-613</td>
<td>-616</td>
<td>-631</td>
<td>-637</td>
<td>-631</td>
<td>-637</td>
<td>-668</td>
</tr>
<tr>
<td>(+) Intangible assets</td>
<td>751</td>
<td>768</td>
<td>785</td>
<td>802</td>
<td>820</td>
<td>839</td>
<td>858</td>
</tr>
<tr>
<td>(+) Property, plant and equipment</td>
<td>1,293</td>
<td>1,381</td>
<td>1,474</td>
<td>1,575</td>
<td>1,682</td>
<td>1,796</td>
<td>1,918</td>
</tr>
<tr>
<td>(+) Investments in associates and JV</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>(+) Other non-current assets</td>
<td>228</td>
<td>240</td>
<td>260</td>
<td>276</td>
<td>286</td>
<td>306</td>
<td>327</td>
</tr>
<tr>
<td>(-) Provisions</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
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<tr>
<td>(-) Other non-current liabilities</td>
<td>24</td>
<td>25</td>
<td>27</td>
<td>29</td>
<td>30</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td>Invested Capital</td>
<td>1,664</td>
<td>1,778</td>
<td>1,895</td>
<td>2,025</td>
<td>2,167</td>
<td>2,315</td>
<td>2,449</td>
</tr>
</tbody>
</table>

(Source: Calculations of the author)

Finally, free cash flow is calculated as the given year’s NOPLAT divided by the change in invested capital between the beginning of the year and year end (Table 5).
After calculating the free cash flow by relying on the projected income statement and balance sheet, the next step in DCF valuation is the calculation of the weighted average cost of capital.

### 7.2.5. Weighted Average Cost of Capital

Considering all the financing a firm takes on, the composite cost of financing is a weighted average of the costs of equity and debt. This is usually called the weighted average cost of capital, or WACC. (Damodaran, 2012) In this chapter Vestas’ WACC is going to be calculated by estimating its components: cost of equity, cost of debt and capital structure targets.

#### Cost of Equity

The capital asset pricing model, or CAPM, is a “centrepiece of modern financial economics” (Bodie et al., 2010, p.105). CAPM is the risk and return model that has been in use the longest and is still the standard for calculating cost of equity. (Damodaran, 2012) In the CAPM, the expected return on any investment \( r_i \) can be written as:

\[
Cost \ of \ equity: \ (r_i) = r_f + \beta_i \cdot MRP
\]

where \( r_f \) is the risk free rate, \( \beta_i \) is the beta of asset i, and \( MRP \) is the market risk premium. In the next paragraphs these three elements will be estimated for Vestas.

1. **The risk free rate** Most risk and return models (including CAPM) begin with an asset that is defined as risk-free, and then use the expected return on that asset as the risk-free rate. What makes an asset risk-free? According to Bodie et al, “a risk free rate is the rate of return that can be earned with certainty”. (Bodie et al., 2010, p.123) In other words, the actual return is always equal to the expected return.

   In developed markets, the government can be considered as a default-free entity and hence the risk-free rate should be the long-term government rate when doing investment analysis on longer-term valuations. (Brealey et al., 2007) The risk-free rate should be measured consistently with how the cash flows are measured. Thus, if cash flows are estimated in
nominal U.S. dollar terms, the risk-free rate will be the U.S. zero coupon bond rate.  
(Damodaran, 2012)

Vestas is a global firm, with exposure to various regions. In order to calculate the cost of equity precisely, a mixed WACC is calculated with three different risk free rates \( (r_f) \) and market risk premiums (MRP) representing the three geographical regions of the company: Europe & Africa, Americas, and Asia & Pacific. The weights will be based on segment revenues. In terms of \( r_f \) and MRP, Germany, the United States and China will serve as proxy.

Ideally, each cash flow should be discounted using a government bond with the same maturity. (Koller et al., 2010) Risk free yields are available from Bloomberg database: the EUR German Sovereign Curve, US Treasury Active Curve and CNH China Sovereign Curve show internal rate of returns (IRR) of government bonds for different maturities (M3, M6, Y1, Y2, Y3, Y5 and Y10). These rates can be interpolated and transformed into forward rates that represent points of the spot curve. These forward rates are then used as risk free rates in the cost of equity calculation.

(2) Beta  
In the capital asset pricing model, exposure to market risk is measured by a market beta. Beta is a risk measure – it is a function of covariance of asset \( i \) with market portfolio and the variance of the market portfolio (Brealey et al., 2007):

\[
Beta \text{ of asset } i = \frac{Covariance \text{ of asset } i \text{ with market portfolio}}{Variance \text{ of the market portfolio}} = \frac{\sigma_{im}}{\sigma_{m}^2}
\]

Vestas’ historical beta can be downloaded from the Bloomberg database, where two types of beta are available: raw and adjusted beta. The raw beta is obtained from the linear regression between Vestas shares return and the returns of the OMX Copenhagen 20 Index\(^8\). On the other hand, the adjusted beta\(^9\) builds on the assumption that a security’s true beta tends to move towards the market average (1.00) over time.

Differences in beta measurement can derive from choices of three variables: (1) length of time period, (2) periodicity and (3) chosen index. Firstly, five years is the most common historical period on which the forward estimate is based. Secondly, the most common frequencies are monthly and weekly. Thirdly, the chosen index is usually the largest index of the given stock market. (Grabowski & Pratt, 2010) For the beta estimate of Vestas, a 2-year historical period

\(^8\) OMX Copenhagen 20 Index consists of the twenty most actively traded shares on the Copenhagen Stock Exchange  
\(^9\) Adjusted Beta = 0.33 \times (1) + 0.67 \times (\text{Raw Beta})
(10/01/2012 – 09/30/2014), weekly periodicity and the OMX 20 Index are used. With these parameters, Vestas’ adjusted beta equals 1.274.

(3) Market risk premium

By definition, risk premium is the expected return in excess of risk-free rate as compensation for risk. (Brealey et al., 2007) When looking at the market risk premium (MRP), we would like to know what investors, on average, demand as a premium for investing in the market portfolio relative to the risk-free rate. In practice, the market risk premium is usually estimated by looking at the historical premium earned by stocks over default-free securities (government bonds) over long time periods. The actual returns earned on stocks over a long time period are estimated, and compared to the actual returns earned on a government security. The difference represents the historical market risk premium. (Damodaran, 2012)

For the estimation of the market risk premium in the case Vestas, a composite MRP is calculated. Similar to the calculation of the risk free rate, three separate market risk premiums are considered: for Germany, the United States and China. Recognized financial professionals such as Fernandez (Fernandez et al., 2014) and Damodaran (Damodaran, 2014) regularly publish market risk premiums estimates. Since there are slight deviations across their estimates, I use an arithmetical average MRP and weight those by segment revenues (Appendix 5).

Cost of Debt

The cost of debt is simpler in calculation than the cost of equity, however, it is equally challenging to construct properly. (Allman, 2010) The cost of debt for an investment-grade company can be estimated by using the yield to maturity (YTM) of the company’s long-term bonds. (Koller et al., 2010) In case the corporate bonds are traded, the YTM can be used as the interest rate. Additionally, if the firm is rated, a typical default spread on bonds with that rating can be used to estimate the cost of debt using the following equation (Damodaran, 2010):

\[
Cost\ of\ debt: \ (r_d) = (r_f + CDS) \cdot (1 - t)
\]

On 23 March 2010, Vestas issued five-year euro-denominated corporate bonds with a nominal value of EUR 600m at a rate of 4.625% and an effective interest rate of 4.8%. (Vestas, 2011) Since then, the firm’s credit metrics improved significantly due to the successful turnaround and solid earnings progress. (Danske Bank, 2014a) In August 2014, Danske Bank reported an
absolute annualised ask YTM of 1.7% for Vestas corporate bonds (Danske Bank, 2014b).
This yield, after multiplied by (1 – t), will be used as the cost of debt for the company.

**Capital Structure**

In computing the weighted average cost of capital for a publicly traded firm, the general rule is that the market value of equity and debt should be used as weights. Koller et al. recommends using the target weights of debt and equity to enterprise value: “the cost of capital should rely on target weights, rather than current weights, because at any point, a company’s current capital structure may not reflect the level expected to prevail over the life of the business” (Koller et al., 2010, p.266) Although the corporate bonds are still in the balance sheet of the company and will mature in March 2015, according to the latest Annual report: “Vestas expects to be able to finance its own growth”. (Vestas, 2014a) Therefore, the target capital structure will be assumed to consist of solely equity from 2015.

Based on the inputs discussed above, the weighted average cost of capital can be calculated in the following way (Table 6):

<table>
<thead>
<tr>
<th>Table 6: Calculation of the Weighted Average Cost of Capital</th>
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<tbody>
<tr>
<td>WACC Calculation</td>
</tr>
<tr>
<td>Risk free rate ($r_f$)</td>
</tr>
<tr>
<td>0.33% 0.41% 0.62% 0.87% 1.21% 1.68% 1.82%</td>
</tr>
<tr>
<td>Market risk premium (MRP)</td>
</tr>
<tr>
<td>5.54% 5.54% 5.51% 5.48% 5.47% 5.46% 5.44%</td>
</tr>
<tr>
<td>Beta (Adjusted, levered)</td>
</tr>
<tr>
<td>1.274 1.274 1.274 1.274 1.274 1.274 1.274</td>
</tr>
<tr>
<td>Cost of equity ($r_E$)</td>
</tr>
<tr>
<td>7.40% 7.46% 7.64% 7.85% 8.18% 8.63% 8.75%</td>
</tr>
<tr>
<td>EV</td>
</tr>
<tr>
<td>0.86 1.00 1.00 1.00 1.00 1.00 1.00</td>
</tr>
<tr>
<td>Cost of debt ($r_D$)</td>
</tr>
<tr>
<td>1.28% 1.28% 1.28% 1.28% 1.28% 1.28% 1.28%</td>
</tr>
<tr>
<td>D/V</td>
</tr>
<tr>
<td>0.14 0.00 0.00 0.00 0.00 0.00 0.00</td>
</tr>
<tr>
<td>WACC</td>
</tr>
<tr>
<td>6.56% 7.46% 7.64% 7.85% 8.18% 8.63% 8.75%</td>
</tr>
</tbody>
</table>

(Source: (Damodaran, 2014) & (Fernandez et al., 2014) & Calculations of the author)

**7.2.6. Terminal Value**

According to Rosenbaum and Pearl, in a DCF valuation, a company’s cash flow is typically projected for a period of five years. The projection period, however, may be longer depending on the company’s sector, stage of development, and the predictability of its financial performance. Given the inherent difficulties in accurately projecting a firm’s financial performance over an extended period of time, a so-called terminal value is used to capture the remaining value of the target beyond the projection period. (Rosenbaum & Pearl, 2009)

Generally, there are two ways of bringing closure to valuation. In other words, there are two common methods used to calculate a company’s terminal value. The first one, the liquidation approach, assumes that the business is shut down and the assets are sold at some point in time. Liquidation value is the amount of cash that could be realized by selling the firm’s assets and
paying off its creditors, and generally it can be estimated based on either the book value of the assets, or the earning power of the assets. (Brealey et al., 2007) The second approach is the going concern approach, which assumes that the firm continues to deliver cash flows in perpetuity. When employing the going concern approach, we have two choices: applying a multiple to estimate the value in the terminal year, or assuming that the cash flows of the firm will grow at a constant rate forever (stable growth rate). (Damodaran, 2012) These approaches are called the exit multiple method (EMM) and the perpetuity growth method (PGM). (Rosenbaum & Pearl, 2009)

In the EMM method, the value of the firm in a future year is estimated by applying a multiple to the firm’s earnings or revenues in that year. Although this approach has the virtue of simplicity, using multiples to estimate terminal value results in a dangerous mix of relative and discounted cash flow valuation. (Damodaran, 2012) On the other hand, PGM calculates terminal value by treating the terminal year’s free cash flow as a perpetuity growing at an assumed rate – the stable growth rate. By definition, perpetuity is a “stream of level cash payments that never ends”. (Brealey et al., 2007, p.83)

The Gordon growth model can be applied in FCFF models for the terminal period. (Viebig et al., 2008) If we assume that cash flows, beyond the terminal year, will grow at a constant rate forever, the terminal value can be estimated as follows:

\[
TV_{\text{(FCFF)}} = \frac{NOPLAT_{t+1} \times (1 - g/RONIC)}{(WACC - g)} = \frac{FCFF_{t+1}}{WACC - g}
\]

Of all the inputs in the DCF model, none creates as much angst as estimating the stable growth rate (g). The reason for it is that small changes in the stable growth rate have a significant effect on the terminal value. Nevertheless, Damodaran provides a basic guideline in estimating the stable growth rate: “no firm can grow forever at a rate higher than the growth of the economy in which it operates”. (Damodaran, 2012, p.428)

It has to be emphasised that under competition, ROIC reverts to WACC due to the empirical observation that companies earning high returns on capital attract competitors. The length of competitive advantage period over which a firm can earn a return on invested capital in excess of cost of capital (ROIC>WACC) depends on the sustainability of its competitive advantage. (Viebig et al., 2008) Will Vestas be able to sustain a competitive advantage? In my opinion the answer is yes: the firm’s global market leader position and large cumulative installation base provides an advantage in the turbine and service business segment, ensuring a long term return above industry average.
In terminal value calculation I am going to apply the perpetuity growth method and calculate with 3% stable growth rate and 15% normalized ROIC, that is, a return on invested capital sustainable on the long run, while applying a WACC of 8.75%.

7.2.7. Results of FCFF Valuation

Taking all results of the fundamental analysis into account, the total operating value ($V_{op}$) of Vestas on the 30th is EUR 4,480m. In order to derive the equity value and fair share price, the value of non-operating assets (NOA) has to be added to operating value. As the company has no marketable securities and all investments in associates and joint ventures are consolidated, non-operating assets include excess cash only. Consequently, the total enterprise value of Vestas is EUR 5,532m. After the subtraction of financial debts, the market capitalisation ($E$) is EUR 4,912m and the derived fair share price is EUR 21.92 (Table 7).

| Table 7: Results of the FCFF Valuation Method |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| TV                | 135              | 268              | 322              | 357              | 371              | 424              | 475              | 279              | 4,847             |
| WACC              | 6.56%            | 7.46%            | 7.64%            | 7.85%            | 8.18%            | 8.63%            | 8.75%            | 8.75%            |
| DF                | 0.9384           | 0.8732           | 0.8113           | 0.7522           | 0.6953           | 0.6401           | 0.5885           |
| PV (FCFF&TV)      | 127              | 234              | 262              | 268              | 258              | 271              | 279              | 2,852             |
| $V_{op}$          | 4,480            | 4,552            | 4,716            | 4,800            | 4,844            | 4,868            | 4,895            | 4,893             |
| NOA               | 1,052            |                 |                 |                 |                 |                 |                 |                 |
| EV                | 5,532            |                 |                 |                 |                 |                 |                 | 224,074,513       |
| D                 | 620              |                 |                 |                 |                 |                 |                 | 4,912             |
| Number of shares  | 224,074,513      |                 |                 |                 |                 |                 |                 |                  |
| Share price       | 21.92            |                 |                 |                 |                 |                 |                 |                  |

The EUR 21.92 share price, when compared to the observed (as of 30th September 2014) share price of EUR 30.95, indicates an overvaluation of Vestas. Nevertheless, the assumptions made are not always hold and therefore scenario- and sensitivity analysis have to be conducted in order to gain a better understanding of the possible range of the share price.

7.2.8. Scenario Analysis

The calculated EUR 21.92 share price is an estimate that correct only if assumptions are correct. Due to the energy political instability and other uncertainties, various business scenarios may occur. In October 2014, for instance, the delivery of a 254 MW Vestas project in Brazil has been cancelled. The cancellation relates to changes to local Brazilian legislation which occurred after the contract between the customer (CPFL Renováveis) and Vestas was agreed in 2011. (Vestas, 2014f) Due to regulatory changes, such cancellations may happen.
and therefore erode the firm’s revenue. Similar uncertainties are associated with the service business segment where the renewal rate poses a huge threat on Vestas and its enterprise value. Additionally, deviations in cost of sales, R&D, distribution and administrative expenses are also possible. Hence it makes sense to design various business scenarios and analyse the effect of changes on the revenue and cost side on Vestas’ value.

Three scenarios are developed: (1) base case, (2) optimistic and (3) pessimistic scenarios. In the optimistic scenario, revenues of both segments are expected to grow by 1% point more, while cost of sales and R&D expenses are expected to be 1% point lower compared to the base case scenario. Moreover, the other cost elements (distribution and administration) are forecast to be 10% less compared to the base case. In the pessimistic scenario the extent of change is the same but with different sign (decrease in revenues and increase in costs).

The scenario-analysis show interesting results: based on the chosen scenario, there may be 18% deviations in the fair share price. Nonetheless, even the price derived from the optimistic scenario does not exceed the current share price (Figure 32).

![Figure 32: Results of the Scenario Analysis](Source: Calculations of the author)

The results of scenario analysis have a huge implication: even if we are optimistic and assume that things (revenues and costs) will turn out positively, the calculated fair share price (EUR 25.94) is still below the current share price (EUR 30.95). This indicates that Vestas is mispriced and significantly overvalued.

### 7.2.9. Sensitivity Analysis

The long term stable growth rate, the weighted average cost of capital and the normalized return on invested capital belong to the most sensitive factors in DCF valuation. By changing g, WACC, or ROIC in the valuation model, one may gain relevant insights into how these factors influence the fair share price of Vestas.
Not surprisingly, growth rate and ROIC are in positive, while WACC is in negative correlation with share price, ceteris paribus. Table 8 and Table 9 provide a detailed sensitivity analysis by assessing the impact of 1% point changes in these factors on Vestas’ estimated share price.

Table 8: Sensitivity Analysis: WACC and Growth Rate

<table>
<thead>
<tr>
<th>EUR</th>
<th>WACC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.75%</td>
</tr>
<tr>
<td>1.0%</td>
<td>16.83</td>
</tr>
<tr>
<td>2.0%</td>
<td>17.67</td>
</tr>
<tr>
<td>3.0%</td>
<td>18.72</td>
</tr>
<tr>
<td>4.0%</td>
<td>20.08</td>
</tr>
<tr>
<td>5.0%</td>
<td>21.92</td>
</tr>
</tbody>
</table>

(Source: Calculations of the author)

Table 9: Sensitivity Analysis: ROIC and Growth Rate

<table>
<thead>
<tr>
<th>EUR</th>
<th>ROIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13.00%</td>
</tr>
<tr>
<td>1.0%</td>
<td>17.49</td>
</tr>
<tr>
<td>2.0%</td>
<td>18.67</td>
</tr>
<tr>
<td>3.0%</td>
<td>20.27</td>
</tr>
<tr>
<td>4.0%</td>
<td>22.53</td>
</tr>
<tr>
<td>5.0%</td>
<td>26.00</td>
</tr>
</tbody>
</table>

(Source: Calculations of the author)

The key takeaway from sensitivity analysis is that the share price derived from the valuation model is more sensitive to WACC and growth rate than to ROIC. Additionally, there may be cases when the fair price is above the currently observed price: for instance if we assume a long term growth rate of 4-5% and a WACC of 6.75%. Consequently, if Vestas will be able to achieve 5% NOPLAT growth rate (g), it might be said that the company is fairly priced. If we take the firm’s fundamentals into consideration, this is an unrealistic assumption.

In chapter 7.3, another discounted cash flow method, the economic value added method will be applied for the valuation of Vestas.

7.3. EVA Method

The economic value added (EVA) or economic profit (EP) method is an approach similar to the free cash flow to firm (FCFF) method. EVA measures the absolute amount of wealth a company creates in a given year. From a practical point of view, EVA is the residual profit left after subtracting the cost of capital from the net operating profit less adjusted taxes. (Viebig et al., 2008) The two key factors in EVA are the return on invested capital and the
weighted average cost of capital. Simply speaking, firms that beat their cost of capital have a positive EVA and are considered to be wealth creators.

Although the result of EVA is consistent with the result of FCFF, EVA can be used for other purposes too, and not exclusively for enterprise valuation. For instance, when measuring the performance of executives or business units, EVA is considered to be more appropriate than book earnings because it takes into account the cost of capital employed to obtain that specific earnings. (Fernández, 2002)

The EVA method can be conducted in three simple steps: calculating (1) NOPLAT, (2) invested capital, and (3) WACC. It is important that the calculation of invested capital is based on the average capital to reflect the fact that NOPLAT is earned during the course of the year, while balance sheet reflects a point in time. (Koller et al., 2010)

In the EVA method enterprise value is calculated as follows:

\[ EV (EVA) = IC_0 + PV(EVA) + PV(TV) \]

where

\[ EVA = (ROIC - WACC) \times IC \]

and

\[ TV (EVA)_t = \frac{NOPLAT_{t+1}}{WACC} + \frac{NOPLAT_{t+1} \times (g/RONIC) \times (RONIC - WACC)}{WACC \times (WACC - g)} \]

Table 10 illustrates the calculations associated with the EVA method. Although the share price derived with the EVA method equals the one we got with FCFF, there is a slight difference in the share of terminal value in the total enterprise value: in FCFF terminal value represents 63%, while in EVA it represents 55% of total enterprise value.
In this chapter, two discounted cash flow methods (FCFF, EVA) have been applied for Vestas. The result of the fundamental analysis and DCF valuation indicates the fair share price of the company is EUR 21.92, which is significantly lower than the current share price (EUR 30.95). This can be interpreted as a notable overvaluation of Vestas. In the next chapter, this result is going to be crosschecked by another commonly used valuation method, the relative valuation.

7.4. Relative Valuation Method

In relative valuation, the core assumption is that the market is correct in the way it prices financial assets on average. In fact, the value of an asset is derived from the pricing of comparable assets using a common variable such as earnings, revenues, cash flows, or book value. (Damodaran, 2012)

The use of relative valuation is popular among financial practitioners for several reasons. First, a valuation based on multiples can be completed with far fewer assumptions and far more quickly than a DCF valuation. Second, a relative valuation is simpler to understand and easier to present to clients and customers. Third, a relative valuation is much more likely to reflect the current mood of the market as it attempts to measure relative and not intrinsic value. (Damodaran, 2010)

There are two subgroups in relative valuation: trading comparables and transaction comparables. On the one hand, trading comparables are built upon the premise that comparable companies provide a reference point for valuing a given company due to the fact that they share key business and financial characteristics, drivers, and risks. On the other hand, transaction comparables follow an approach based on precedent transactions and multiples paid for comparable companies in prior transactions. (Rosenbaum & Pearl, 2009)

7.4.1. Types of Multiples

(1) Earnings Multiples

An intuitive way to think of a value of any asset is as a multiple of the earnings that asset generates. The most widespread multiple is the price-to-earnings (P/E) multiple, which is the ratio of the market price per share to the earnings per share:

\[
P/E = \frac{\text{Market price per share}}{\text{Earnings per share}} = \frac{P}{\text{EPS}}
\]

Another important earnings multiple is the EV-to-EBITDA multiple, which is not equity but a firm value multiple: it relates the total market value of the firm, net of cash, to the earnings before interest, taxes, depreciation, and amortization of the firm (Damodaran, 2012):
Very importantly, cash has to be netted out since the interest income from the cash is not counted as part of the EBITDA, and not netting out the cash would result in an overstatement of the EV/EBITDA multiple. (Damodaran, 2012)

(2) **Book Value Multiples** The most widely used book value multiple is the price-to-book value (P/B) ratio, which is computed by dividing the market price per share by the current book value of equity per share. Although the multiple seems to be fundamentally consistent, there is a potential for inconsistency in case there are multiple classes of shares outstanding, and the price per share is different for the different classes of shares. Since the market value of equity refers to the common equity only, the portion of equity attributable to preferred stock should be excluded. (Damodaran, 2012) These problems can be mitigated by computing the price-to-book ratio as the total market value of equity divided by the book value of equity:

\[
P/B = \frac{\text{Market value of equity}}{\text{Book value of equity}}
\]

(3) **Revenue Multiples** In recent years alternative multiples have been gained foothold in practice. For instance, in case of firms with negative earnings, revenue multiples have replaced earnings multiples. (Damodaran, 2012) The most common revenue multiple, the enterprise value-to-sales (EV/S) ratio, is calculated as the market value of the firm, net of cash, divided by the revenues generated by the firm:

\[
EV/S = \frac{\text{Market value of equity} + \text{Market value of debt} - \text{Cash}}{\text{Revenues}}
\]

(4) **Sector-specific Multiples** The value of a firm can be standardized using a number of sector-specific multiples. For instance, social media companies can be judged by their market value of equity per user. Similarly, the value of electricity generators can be computed on the basis of kilowatt-hour (kWh) of electricity produced. (Damodaran, 2012)

Is it sensible to apply a sector-specific multiple for Vestas? Enterprise value (or market capitalisation) per annual capacity installed (MW) offers the opportunity to do so, however in my opinion this does not work for two reasons: firstly, it leaves out of consideration the servicing business segment and secondly, it is highly effected by accounting principles that determine the recognition of turbine installations. Therefore, sector-specific multiples are not going to be applied for the valuation of Vestas.
7.4.2. Peer Group

In fact, no two firms are identical. The challenge of relative valuation is to find firms that are similar to the one we value. In case firms are in the same industry, their risk, growth potential, and cash flows can still differ. (Damodaran, 2012)

When choosing peer group for Vestas, I first consider a wide group of listed companies offered by the Bloomberg database. Although conglomerate manufacturers such as General Electric, Siemens, Samsung, Hitachi and Daewoo are also competing on the wind turbine industry, they are not considered as peers due to their diversified business line portfolio.

Table 11: Unfiltered Peer Group

<table>
<thead>
<tr>
<th>Company</th>
<th>HQ</th>
<th>Market Cap (bEUR)</th>
<th>Sales 2013 (mEUR)</th>
<th>EBITDA CAGR 2013-2016</th>
<th>Assets 2013 (mEUR)</th>
<th>Geographical Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vestas</td>
<td>Denmark</td>
<td>5,737</td>
<td>6,084</td>
<td>13%</td>
<td>5,640</td>
<td>Diversified</td>
</tr>
<tr>
<td>Goldwind</td>
<td>China</td>
<td>4,153</td>
<td>1,494</td>
<td>79%</td>
<td>4,235</td>
<td>China (89%)</td>
</tr>
<tr>
<td>Sinovel</td>
<td>China</td>
<td>2,112</td>
<td>448</td>
<td>n.a.</td>
<td>2,878</td>
<td>China (77%)</td>
</tr>
<tr>
<td>Gamesa</td>
<td>Spain</td>
<td>2,034</td>
<td>2,336</td>
<td>12%</td>
<td>4,759</td>
<td>Diversified</td>
</tr>
<tr>
<td>Nordex</td>
<td>Germany</td>
<td>1,055</td>
<td>1,429</td>
<td>27%</td>
<td>1,191</td>
<td>Europe (92%)</td>
</tr>
<tr>
<td>Guodian</td>
<td>China</td>
<td>986</td>
<td>3,114</td>
<td>11%</td>
<td>6,543</td>
<td>China (100%)</td>
</tr>
<tr>
<td>Xiangtan</td>
<td>China</td>
<td>931</td>
<td>808</td>
<td>n.a.</td>
<td>1,880</td>
<td>China (99%)</td>
</tr>
<tr>
<td>Huayi</td>
<td>China</td>
<td>691</td>
<td>187</td>
<td>n.a.</td>
<td>547</td>
<td>China (100%)</td>
</tr>
<tr>
<td>Suzlon</td>
<td>India</td>
<td>521</td>
<td>2,499</td>
<td>154%</td>
<td>3,675</td>
<td>Diversified</td>
</tr>
<tr>
<td>MingYang</td>
<td>China</td>
<td>241</td>
<td>348</td>
<td>n.a.</td>
<td>1,358</td>
<td>China (98%)</td>
</tr>
</tbody>
</table>

(Source: (Bloomberg & Annual Reports, 2014))

As Table 11 shows, there are ten significant pure-play wind turbine manufacturers worldwide (including Vestas). Although Vestas is the largest in terms of market capitalisation and last year sales, Chinese manufacturers are overrepresented in the top ten.

In order to base the relative valuation on sound foundations, a short listed peer group is developed. Goudian, Xiangtan, Huayi and Mingyang are ruled out due to their relatively small market capitalisation and high dependency on the Chinese market. Additionally, Chinese manufacturer Sinovel is taken out of the peer group since the company experienced a -25% annual drop in sales between 2009 and 2013 and trading of its corporate bonds were suspended due two consecutive yearly loss. (Jianxiang & Smith, 2014) Finally, Suzlon is not excluded as it has a significantly higher EBITDA growth estimate (154%). Accordingly, a filtered peer group consisting of three peers is created (Table 12). Goldwind, although highly exposed to China, remains part of the peer group in order to have a “representative” of the Asian market accounting for 10-15% of Vestas sales.
After selecting the universe of comparable companies, earnings, book value and revenue multiples are going to be calculated and applied for the valuation of Vestas.

### 7.4.3. Results of Relative Valuation

Taking the selected peer group into account, four types of multiples are downloaded from the Bloomberg database: P/E, P/B, EV/EBITDA and EV/SALES. For every multiple, two timeframes are applied: the current value of the multiple that is based on the last twelve months (LTM), and the 2014 estimate. This enables that not only historical data but also forecasts are taken into consideration and therefore it provides a more comprehensive estimate.

#### Table 13: Peer Group Multiples

<table>
<thead>
<tr>
<th>Multiple</th>
<th>P/E</th>
<th>P/B</th>
<th>EV/EBITDA</th>
<th>EV/SALES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goldwind</td>
<td>24.8x</td>
<td>24.5x</td>
<td>2.5x</td>
<td>2.4x</td>
</tr>
<tr>
<td>Gamesa</td>
<td>25.2x</td>
<td>21.7x</td>
<td>1.9x</td>
<td>1.6x</td>
</tr>
<tr>
<td>Nordex</td>
<td>45.3x</td>
<td>28.6x</td>
<td>3.1x</td>
<td>3.1x</td>
</tr>
<tr>
<td>Median</td>
<td>25.2x</td>
<td>24.5x</td>
<td>2.5x</td>
<td>2.4x</td>
</tr>
<tr>
<td>Vestas (EURm)</td>
<td>LTM</td>
<td>2014E</td>
<td>LTM</td>
<td>2014E</td>
</tr>
<tr>
<td>EV</td>
<td>7,843</td>
<td>7,212</td>
<td>6,458</td>
<td>6,094</td>
</tr>
<tr>
<td>E</td>
<td>10,500</td>
<td>8,539</td>
<td>5,413</td>
<td>5,649</td>
</tr>
<tr>
<td>Share price</td>
<td>46.86</td>
<td>38.11</td>
<td>24.15</td>
<td>25.21</td>
</tr>
</tbody>
</table>

(Source: Bloomberg (2014) & Calculations of the author)

Multiplying the adequate Vestas figure (denominator) with the median value of the multiples gives a market capitalisation or enterprise value. P/E and P/B multiples, however, show high deviations (Table 13). This can be attributable to the fact that peer companies have higher financial leverage compared to Vestas (Figure 33).
Consequently, P/E and P/B multiples are not reliable and therefore I consider only the results of EV/EBITDA and EV/Sales multiples. According to these, the enterprise value of Vestas is in a range between EUR 6,094m and EUR 7,843m, and the fair share price is between EUR 29.12 and EUR 36.93 (Table 13). Considering the current share price (EUR 31.95) and the results of relative valuation, Vestas share seem to be fairly priced. Hence, relative valuation does not confirm the results of discounted cash flow method. What may be the reason for it? Although it is not easy to answer, a potential reason could be the hype that surrounds the wind turbine makers. It may be the case that the market overestimates the growth and profitability prospects of the sector.

7.5. Summary of Valuation

At the end of the valuation process, discounts and premiums have to be considered. The most common valuation discounts and premiums arise from the concepts of control and marketability. (Pratt & Niculita, 2008) Considering that Vestas shares are traded on a stock market (OMX Copenhagen), stocks are liquid and easily marketable. Additionally, every shareholder has minority interests (<5%) with little or no input on how the company is run and therefore neither control premium is applicable. (Hitchner, 2011)

The applied valuation methods indicate significantly different share prices for Vestas. This is not a big surprise since the different approaches to valuation generally yield different estimates of value for the same firm. These differences between estimates come from the different views on market efficiency. In discounted cash flow method the market is assumed to be inefficient, while in relative valuation, we assume that the market is efficient: it might make mistakes on individual stocks but is correct on average. (Damodaran, 2012)
From a fundamental analysis point of view, the market is inefficient in the way it prices Vestas. From a relative valuation perspective, however, the market price is more or less correct.

<table>
<thead>
<tr>
<th>Table 14: Fair Share Price of Vestas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DCF</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Share Price (EUR)</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>Share Price (EUR)</td>
</tr>
</tbody>
</table>

(Source: Calculations of the author)

In case we consider both the DCF method and the EV multiples, and give 50% weights for both, the estimated fair share price is EUR 27.32 (Table 14). Still, this derived price is below the current one.

If I were an analyst of a leading investment bank, I would not give weight to relative valuation and rely exclusively on the result of discounted cash flow for one simple reason: the DCF and relative valuation follow two primarily different approaches. DCF builds on the firm’s fundamentals while relative valuation assumes the market is correct in the way it prices financial assets. Is it possible that the market is not correct? The answer is a definitive yes: the hype that surrounds wind energy and the broader green energy sector might lead to mispriced stocks and the market might overestimate the sector’s growth and profitability outlooks.

Vestas operates on a market with high competition and price war. Due to the number of competitors, the relatively standardized products and low entry barriers for industrial conglomerates, it is extremely difficult to earn excess profit. No doubt, Vestas will be able to grow gradually in the coming years and this growth will be profitable, but only to a certain extent.

From the DCF method and from a fundamental analyst’s perspective, the fair value of Vestas shares is EUR 21.92 which is far below from the observed share price (EUR 30.95). Consequently, it can be concluded that Vestas shares are highly overvalued and therefore they are not recommended for buying. Analysts’ consensus ratings confirm this result: as of 30th September 2014, 41.7% of analysts gave sell recommendation, compared to 25% and 33.3% who gave hold and buy recommendation, respectively.
7.6. Other Considerations

In the DCF valuation method I assumed that from 2015 the company is financed solely from equity. This assumption is based on the company’s statement in its latest Annual Report: “Vestas expects to be able to finance its own growth”. (Vestas, 2014a, p.17) Nevertheless, the management may consider a leveraged capital structure in order to increase the firm’s enterprise value. In this final chapter I determine the optimal capital structure for Vestas in order to maximize its enterprise value.

According to Modigliani & Miller (MM), financing decisions and capital structure has no impact on the enterprise value and therefore there is no optimal capital structure. The MM, however, is based on unrealistic assumptions (e.g. no taxes, no transaction costs). (Brealey et al., 2007)

The most obvious benefit of financial leverage is the reduction of taxes since interest charges are tax deductible. Replacing equity with debt reduces taxable income and therefore increases enterprise value. On the other hand, financial leverage has some costs too, such as business erosion and conflicts of interest among investors. Although the fundamental question in designing a company’s capital structure is simply the choice between debt and equity, there is no exact way to determine the optimal capital structure. (Koller et al., 2010)

In order to find the optimal capital structure I have to take into account that – by changing the target D/EV ratio – several factors change in the valuation model. Firstly, with the increasing D/EV, cost of debt rises due to the fact that credit institutions will require higher return for higher risk. Secondly, the beta applied in the DCF is a levered beta that reflects the current capital structure of the company. Hence it has to be first unlevered and then relevered with the modified D/EV ratio. The so-called Hamada formulas\(^\text{10}\) are commonly used for unlevering and relevering equity betas. (Grabowski & Pratt, 2010) The following formulas will be used:

\[
B_U = \frac{B_L}{1 + (1 - t) \times (D/E)} \quad \text{and} \quad B_L = B_U \times (1 + (1 - t) \times (D/E))
\]

In order to estimate the optimal leverage, some assumptions have to be made. For the cost of debt I assume that Vestas is able to issue corporate bonds (or take out loans) with the current conditions up to a D/EV ratio of 0.40.

\(^\text{10}\) In principle, the market value of debt (D) and equity (E) has to be used
Why 0.40? As of September 30th 2014, pure-play competitors had a total debt to EV ratio of 0.42 on average. Above a D/EV of 0.40, cost of debt ($r_D$) is assumed to grow proportionally – by 0.05% points with every 1% points increase in the D/EV ratio.

**Figure 34: Determining the Optimal Capital Structure for Vestas**

Figure 34 illustrates the results of optimal capital structure calculation. With a capital structure consisting of exclusively equity, Vestas’ enterprise value is EUR 5,532m (result of base case DCF valuation). However, by increasing the share of debt in capital structure, the management can increase enterprise value up to EUR 6,933m. Consequently, the company is advised to increase its leverage up to 0.46, or 46%, in order to maximize enterprise value. Above this rate, EV starts to drop due to the increase in default risk and cost of debt.
8. CONCLUSION

All in all, based on the fundamental analysis and discounted cash flow valuation, the fair share price of Vestas is EUR 21.92. This, compared to the current share price of EUR 30.95, indicates that the firm’s shares are mispriced and the company is overvalued.

In my thesis I conducted a detailed analysis in order to gain a better understanding of industry dynamics. Starting from energy and electricity market trends it was shown that global demand is expected to grow gradually in the next decades. Renewable sources are gaining share in the energy mix due to energy targets and subsidy schemes.

In these days, wind energy is the most developed and most cost competitive renewable source in power generation. Wind power is a clean energy source with enormous growth prospects: although currently it accounts for only 2% of the global electricity consumption, it is expected to deliver 7% by 2035. Due to the continuously falling levelized cost as well as the feed-in tariffs and other types of financial schemes, wind competes successfully with traditional fossil and other renewable sources.

Without doubt, the market Vestas operates in has high growth prospects: electricity demand is set to increase and there is a remarkable shift towards renewable sources in the energy mix, mainly driven by national and supranational (e.g. European Union) energy targets. In other words, not only the whole cake (electricity demand) grows, but also the slice of the cake (share) renewable sources acquire. The regulative environment (energy policies, subsidies and other support schemes) is, however, very unstable and therefore brings volatility into global annual installations.

In the wind turbine manufacturing sector, pure-play manufacturers and large industrial conglomerates compete heavily on price in order to gain market share in their core markets and enter new ones. Similar to what happened in the solar panel industry, the emergence of new entrants (conglomerates and Chinese manufacturers) and the increased industry rivalry deteriorated the profitability of the sector in the past years. Not only earnings before interest and taxes dropped dramatically but also the return on invested capital.

Vestas, the largest wind turbine manufacturer, also faced challenging times. Nonetheless, after a two-year turnaround initiated in 2011, the company got back on the right track by significantly reducing its costs and putting emphasis on the profitable service business segment. Although the company sold almost half of its production plants, the proximity to its regional customers has been conserved and its corporate strategy fits well into current market
conditions: the company is focusing on operational excellence, capturing the potential of service business, decreasing the levelized cost of wind energy, and gaining additional share in emerging markets.

Still, the question whether there is a direct way to profitable growth for Vestas comes up. Growth prospects remain high and therefore wind turbine makers continue to face market demand. After an anticipatory consolidation driven by potential bankruptcies due to the drop in profitability, Vestas is expected to head back towards profitable growth. Nonetheless, competitive dynamics indicate that the potential for achieving excess return is limited, putting a cap on Vestas’ potential future profitability.

On the 30th September 2014, Vestas shares closed at EUR 30.95. Discounted cash flow valuation, which is based on the firm’s fundamentals, resulted in a significantly lower fair share price, EUR 21.92. On the other hand, results of relative valuation indicate that Vestas shares worth EUR 29.9-35.5. If the market is assumed to be correct in the way it prices financial assets, Vestas is traded on its fair price. Is it possible that the market is not correct? The answer is a definitive yes: the hype that surrounds wind energy and the broader green energy sector might lead to mispriced stocks and it might be the case that the market overestimates the sector’s growth and profitability outlooks.

Based on the firm’s fundamentals and the conducted DCF valuation, it can be concluded that Vestas is significantly overvalued and therefore my proposal to investors sounds as follows: sell.

Does this overvaluation apply for other pure-play wind turbine manufacturer? The answer is undoubtedly beyond the scope of this thesis. In order to draw conclusions for the entire wind turbine sector, competitors have to be analyzed and valued separately. This is something I would be more than happy to do in my future professional career.
APPENDICES

1. Assumptions

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<td>Operating cash / Revenue</td>
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<td>Payable turnover (days)</td>
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<td>Cash (operative) / Revenue</td>
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<td>1.00%</td>
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<td>Cost of sales (Turbine)</td>
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<td>Cost of sales (Service)</td>
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<td>R&amp;D costs / Revenues</td>
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<td>3.00%</td>
<td>3.00%</td>
<td>3.00%</td>
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<td>30.00%</td>
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2. Projected Income Statement

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<td><strong>Revenue</strong></td>
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<td>6,797</td>
<td>7,374</td>
<td>7,830</td>
<td>8,112</td>
<td>8,670</td>
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<td>- Cost of sales</td>
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<td>5,685</td>
<td>6,166</td>
<td>6,547</td>
<td>6,780</td>
<td>7,245</td>
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<td><strong>Gross profit</strong></td>
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<td>1,112</td>
<td>1,207</td>
<td>1,284</td>
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<td>(-) R&amp;D costs</td>
<td>162</td>
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<td>203</td>
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<td>(-) Distribution expenses</td>
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<td>192</td>
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<td>(-) Administrative expenses</td>
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<td>___________________________________</td>
<td>354</td>
<td>378</td>
<td>392</td>
<td>408</td>
<td>423</td>
<td>440</td>
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<td><strong>EBITDA</strong></td>
<td>871</td>
<td>931</td>
<td>999</td>
<td>1,063</td>
<td>1,115</td>
<td>1,187</td>
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<td><strong>EBIT</strong></td>
<td>517</td>
<td>554</td>
<td>607</td>
<td>655</td>
<td>692</td>
<td>747</td>
<td>808</td>
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<td>(+/-) Income from inv. in JV</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>(+) Financial income</td>
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<td>0</td>
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<tr>
<td><strong>Profit/loss before tax</strong></td>
<td>507</td>
<td>543</td>
<td>607</td>
<td>655</td>
<td>692</td>
<td>747</td>
<td>808</td>
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<tr>
<td>(-) Corporation tax</td>
<td>127</td>
<td>136</td>
<td>152</td>
<td>164</td>
<td>173</td>
<td>187</td>
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<td><strong>Profit/loss for the year</strong></td>
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<td>407</td>
<td>455</td>
<td>491</td>
<td>519</td>
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<td>(-) Dividend</td>
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<td>122</td>
<td>137</td>
<td>147</td>
<td>156</td>
<td>168</td>
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<td><strong>Net Income (after dividend)</strong></td>
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<td>319</td>
<td>344</td>
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## 3. Projected Balance Sheet (Assets)

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<td>7,335</td>
<td>7,854</td>
<td>8,556</td>
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<td>Completed development projects</td>
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<td>Plant and machinery</td>
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<td>Other fixtures and fittings, tools and equipment</td>
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<td>157</td>
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<td>179</td>
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<td><strong>Other non-current assets</strong></td>
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<td>468</td>
<td>486</td>
<td>497</td>
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4. Projected Balance Sheet (Equity and Liabilities)

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<td>Equity and Liabilities</td>
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5. Weighted Average Cost of Capital

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6. Value Drivers

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7. Adjusted Beta

(Source: Bloomberg)
## 8. Scenarios

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9. Share Price

(Source: Bloomberg)
REFERENCES


ONLINE REFERENCES


