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Renewable Energy Corporation ASA

Case study

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This thesis was written as a part of the master program at NHH. Neither the institution, the advisor nor the sensors are - through the approval of this thesis - responsible for neither the theories and methods used, nor results and conclusions drawn in this work.

Abstract

In this thesis we have studied Renewable Energy Corporation ASA, a major player in the market for photovoltaic energy. We examine the sharp reduction in share price in the spring of 2008, and finds that the reduction can be reasonably explained by company specific events and general industry development. We also analyze the industry and the company specific factors that determine the outlook for the industry and for the company specifically. Finally, we calculate the implied future expectations for growth and profitability given by the market price in March 2008.

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Foreword

This thesis is a part of the Master of Science Program in Economics and Business Administration at the Norwegian School of Economics and Business Administration. The purpose of this thesis is to apply the knowledge we have gained during our studies.

We have chosen to focus our thesis on Renewable Energy Corporation ASA (REC) and the solar energy industry because REC is a Norwegian blue-chip company in an exciting and rapidly growing market and one of the large participants on the world market. Additionally, there has been written few papers on REC, and the commercial photovoltaic (PV) industry is still at an early stage.

Our paper is not a conventional valuation in that its aim is not to calculate a "correct" value of the company. Our aim is rather to figure out what expectations about future growth and profitability the market price implied after the market capitalization of the company fell dramatically in our observation period. Furthermore, we have found it interesting to compare our valuation of the events during the period with the reaction of the photovoltaic industry and the stock markets, and to see if we could find justification for the massive share price reduction.

The work has been challenging and interesting, and we feel that we have been able to use a lot of what we have learned during our studies at NHH. We were especially intrigued by the fact that we found that we could explain most of the drop in value through a combination of company specific events and industry factors, as we originally expected the fall to have been exaggerated and irrational

Finally, we wish to thank our supervisor Zheng Huang for her help in writing the thesis.

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1. Introduction

This thesis is centered on Renewable Energy Corporation ASA over the period from December 14, 2007 to March 14, 2008. Coming up to the end of 2007, the share was priced at a P/E of close to 70, implying an impressive future profit margin and growth that few industries can support. Following the general downturn in the financial markets due to the credit turmoil that initiated from the US sub-prime market during the summer of 2007, the share has depreciated by more than 50% during our focus period. By focusing on the events that occurred in this period we wish to analyze the large fall in the market capitalization by analyzing the events we believe has had the greatest impact and determine whether the drop could actually be justified by changes in fundamentals.

The most obvious reason behind such a drop in the share price could be statements by the company that future income will be lower than previously expected. Even if the statements were vague, management indicated lower margins during the period. Furthermore, REC has announced that the expansion of a plant is delayed, leading in turn to delayed cash flows which from a present value standpoint should clearly reduce the value of the company. Finally, we wish to look into the market in general to see if we can see indications to the fact that the bearish market conditions have caused investors to sell the REC share simply from a belief that stock markets generally are less promising than they were a year ago.

1.1 Choosing the observation period

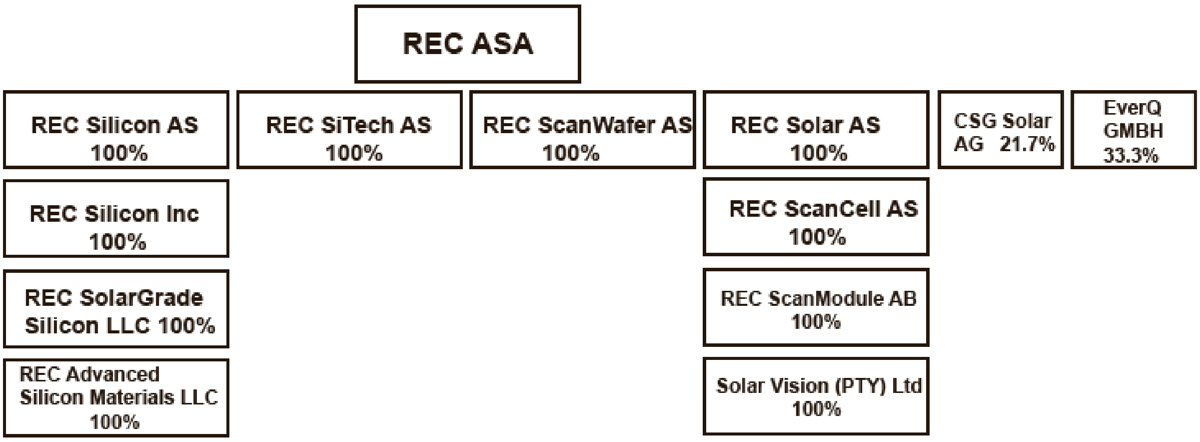
When examining the share price crash we have chosen to look at the period between December 14, 2007 and March 14, 2008. This time frame allows us to observe the effects of the main negative news received during this time, as well as a number of weeks before and after.

1.2 Significant events

We have focused on the most significant events over the course of our observation period, what effect these have had on the market valuation of the company, and thereby to which degree the sharp drop in valuation can be explained by the events during the period. Our aim will then be to analyze whether the market has overreacted or underreacted to the new information in the market. In addition to the sharp drop the Oslo Stock Exchange saw during the first few weeks of the year, REC held a capital markets day on January 18, announced a delay and increased costs for their new plant in Moses Lake, Washington, and announced the results for the fourth quarter of 2007. A complete list of the events over the period can be found in Appendix I.

2. The REC Group

Renewable Energy Corporation ASA, was initially incorporated as a Norwegian private limited company in 1996, and after a series of acquisitions, the company went public in 2006 as a public limited company (US: Corporation) trading on Oslo Stock Exchange (OSE) under the ticker REC. Even though this thesis will focus on the group as such, it is vital to remember that REC, as the publicly listed company, is just a holding company with 100% ownership in the following subsidiaries: REC Silicon AS, REC SiTech AS, REC ScanWafer AS and REC Solar AS in addition to two joint ventures – CSG Solar AG and EverQ GmbH.



2.1 REC Silicon

REC Silicon is the first part of the production chain in REC, producing polysilicon and silane gas both for the photovoltaic (PV) industry and the electronics industry. According to REC, the supply of polysilicon has been scarce over the last years, thus giving REC a competitive advantage in its position as producer of cells, wafers and modules. However, given the fact that the raw material is simple, one might argue that REC might have been equally well off by selling to excess prices. The loss they would incur by choosing this path of action would inevitably be the indirect costs of not knowing that you have a reliable source of materials, e.g. increased down time for machinery.

REC Silicon has slightly more than 600 employees, and from its two plants in the US; in Moses Lake, WA and in Butte, MO, it contributes to about 31% of the REC Group’s total revenue and 40% of the group’s EBITDA.

After the expansions that were delayed in the beginning of 2008, REC Solar should have an annual capacity of 13,500 tons of polysilicon, more than twice as much as the capacity just two years ago. The same expansions took place for the raw material of polysilicon, monosilane gas, where REC has more than doubled its capacity from 2006 to 2008 from 8,000 to 20,000 tons.

Producing Solar and electronic grade silicon may be done in several different ways, and REC has a patented, proprietary way of producing polysilicon differentiating the company from its competitors, primarily by the fact that the process hardly produces any by-products and uses significantly less energy. This is known as the “Fluidized Bed Reactor” (FBR) process.

According to the company, REC Solar has two core strategic objectives – namely increasing capacity and production while lowering production costs. Over the last years, the obligations of delivering electronic grade silicon have subsided, enabling a stronger emphasis on supplying REC Wafer and REC Solar (REC 2008).

2.2 REC Wafer

REC Wafer, which strictly speaking is a collective term for the two companies REC ScanWafer and REC SiTech, is the largest part of the group both in terms of gross revenue and EBITDA, contributing 55% of the group’s total. Both the REC Wafer plants are situated in Glomfjord, Norway, and are separate companies, though there are significant operational synergies between the two. While ScanWafer is the world’s largest supplier of multicrystalline silicon wafers to the PV industry, SiTech manufactures monocrystalline ingots, subsequently processed into wafer for monocrystalline solar cells.

In 2006, 16% of REC Wafer’s volume was sold internally to REC Solar and about 64% was sold to three other large customers, leaving the four largest customers with a substantial 80% of total volumes. The company’s market share was 25% of multicrystalline wafers and 15% if the total wafer market is taken as one unit, regardless of technological base.

The difference between mono- and multicrystalline wafers, consisting of equally pure silicon, is simply how the molecules are built up or more accurately, the number of impurities in the molecular structure of the wafers. Even though monocrystalline wafers have higher efficiency, it still represents only a small niche compared to multicrystalline wafers with less than 10% of the produced wafers consisting of monocrystalline silicon (REC 2008).

2.3 REC Solar

REC Solar AS produces solar cells and modules at its plants in Narvik, Norway and Glava, Sweden respectively. Even though it supplies the end user with the actual energy producing units, Solar is the smallest wholly owned subsidiary in the REC group, with 14% of the total revenue and 5% of the total EBITDA. In addition to the production of cells and modules, the company has a minor operation in South Africa focusing on small, private photovoltaic solutions to private consumers.

REC Solar's production of multicrystalline cells and modules is supplied, as previously mentioned, mainly by REC Wafer. The main market according to the company is the European with Germany and the Mediterranean countries being the most attractive segments (REC 2008).The company does not sell directly to end users and retailers, only to wholesalers and project developers.

3. Company and industry analysis

We will now briefly describe the history of the Photovoltaic Industry (PV), technology developments and the subsidies used in the photovoltaic industry. We will then analyze the industry using the Porter's five forces framework to highlight what factors will be crucial to the future development of REC.

3.1 History of Photovoltaics

Photovoltaic power generation (PV) as a known phenomenon dates back to 1839 when it was discovered by the French physicist Alexandre-Edmond Becquerel, when he observed an electrode in a conductive solution exposed to light. It was not until 1883 however, that the first solar cell was built by Charles Fritts. During the 19th century, the technology was at an experimental stage, with solar cells having an efficiency of less than 1%. In 1904 Albert Einstein published his article on the Photoelectric effect "On a Heuristic Viewpoint Concerning the Production and Transformation of Light", which was one of the main reasons he received the Nobel Prize in Physics in 1921 (PV Resources, 2008).

During the first half of the 20th century, continuous improvement was made to the technology, but it was not until 1954 that Bell Labs announced the first modern Silicon solar cell, having an efficiency of about 6% (PV Resources, 2008). At the time New York Times stated that solar cells would eventually lead to a source of "limitless energy from the sun". The following year, Hoffman Electronics' Semiconductor Division announced the first commercial PV product with an efficiency of only 2% at a price of $25 per cell which produced 14 mW, resulting in a price per watt of $1785. The effect of commercial PV products rapidly increased reaching 8% in 1957, 9% in 1958, 10% in 1959 and 14% in 1960, all by technologies patented by Hoffman Electronics.

In 1959, the first PV powered satellite, Vanguard I, which operated for eight years, was launched; it is currently also the oldest satellite orbiting earth. This was a milestone in the history of PV power as the products were primarily used in satellites and space shuttles for the two following decades, creating vital funding from various governments to research and develop the technology. Early in the 1970's the first commercial companies focusing on terrestrial uses of solar power were established. In 1977, President Jimmy Carter installed solar cells on the roof of the White House and promoted incentives for solar energy systems. The same year, the Solar Energy Research Institute, later to become the National Renewable Energy Laboratory, was opened in Golden, Colorado. The Laboratory is today the United States' primary source for renewable energy and energy efficiency research and development. At the time total PV production had risen to above 500 kW (PV Resources, 2008).

The experimenting on utilizing solar power on civil transportation started in the early 1980s as Solar Challenger, the first plane ever powered by solar energy, took off for the first time in 1980. In 1982 Volkswagen commenced trials of PV powered start ups of vehicles. At the same time, PV applications were starting to be utilized for electricity in houses. A solar plant was included in the electricity grid in California in 1983, producing sufficient power for 2,000 to 2,500 households and PV power plants were set up to supply the demand from a village in Tunisia. During the century, several projects are completed in developing countries for electricity supply. The first commercial thin-film module, G-4000, was introduced in 1986 by ARCO Solar.

During the 1990s several commercial PV companies were established, as it was regarded that solar energy could become commercially viable on a large scale, often referred to as reaching grid parity. The landmark figure of 20% efficiency was reached in 1992, and the technology was improved throughout the decade, resulting in higher efficiencies and most importantly lower production costs.

The years after 2000 have been dominated by an increased focus on renewable energy by companies, media, politicians and the general public, and a large increase in both produced and installed PV power. This is also evident in the many listings of solar companies during the first years of the decade, many of these in Germany (PV Resources, 2008).

As this brief history has shown, the PV industry is in rapid development. To put the growth during the last 25 years in perspective total sales in 1982 were more than 9.3 MW and the following year the volume had risen to 21.3 MW with sales of $250,000,000 reflecting a price of $11.73 per watt, less than 0.7% of the price per watt in 1955. Going forward to 1999, total installed PV power reached 1000 MW or 1 GW, an annual increase of 127% annually since 1983. It is estimated that the cumulative installations at the end of 2007 totaled 9.8 GW, with as much as 2.83 GW installed during the year, an increase year over year of 63%. The market is, however, still very concentrated, with four countries accounting for 86% of installations, of which Germany alone had 47% (REC, 2008).

3.2 Technology

A solar cell is a semiconductor device that transforms sunlight into electricity. Semiconductor material is placed between two electrodes. When sunshine reaches the cell, free negatively charged electrons are discharged from the material, enabling conversion to electricity. This is the so-called photovoltaic effect.

Currently, the raw material used in production of mass production of solar cells is almost exclusively silicon, Si, with the atomic number 14. Silicon is a solid metalloid with a melting point of 1420 degrees Celsius. There are several advantages to silicon that makes it the prevailing ingredient in the PV industry: First, Silicon is the second most abundant element in the earth’s crust, only after oxygen, with 25.7%) (Web elements, 2008). Second, it is neither poisonous nor causes any environmental problems. Finally, transformation into conductors is relatively easy. In addition, it maintains its electrical properties up to 125°C, and is therefore reliable even in harsh conditions.

The silicon is purified through a number of chemical processes to create solar grade silicon which is at least 99.9999999% pure and shaped into large square ingots. One of the main areas for development in the making of silicon ingots is to improve the quality by making ingots with fewer defects and by increasing throughput to increase production without increasing the fixed costs (REC, 2008). Higher quality ingots will also yield better results further down the line by increasing the efficiency of the solar panels.

The ingots of solar grade silicone are then cut using a wire to create thin wafers. The focus in this business area is to increase the ability of the wafers to convert sunlight into energy, and to cut production costs. One of the sources of possible cost cutting is by improving the quality of the silicon ingots, cutting thinner wafers and creating less waste when cutting (REC, 2008). This will directly decrease costs due to less use of material.

The wafers are then assembled into solar cells, by stacking layers of wafers. This allows the wafers to absorb sunlight and generate a current when the photons in the sunlight push electrodes from one silicon wafer to another. The main focus areas in the construction of cells and their assembly into modules is increasing the efficiency and realizing economies of scale in production. REC's new production processes targets a cell efficiency of 16%, increasing to more than 18% when the current technology matures (REC, 2008).

As an alternative to silicon based solar panels, various materials can be viable, but they have significant drawbacks compared to conventional panels. Gallium arsenide (GaAs) has the advantage that it can be used for highly efficient PV systems, reaching efficiencies above 30%, but is significantly more expensive per watt, thus it is primarily used for applications like satellites and space exploration. Cadmium telluride is a material used for thin-film applications and has the promising advantage that it can produce PV applications relatively cheaply. However, its efficiency in commercial use is currently far from par with silicon based applications. Additionally, the material used in the production is highly poisonous. Lastly copper indium diselenide, used to create thin-film PV applications, are somewhat promising due to the fact that it can create relatively high efficiency applications, up to almost 20%, at a substantially lower cost than silicon applications. However, the technology is not yet commercially viable because of production issues.

In general, commercially produced cells can be divided into two categories, crystalline solar cells and thin film solar cells. While crystalline solar cells are produced by creating large ingots of pure silicon that are cut and pressed into thin wafers, thin film solar cells are created by depositing thin layers of semiconductor material onto sheets of glass. The main difference between the two technologies can be generalized into a question of efficiency, life expectancy, production cost and output per area. Typically, crystalline applications are more expensive and more efficient with efficiencies of 13 – 21%, whereas thin film applications are cheaper but less efficient (5 – 12%). In theory, a solar cell made from one semiconductor material only can convert about 30% of the solar radiation energy it is exposed to into electricity. Efficiencies up to 25% have been reached by the use of laboratory processes, and by using multiple semiconductor solar cells, efficiencies above 35% have been achieved (REC, 2008).

3.3 Subsidies

In addition to strong sunshine, the PV industry currently relies heavily on government incentive systems and subsidies driving demand in most markets. National government incentive programs, such as feed-in tariffs for PV installations, have been crucial in boosting industry growth, simply because the cost of PV generally has been above the cost of conventional energy sources (REC 2008).

Government incentives and subsidies can take various forms depending on what the government prefers. A feed-in tariff is a form of subsidy where the government guarantees a price for the electricity that is generated by PV installations and fed into the electricity grid. This enables the PV installations to earn money for the owner when it generates more power than he can use. The price paid for electricity fed into the grid is usually higher than that of grid electricity. This is the preferred incentive system used in many large markets, including Germany, France, Italy and Spain. Another form of subsidy can be a program that gives a tax credit to buyers of PV systems or investment subsidies that where the government refunds part of the price of the PV system. Some states, including California, use a combination of an investment subsidy and a feed-in tariff. In the case of an investment subsidy, the cost will fall to the taxpayer, while the cost of a feed-in tariff will fall to the electricity customers.

The growth of PV power in new regions has traditionally been supported by a range of different incentive programs (REC 2008). Over the past few years, incentive schemes have been adopted in more regions, most notably in Europe and the US. Many countries have also adopted legislative environmental targets which are expected to further support the demand for renewable energy sources.

REC believes government initiatives will continue to support PV investments, and estimates that subsidized demand will rapidly increase towards 2012 and beyond. Political and economic developments may potentially affect the incentive schemes negatively. In the US, the federal tax credit was not extended in 2007, and the upcoming election may slow the progress through congress in 2008. However, new incentive schemes are being implemented in several states and cities. In Germany, proposals are in place to accelerate the decline rate for feed-in tariffs from 2009, and similar proposals may be forthcoming in other European nations. Other major markets are less dependent on incentives, although reduced political support may potentially negatively affect demand also in these regions (REC 2008).

A cut in the subsidies before PV is at or close to grid parity could seriously harm the development of the PV industry because PV will become too expensive to be a viable mass-market alternative to conventional energy sources. A resulting drop in demand would also lead to a slower technological development, unless the price of PV already is close to being competitive.

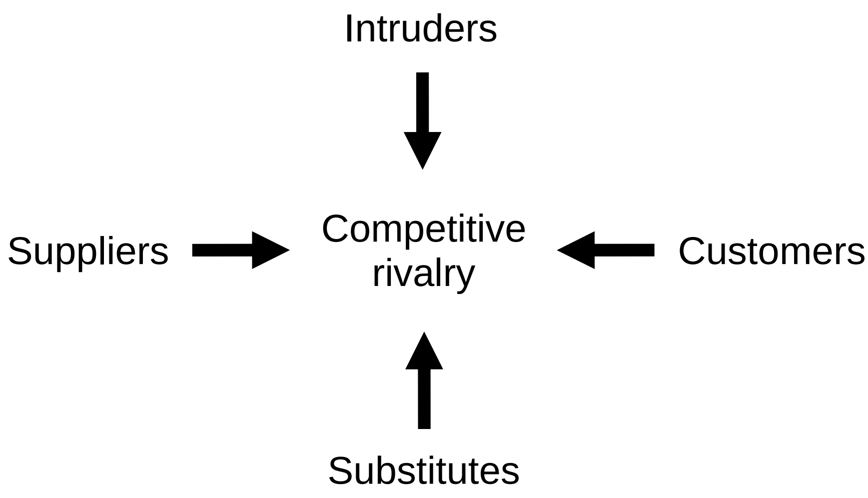
The market price of PV and the subsidies will adjust according to the production cost of PV and the cost of electricity generated from other sources, or more generally; the electricity grid price. As the cost of producing and selling PV modules decreases and the cost of alternative energy increases, there should be less need for subsidies to ensure the competitiveness of solar power.

It is believed that government policies and corporate investments around the world will continue to become "greener" through the end of the decade. We expect tightening emission standards and strong government support for renewable energy in nearly all OECD countries, as governments need to satisfy already agreed international treaties, for example the Kyoto treaty, and their long-range environmental goals (CLSA 2008).

3.4 Michael Porter's Five Forces framework

In this section we wish to describe the external forces that affect the PV market in general, which therefore have direct implications to REC's growth and profitability. Following up on this we will then evaluate to which extent these forces constitutes future threats or opportunities for the company, or in other words, which factors that contributes most to the competition in the industry. Consequently we will have a better understanding of the risks to future growth and profitability.

Michael Porter's Five Forces focuses on five competitive forces that will determine the profitability of an industry (Hill and Jones 2004). The common theme for all of them is that the higher presence there is of each one, the fiercer the competition will be, and the possibilities of raising income and profitability are less. On one hand, a strong presence of each of the forces will as mentioned reduce the companies' potential revenues. At the same time, absence will enhance the opportunities to strengthen the position in the industry.



As we can see there are four forces in the model, each affecting the competition between the companies in the industry. The four forces are the bargaining power of suppliers, the bargaining power of customers, threats from intruders and threats from substitutes. These four factors create the basis for the last of the five forces; the competitive rivalry within the industry (Hill and Jones 2004).

3.4.1 Suppliers and Customers

With regards to suppliers and customers, their bargaining power towards the industry in general has a potential of generating threats and opportunities for the companies within the industry. A general consideration that would be relevant in both relationships is each party's degree of commitment and reliance upon the other, in other words the cost of changing a relationship to a new customer or supplier. A supplier's bargaining power is typically strong in cases where he is a position to deliver a product on superior terms than his competitors and consequently, the customer is dependent upon him. The reverse would be true if the customer(s) of a given product is limited, so that the company has no other option than supplying these at terms dictated by the customer. Thus the larger a company's bargaining power is towards its customers and suppliers the more likely it is that transactions will be more favorable for the company, and vice versa.

3.4.2 Substitutes

Put simply, a company's potential substitutes are products that can cover its customers' needs in more or less the same way as the former's products (Hill and Jones 2004). The presence of such substitutes constitutes a severe threat for the industry, as customers can change their habits of consumption towards other products and therefore are more sensitive to changes in the price and quality of a product. As a result of an existence of closely related substitutes, the competition with regards to price and quality, which could in turn affect costs, would increase and thus lower profitability in the market in general. In the opposite situation, with few substitutes, opportunities arise for higher margins and profitability.

3.4.3 Intruders

The threat of intruders comes from companies not currently established in the industry that might consider entering; competing for the same customers as currently established companies. Unless the market is in a situation of considerable growth, the level of competition will increase with the number of companies established in the industry, which in turn will be characterized by lower margins and less opportunities for high profitability (Hill and Jones 2004). The significance of this threat relies upon the current and future barriers of entry into the industry. These are the factors that dictate how hard it is for companies to establish themselves in the market.

The lower the entry barriers are, the more likely it is to see a large amount of new companies entering the industry, and thus lowering profitability through increased competition. Typical examples of entry barriers to an industry are large capital investments, the presence of economies of scale, patents, long term contracts, governmental regulations, patented technologies and access to competent employees.

3.4.4 Competitive rivalry within the industry

The four above mentioned forces will, as previously pointed out, affect the internal competition in the industry, in terms of market share and margins. If this internal competition is strong, it would represent a threat to the established companies, as it limits their opportunities with regards to pricing of products end thus the potential of maximizing profits. The intensity of the competition between the companies will, according to Hill and Jones (2004), be a result of the number and size of the competitors, supply and demand to and from the industry and entry and exit barriers. Depending on the nature and size of the business, it might also be plausible to assume that historical or personal events have encouraged either cooperation or competition.

3.5 Porter Analysis of the photovoltaic industry

REC is a major company in the PV industry, but it is important to make it clear that there are several distinct subgroups within this industry. The first market is the market for solar grade silicon, where REC Silicon is the largest manufacturer. This industry purifies silicon up to a level where it is usable for PV applications and shapes the purified silicon into ingots. The second general market is that of wafers. The silicon ingots are cut using a wire to create thin wafers that are then assembled into solar cells. REC Wafer is the manufacturer with the largest capacity in this market. The final market is the Module market where solar cells are assembled into products that produce power and are sold to customers. This is the market in which we find REC Solar, though REC's presence in this market is considerably smaller than in the two former.

There are two main drivers of the growth in the industry. The first is the general development of energy prices and demand, and the second is the climate change crisis (REC 2008). The access to energy is essential for both developed and growing economies, and the climate change is one of the premier issues on the global agenda. The world will have to find affordable and more climate-friendly ways of supplying the energy it needs to grow and develop. Today, solar energy is too expensive to compete with more conventional ways of supplying energy, like coal and oil, so one of the industry's main challenges is to cut costs in order to become competitive (grid parity). A consequence of this is that when the cost of the alternatives rise, the competitive position of solar energy improves. A rising oil price will thus be advantageous for the outlook of the PV industry.

3.5.1 Suppliers and Customers

The high-purity silicon industry, which produces solar grade and electronics-grade silicon, is in effect an oligopoly with a few large producers. Their inputs can be either quartz in the form of sand, rocks or raw quartz, or metallurgical grade silicon with is the result of combining quartz and carbon, and which has a purity of between 98% and 99.99%. Both quartz and metallurgical grade silicon are easy to come by and are traded as commodities, with a high level of competition. Silicon is the second most abundant material in the earth's crust and there should therefore be no shortage of raw material for the solar grade silicon producers, the inputs are relatively cheap and the suppliers have little power.

The products of the solar grade silicon producers is solar grade silicon, higher purity electronics grade silicon and silane gas which can also be used to make silicon. Their consumers are thus producers of Photovoltaic wafers, makers of semiconductors and manufacturers of LCD panels (REC web site, 2008). There are few producers of especially solar grade silicon and relatively many customers, so the customers have little power, as evident from the very high margins, close to or above 50%, that the industry has enjoyed during the last few years. These margins have been caused by a large demand from customers as well as a limited manufacturing capacity within the business. The effect of the high margins has been rapid investment in production capacity which will come online during 2008 and 2009, reducing the shortage and thus the power the industry has over its customers.

The wafer producers draw their inputs from the solar grade silicon producers, and are strongly affected by the oligopoly situation. They have few sources for silicon and the wafer industry has more companies and more competition. The result of this is that each company in the wafer industry has little power over its suppliers since the suppliers are few, have many potential customers in the wafer industry, as well as other customers for its products. With supply expected to expand and to a large degree eliminate the shortage, as discussed above, the bargaining position of the wafer industry is likely to improve. The silicon cost of the wafer producers is a larger proportion of total costs than for the semiconductor industry, and the industry is smaller, so in a case where there is a shortage of silicon, their bargaining position will be relatively weaker.

Wafer producers sell wafers to cell manufacturers and cells to module manufacturers. Again, the number of cell – and module manufacturers greatly outnumber the wafer producers, a fact that is countering some of the negative effect on the supplier side.

Going even further in the process, the manufacturers of modules source their inputs from the wafer producers, with a limited bargaining power as described above. However, as this supply is less than what is currently in demand from wholesalers and large homebuilders, a significant bargaining power is maintained towards the customers.

3.5.2 Substitutes

As previously mentioned in chapter 3.2, the only commercially viable substitute for solar grade silicon, or its associated products, are thin film products using other raw materials, though these have either a significantly lower efficiency or are more expensive to produce. It should be kept in mind that the ultimate need that is fulfilled is not the need for PV products as such but a need for electricity. Even though PV products have the profound advantage that it is emission free and environmentally friendly, the entire industry should be viewed upon as a politically correct source of energy that is in most cases still largely dependent upon governmental subsidies.

Consequently, the PV industry, with the exception of some areas close to the equator, should be considered as a substitute for conventional sources of power, and thus the substitutes for the entire PV value chain is, among others, coal, oil, nuclear and hydro power. The presence of viable substitutes is therefore currently very significant and we may see other environmentally friendly products being commercialized in the future. Thus, this force is definitely a significant threat to the industry as such.

As previously mentioned, the most important challenge for the PV industry is to achieve cost parity with more conventional energy sources, even without subsidies. Thus, when the cost of other sources of energy increases, solar energy becomes relatively cheaper and the industry’s competitive position is improved. A third factor, for example the oil price, thus has an impact on the fortunes of the sector, with an increasing oil price as we have seen in the winter and spring of 2008 should improve the outlook for solar energy.

3.5.3 Intruders

The number of companies that would like to have a piece of the growing PV industry should be high, since the high margins the different segments have enjoyed profit margins near to or exceeding 50% over the last years. Potential intrudes in the silicon industry could be companies in the chemicals industry and companies that already produces metallurgical or electronics grade silicon. Other potential intruders could be PV companies with their existing focus further downstream who wish to secure their supply of solar grade silicon at competitive prices, which has been a major bottleneck for many manufacturers.

To start producing silicon, a new competitor would need to build a large facility, which would be capital intensive, but this is not a large problem as long as the demand for and price of silicon is at a level so that the company can cover its cost. Existing silicon producers may have an edge in that they could modify their existing facilities, but as of yet, the demand for electronics grade silicon is high enough that they would have to or prefer to start a new construction. Other than the obvious hurdle of starting up as a new competitor, the raw material is easy to get to and the demand for the end product is strong. The technology is well known, but there are other established manufacturers that may be more cost effective than a new competitor could be from the outset. The rapidly growing market for silicon ensures that the existing firms could still grow even if new competitors enter, but the market price would be expected to drop. The main deterrent for any potential intruders would be that the existing companies have already planned to expand or are expanding their capacity, and with their experience in purifying silicon at a low cost they are likely to be better able to withstand price falls. For any potential intruders, there would also be exit barriers to take into consideration. Large, specialized investments are needed to enter the sector, and these are not easily reversible if the company should choose to withdraw, and since the markets for different types of silicon are correlated, changing focus could also be a problem.

The effect of new entrants into the market would be increased supply, maybe even to the point where it exceeds demand, which in turn would drastically reduce prices and the sector’s margins. This would have a strong negative effect on both existing and new companies.

In the wafer sector, the same hurdle of new investment applies, but with some added barriers to entry for new competitors. First, the lack of silicon supplies ensures that if silicon is available, it would come at a high cost. Second, it is much harder to produce wafers that are competitive both in cost and effectiveness than it is to produce silicon, so the technology would also act as an entry barrier. The wafer market is also expanding, so a new entrant would not need to eat into the sales of existing companies, but increased supply and competition would be expected to reduce margins in this sector in the future. There are also exit barriers that ensure that any entry would be a long-term commitment. The companies in the wafer sector are currently operating at high margins due to strong growth in demand and limited current supply, but new entrants would definitely increase demand and apply a downward pressure to prices and margins.

In the module sector, there is less specialized technology since the modules are made up of already assembled solar cells, and the sector is more competitive than further upstream. In this sector marketing, distribution and cost efficient production is of high importance, but since there is more assembly involved rather than highly technical engineering as it is further upstream, new entrants may be able to become competitive. There are therefore fewer barriers to entry than in the other sectors. This may make it easier for new entrants to compete, but the relatively lower margins in this sector may make the sector less attractive. The market for modules is growing rapidly and existing companies could continue to grow even if the number of competitors increases, making the threat less serious.

3.5.4 Competitive rivalry within the industry

The high margins and high growth expectations in the PV industry look attractive for both existing companies and potential intruders at the present. Rapid expansion should increase competition and decrease margins, and economies of scale end experience should be able to drive costs downwards. A more balanced market with respect to supply and demand will increase the focus on the competition between the various technology platforms, so more emphasis will be put on the advantages and disadvantages of the various technology platforms in different applications (REC 2008). This means a trend towards generally more commercially-driven markets for PV in the coming years.

The high growth also ensures that the level of competition between companies is relatively low and reduces the threat from potential intruders, because they could gain market share without reducing the sales of existing competitors. The market size will continue to be determined by the supply side as long as there is a shortage of silicon, and new entries would thus be expected to be deferred until enough silicon can be supplied. The previously discussed barriers to entry and the few companies that dominate the silicon and wafer sectors today would, however, make any large-scale entry into the silicon and wafer industries less likely.

Since the companies in the industry can all rapidly grow as a result of the large demand growth for products in all segments, the level of internal competition should be low at the present and as long as the market is growing rapidly. Over the next few years, the market will change from being primarily driven by incentive systems to being increasingly driven by commercial factors (REC 2008). The development of the incentives to users of solar modules is undecided at the time of writing, and this contributes to a great deal of uncertainty regarding the future competitive situation in the industry. Supply of modules to the end user will most likely exceed demand sometime between 2010 and 2012, which will require that some of the production is placed on the market at grid-parity pricing, regardless of production cost, to be a viable alternative to other energy sources (REC 2008).

3.6 SWOT analysis of REC

We will now build on the five forces analysis which focuses on the industry and use the SWOT model to analyze REC. The purpose of this study is to illustrate the competitive position of REC and the factors that will determine how the company succeeds.

3.6.1 Theory

The SWOT model analyses the internal (strengths and weaknesses) and external (opportunities and threats) characteristics that define a company and its competitive position (Hills and Jones, 2004).The strengths are the competencies and resources within the organization that will enable the company to exploit the opportunities and fight off threats. These are also the distinguishing factors that give the company an edge over their competitors.

Weaknesses are the resources or competencies that the company lacks or should improve upon. The weaknesses may hinder the company to compete adequately with its competitors, exploit opportunities and withstand the threats they face.

Opportunities are external factors that are favorable to the companies and products. These could be technological breakthroughs, political factors or economic trends that define or change the environment in which the company operates.

Threats are also external factors that are defined in much the same way as opportunities, but these are rather factors that could threaten the competitive position of the company, erode its strengths or limit its growth.

Together, these four factors highlight how the companies could use their strengths to tackle opportunities and threats, and the areas where there is room for improvement.

3.6.2 Analysis

REC is a leading company in the PV industry, but it will be useful to perform an analysis to explain the sources of its strong position and the factors that may determine its future performance.

The company’s main strength is that it is built in an integrated value chain, reaching from silane and polysilicon production to module systems deliveries. The integrated approach provides in-depth industry insights and the opportunity to exploit operational synergies and apply consistent manufacturing principles throughout the value chain (REC 2008). Additionally, it has diversified technologically through its stake in EverQ, which produces solar cells based on the string-ribbon technology. The vertical integration and the capacity of REC Solar as a producer of solar silicon have ensured that REC has had and will have a stable supply of silicon. In 2007, over 60% of the silicon produced by REC was used within the company (REC 2008). Second, REC is one of the cost leaders in the industry, and has leading-edge manufacturing capabilities (CLSA 2005). Third, REC has initiated large capacity expansions, which will aid in de-bottlenecking the upstream end of the value chain. Fourth, the company has spent and committed large resources to research and development to maintain their position at the forefront of the industry. A recent example is the Fluidized bed reactor which will make the production of silicon more cost efficient (REC 2008). Finally, REC has a strong management team with deep expertise in the solar sector (CLSA 2005).

As we see it, REC has two main weaknesses that may darken the company’s outlook. The first is that the company is largely reliant on subsidies to the buyers, since the cost of solar energy is still above the cost of energy in general (REC 2008). This would also be the case for other PV companies. The second weakness is that the company is largely dedicated to one technology for the time being, although large resources are committed to research and development. Less dramatic factors may be that the company still cannot produce enough to satisfy demand, and the fact that some of the production takes place in Norway, which is a relatively high-cost country.

The company has bright and significant opportunities in our opinion. First, the rapidly growing market for solar energy and demand for energy in general should ensure that REC can continue the strong profitable growth it has had in the past. The rapidly growing economies in Asia will require a lot more energy as their living standards approach those of the western world. There is also a strong focus on environmentally friendly energy and the climate effects of using fossil fuels for energy production. The current demand for solar energy is dependent on government subsidies, and new market may open up as more governments see subsidized solar energy as a way of reducing their use of fossil fuels and thus their carbon emissions (REC 2008). As discussed in the five forces analysis in section 3.5.2, the main realistic substitute for solar energy is the use of nuclear and fossil fuels. Rising prices of alternative energy sources, the main of which are oil, gas and coal increases the grid prices solar power needs to compete with to be an alternative, even without subsidies, and is thus advantageous for REC.

The main threats for REC are that when the market matures the competition will intensify and be more commercially driven. This will mean price competition and REC are threatened by the possibility that competitors will be able to cut costs further, making their competitive position weaker. A technological breakthrough, that either makes production more efficient or replaces the current wafer technology as the most commercially viable, for example more efficient thin-film panels, could seriously harm REC's growth potential. If the current wafer technology due to technological advances becomes outdated or too expensive, REC could have a serious problem selling their products. Furthermore, a loss of subsidies would make it much harder to make solar energy cost efficient, and could drastically reduce demand. Since the growing demand and thus production volumes is one of the main drivers in REC's ambitious cost-cutting program, a reduction of subsidies would be dramatic for the company. A continued lack of silicon could slow growth, and since the company is integrated, it would hurt several segments.

The SWOT analysis has described REC's competitive position, its strengths and weaknesses and the required conditions for further growth. The company has great opportunities and should have the resources to take advantage of them. The main risk is that the technology would be surpassed by one that is either more efficient, more cost effective, or both.

4. Discounted cash flow analysis and valuation

In this section, we will introduce the valuation framework which we will use in our analysis. We will present the discounted cash flow method of financial valuation, specific applications of this methodology and discuss the background of the inputs to the model.

4.1 Introduction

The theory of discounted cash flow (DCF) valuation models is based on the time value of money, more precisely the notion that money received today is worth more than money received tomorrow, and was formerly introduced by John Burr Williams (1938). To deal with this principle, we discount the future cash flows by an appropriate discount rate, most often the opportunity cost of capital, as Miller and Modigliani stated in their famous 1958 article: "(…) what the assets add to the firm's value is given by capitalizing the stream it generates at the market rate of interest (…)".

A DCF can have a range of different uses, from the common way of valuing shares by discounting the expected future dividends, valuing a company by calculating the present value of its future earnings and, as we will see, we can value any stream of capital. In general, the common factor of all types of DCF valuation is that high returns and high growth are the main drivers of value. One important thing needs to be pointed out here, however. As emphasized by Miller and Modigliani (1961), a company does not become a "growth stock" merely by having revenues and assets that grow over time. For growth to be profitable, and for the company to become especially attractive to investors, it will also need to produce growth with returns above the cost of capital.

There are several different ways to value a company within the DCF framework. The most common is the enterprise discounted cash flow method (WACC-approach), where the firm's total cash flows are calculated and discounted. Other frameworks include economic profit, which focuses on value creation, and adjusted present value, which highlights capital structure effects. All the above frameworks require a cost of capital to discount the cash flows, but the cost of capital can in no way be taken as given. As we will see, the appropriate cost of capital changes according to the method we use, the characteristics of the firm, the market conditions and in some cases the firm's leverage.

Much of the academic discussion on the valuation of companies has centered on the cost of capital, debt and taxes, and how to deal with them within the frameworks. We will now go through the main developments in the literature, to get a general overview before we explore the topics in greater detail.

In their original 1958 article, Miller and Modigliani (MM) argued that under stringent assumptions, the way a firm was financed is irrelevant "(…) the distinction between debt and equity funds reduces largely to one of terminology". But under more realistic conditions, where uncertainty and taxes are included, leverage can have important implications, as MM illustrate. "In particular, the use of debt rather than equity funds to finance a given venture may well increase the expected return to the owners, but only at the cost of increased dispersion of the outcomes." In other words there will be more risk.

MM revised their original article in 1963 and modified their arguments to include taxes. The first main point in the article "Corporate income taxes and the cost of capital" is that companies need to take corporate and personal taxes into consideration when they decide their capital structure and dividend payments. Personal taxes are relevant because in the end, investors care about what they receive in their accounts after taxes of all forms (corporate and personal) are paid. The second is that even though leverage can add value through the tax shield, the implication is not that a firm should maximize the amount of debt in their capital structure. Many factors, such as debt covenants, the increased variability of returns with higher leverage, and the costs of financial distress (which may be substantial) impose limits on the optimal amount of debt.

Merton Miller develops the argument further in his 1977 article and argues that "(…) even in a world in which interest payments are fully deductible in computing corporate income taxes, the value of the firm, in equilibrium will still be independent of its capital structure.". Miller refers to a study of American railroad companies by Jerold Warner (1977), where "Warner finds, for example, that the direct costs of bankruptcy averaged only about 1 percent of the value of the firm 7 years before the petition was filed; and when he makes a reasonable allowance for the probability of bankruptcy actually occurring, he comes up with an estimate of the expected cost of bankruptcy that is, of course, much smaller yet.".

Additionally; "When the personal income tax is taken into account along with the corporation income tax, the gain from leverage, G_L for the shareholders in a firm holding real assets can be shown to be given by the following expression: $G_L = \left[1 - \frac{(1-\tau_C)(1-\tau_{PS})}{1-\tau_{PB}}\right]$

where τ_C is the corporate tax rate, τ_{PS} is the personal income tax rate applicable to income from common shares, τ_{PB} is the personal income tax rate applicable to income from bonds and *B,* is the market value of the levered firm's debt. "

Miller also comments on the tax rates, and finds that "(...) when all tax rates are set equal to zero, the expression does indeed reduce to the standard MM no-tax result of G_L=O. And when the personal income tax rate on income from bonds is the same as that on income from shares - a special case of which, of course, is when there is assumed to be no personal income tax at all-then the gain from leverage is the familiar $\tau_C B_L$. But when the tax rate on income from shares is less than the tax on income from bonds, then the gain from leverage will be less than $\tau_C B_L$. In fact, for a wide range of values for τ_C, τ_{PS} and τ_{PB}, the gain from leverage vanishes entirely or even turns negative!" Miller is not so sure that the established notion that leverage adds value is accurate, and even states examples of cases where adding debt will actually reduce value.

The argument that debt is not necessarily valuable in all cases is supported by Modigliani (1982) where he argues that debt is valuable in so far as it shelters income from taxation. At high levels of leverage, this gain may be balanced by a growing probability that income will fall below a level where the shelter cannot be used. With the possibility to carry forward losses, this argument is however, somewhat less important.

After this brief literature review, we will now present the three main frameworks for valuing companies using the DCF method, before we review cost of capital and leverage.

4.2 Enterprise discounted cash flow

The enterprise discounted cash flow methodology is the favorite method of many practitioners and academics to calculate the market value of a firm's levered cash flow, because it relies solely on inflows and outflows of cash to the company (Copeland et al. 2005). The value of the company is usually calculated through a two-step model: $V_L = \sum_{t=1}^{t} \frac{FCFF}{WACC} + \frac{FCFF^{t+1}}{WACC-g}$ The first step is to calculate the present value of the cash flows during a projection period (1, 2 …t, often 5-10 years) where the developments in revenues, costs and investment can be calculated with some certainty. The second step is to calculate the value of the cash flows from the first period after the projection period and into perpetuity. In this period second element, a perpetual growth rate, in many cases assumed to be equal to or near the growth rate of the economy as a whole, needs to be specified. Naturally, a higher growth rate will increase the value of the firm, as long as it makes a return higher than its cost of capital.

Using this method, the weighted average cost of capital (WACC) is used to discount the cash flows to the firm (FCFF) and thereby calculate the enterprise value. The enterprise value is the value of the firm's total equity and debt, so to calculate the equity value the value of debt needs to be subtracted from the total firm value. The FCFF is usually interpreted as the net operating profit less adjusted taxes (NOPLAT). In this context, adjusted taxes mean that interest payments should not be deducted before calculating taxes, because the tax saving of interest is wholly cared for in the tax-adjusted cost of debt. Measures of earnings before interest and taxes (EBIT or EBITDA) treat the firm as if it was financed only by equity, but we still need to deduct taxes, because the relevant cash flow is that to the firm, after tax. If we subtract interest from the cash flow and then discount by the WACC, we will overestimate the value due to the tax shield being counted twice.

The WACC $\left(WACC = \frac{E}{V} * re + \frac{D}{V} * rd * (1 - Tc)\right)$ is leverage-sensitive, which means that the discount rate should be adjusted in response to a change in leverage. By using this method, we inherently assume that the leverage ratio stays constant, and a specific implied discounting of the tax shields created by the firm's debt. It is therefore not straightforward to use the WACC approach to value a company with varying leverage, although it is possible by estimating a new WACC for each period, which can be a complicated procedure. The WACC approach thus makes some critical assumptions: First, it assumes that the D/V-ratio is constant over time. This implies that the firm follows a target debt to market value ratio, often meaning that the amount of debt should increase over time. Furthermore, WACC captures the value of the debt tax shield directly in the cost of capital, and thus overvalues this effect if leverage decreases over time, and undervalues the effect if debt increases.

Miles and Ezzell (1980) show that under given conditions, discounting by the WACC can produce an accurate valuation. "Our analysis shows that if the unlevered cost of capital, the cost of debt, the tax rate, and the market value leverage ratio are constant for the duration of the project, then the value of the project's levered cash flows can be obtained by discounting the unlevered cash flows at a rate: 1. That is invariant with respect to the time pattern and duration of the levered cash flows and 2. That is equal to the textbook WACC. (…) The critical assumption for evaluating the validity of the textbook (WACC) approach is concerned with the firm's financing policy. When management acts to maintain a constant debt to market value ratio, in terms of realized market values, the investment decision impacts upon the riskiness as well as the magnitude of future tax shields created by debt financing." The conditions are rooted in the general consensus that the WACC is an appropriate discount rate for either (1) a one-year project life or (2) level perpetual cash flows. A number of authors, including Myers (1974) have argued that the WACC approach does not generally provide correct valuations of uneven finite cash flows.

In practice costs of capital change and: "(…) the assumption of debt rebalancing each period is often not very realistic and not consistent with firms' practice. In reality the debt is often sticky and debt adjustments depend upon shareholders willingness (to issue or withdraw debt)" (Mazzari et al. 2007). This means that even though the enterprise discounted cash flow method is simple to use and common amongst practitioners, it may not always be in tune with the requirements of business applications. The quote highlights some of the difficulties that the enterprise discounted cash flow method produce.

The WACC is an expression for the companies opportunity cost of capital and represents a blended required return of the firm's debt and equity holders, based on their market-based values. Examples often portray the WACC as a mix of the required returns for shares and long-term debt, but in practice it may also contain elements such as preferred shares. The weight of each component is calculated as the market value of the component divided by the sum of the components. We can now see that the firm's leverage policy becomes important when the WACC is used to discount cash flows more than one period into the future, as the appropriate weights in future periods may be different from the starting period, unless the firm rebalances its leverage ratio.

The WACC methodology usually encourages a firm to add debt, since the after-tax cost of debt is lower than the cost of equity, due tax regulations that allows firms to deduct interest payments. The methodology thus implies that debt adds value, although the exact value of the tax shield under different conditions has been widely discussed. Mazzari et al. (2007) specified the implications of using the WACC on a growing firm: "We have demonstrated that the WACC formula, when used in a growth context, implies that a) debt tax shield related to already existing debt are discounted using k_d; b) debt tax shield related to new debt, due to growth, are discounted, according to a mixed procedure, using both k_u and k_d. Thus, the widely used WACC approach in a growth context always implies rigid assumptions regarding both the pattern of debt over time and the discount rate applied to tax deductions generated by the debt. (…) in a growth scenario the *WACC* formula implies a set of assumptions that are neither understood nor consistent with the business and cash generating model of most firms."

We can argue that these implications of using the WACC are quite restrictive. Using k_d to discount the tax shield related to existing debt implies that this tax shield has the same riskiness as the existing debt. This may not be accurate, especially in cases with high leverage, where the asset may determine the company's ability to repay its debt, implying that the tax should be discounted at a higher rate reflecting that risk.

As we have shown, the use of the enterprise discounted cash flow method is a popular and relatively straightforward way of calculating the value of a firm. The use of the WACC in the model has some drawbacks that can limit the accuracy of the model, except under strict conditions, especially with regards to a constant leverage ratio, variable cash flows and the implied discounting of the tax shield.

4.3 Adjusted Present Value

As an alternative to the enterprise discounted cash flow model, Myers (1974) found that "An alternative procedure is clearly needed for cases in which one or more of the assumptions underlying the weighted average cost of capital formulas are seriously violated.", and developed a model that separates the value of operations into two components; the value of operations as if the company were all-equity financed and the value of tax shields that come from the capital structure: $APV = Unlevered\ Value + Present\ Value\ of\ Tax\ Shields$.

Where the WACC approach implicitly discounts the tax shield, the APV approach allows for different choices regarding the tax savings profile and the discount rates. The model is developed in the background of the Miller and Modigliani (1958) proposition that a company's financial structure should not affect the value of the firm, except through imperfections such as distress costs and taxes. The advantage of this is that the assumptions in the WACC-valuation regarding constant leverage can be eased, and made more in tune with firms' actual behavior. The APV method should give precise valuations of a company planning to change its capital structure, and is popular for valuing leveraged buy-outs.

In practice, we need to value the company's unlevered cash flow by discounting it at its unlevered cost of capital, k_U ($k_U = r_f + \beta_u * (E(r_m) - r_f)$).

The unlevered beta cannot be observed, and to find the value we have to impose some restrictions to find β_U, depending on the scenario. There are several ways of calculating the unlevered beta, depending on the chosen assumptions. Fernandez (2006) summarizes the different methods:

Theories	B_U	DTS discounting	Usage
Fernandez (2004)	$\beta_U = \frac{E\beta_L + D(1-T)\beta_d}{E + D(1-T)}$	K_U	Fixed book-value leverage ratio
Miles-Ezzell (1980)	$\beta_U = \frac{E\beta_L + D\beta_d[1-TK_d/(K_d)]}{E + D[1-TK_d/((1+K_d)]}$	$K_d\, for\ first\ year$ $K_U\, for\ following$	Fixed market-value leverage ratio
Myers (1974)	$\beta_U = \frac{E\beta_L + (D-DTS)\beta_d}{V_U}$	K_d	Constant debt in each period

β_U = Beta of unlevered equity = Asset beta
β_d = Debt beta
β_L = Beta of levered equity
K_d = Cost of debt

D = Value of debt
E = Value of Equity
DTS = Value of debt tax shield
T= Tax rate

The value of the tax shield should be discounted according to the theory used, and added to the unlevered value, as per the formula for APV above. Many have tried to argue the correct value of the tax shield created by a company's debt. Miles and Ezzell (1980) showed that the WACC method assumes that capital structure is rebalanced (either period by period or continuously) so as to maintain the same capital structure proportions. This in turn implies that when future asset values are uncertain, the value of future debt tax shields is also uncertain, and takes on the risk characteristics of the assets. This should imply that the tax shield should be discounted by the unlevered cost of capital (k_U) found through the asset beta. If the debt is constant and the firm is certain to be able to pay it back, the tax shield should be discounted at the (usually lower) cost of debt (k_d).

Modigliani (1988) demonstrates that the tax advantage can vary from 0 to τ_C, depending on the corporate tax rate τ_C, the personal tax on capital gains τ_{PE} and the personal tax on interest income τ_{Pd}. Miller expresses the value of a levered firm as $V_L = V_U + \frac{l*r*D}{1+p}$ where l represents the tax advantage calculated by $l = 1 - (1 - \tau_C)(1 - \tau_{PE})/(1 - \tau_{Pd})$, r is the cost of debt, D is the amount of debt and p is the chosen discount factor. The above formula for V_L implies that the value from leverage is proportional to D, but in the case of bankruptcy costs and the case that taxable profits may fall below the available savings from the tax shield, the proportionality may only be valid up to a point.

It is clear that "(…) the value of leverage to investors must depend on the amount of additional taxes, corporate and personal, that could be avoided by paying out an additional dollar of corporate returns in the form of interest (which is subject to the personal income tax) while reducing by a dollar shareholders profits (which are subject to the corporate plus the appropriate personal income taxes)" Modigliani (1988). This means that in the special case of no personal taxes, or a tax on interest income equal to the tax on capital income, the total taxation and thus the tax shield reduces to τ_C. At the other end of the scale, with $\tau_{Pd} > \tau_{PE}$, the tax shield would be less than τ_C, or even zero in the case that $\tau_{PE} = 0$ and $\tau_{Pd} = \tau_C$.

After now having discussed the treatment of the tax shield in the APV model with regards to the correct way of discounting the tax shield under different conditions, and highlighting how the APV model is different from the WACC approach, we will continue with a brief presentation of three alternative valuation methods; Discounted economic profit, multiples and real option valuation.

4.4 Economic profit, multiples and real option valuation

Discounted economic profit is gaining popularity due to its close links to economic theory and competitive strategy (Copeland et al. 2005). The enterprise discounted cash flow model presented above has been criticized for providing little insight into the performance of the company. If a company experiences declining free cash flow, it can both signal declining profits or that the cash flow is used for capital expenditures. The economic profit model highlights how and when the company creates value and should, when applied correctly, give the same valuation as the enterprise discounted cash flow model.

Economic profit is defined by: $EP = Invested\ capital * (ROIC\ - WACC)$, but since the return on invested capital can be written as: $RIOC = \frac{NOPLAT}{Invested\ Capital}$, we can define economic profit as: $EP = NOPLAT - (Invested\ capital * WACC)$, which highlights the company's capital cost. A company only creates economic profit (also called Economic value added) if the return on the capital employed in the company is greater than the cost of capital. We can then calculate the value of the company by discounting each period's economic profit back to the present by the WACC.

If we assume that the return on future projects is equal to the company's historic WACC, we can calculate its value by: $V_0 = Invested\ Capital_0 + \sum_{t=1}^{\infty} \frac{NOPLAT - (Invested\ capital_{t-1} * WACC\ )}{(1 + WACC)^t}$. The advantage of the economic profit model is that it highlights the value drivers of the company year over year. The application of this framework is different from that of the enterprise discounted cash flow, but the same cost of capital is used, namely the WACC. The economic profit method highlights whether a company earns profits in excess of its cost of capital in a given year, even if the cash flow continues to grow, something the enterprise discounted cash flow model would not capture.

As we demonstrated in the introduction to the WACC in the previous section, the WACC is only perfectly correct under certain strict conditions, These conditions would also apply to the Economic Profit model, and we presented evidence on the implications of using the WACC compared to the APV model in the presentation of the adjusted present value model in section 4.3.

The next way to value a company is to use a multiples valuation, where a company is valued relative to a peer group. Liu et al. (2002) speculate that"(…) multiples are used primarily because they are simple to comprehend and communicate".

The procedure is to first calculate the ratio of share price to a chosen value driver, such as earnings, sales or assets, for a group of comparable companies, and then multiply the ratio by the company's value driver. The most common ratios are the P/E ratio, asset multiples such as the Price/Book ratio and sales or earnings multiples, such as EV/sales or EV/EBITDA. Liu et al. (2002) find that "(…) multiples based on forward earnings explain share prices reasonably well for a majority of our sample. In terms of relative performance, our results show historical earnings measures are ranked second after forward earnings measures, cash flow measures and book value are tied for third, and sales perform the worst."

A multiples valuation can be simple to perform, but the main challenge is to find truly comparable companies. Ideally, the peers should have identical risk, growth and leverage, but to find one (or even more) companies that are identical in all respects is unrealistic in practice, so the multiples may need to be adjusted for the thee above factors, which makes the process more difficult. A multiples valuation can be used to identify misprices shares, to establish a "ballpark" valuation, and is often used to complement comprehensive valuations, such as those described above, and to obtain terminal values in such models. (Liu et al. 2002) Another common use for a multiples valuation is to value start-up companies, because they usually have a short history of cash flows and an uncertain future.

The third alternative method we will present is the real option valuation method. A real option is the right, but not the obligation, to undertake some business decision; typically the option to make an investment. Real options can be used to explain the difference between the value of a company calculated by traditional financial analysis and certain businesses stock market valuations.

Options analysis was developed by Fischer Black and Myron Scholes (Black and Scholes 1973), and is based on the concept of a replicating portfolio. They argue that the payoff of an option that is correctly priced could be replicated by taking long and short positions in options and the underlying share. Since corporate liabilities can be viewed as combinations of options, the option analysis is also applicable to corporate liabilities such as shares and bonds.

The exercise price used in the option formula is the cost of investment, and the strike price is the present value of cash flows the project is expected to generate if exercised. Translated to a valuation of a company, the value of the company should be the sum of the value of the options tied to it.

In the APV and the Real Option Valuation (ROV), we use the same cash flow as an underlying asset, but the APV does not account for the value of uncertainty and flexibility. Consequently, we should arrive at a higher value using the ROV approach. The uncertainty is expressed by the standard deviation. By flexibility, we mean the right to postpone the investment, choose the level of investment, or to not invest at all.

An APV analysis will only recognize the present value of expected cash flows and the present value of fixed costs. The ROV on the other hand accounts for the uncertainty of future cash flows, the timeframe during which the investment could be postponed, the cost of preserving the option, and also the risk-free yield of not having to invest before the time of maturity in addition to the ones identified by the APV analysis.

When we have now presented several methods of valuing companies, we will discuss a few central topics, including leverage, the cost of capital and the cost of debt.

4.5 Capital Structure

Debt is usually a prominent part of any capital structure, but the debt to equity ratio varies greatly between different companies, even within the same industry. Capital intensive industries such as utilities, banks, real estate developments, steel petroleum and mining rely heavily on debt, while pharmaceutical companies and service-companies are predominantly equity-financed. Right off the bat it is important to remember that there are many different flavors of debt, as well as different types of equity and various combinations of the two. According to the Miller and Modigliani argument above, the financing policy of the firm is irrelevant, but the discussion showed that the underlying assumptions do not hold in practice, so the topic is worth further study.

The primary question may be why a company should use debt at all. If MM were correct, a capital structure with debt would not provide any benefits over all-equity financing, so it will be interesting to highlight how the breaches of the MM perfect market conditions provides incentives to actually include debt in the capital structure. (This question could of course be framed in the opposite manner, why actually include equity when you could invest other people's money: i.e. use debt) The first clue to how debt can generate value, the interest tax shield, is already discussed extensively in this thesis and will thus not be discussed further here. The second main rationale for using debt is that a levered company may generate higher returns to equity than if it was all-equity financed, as long as the return on assets, or in other words, the money the company generates, is higher than the cost of borrowing. Leverage can thus be very positive for the return of the owners, and may be desirable, especially with limited liability ownership, as the equity owners are liable for a limited quantity of the total invested capital. Although their liability may be limited to their equity, the drawback is that the risk (at least as the amount of leverage increases above the negligible) of the invested equity increases, because interest payments have priority over dividends, and equity holders are thus entitled to cash flows in excess of the interest payments. Higher leverage may increase the risk that there will be nothing left for the equity holders, but in return all returns in excess of the interest accrue to them.

Where there are benefits from employing debt, as evident above, there would logically also have to be some factors that may limit the optimal amount of debt in a company's capital structure. The Trade-Off Theory of capital structure, first proposed by Kraus and Litzenberger in 1973, states that for each firm, there exists a debt-to equity level that maximizes the firm's value. Up to a point, the tax shield increases the firm's value, as we have discussed, but after this given point, the costs of debt start to reduce the firm's value. The Miller and Modigliani set of firm and market characteristics imply that bankruptcy is quick and painless, but in reality, going bankrupt or even getting close can be very costly. The costs can be very direct, such as lawyer fees, fees to bankers that may help with restructuring and the costs of having to devote time and manpower to handle the situation. More indirect costs may be a reduced freedom to operate, having to forego investment opportunities or postpone business developments, or even having to cut back on business activities to try and avoid going bankrupt. The second important set of indirect costs is the loss of reputation the company may experience. Customers may be hesitant to purchase goods or services from a company near bankruptcy, suppliers may demand cash payments, competitors may see an opportunity to enhance their position at the expense of the troubled company and investors may pull out or demand a high compensation for investing.

The above-mentioned costs of financial distress will reduce the firm value as they become more likely and thus work against the value created by a higher debt level, since a high debt level makes the company's cash flow riskier. So the inclusion of debt in the capital structure will increase the value of the firm up to the point where the increasing costs of distress start to dominate the value of the tax shield. Frank and Goyal (2003) found support for the Trade-Off theory, but both Miller (1977) and Myers and Majluf (1984) have criticized the theory for not giving a good description of what firms do in practice, and Myers took the criticism further by proposing the Pecking-Order Theory of capital structure.

The Pecking-Order Theory of capital structure dictates the hierarchy many firms follow when they need to issue capital. "The pecking-order theory of capital structure, which predicts that firms prefer internal to external finance, is one of the most influential theories of corporate leverage". (Myers and Majluf, 1984) The authors proposed the pecking-order based on their theory that companies preserve financial slack in the form of cash, liquid assets and excess borrowing capacity to not "…be forced to issue stock when our firm is undervalued by the market." Frank and Goyal (2003) found no evidence in their studies to support the Pecking-Order theory, but several authors, as already mentioned have argued that it is a better approximation of reality than the trade-off theory.

Managers will have superior information regarding the true value of their shares, and should thus want to issue shares only when they feel that the shares are overvalued. The authors argue that the signal sent by a firm that chooses to issue shares when not needed sends a clear signal that managers, knowing their superior information, feel that the shares are overvalued, and is thus clearly negative. The authors also argue that companies prefer debt to equity if external financing is required, because they act in the interest of existing shareholders, and, as we stated, would not issue shares at less than their actual worth, because this would benefit new shareholders at the expense of old shareholders, even in the new project is profitable. A project with a negative expected NPV would not be undertaken, because it would reduce the wealth of both existing and new shareholders. Old shareholders know that even though equity is raised to fund a new investment, the realized NPV may be outweighed by the loss off issuing new equity at a too low price, and they would thus view an issue not a guarantee that they the investment opportunity would be positive for them, but only that its expected NPV is non-negative. Investors would thus interpret an equity issue as bad news. (Myers and Majluf 1984)

If the firm could issue risk-free debt instead, there would be no problem, and all positive-NPV projects would be undertaken. If the debt is risky, the authors argue that more projects would be undertaken by issuing risky debt than by issuing equity, or more generally, that safer securities are better than risky ones. The reasoning behind this is that the firm would issue securities and invest if the investment's NPV equals or exceeds the capital gain on newly issued shares, increasing old shareholder's wealth. The argument will be analogous for debt, but option pricing theory suggests that the capital gain (or loss) of newly issued debt will have the same sign but a lower absolute value, making a debt issue preferable to an equity issue.

The NPV of the investment should be the same regardless of the choice of financing, so an equity issue should signal that the cost to the existing shareholders of an equity issue is less than for a debt issue, and vice versa. In equilibrium, investors would expect that the gain for new share- (bond-) holders is equal to zero, given what is known at issue, with |Gain from equity|>|Gain from debt|, as stated above. This is because if the capital gain for the new shares is positive, this means that they were issued at a too low price, which would be disadvantageous to the old shareholders. Therefore the only way for it to be optimal to issue equity is if the issue price of new equity is high enough that |Gain from equity|<|Gain from debt|, but this would at the same time imply a sure loss for new shareholders, because the newly issued shares are overpriced. There can thus be no issue price where the company is willing to issue new equity and the investors are willing to buy, because the issue would have to be overpriced. (Myers and Majluf, 1984)

Finally, it should be said that it may not be irrational to issue equity in certain cases. If there are disagreements between the company and investors about the future variance of the firm, the correct price of new debt might not be agreed on. If the firm is actually safer (less volatile) than the investors think, the company may not be able to raise debt on fair terms: "Thus, a decision to issue equity may not signal a sure capital loss for new shareholders, but simply that the firm is safer than prospective bondholders think. Thus equity issues are not completely ruled out in equilibrium." (Myers and Majluf, 1984)

4.6 CAPM and calculating the cost of capital

To be able to perform a sensible valuation, we need to define a cost of capital. When calculating the cost of capital, we usually base it on an alternative and risk-free return, plus an appropriate rate to reward the investors for taking risk. The most common method of calculating the cost of capital is the Capital Asset Pricing Model. The CAPM was introduced by Jack Treynor, William Sharpe, John Lintner and Jan Mossin independently, building on the earlier work of Harry Markowitz on diversification and modern portfolio theory, and defines the theoretically appropriate return of an asset, given its risk. (CAPM: $r=r_f + \beta (E(r_m) - r_f)$) The required return for an investor can be calculated by the CAPM model, assuming that the investor is well-diversified, and that markets are efficient. We can see that the required return comprises of the risk-free interest rate r_f, for example a government bond, plus a compensation for risk, $\beta (E(r_m) - r_f)$. The beta, β, is by calculating the covariance of the monthly returns of the asset with the monthly returns of the market portfolio represented by a chosen index, usually the exchange where the asset is listed, or a general market index. This is then divided by the market portfolio variance. (The precise formula for the beta is: $\beta_a = \frac{Cov(r_i,r_m)}{Var(r_m)}$). The beta is then multiplied by the market premium $(E(r_m) - r_f)$, which is the excess return over the risk-free rate one would historically expect to earn by investing into the market portfolio. This can of course change over time as it depends on the expected market return and the risk-free rate at a given point in time, but historic averages are usually used.

The resulting cost of capital is then used to discount the future cash flows back to the present to determine its theoretically correct price, and represents the risk-adjusted return that the investor has to get to make the investment worthwhile, given the risk the investor subjects himself to when investing.

4.7 Cost of debt

When firms want to raise debt, they have two main routes to go down. They can either go to a bank and borrow the money and pay the bank interest, or issue a corporate bond. There also exist other types of securities, such as convertible bonds and mezzanine debt, but for the purpose of this chapter, we will consider corporate bonds.

A bond is a fixed income security issued by a borrower that obligates the issuer to make specified payments to the holder over a specific period. The investor who buys the bond in effect lends money to the entity for a defined period of time. The lender issues a bond that states the coupon (interest rate) that is to be paid as well as the maturity, the date that the par value of the bond will be returned. The interest is usually paid semi-annually, and the level of the coupon is determined by the general interest rate and the risk connected with the bond.

The coupon rate can be set as fixed throughout the lifespan of the bond, or to vary with a spread over a market interest rate, such as LIBOR (London Interbank Offered Rate). The offered interest rate or the premium over LIBOR is determined by the bond's probability of default. This can be done because all bonds are rated with respect to their riskiness. The ratings, issued by either S&P or Moody's, determine what interest premium the lender has to pay to the investor. Treasury-bonds and AAA-rated bonds have the lowest premium, but when you drop down to speculative- or junk-bonds, CCC being the lowest rating except default, the premium will be very large to attract investors willing to take the risk. Even though bonds are quoted with promised yields at issue, investors are concerned with expected returns and we will thus have to correct for this. This is done by including the probability of default, in the form of ratings, in our calculations.

The interest rate a company should pay may also be approximated by estimating a debt beta in much the same way as we did for equity above, by taking the movement of the price of the bond to the market portfolio. In this case, a β equal (or close) to zero would imply safe (AAA-rated) debt, and a higher β would imply riskier debt and thus require the company to pay a higher interest rate.

5. Analysis

The purpose of this analysis will be to figure out if the price drop from December 14 to March 14 (NOK 266 to NOK 125, a 53% drop) can be justified by the events in the period. We will examine the impact of the company specific events through our valuation model, and combine this with the effects of the general market and industry index movements. We will also examine what possible growth and margin expectations could justify the pricing at the end of our observation period.

In the Porter and SWOT analysis in section 3 we have discussed the effect of external factors, such as technology developments and the development of subsidies, on the company and its ability to achieve its required growth and margin targets.

As we introduced in the previous section, both the margin and the growth contributes to the pricing of the company, and there may be many combinations of the two that yield the value at the start and at the end of the period. Our goal will then be to highlight the changes over the period, and to give values, supported by extensive sensitivity analysis, that can support the given market prices. This will show how much of the company's value that is subject to external risk factors that in some part is outside the company's control. A company such as REC, where much of the value lays in the future growth and profitability of the company, and less in the current performance, will inherently be subject to much such risk.

We will now set up a valuation model for REC. To make it possible for us to calculate effects on the share price by changes in expectations, the model will need to highlight margin and growth requirements, and be dynamic and self sustained in order to allow us to run informative sensitivity analysis on these two, as well as WACC and perpetual growth.

5.1 Data

The starting point of any analysis is to gather the necessary data. Our primary source of financial data will be the quarterly and annual reports released by REC since its listing on the Oslo Stock Exchange (OSE) in May 2006. The financial statement data is reported according to the International Accounting Standards (IAS). We have also derived great utility from analysts' reports on REC, as well as the Solar Energy industry in general. We have used the OSE homepage to find data on the REC share price and the development of the OBX index.

5.2 Choice of method

In our literature and method discussion above, we highlighted two different methods of valuing a company, the APV and WACC approaches, each with its benefits and drawbacks. When we will now choose one of the two methods we will have in mind that the model will serve as a basis for our analysis and that the purpose of this analysis is primarily not to value the company, but rather to figure out the underlying value drivers inherent in the market price at our key points in time. There are two main differences between the models: The APV model is rarely used in practice, and introduces more variables, but is the theoretically correct approach, especially if the leverage of the company is expected to change. The WACC approach is simpler to implement, but it may lead to an inaccurate valuation when the leverage changes.

Since the focus of the paper will be on the inherent value drivers of the company, we need a model where we can perform analysis without introducing too many variables. The changes in leverage are expected to be relatively small, and the difference between the WACC approach and the APV approach should thus be small in practice. We have thus chosen to use the WACC approach due to its relative ease of implementation and our expectation that any measurement error will be relatively small.

The multiples valuation can be a simple way of establishing a proxy for the value of the company, but it is not suitable for the analysis we wish to do. The economic profit model highlights where the company makes money but is less suited for our analysis than the WACC approach because it introduces more variables. The real options approach is complicated, and again includes many variables that may increase the uncertainty of our results.

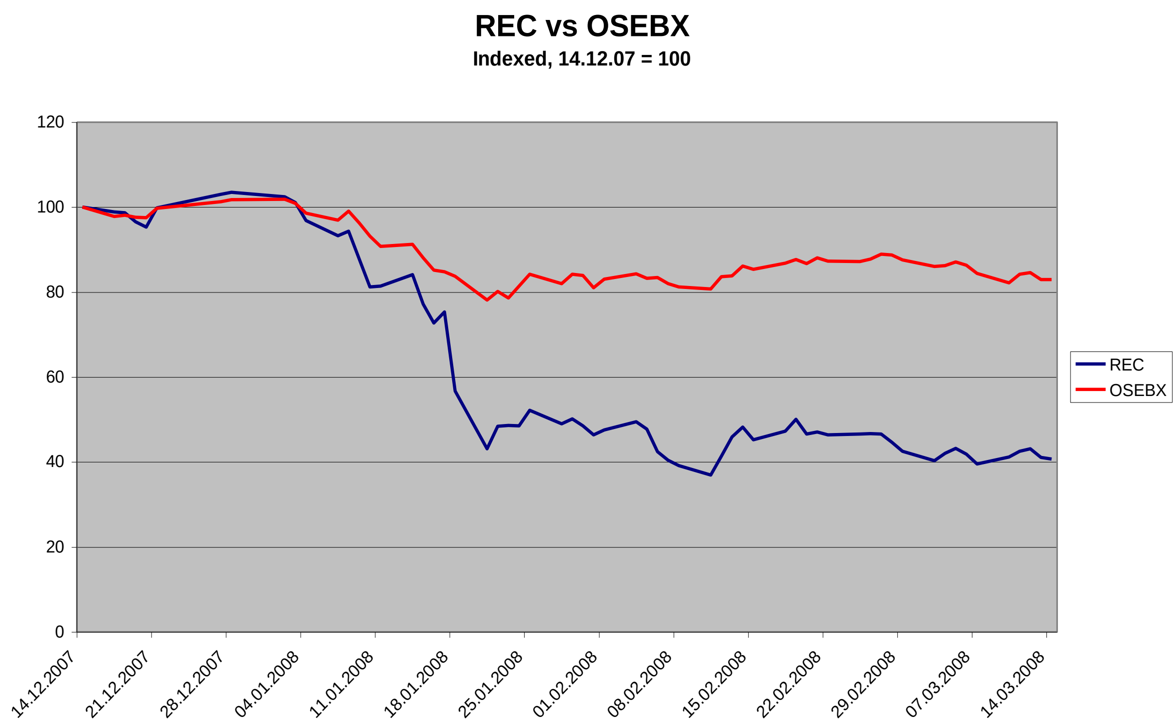
5.3 Data processing

When we now start to process our data and put it into the WACC framework, we need to remind ourselves that what we want to do is to find combinations and sets of growth and probability rates that bridge the gap between the accounting numbers and the market price at the start and the end of our study period. We will gather our accounting data from the 2007 annual report. The numbers here were available in March through the fourth quarter report. While we are aware that the numbers for fourth quarter 2007 were still uncertain in

December, there were no significant surprises when they were released. We will therefore include them in their ex-post nature for the December numbers as well. The interesting analysis will be on the future outlook for the company signaled in the reports, coupled with news events in the period, and the changing stock market valuation of the company.

We now set up a valuation model, where the purpose is to be able to simulate the projected growth and profitability rates with the aim of finding out what rates are required to support the valuation and how these requirements have changed over the course of the study period.

5.4 Events in the observation period



This is a short overview of the two most significant events in the observation period from December 14 2007 to March 14 2008. A complete list of events can be found in Appendix I.

REC's Capital Market Day (CMD) – 18.01.08

On January 18, REC invited investors, analysts and representatives of the press to their Capital Market Day, a day of presentations regarding the strategic situation and various business developments for the company.

In their presentation, REC presented both good and bad news, but most notably was a slide depicting their guiding for future margins. The presentation slide showed in vague but understandable terms that REC expected margins to drop in 2008, before recovering in the years following. The reasons for lowered margins in the short run were higher ramp-up costs related to their substantial capacity expansion.

Moses Lake Delay – 06.02.08

On February 6, REC announced their plant construction in Moses Lake would be delayed by 2 months. Costs were now expected to be up around 20%, up from a former budget of USD 660mn.

We have included these two events in the model for March. The delay at Moses Lake is interpreted as a 35 percentage point drop in revenue growth. This is offset by a 20 percentage point revenue growth increase in 2009 when the plant finally completes. The combination of the cost increase at Moses Lake and the general downward guiding of the margin for 2008 are interpreted as a 30 percentage point drop in EBITDA margins for 2008. More details can be found in section 5.5.3.

5.5 Model setup

We will now go through each of the items in the income statement and balance sheet and describe how they are treated and how we create the model to get the free cash flow. Neither the income statement nor the balance sheet can be viewed in isolation, since there are intrinsically linked. We will first need to define a key economic driver and a plug variable to base our model on.

The key economic driver in our model is the growth rate in operational revenues. As we have constructed the model to perform analysis on this growth rate, many of the other variables is in some way tied to the revenues.

The plug variable is a buffer that will make the balance sheet balance. By setting the plug variable to automatically “plug” any holes in the balance, we get a dynamic spreadsheet model that keeps the projections balanced automatically. The most common choice is the cash account. Cash is very liquid, and is therefore an appropriate buffer, but it has a significant drawback in that it cannot become negative. In such a case, long-term debt would be more appropriate. Alternatively, we can use a combination of the two where the long-term debt is increased when the cash goes below a given level, e.g. zero.

5.5.1 Income Statement

Revenues

The basis of the income statement, revenues grow by a given percentage each year. Growth is likely to be very heavy in the next 3 year period as planned expansions come online. It will then drop steadily as the industry approaches maturity. Our base case in the March scenario is 25% revenue growth for 2008, consistent with the guiding in the Q4 report (REC Q4 2007, p12). The low 2008 growth is expected to be made up in 2009, at a projected 80% growth, and 2010 at 50% when the last of the current expansions should be active. 30% growth in 2011 and 20% in 2012 complete the base case curve.

To maintain the general shape of the curve but still allow sensitivity analysis, Revenues are adjusted by a factor named Sales Growth Modifier (SGMod). In the base case, this is at 100%, but it is allowed to move between 60% and 140% later on. Adjusting this factor will adjust the entire slope of the revenues curve. As an example, SGMod 60% would have 2008 growth at (60%*25% =) 15%, 2009 at 48%, etc.

Costs

We calculate the cost of goods sold by consolidating the entries for cost of materials and changes in inventories.

We assume that the other operating expenses are a fixed percentage of sales. Some of these costs may not be fully variable, and may thus grow at a slower pace, but we have taken a cautious approach.

This allows us to consolidate all operating expenses into a single entry. The projections for this entry are calculated through a projected EBITDA margin. The base case March scenario here is a flat 50% EBITDA margin for the years 2009-2012. REC has previously guided slight increases in margin, but we take a cautious approach and assume it will remain around current levels. Significant cost improvements are likely to be matched by lowered prices through increased supply and subsidy reductions. For 2008, REC guided the margin down significantly on the Capital Market Day (CMD, Closing Notes) and later in the Q4 2007 and

2007 Annual Reports. Cost increases are due to expansion related activities like employee training and similar. EBITDA margin for 2008 is estimated at 20% in the March scenario.

Like Revenues, EBITDA margin is adjusted by a factor called EBITDA Margin Modifier (EMMod). See Revenues for detailed explanation.

Depreciation and amortization

The impairment related to property, plant and equipment is consolidated with the depreciation account. Depreciation is assumed to have a constant ratio to Property, plant and equipment (PPE) excluding assets under construction. The ratio is based on 2006 and 2007 numbers, and is calculated to be 9.7%.

Amortization is calculated as a constant ratio to other intangible assets. The amortization for 2007 included a full amortization of the order backlog for EverQ, which is considered to be an extraordinary event. Because of this, we base the ratio on the 2006 numbers alone, and we get a ratio of 17.4%.

Share of loss of associates

This is forecasted as being zero, as it seems unreasonable that REC will continue to invest in associates with increasing losses. In the case of the existing investment in CSG Solar, the relative size of the investment have been reduced significantly at the start of 2008, due to a share offering, in which REC chose not to participate. After the offering, REC's ownership is just 9%, which has led us to treat this not as an investment in an associate, but rather as an investment in shares. We also assume that this position is fully liquid, so that we can forecast that the company will receive normal market returns.

Financial income and financial expenses

This is calculated as a percentage return and percentage interest payments on the financial assets and the interest bearing liabilities.

The financial income is connected to Investments, derivatives, bank accounts and cash. We will thus sum up the interest-bearing and profit-yielding accounts and assume that they will yield a continuous percentage of income. Since some of REC's financial assets are risky investments, we have assumed that they can expect a return of 50 basis points above the risk free rate. For risk free rate calculation, see WACC below. This amounts to an expected 5% return on interest bearing financial assets.

The financial expenses are connected to interest bearing liabilities, mainly borrowings. We will assume an average cost of debt, and assume that the financial expenses will continue to be a given percentage of borrowings. According to the Annual Report, REC has two main accounts for bank borrowings; NOK800m with a variable rate of 6.2% and $150m with a variable rate of 5.2%, both as of year-end 2007. The general interest rates have risen during 2008, so in the name of caution we have used a long-term rate of financial expenses of 6%.

Currency and derivative gains and losses, and effect on convertible loans

We have set the expected gain/loss equal to zero. REC uses derivatives to hedge foreign exchange risk, and the derivatives hedge should have an expected value of zero. The net currency effect is related to changes in exchange rates. Since these changes have an expected value close to zero, we estimated the future currency effect to be zero.

The fair value effect on convertible loans is connected to the inherent warrant included with the convertible, as this warrant value is interpreted as a cost to the company. The International Accounting Standards require the warrant value to be separated from the debt issue when it is issued in a foreign currency (IAS §39). At the time of writing, REC does not have any outstanding convertible loans, as all convertibles were converted into shares in 2006. Due to the current financial situation of the company, we would not expect the company to issue further convertible bonds in the future due to pecking-order considerations described in section 4.5.We thus assume that this line will be zero in the future, as it was in 2007.

Income tax expense

The income tax expense is calculated as a percentage of the profit before tax. The company's effective tax rate was 32.6% in 2007. As of January 2008, the tax rate for EverQ in Germany is dropped from 33% to 23%. EverQ GmbH and other non-core businesses accounted for approximately 6% of total profits, so we have adjusted the estimated future effective tax rate to be used in the model to 32%.

5.5.2 Balance Sheet

Intangible assets

We think that future growth will be more through organic growth than acquisitions, as evident in the company's recent projects. Still, some acquisitions will probably be performed. Because of this, we believe that the goodwill entry will grow at a slower pace than other assets. We roughly estimate that the growth rate will be half that of property, plant and equipment (PPE). The same will apply to other intangible assets, which consists of customer relationships and assets under construction from acquisitions. The main purpose of this projection is to avoid an overstated estimate of cash and cash equivalents, since that is our plug variable.

Property, plant and equipment

Investments in property, plant and equipment is needed for the company to be able to continue and increase their production. Likely future price drops in the PV market will reduce revenues generated relative to invested capital, but productivity increases as the industry matures will have the opposite effect.

We have consolidated prepaid CAPEX from the balance sheet into assets under construction (and thus property, plant and equipment) for the purpose of projection. The Land and buildings, Machinery and other tangible assets accounts are consolidated into functional PPE. Strictly speaking, this will result in slightly erroneous depreciation rates, since land should not be depreciated. Since REC does not disclose land separately, we will have trouble separating it out. As long as we assume book value of land remains at roughly the same ratio to other items in PPE, the effect will be minimal.

PPE in 2007 is 129% of revenues. However, 3.9 billion (46%) of PPE consists of assets under construction and prepaid CAPEX, thus this capital is not currently producing revenues. Functional PPE is 70% of revenues in 2007. Looking at REC’s investment plans and projected capacity increases until 2010, they have a total of 12 billion of investments in the pipeline, and expect capacity to increase by between 200% and 300% by 2010. Assuming this includes current assets under construction, this suggests functional PPE of around 16 billion in 2010. According to REC’s projections, capacity growth will bring revenues to around 23 billion all else equal. This suggests that REC expects a medium term functional PPE/revenues ratio of (16bn / 23bn) 70%. In other words, they expect the ratio to remain roughly constant from current numbers. This ratio is expected to be held constant in perpetuity, due to a balance between price drops and productivity increases in the industry.

Currently, Assets under construction are at 85% of functional PPE. Longer term, it seems to us to be more likely that assets under construction will be closer to 25% of functional PPE.

We base this on the fact that REC is currently pursuing an aggressive expansion strategy in a startup phase, and capacity growth investment is likely to drop off in the longer run, but never approach zero if growth is to be maintained. Based on this, our projection is that the ratio of assets under construction to functional PPE drop by 20% each year until it reaches 25% in 2011.

Financial assets

As we first discussed under "Share of loss in associates" above the investment in CSG Solar is no longer large enough to warrant associate status and the investment is thus consolidated into "Investment in shares" from 2008 onwards.

Investments in shares and other non-current receivables are expected to grow as the same rate as revenues, thus maintaining their current ratio. The Restricted bank account is a prepayment from EverQ to REC Solar for deliveries of Silicon starting early 2008, and will thus be phased out.

Deferred tax assets

Deferred tax assets are held as a constant share of the taxes paid in a given year, and taken as a share of the number for 2007, as the 2006 numbers would be of little relevance.

To simplify cash flow projections, we keep all assets and liabilities related to deferred tax constant. In essence, this means that all future income tax expenses will equal the income tax cash flow for each year. This is a reasonable assumption because REC is expected to deliver positive results in the foreseeable future, and thus deferred tax is not likely to grow dramatically over time.

Current assets

Inventories and trade and other receivables can be expected to maintain a constant ratio towards revenues, and is calculated as the share of both 2006 and 2007 accounting figures.

Current tax assets are projected to remain at zero. The current portions of derivatives and restricted bank accounts are consolidated into cash and cash equivalents.

Cash and cash equivalents is used as our main plug variable as discussed at the beginning of section 5.5.

Equity

Since we have not found any evidence that the company is planning to issue shares, we have held share capital, share premium and other paid-in capital constant. Our tests show that there is no for REC to issue shares to finance their expansions in most scenarios.

Other equity and retained earnings

We have consolidated other equity and retained earnings and profit/loss for the period into one account. This account is the primary link between the income statement and the balance sheet, and the growth of this entry is given by the retained earnings in the income statement.

Minority interests

The minority interest is of a negligible size relative to the company as a whole and is treated as zero for all future projections.

Non-current liabilities

Retirement benefit obligations and provisions and other non-interest bearing liabilities are expected to be held at a constant rate to revenues.

Deferred tax liabilities are expected to grow at the same rate as tax expenses.

Non-current interest bearing prepayments are consolidated into non-current interest bearing financial liabilities. This entry is used as our second plug variable. We have imposed a rule here saying that debt to equity ratio should remain constant over the projection period. This is necessary to uphold the basic assumptions of the WACC approach. In 2007, this ratio was 0.22. The entry is programmed to assume a value that maintains this ratio. In the case that cash runs negative, debt is increased further to cover the gap. This can temporarily bring debt to equity ratio away from the target, but in our tests it is rectified quickly in subsequent years.

Current liabilities

Trade payables and other liabilities are considered to be held at a constant ratio to revenues. We have used the numbers from 2006 for trade payables, because the 2007 numbers were influenced by extraordinary events. Current tax liabilities is considered to be a constant fraction of tax expenses, and derivatives and interest bearing liabilities is consolidated, and considered to be held at a constant fraction of revenues. This can be done because current liabilities is money that is used to for short-term funding of operations, and should thus be required in greater amounts as turnover increases. We have limited current interest-bearing financial liabilities to 5%, because REC has loan covenants that limit the share of current assets to current liabilities to at least 1.5:1.(REC 2008, p.104) This makes current liabilities about 20% of revenues, while current assets (inventories, and receivables) adds up to 29%.

The following table summarizes the above.

Entry	***Value***	***Relation***	***Dependant on***
Driver value			
Sales Growth Modifier [SGMod]	100,0 %		Itself
EBITDA Margin Modifier [EMMod]	100,0 %		Itself
Functional relationships			
Depreciation	-9,7 %	Fraction	PPE, functional
Amortization	-17,4 %	Fraction	Other intangible
Share of loss of associates	0,0 %	Assumption	Assumed zero
Financial income	5,0 %	Fraction	IiS, RBS, Cash
Financial expenses	-6,0 %	Fraction	Fin liab,int bearing
Net currency gains/losses	0,0 %	Assumption	Assumed zero
Net gains/losses derivatives	0,0 %	Assumption	Assumed zero
Fair value & foreign exchange effect on convertible loans	0,0 %	Assumption	Assumed zero
Income Tax Expense	32,0 %	Fraction	Profit before tax
Goodwill	50,0 %	Fractional growth	PPE, growth rate
Other intangible assets	50,0 %	Fractional growth	PPE, growth rate
Property, plant and equipment, functional	70,0 %	Fraction	Revenues
Assets under Construction	25,0 %	Fraction	PPE, functional
Investments in associates	0,0 %	Fraction	Assumed zero
Investments in shares	0,1 %	Fraction	Revenues
Other non-current receivables	2,7 %	Fraction	Revenues
Restricted bank accounts	5,1 %	Fraction	Revenues
Deferred tax assets		Constant	Constant
Inventories	10,6 %	Fraction	Revenues
Trade and other receivables	18,4 %	Fraction	Revenues
Current tax assets		Constant	Constant
Cash and cash equivalents		***Plug variable***	***Plug variable***
Share capital		Constant	Constant
Share premium and other paid in capital		Constant	Constant
Other equity and retained earnings		Given by income	Given by income
Minority Interests	0,0 %	Assumption	Assumed zero
Retirement benefit obligations	1,7 %	Fraction	Revenues
Deferred tax liabilities		Constant	Constant
Non-current financial liabilities, interest bearing		***Plug variable***	***Plug variable***
Provisions and other non-interest bearing liabilities	1,8 %	Fraction	Revenues
Trade payables and other liabilities	15,2 %	Fraction	Revenues
Current tax liabilities		Constant	Constant
Current financial liabilities, interest bearing	5,0 %	Fraction	Revenues

5.5.3 December adjustment

The numbers listed above are for the March 2008 scenario. We have created a second set of projections for the December 2007 scenario. There are a limited number of changes, all related to lack of the information given during the observation period. The adjustments are summarized in the following table.

Projection adjustments	December scenario	March scenario
Base case revenue growth 2008	60%	25%
Base case revenue growth 2009	60%	80%
EBITDA margin 2008	50%	20%

Base case revenue growth for 2008 is adjusted from 25% in March to 60% in December, since delays at Moses Lake were not known at the time. This is offset by slightly lower growth in 2009, since some of the expansions are completed in 2008 instead. The December 2007 numbers are supported by analyst estimates at the time.

Base case EBITDA Margin for 2008 is adjusted from 20% in March 2008 to 50% in December 2007. Without information about the cost increases for Moses Lake and the guiding from REC towards lower 2008 margins due to startup costs, the market had no reason to expect a temporary drop in the margin.

5.6 Free cash flow calculation and valuation

5.6.1 Finding Free Cash Flow to Firm

To calculate Free Cash Flow to Firm (FCFF), we start with the profit for the period. Depreciation & amortization is added back in, as well as interest paid after tax. The latter is necessary since the interest payments should not be considered a negative cash flow for the debt owners. We use the after tax number since we have also received tax benefits from these payments that should not be included as a positive cash flow. Increases in Net Working Capital and Capex are then subtracted to find FCFF.

5.6.2 Weighted Average Cost of Capital

As described in section 4.2 we will perform our valuations based on a discounted cash flow method where we, in addition to the expected cash flow from the company, need a discounting factor for future cash flows. This is thus the theoretical return an investor would need in order to have a neutral return from the cash flow of REC compared to his opportunities.

As the estimation of WACC, $\left(WACC = \frac{E}{V} * re + \frac{D}{V} * rd * (1 - Tc)\right)$, is a weighted sum of the required return of both equity and debt, it requires a fixed ratio of equity to debt. This is incorporated into our projections. Using the ratio from REC's 2007 annual report, E/V = 0.82 and D/V = 0.18 and the expected future tax rate is 32%. The next step would then be to estimate the cost of equity, which we do from CAPM ($r_a = r_f + \beta * (E(r_m) - r_f)$).

In order to calculate the return that we could have expected from a strict theoretical point of view, we would need to estimate REC's beta. Having this relationship to the market, represented by OBX, we can then calculate the expected return over our estimation period by using CAPM. Since, as previously thoroughly explained, there has been several events that, reasonable or not, has impacted the market capitalization/share price of REC, we have chosen to estimate the beta over the period from listing to December 14, 2008 for this purpose. Calculated on a daily basis, we then obtain a β of 1.24, indicating that we are to expect a ratio between returns in REC and OBX of 1.24:1 (VAR_{OBX} / $COV_{OBX:REC}$].

The next question is what investors could expect as the future risk free return and market premium. Given that investors have a long term perspective for their position in REC, which is plausible due to the fact that the company has a significant growth potential and the majority of the cash flow will be several years into the future, we have used a long term risk free return. Even though the company's capital exposure is diversified in different markets and thus are exposed to different rates, we should due to interest rate parity expect that these differences will be compensated by changes in exchange rates. We have chosen to use a risk free interest rate of 4.5%, which corresponds to the average of the yield on 5 years

Norwegian Government Bonds (ST5X) at the start and end of our observation period. As our estimate for the market premium, i.e. the excess return we can expect by taking market risk, we have chosen a rate of 5.5% – slightly lower than historical risk premium, but in our opinion a modest and reasonable assumption. Calculating the cost of equity from these numbers gives a required return of 11.3% to shareholders.

In order to convert this into the weighted average cost of capital, we would then need to include REC's marginal cost of debt, which again is something we do not have information enough to give an accurate estimate of. However, given their relatively modest leverage, but uncertain future, we find it reasonable to believe that they would need to pay a margin of about 150 basis points over the risk free rate, resulting in a marginal cost debt of about 6 percent in the long run. This is consistent with their current cost of debt.

Using these figures, which are our best estimates for the cost of capital to the company and the current debt ratio, we get a WACC of 10.02%, which for all practical purposes is 10%, which we will to use throughout the analysis.

5.6.3 Terminal Value and discounted value

To determine the value of the operations after our projection period (2013 onwards), we estimate a terminal value for 2012. We start out by setting a base case terminal growth rate of 4%. This is higher than the long run expected inflation, which reflects our view that the solar industry will continue to grow faster than the market average for some years still. We then adjust the 2013 income statement and cash flow by setting revenue growth equal to the terminal growth rate. This gives us values for capital expenditure and working capital that are reasonable for sustained, slow growth.

By using the FCFF for 2013, our WACC and terminal growth rate as inputs in the terminal value formula explained in the theory section, we are able to find a terminal value of the firm in 2012.

By discounting the 5 year Free Cash Flow to Firm, with terminal value added on to the fifth year, we arrive at our estimated market capitalization. Dividing this by the number of issued shares at year end 2007 gives us our estimated correct share price for REC.

5.7 Results and sensitivity analysis

In this section we will present the results of our analysis where we explain our views on the developments in the period, as well as a sensitivity analysis that illustrate the effect on a change in different factors on the valuation of the company.

5.7.1 Event driven drop (Model result)

For our base case numbers, we arrive at a December price of NOK 239 (compared to actual December 14 price of NOK 266.0) and a March price of NOK 208 (compared to actual March 14 price of NOK 125).

It should be noted that the only difference between the scenarios are the company specific events in the observation period. The main purpose of these numbers is to observe the price drop that should be expected when we look at the company in isolation, keeping all other factors constant. As we observe from these numbers, the raw expected value of the company specific events should have caused a price drop of around 13% over the observation period.

To determine the full expected drop, we can include either the market driven drop or the industry drop.

5.7.2 Market driven drop (OBX)

As the OBX over the period had a cumulative negative return of 15.9% (($INDEX_{March14,\ 2008}$ / $INDEX_{December14,\ 2008}$) - 1) we should then according to CAPM expect the REC return to be β_{REC} * $RETURN_{OBX}$, 1.24 * -15.9% which equals a negative return of 19.7%. By adding on the value of the company specific events, this approach would lead us to believe the price of REC should have dropped around 33% during the period.

5.7.3 Industry drop (Mac Solar Energy Index)

If we want to look at industry specific factors instead, we can look at the return of the MAC Solar Energy Index, which is calculated and published by MAC Indexing LLC (2008). This index, in which REC is included with a weight of 7.6% (April 14, 2008), has had a decline of 34.12% during our event period. If we remove the impact of REC on this index, we discover that the remaining companies have had a negative return of 30.1% over the period. It is not unreasonable to expect REC to correlate strongly with this index when we exclude company specific events. Thus, by adding on the value of the company specific events, this approach lead us to believe the price of REC should have dropped around 43% during the period.

5.7.4 Sensitivity analysis

As we can see above, we cannot fully explain the REC price drop. We come closest by combining the company specific event driven drop and the drop in the industry index, but REC still dropped 10% more than we can explain specifically. However, as we can see from the following sensitivity matrices, slight changes in consensus for future expectations could have substantial effects on the share price.

These matrices show how much our March estimated share price would change if our input variables changed. The center of all the matrices represents the base case values. As mentioned before, our model estimates a March share price of NOK 208. The actual share price on March 14 was NOK 125, 40% lower. As can be seen in the first sensitivity matrix, one specific combination that would yield that result might be an EBITDA margin modifier of 80% (implies 40% EBITDA margin perpetually) and a sales growth modifier of 90%. These numbers do not seem unreasonable when we consider the expected slowdown in the general economy, as evident by the general state of the financial markets. A summary of the calculations with these expectations can be seen in Appendix III.

	Sensitivity matrix - Share price change relative to base case *EBITDA margin and sales growth variable. WACC and perp growth fixed at base case.*			EBITDA margin modifier		
		60 %	**80 %**	**100 %**	**120 %**	**140 %**
	60 %	-74 %	-54 %	-34 %	-15 %	5 %
Sales growth modifier	**80 %**	-71 %	-45 %	-19 %	8 %	34 %
	100 %	-68 %	-35 %	0 %	35 %	69 %
	120 %	-63 %	-22 %	22 %	67 %	112 %
	140 %	-59 %	-8 %	49 %	106 %	163 %

	Sensitivity matrix - Share price change relative to base case *WACC and perp growth variable. EBITDA margin and sales growth fixed at base case.*			WACC		
		12 %	**11 %**	**10 %**	**9 %**	**8 %**
	3,0 %	-37 %	-26 %	-12 %	7 %	35 %
Perpetual growth	**3,5 %**	-35 %	-22 %	-6 %	16 %	48 %
	4,0 %	-31 %	-18 %	0 %	25 %	64 %
	4,5 %	-28 %	-13 %	8 %	37 %	85 %
	5,0 %	-24 %	-7 %	17 %	52 %	112 %

	Sensitivity matrix - Share price change relative to base case *WACC and EBITDA margin variable. Perp growth and sales growth fixed at base case.*			WACC		
		12 %	**11 %**	**10 %**	**9 %**	**8 %**
	60 %	-80 %	-75 %	-68 %	-58 %	-42 %
EBITDA margin modifier	**80 %**	-56 %	-47 %	-35 %	-17 %	10 %
	100 %	-31 %	-18 %	0 %	25 %	64 %
	120 %	-6 %	11 %	35 %	68 %	118 %
	140 %	19 %	40 %	69 %	110 %	171 %

	Sensitivity matrix - Share price change relative to base case *WACC and sales growth variable. EBITDA margin and perp growth fixed at base case.*			WACC		
		12 %	**11 %**	**10 %**	**9 %**	**8 %**
	60 %	-54 %	-46 %	-34 %	-19 %	5 %
Sales growth modifier	**80 %**	-44 %	-33 %	-19 %	1 %	32 %
	100 %	-31 %	-18 %	0 %	25 %	64 %
	120 %	-17 %	0 %	22 %	54 %	102 %
	140 %	0 %	21 %	49 %	88 %	147 %

In the sensitivity matrices we observe that even a slight change in any of our four main model variables can explain the difference between the observed price drop and our estimates. It is absolutely plausible that consensus expectations have changed during the period.

In the case of the WACC, it is for instance plausible that the market has observed a higher risk of bankruptcy given the looming delays in Moses Lake. Considering the massive capital expenditures made by REC in the growth phase, additional delays could in extreme cases affect the financial status of the company. It is also possible that investors have recalculated betas with rather short calculation periods, and have arrived at new higher values after the initial price drops.

Sales growth and terminal growth rate consensus could certainly have been reduced, as the delays and downward guiding has diminished investor trust in the company. Expected margins could also have dropped as investors started doubting REC’s promises to recover margins from the drop in 2008. In addition, it is absolutely possible that some of our other estimates differ from the consensus. Due to the inherent nature of the two-step discounted cash flow method, small changes can have rather large effects. This is especially true for the terminal value calculation, where changes in future capital structure, in addition to the variables we have discussed above, could have significant effects when the cash flow grows into perpetuity.

Given the extreme effect on price from rather modest changes in future expectations, we feel the 53% drop is within reasonable bounds from our closest estimate for the share price reduction (43%, section 5.7.3), even if it is slightly on the extreme side.

6. Conclusion

The results from our valuation model show that the company specific events in the period roughly justify a 13% share price reduction. This is significantly less than the actual share price reduction of 53%, but no changes have been in the model made to accommodate the changes in the economic environment in the period. By including the movement caused by market or industry driven factors in the period, we can justify a 33% or 43% price reduction respectively. This is much closer to the observed drop.

The valuation of REC changed drastically over our study period, but our results suggest that the fall in market capitalization can be justified. Given the high effect we have shown that rather modest changes in expectations can have, we feel that a price drop of 53% is close enough to our 43% estimate that we cannot call the price drop severely exaggerated.

The valuation of REC is to such a degree dependant on uncertainties and assumptions that a perfect ex-ante valuation is extremely difficult to justify. This is also evident from the high volatility in the share price, as the market scrambles to adjust to any changes in sentiment.

At the present, REC is a company that is reliant on three main factors: That it can reach its ambitious cost-cutting goals; that the industry subsidies are upheld until the cost of solar energy is competitive with conventional sources of energy; and that their technology is not surpassed by one that is either cheaper, more efficient, or both.

The PV industry has been affected negatively by the financial markets during the winter of 2007/2008. The valuation of the industry is very much dependant on future expectations, and as such threats of economic slowdown can have a large impact. However, the world will still need an ever-increasing amount of energy, and there will be a growing focus on supplying this energy in a cost-effective and environmentally-friendly way. We therefore see a bright future for both REC and the photovoltaic industry, with no sunset in sight.

7. Postscript

Three months after our study period ended, on June 14, the REC share price ended at NOK 134 which values the company at NOK 66.2bn. During the period following our study period, some of the uncertainty regarding the future outlook has been resolved, especially with regards to subsidies, demand and capacity expansions. Solar energy subsidies in Germany, which is seen as a good indicator for future policies also in other countries, has been resolved, with the result that the subsidies are upheld and not dramatically reduced as was speculated. The reduction in subsidies will be limited to 10% per year, much lower than the 25% that was feared.

On May 12, REC signed an agreement with Gintech for delivery of wafers until 2015. The deliveries will start in the second half of 2009, and the delivered volumes will increase throughout the contract period, while the price Gintech pays will fall. The agreement has a value of $600m, and brings the total volume of signed delivery agreements up to NOK 30bn for the period from 2007 to 2015. The agreement also ensures that 80% of REC’s production volume for 2010 is already sold.

The company finally decided on June 17 that it would go forward with its plans to build a new factory in Singapore. This means that REC will spend NOK 13bn on building the first step of a large facility that will be able to supply 740 megawatts of wafers, 550 megawatts of cells and 590 megawatts of modules before 2012. According to CEO Erik Thorsen, the investment supports REC’s position as a leading supplier of competitive solar energy solutions and their goal of reducing costs and ensuring profitable growth (Dn.no, June18, 2008).

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Appendix I

Event Timeline

Stock Market Releases:

December 11, 2007: REC secures a NOK 4bn wafer sales contract

http://www.newsweb.no/newsweb/index.jsp?messageId=165626

January 18, 2008: REC holds their Capital Markets Day. Downwards guiding.

http://www.recgroup.com , Presentation Material

February 6, 2008: REC announces 2 month delay for Moses Lake plant. 20% increased costs up from former USD 660m.

http://www.newsweb.no/newsweb/index.jsp?messageId=202164

February 12, 2008: REC releases 4Q 2008 results.

http://www.newsweb.no/newsweb/index.jsp?messageId=202600

April 1, 2008: REC Board of Directors approves 2007 financial statements. No change in profits from preliminary results presented in 4Q report.

http://www.newsweb.no/newsweb/index.jsp?messageId=206304

Dagens Næringsliv

December 5, 2007: Solar rises on expectations for German and US legislation

http://www.dn.no/forsiden/borsMarked/article1260582.ece

December 11, 2007: REC secures wafer deal of NOK 4bn to 2015.

http://www.dn.no/forsiden/borsMarked/article1267732.ece

December 22, 2007: Experts warn against possible bubble in green energy.

http://www.dn.no/forsiden/borsMarked/article1277198.ece

January 7, 2008: S&P include REC in their 30 stock list of global stock picks for 2008.

http://www.dn.no/forsiden/borsMarked/article1283886.ece

January 15, 2008: Strong guiding from REC peers.

http://www.dn.no/forsiden/borsMarked/article1291193.ece

January 16, 2008: Possible USA recession threatens REC.
http://www.dn.no/forsiden/borsMarked/article1291900.ece

January 18, 2008: REC plummets after a slide in their CMD presentation indicates falling margins in 2008.
http://www.dn.no/forsiden/borsMarked/article1294028.ece

January 22, 2008: Goldman lowers price target for REC.
http://www.dn.no/forsiden/borsMarked/article1296598.ece

February 6, 2008: Delay and cost increase for Moses Lake plant. Increases uncertainty around other projects like Singapore.
http://www.dn.no/forsiden/borsMarked/article1308264.ece

February 11, 2008: Credit Suisse cuts price target for REC considerably.
http://www.dn.no/forsiden/naringsliv/article1311557.ece

February 12, 2008: REC releases positive Q4 numbers.
http://www.dn.no/forsiden/resultater/article1312095.ece

February 19, 2008: Credit Suisse cuts price target for REC, but maintains outperform.
http://www.dn.no/forsiden/borsMarked/article1318211.ece

Later events:

March 5, 2008: Tax gift in Singapore amounts to NOK 1bn yearly
http://www.dn.no/forsiden/naringsliv/article1328894.ece

Early April/Late March: Industry Convention in Munich shows positive signs for industry.
http://www.dn.no/forsiden/borsMarked/article1373161.ece

May 30, 2008: German help for REC
http://www.dn.no/forsiden/borsMarked/article1413871.ece

June 12, 2008: REC almost sold out
http://www.dn.no/forsiden/borsMarked/article1422740.ece

June 18, 2008: REC builds giant factory
http://www.dn.no/forsiden/borsMarked/article1426811.ece

Appendix II

Income statement and balance sheet projections for the base-case March scenario, Top left.

INCOME STATEMENT

YEAR ENDED DECEMBER 31 (NOK IN THOUSAND)	NOTES	Historic 2005	2006	2007
Revenues	5	2 453 916	4 334 072	6 642 043
(Base Sales Growth)			57 %	43 %
(Base Case EBITDA margin)		66 %	55 %	52 %
Operating Expenses		(1 623 735)	(2 369 479)	(3 469 771)
EBITDA		830 181	1 964 593	3 172 272
Depreciation	6	(215 086)	(345 684)	(492 856)
Amortization	7	(13 648)	(44 481)	(91 725)
EBIT		601 447	1 574 428	2 587 691
Share of loss of associates	8, 24	(7 052)	(18 330)	(45 465)
Financial income	24	6 261	164 173	314 639
Financial expenses	24	(145 572)	(148 500)	(63 563)
Net currency gains/losses	24	68 036	(50 232)	(345 737)
Net gains/losses derivatives	24	-	18 640	(470 218)
Fair value & foreign exchange effect on convertible loans	24	(493 037)	(796 219)	-
Net financial items		(571 364)	(830 468)	(610 344)
Profit before tax		30 083	743 960	1 977 347
Income tax expense	18	(26 160)	(285 630)	(643 994)
Profit for the period		3 923	458 330	1 333 353
Dividends		-	-	-
Retained earnings		3 923	458 330	1 333 353

BALANCE SHEET

YEAR ENDED DECEMBER 31 (NOK IN THOUSAND)	NOTES	Historic 2005	2006	2007
ASSETS				
Non-current assets				
Goodwill	7		792 284	799 456
Other intangible assets	7		254 950	256 359
Intangible assets	7		1 047 234	1 055 815
Property, plant and equipment, functional	6		4 023 014	4 595 277
Assets under Construction	6		620 787	3 949 280
Property, plant and equipment	6		4 643 801	8 544 557
(Property, plant and equipment growth rate)				84 %
Investments in associates	8		52 658	8 548
Investments in shares	10		1 126	1 237
Other non-current receivables			10 425	180 194
Restricted bank accounts	14		141 991	340 774
Financial assets			206 200	530 753
Deferred tax assets	18		2 742	230 758
Total non-current assets			5 899 977	10 361 883

Top right.

	Projected				
2008	2009	2010	2011	2012	2013+
8 302 554	14 944 597	22 416 895	29 141 964	34 970 356	36 369 171
25 %	80 %	50 %	30 %	20 %	4 %
20 %	50 %	50 %	50 %	50 %	50 %
(6 642 043)	(7 472 298)	(11 208 448)	(14 570 982)	(17 485 178)	(18 184 585)
1 660 511	7 472 298	11 208 448	14 570 982	17 485 178	18 184 585
(989 579)	(1 577 671)	(2 061 151)	(2 481 016)	(2 977 219)	(3 096 307)
(48 983)	(63 538)	(73 273)	(80 736)	(88 810)	(90 586)
621 949	5 831 089	9 074 023	12 009 230	14 419 150	14 997 692
-	-	-	-	-	-
170 948	58 802	136 303	378 691	691 523	1 265 067
(185 548)	(256 043)	(357 919)	(484 936)	(632 378)	(775 588)
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
(14 600)	(197 241)	(221 616)	(106 245)	59 145	489 479
607 349	5 633 848	8 852 407	11 902 985	14 478 295	15 487 171
(194 352)	(1 802 831)	(2 832 770)	(3 808 955)	(4 633 054)	(4 955 895)
412 998	3 831 017	6 019 637	8 094 030	9 845 240	10 531 276
-	-	-	-	-	-
412 998	3 831 017	6 019 637	8 094 030	9 845 240	10 531 276

	Projected				
2008	2009	2010	2011	2012	2013
875 526	1 135 683	1 309 698	1 443 094	1 587 403	1 619 151
280 752	364 176	419 977	462 752	509 027	519 208
1 156 278	1 499 858	1 729 675	1 905 846	2 096 430	2 138 359
5 811 788	10 461 218	15 691 827	20 399 375	24 479 249	25 458 419
4 358 841	5 753 670	5 492 139	5 099 844	6 119 812	6 364 605
10 170 628	16 214 887	21 183 966	25 499 218	30 599 062	31 823 024
19 %	59 %	31 %	20 %	20 %	4 %
-	-	-	-	-	-
12 231	22 016	33 024	42 932	51 518	53 579
225 243	405 437	608 155	790 601	948 721	986 670
425 968	766 742	1 150 112	1 495 146	1 794 175	1 865 942
663 441	1 194 194	1 791 291	2 328 679	2 794 415	2 906 191
230 758	230 758	230 758	230 758	230 758	230 758
12 221 106	19 139 698	24 935 691	29 964 501	35 720 665	37 098 333

Bottom left.

Current assets			
Inventories	13	508 455	655 165
Trade and other receivables	12	995 188	1 019 802
Current tax assets		59 323	-
Cash and cash equivalents	14	7 317 600	5 908 486
Total current assets		8 880 566	7 583 453
Total assets		14 780 543	17 945 336
EQUITY AND LIABILITIES			
Equity			
Share capital	15	494 326	494 315
Share premium and other paid in capital	15	8 549 744	8 548 841
Paid-in capital	15	9 044 070	9 043 156
Other equity and retained earnings		1 592 447	2 713 556
Minority Interests	15	-	346
Total Equity	15	10 636 517	11 757 058
Non-current liabilities			
Retirement benefit obligations	19	103 231	116 200
Deferred tax liabilities	18	233 714	310 320
Non-current financial liabilities, interest bearing	17	2 498 417	2 639 147
Provisions and other non-interest bearing liabilities	20	201 989	116 871
Total non-current liabilities		3 037 351	3 182 538
(Target debt:equity ratio)			
Current liabilities			
Trade payables and other liabilities		659 962	1 334 985
Current tax liabilities		152 854	480 413
Current financial liabilities, interest bearing		293 859	1 190 342
Total current liabilities		1 106 675	3 005 740
Total liabilities		4 144 026	6 188 278
Total equity and liabilities		14 780 543	17 945 336
Balance test		-	-

CASH FLOW

		Historic		
YEAR ENDED DECEMBER 31 (NOK IN THOUSAND)	NOTES	2005	2006	2007
Profit for the period		3 923	458 330	1 333 353
Depreciation & Amortization		228 734	390 165	584 581
Interest paid, after tax		98 989	100 980	43 223
Change in Net Working Capital		(25)	456 291	(1 787 064)
Capex		215 080	4 989 485	4 393 612
FCFF		116 591	(4 496 301)	(645 391)
Terminal Value				
Discounted FCFF				
WACC	10 %			
Outstanding shares		494314,725		
Terminal Growth	4 %			
MCAP		102 900 653		
Price		208		

Bottom right.

880 186	1 584 334	2 376 501	3 089 451	3 707 341	3 855 635
1 524 179	2 743 522	4 115 283	5 349 868	6 419 841	6 676 635
-	-	-	-	-	-
2 980 763	387 283	1 542 929	6 035 748	11 984 769	23 381 816
5 385 127	4 715 139	8 034 713	14 475 067	22 111 952	33 914 086
17 606 233	23 854 837	32 970 403	44 439 568	57 832 616	71 012 419
494 315	494 315	494 315	494 315	494 315	494 315
8 548 841	8 548 841	8 548 841	8 548 841	8 548 841	8 548 841
9 043 156	9 043 156	9 043 156	9 043 156	9 043 156	9 043 156
3 126 554	6 957 570	12 977 207	21 071 237	30 916 477	41 447 754
-	-	-	-	-	-
12 169 710	16 000 726	22 020 363	30 114 393	39 959 633	50 490 910
145 250	261 450	392 175	509 828	611 793	636 265
310 320	310 320	310 320	310 320	310 320	310 320
2 677 336	3 520 160	4 844 480	6 625 166	8 791 119	11 108 000
146 089	262 960	394 440	512 772	615 326	639 939
3 278 995	4 354 890	5 941 414	7 958 085	10 328 558	12 694 524
0,22	0,22	0,22	0,22	0,22	0,22
1 261 988	2 271 579	3 407 368	4 429 578	5 315 494	5 528 114
480 413	480 413	480 413	480 413	480 413	480 413
415 128	747 230	1 120 845	1 457 098	1 748 518	1 818 459
2 157 529	3 499 222	5 008 626	6 367 090	7 544 425	7 826 985
5 436 524	7 854 111	10 950 040	14 325 175	17 872 983	20 521 509
17 606 233	23 854 837	32 970 403	44 439 568	57 832 616	71 012 419
-	-	-	-	-	-

	Projected				
2008	2009	2010	2011	2012	2013
412 998	3 831 017	6 019 637	8 094 030	9 845 240	10 531 276
1 038 562	1 641 209	2 134 425	2 561 752	3 066 028	3 186 893
126 173	174 109	243 385	329 756	430 017	527 400
1 577 609	581 799	654 524	589 071	510 528	122 527
2 615 650	7 621 931	7 030 230	6 796 268	8 077 062	4 320 270
(2 615 527)	(2 557 394)	712 693	3 600 199	4 753 695	9 802 773
				163 379 543	
(2 377 752)	(2 113 549)	535 457	2 458 984	104 397 513	5 533 410

Appendix III

Implied market expectations on March 14, 2008.

YEAR	2008	2009	2010	2011	2012	2013+
Revenues	8 302 554	14 944 597	22 416 895	29 141 964	34 970 356	36 369 171
(Sales Growth)	23 %	72 %	45 %	27 %	18 %	4 %
(EBITDA margin)	16 %	40 %	40 %	40 %	40 %	40 %
EBITDA	1 301 840	5 597 914	8 116 975	10 308 558	12 164 099	12 602 006
Profit before tax	269 996	3 852 710	5 913 379	7 813 147	9 326 812	9 935 708
Profit for the period	183 597	2 619 843	4 021 098	5 312 940	6 342 232	6 756 281
FCFF	(2 629 900)	(2 883 649)	(234 309)	1 801 700	2 292 367	6 182 280
Terminal Value					103 038 001	
Discounted Cash Flow	(2 390 818)	(2 383 181)	(176 040)	1 230 585	65 401 871	3 489 736

WACC	10 %	
Outstanding shares		494314,725
Terminal Growth	4 %	
MCAP		61 682 418
Price		125