

# **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

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## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**



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## **Executive summary**

The goal of this thesis is to determine the share price of Q-Cells SE, a German company within the solar energy sector, traded on the Frankfurt stock exchange. The company has since its foundation in 1999 experienced a significant growth and is today a market leader within their industry with sales passing € 1250 million in 2008.

Q-Cells SE has currently employed 2500 employees all over the world; in addition they are engaged with five joint ventures and associated companies.

The strategic analysis reveals a company with a significant foothold in its industry and good possibilities for influencing its current and future surroundings. As the market leader the company gains economies of scale and has a robust financial platform.

The company is constantly developing within new technologies through R&D and acquisitions; as a result it has a strong technology base with solid positions in the future prevailing technologies, which makes it competitive for the future.

The financial statement analysis reveals that the company has a robust and solid economy, with strong solidity, liquidity and profitability. The equity ratio of 66 % puts the company in a good position for further growth and more independent strategically choices.

The calculation of the share value is a result of the estimation of future financial performance, and by employing the DCF- and EVA valuation models; we arrived at a share price of € 15.16.

Our estimate is 3.12 % higher than the share price traded 22.06.2009 on the Frankfurt stock exchange, it indicates that the stock at that moment is traded at a discount, which is to some extent supported by the price multiples, which all rank Q-Cells as a better investment than its comparable competitor, Solar World.

## **1. Introduction**

This thesis is a part of the Master of Science in Economics and Business Administration program at Copenhagen Business School. We are two students from the specialization within Finance and Strategic Management and the aim of this master's thesis is to apply our knowledge on a practical, real life case.

The environmental issue is something that both of us have great interest in, and we believe that the challenges the entire world are facing today when it comes to climate challenges due to pollution and thereby global warming can be met and dealt with not only in a responsible fashion, but also in a highly profitable way of action.

One of the main contributors to global warming is carbon dioxide ( $CO_2$ ), which is generated when fossil fuels like coal, gas and oil are burned.

The world will always need energy, but with time the focus has shifted towards renewable energy sources. These sources of energy have the advantage of not creating  $CO_2$  as a bi-product when utilized for the purpose of extracting energy.

The solar energy is one of the sources with the greatest potential and therefore makes of a very interesting sector to look deeper into.

We are not engineer students as little as we are political students, so even though the environmental issues serve as a background for our thesis, have no doubt that we are interested in the economic matters that this background entails and the growth of solar energy corporations the last years are definitely one of those implications.

We have chosen to focus on the German solar energy corporation Q-Cells SE (Q-Cells). Q-Cells are not only one of the market leaders, but the market leader at the moment of time, within their industry, as they outgrew Sharp in the year 2007.

Our aim is to undertake financial and strategic analyses and make a thorough valuation. We do this in order to get the opportunity to really get to know the chosen corporation as well as the industry it belongs to.

## 1.1 Problem Scope

In our initial work we established quite early that we wanted to do an analysis of a corporation that operates within renewable energy sources.

Corporations who operate within such industries are labeled as cleantech companies. The cleantech industry is getting large, and the cleantech label contains many different segments.

The Cleantech Group (CG) is a company that provides information, research and connections within these specific segments, and CG have been credited as the originator of the very term cleantech.

CG defines cleantech as:

- *New technology and related business models that offer competitive returns for investors and customers while providing solutions to global challenges*

CG continues their explanation of the cleantech industry by saying that it:

- *Represents a diverse range of products, services, and processes, all intended to:*
  - *Provide superior performance at lower costs*
  - *Greatly reducing or eliminating negative ecological impact*
  - *Improving the productive and responsible use of natural resources*

Both of this paper's author's have found this cleantech industry very interesting, especially in the last few years, as the awareness of the challenges that pollution and global warming entails has grown larger and wider.

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As of today, the cleantech industry includes as many as eleven segments, where the main segments are:

- *Energy Generation*
- *Energy Storage*
- *Energy Infrastructure*
- *Energy Efficiency*
- *Transportation*
- *Water & Wastewater*
- *Air & Environment*
- *Materials*
- *Manufacturing/Industrial*
- *Agriculture*
- *Recycling & Waste*

While we had several segments of interest we chose to look deeper into the segment of energy generation.

This segment consist of five main categories and that is solar, wind, hydro and marine, biofuels and geothermal.

Both of us had an interest in wind energy as well as solar energy, and already knew something about these industries and some of their consisting companies. After some research we came up with a preliminary list of interesting corporations to write about and turned our focus more toward what we more precisely wanted to write about in our thesis.

In our reasoning towards the more specific area of research to conduct, we both agreed to choose a topic that allowed us to go in depth of the company and really get to know the parts it was put together by, as well as some of the parts surrounding it and it's environment, as a contrast to for example only focus on some specific financial challenges or perhaps some narrowed in strategic challenges.

Therefore it became obvious quiet early in the process that some sort of company analysis, where we could go deeper into the corporation's key figures, as well as their strategic handlings, would be the best angle in order to incorporate the analysis we wanted.

When we then wanted to find out more specifically what sort of analysis to really make use of and go in depth of, we discussed several well-known models or frameworks and their possibilities in accordance with our objectives.



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We started off by contemplating the opportunity to make the most of a strategic analysis, and simply make our thesis a very detailed strategic analysis, which included several industry analyses, like the Porter's Five Forces model, the PESTEL analysis and for example the Industry Life Cycle analysis, in addition perhaps to other competitor analysis, like, say, a competitor intelligence analysis and a segmentation analysis.

While we initially saw some good sides about this point of view for the thesis, we also came up with several negative sides about this approach, but we thought it would make our paper too homogenous and too narrow, and also we did not see how it could let us develop a genuine and productive problem scope that really could reveal some new and insightful results.

Still, we did not reject our initial thoughts completely, but rather we decided to use the strategic analysis as a means of achieving some more complete results about the corporation of choice.

More specifically we wanted to include the strategic analysis in an analysis that in total would let us say more about the corporation than a strategic analysis would do on its own.

This decision made us think about what other analysis to do, and most important, of course, what did we really want to focus our research toward and thus; what did we really want to get the answers to.

We started discussing the possibility to do a valuation, as it would really allow us to dig in to the corporations' key figures. After some discussions about the subject and some initial research on it, we came to the conclusion that such an analysis would easily be the main part, as it is a very thorough analysis.

Still it would not be so extensive that it would be problematic also to include a strategic analysis that in our opinion would complement the valuation model in an effort to make a realistic and precise conclusion of what the corporation's value is.

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In addition to of course present the corporation of choice in a proper manner, we still thought that the thesis lacked something, in order to make as thoroughly an analysis as possible of the corporation.

We figured that in order to make the best use of central key figures made by the company an accounting analysis could be included, without losing perspective of arriving at the best possible conclusion, but rather on the contrary, actually, as we felt that it would complement and improve the overall analysis.

We felt that we were now getting closer to achieving our initial thought; to first and foremost take a deep and thorough look at a corporation, and as well some of its surrounding environments.

One last thing that we wanted to include, as we felt that it would improve the thesis and its goal, was a budget and forecast model. So eventually we came to the conclusion that we could start our analysis part of the paper by doing a strategic analysis, followed by an accounting analysis, as well as developing a budgeting and forecasting model, and then finally do the main part of the analysis, namely the company valuation.

Still, with our opportunity of writing a thesis with a maximum of 120 pages, we would not by our opinion loose the opportunity to go in depth and make the thorough discussions necessary to develop well reasoned conclusions to our problems.

Having decided specifically what to do in our thesis, we needed to make a decision on what specific segment and corporation to write about.

The choice was narrowed down to wind- and solar-energy generation, and we put down one central criteria for this decision; interest. The choice of first looking for interesting corporations within solar energy thus came as a result of interest, for the both of us, as we are most fascinated by this segment.

When choosing the specific corporation to write about we had several criteria.

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We did not want to choose a corporation where we would be dependent on contacts within to get a hold of necessary information.

That restriction made us choose a corporation submitted to rules about the publication of key figures in for example quarter- and annual reports, which are typically rather large, listed corporations.

We also wanted to make an analysis of a company who had experienced growth and success since the start-up, and we began looking for corporations among the largest within the industry and segment.

We found that the German corporation Q-Cells was now the largest manufacturer of solar cells in the industry, after exceeding Sharp sometime in the year of 2007.

We could now define explicitly our problem scope, with regards to the industry and the corporation, as well as with regards to the area of research.

Our problem scope is:

- *A company analysis and valuation of the solar energy corporation Q-Cells SE*

We feel of course that this problem scope satisfies methodological criteria as such; that the area of research is of interest and concerns essential relations in society, that it opens for new and original studies of the social relations of choice and that it allows for fruitful and productive approaches, and that the research can be continued and brought forward in a meaningful way<sup>1</sup>.

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<sup>1</sup> Grønmo, Sigurd, "Samfunnsvitenskapelige Metoder"

## 1.2 METHOD

### Research approach

When deciding for research design there are two critical questions that needs to be addressed<sup>2</sup>;

1. Is the research design suitable to answer the problem?
2. Can the research design we have chosen affect the result we will achieve?

As we formulated in the problem scope we want to perform a full company analysis on the solar energy corporation Q-Cells that includes a strategic analysis and an accounting analysis, a budget and forecast, and a valuation.

If the research is going to be valid we need it to be in line with the problem scope, and when deciding on the research design, there are two dimensions to choose between<sup>3</sup>;

1. If the research is going across (extensive) or in depth (intensive)
2. If the research is descriptive or explanatory

For our purpose the best approach is an intensive design since the research is mostly based on document studies, further should this design be explanatory since it is different factors that need to be uncovered to calculate the right value of the company.

By choosing this design we fulfill both questions presented above.

### Collection of data

We have chosen to use mainly a qualitative method in this paper. A qualitative research method have four different approaches of data collection<sup>3</sup>: open individual interview, group interviewees, observation and a document study.

Our data collection would mainly be a document study, that is, a search within secondary data such as; reports, publications from internet, newspapers, periodicals and annual reports.

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<sup>2</sup> Jakobsen , Dag I. "Hvordan gjennomføre undersøkelser?"

<sup>3</sup> Jakobsen , Dag I. "Hvordan gjennomføre undersøkelser?"

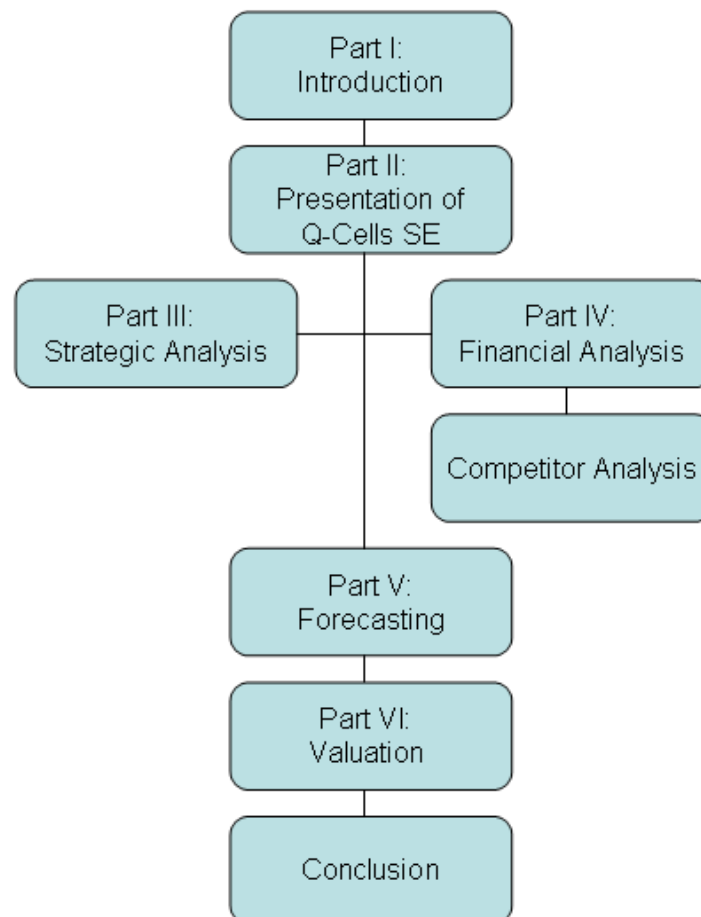
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From these sources we will get accounting numbers, financial key figures and general information on the company's history, situation and its markets. We will not perform any interviews to collect primary data, since we do not have access to any persons within the company.

However, it would make us take a rather different approach to our problem scope, an approach in which we were not interested.

The approach of the paper will be like this:

**Figure 1: Approach of the Master's thesis**



**Source: own creation**

### **Introduction and presentation of empiricism, chapter 1 and 2**

The first chapter, the introduction, will briefly give a presentation of the method, problem scope, executive summary and the limitation of the paper.

The goal of that chapter is to highlight what we are searching for and how we will address our problem in order to solve it.

Chapter two consists of a presentation of the company's history, ownership, products, organization, economy, markets and management.

The purpose of this presentation is to give an understanding of the company's situation, which will figure as a framework for the rest of the papers analysis.

### **Strategic and financial analysis, chapter 3 and 4**

The strategic analyses consist of PESTEL, Five forces and SWOT analysis, which form a picture of the company's strategic situation.

The financial analysis will employ numbers from the annual reports to create a framework for the company's financial situation. This part will also look at another company within the same segment as Q-Cells, and employ the corporations' figures into a comparative analysis. The purpose is to see how Q-Cells perform compared to a rival, hence get valuable information to employ in the valuation part.

### **Budget and Forecasting, chapter 5**

Based on the information from the previous parts will we in the fifth chapter employ both strategic and financial findings to say something regarding the current situation and the future for Q-Cells.

We will in the end of the chapter present the estimation of the future income statement and balance sheet.

## **Valuation, chapter 6**

In chapter six, we will employ the findings in the other chapters to calculate the value of the Q-Cells share. This will be done with the valuation methods DCF and EVA, completed by multiple analysis and sensitivity analyses.

## **Conclusion, chapter 7**

In the last chapter we will give the conclusion of the thesis, based on the findings throughout the whole paper.

## **Analysis of data**

After the research we need to structure and categorize the data material, to get the overview. This is a critical phase since it creates the foundation for the rest of the paper.

The overall goal is to combine the financial and the strategic part, and when doing this it is important to reveal the different factors and combinations, that is not only find out what the factors say, but reveal what they say in their context.

## **1.3 Limitations**

Our main limitation has been the lack of primary data, as we have based our research on secondary data only, and this can have some drawbacks.

Secondary data have the drawback that it might not be aimed at our purpose, as it very well could be made for a different intention. However, we think that the data we have used in this paper do have the quality that is required for us to make use of them in relevance to our problem scope.

Q-Cells is a large company with a complex organization structure. This has made some implication in our research and could be a limitation of the paper, when we do not have the time or the resources to go in depth on every single one of the companies having attachments to Q-Cells.

However, we do believe that what we have covered is good enough.

## **2 Presentation of Q-Cells SE**

### **2.1 History**

Q-Cells was founded at the end of 1999, when the four founders came together and jointly build an independent solar energy corporation, at that time named Q-Cells AG.

They started their production of silicon cells in the summer of 2001 counting only 19 employees. Already in 2002, 8 months after the production start-up, their first plant broke even, with revenue of €17.3 million.

The growth of the company has been significant since then, with a growth in revenues as large as 164 % from 2003 to 2004, which was continued by a steady and significant growth all the way up to 2008 (illustration in appendix 1; Revenues).

Also the earnings of Q-Cells have had a very positive development since the start-up. Represented by earnings before interest and tax (EBIT), the figures have kept up with the very encouraging sales revenues (illustration in appendix 1; EBIT).

In 2004 Q-Cells made their first investment in another company when investing in CSG Solar AG, a company in the thin-film technology business. Today, Q-Cells have six subsidiary companies, and hence a huge stake in the different areas of technology development.

The company went public in October 2005 with an Initial Public Offering (IPO), which was priced to € 38 per share, and the IPO have created even more opportunities for growth for the company (illustration in appendix 1; Total assets).

Q-Cells today employ more than 2,568 workers and the company is the largest solar cell manufacturer in the world, after exceeding Sharp in 2007.

Q-Cells have achieved several prestige awards after its start up, such as; Ethics in Business 2005, German Foundation Award 2005 and Germany's Best Employer 2008.



## **2.2 Economy**

The market value of Q-Cells' ordinary shares just exceeded € 2,000 million at the end of December 2008, as the share closed at € 25.3, significantly reduced from the all-time high notation of € 99.62 in December 2007.

At the end of 2008 the corporation had a net debt of € 488.6 million. In addition, Q-Cells has a credit line of € 750 million at its disposal at the end of 2008 to finance growth.

Q-Cells' shareholder equity, that is the corporation's total assets minus its total liabilities, is estimated to € 1,876.7 million at the end of 2008, which makes of a shareholder equity ratio around 66.2 %.

Shareholders' equity covers almost the entire non-current assets, as it covers around 90 %, which means that Q-Cells continues to exhibit a very sound balance sheet structure, thereby a very good base for financing the growth planned for the next few years.

Q-Cells had an overall outflow of funds to investment activities of € 241 million.

An additional € 12.3 million was spent on acquiring, or increasing, investments in companies with new and promising technologies, signaling the efforts of the company to grow in the future as well.

Overall, Q-Cells' liquidity actually decreased by € 254.2 million to € 159.9 million in the first three quarters of 2008. The company's liquidity was, however, guaranteed at all times and there were no bad debts and no default risks that have been identified by Q-Cells themselves at present of 2008.

## **2.3 Management**

The management team at Q-Cells consists of four chief positions, with the Chief Executive Officer at the very top (illustration appendix 3).

Anton Milner is the Chief Executive Officer and also one of the co-founders of the company.

Milner has worked at Royal Dutch Shell, one of the world's largest oil and gas corporations, where he was involved in oil trading, risk management, gas trading and business analysis, and at management consultants McKinsey & Company, where he left as Senior Engagement Manager.

This British-born engineering graduate has been on the board of Q-Cells since 2000, and his board responsibilities comprise Strategy and Investments, Business Development, Sales, Marketing, Wafer Purchasing and Public Relations.

As the Chief Financial Officer (CFO) is Dr. Hartmut Schüning, and after having graduated in Business Studies, Schüning started to work on the auditing and advisory side at PricewaterhouseCoopers AG where he worked until 1997, when he started as a CFO at Tecis Holding AG, a German company providing financial and legal services<sup>4</sup>.

In January 2003 he started as a CFO in another German company, called Edding AG, an international manufacturer of marking, writing and visual communication products.

Since October 2004 he has been on the board at Q-Cells with responsibility for Finance, Investor Relations, Personnel, IT and Legal Affairs.

Gerhard Rauter, born in Austria in 1958, is the Chief Operating Officer (COO) in Q-Cells.

From 1979 he worked in managerial positions at different facilities in Germany for Siemens AG, an electronics and electrical engineering corporation, before he in 1999 moved to the semiconductor company Infineon Technologies AG.

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<sup>4</sup> <http://www.google.com/finance?q=Tecis+Holding+AG>

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In October 2007, Gerhard Rauter was appointed COO at Q-Cells, with responsibility for Production, Inter-Services, Quality, Safety and Process Technology.

Dr. Florian Holzapfel is the Chief Technology Officer.

The industrial engineering and MBA graduate, born in 1975, and thus the youngest chief at Q-Cells, worked six years for McKinsey & Company, and, during the same period, completed a doctorate in Economics at Martin Luther University of Halle-Wittenberg in Germany.

In 2005, he was appointed Consultancy Project Manager for Q-Cells.

In spring 2006 he joined the company as Managing Director Technology and assumed provisional leadership of the Technology division in the summer of that year, overseeing the expansion of the division. He has been on the Board since December 2006, responsible for Technology.

### **2.4 Ownership**

Q-Cells has since 2005 been a publicly traded corporation, and the number of outstanding shares, counting an excessive 113 million, is divided among approximately 30.5 million preference shares without voting rights and 82.9 million ordinary shares with voting rights.

Among the shareholders, Good Energies Investments, a leading global investor in renewable energy and energy efficiency industries, is by far the largest, with almost 30 % ownership of the ordinary shares.

Second largest is Baillie Gifford, a United Kingdom-based investment trust, with an ownership share of approximately 5 %.

Remaining shareholders are spread between the management team, the board and other institutional and private investors (illustration in appendix 2).

## **2.5 The Organization**

Q-Cells has currently five companies which are either joint ventures or associates, and three companies that are full consolidations. The co-operations are mainly based on supplies of different raw materials to Q-Cell's main production of solar cells. The complete organization is illustrated in appendix 2, and the involved companies are presented in the following.

The companies provide Q-Cells with two different raw materials, based on either wafer technology or thin-film technology.

### **2.5.1 Presentation of the companies**

The stakes in Solibro, Sovello, Solaria, CSG Solar and SilQ PV Energy are consolidated using the equity method, and Calyxo, Sontor and VHF Technologies are full consolidated.

Q-Cells are investing in these companies as a part of their technology development and several of these companies are technology leaders in their fields and can be major contributors with raw material for Q-Cells.

In the following section we will present the central fully owned companies, the joint ventures, and the associated companies, in that sequence.

#### **2.5.1.1 Full consolidated companies**

A full consolidated company is a subsidiary company which combines its assets, liabilities and other financial items, and report under the umbrella of the parent company<sup>5</sup>.

The most significant companies in this category are Sontor GmbH, Calyxo and VHF Technologies.

#### **VHF Technologies**

VHF Technologies, is located in Yverdon-les-Bains Switzerland, and Q-Cells invested in this company in 2006 and has increased its stake since, up to today's 58.1 %.

The company manufactures flexible, thin and lightweight photovoltaic modules, and names its products "Flexcell".

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<sup>5</sup> <http://www.investopedia.com/terms/c/consolidate.asp>

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Their main sales market in future will be PV systems for industrial roofs with a low buckling load and the company's production capacity from 2009 is 25 Megawatt peak (MWp) annually, which corresponds to 25 000 Kilowatt (kW).

### **Sontor Gmbh**

Sontor is a wholly owned subsidiary of Q-Cells. The company started with research back in 1994, but they did not, however, build their factory before 2006.

Sontor has developed silicon-based thin-film technology since 2006 and is a technology leader in this field, currently employing 156 people<sup>6</sup>. Sontor's technology was jointly built up by Q-Cells, Applied Materials in Santa Clara, California, and the Julich Research Center in Germany<sup>7</sup>.

Sontor GmbH's goal is to contribute to mass production of raw materials to Q-Cells production. They produced 3,6MWp in 2008; however, during 2009 they are expected to scale up their production to fully employ their 24MWp potential<sup>6</sup>.

Q-Cells interest in this company is according to them, their huge potential of cost reduction and efficiency improvement. The main challenge is to get their production capacity big enough, so they can contribute to the mass production.

### **2.5.1.2 Joint Ventures**

Joint ventures are companies that are managed jointly with other companies; these companies are Sovello, Solibro and SilQ PV Energy S.L.

#### **Sovello**

Sovello was founded in 2005 as a JV between Q-Cells, the US company Evergreen Solar Inc. and the Norwegian company REC Group. All the three companies have an equal stake of 33.3 % in the company, which until November 2008 was named EverQ.

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<sup>6</sup> <http://www.snec.org.cn/Printpage.asp?ID=6021>

<sup>7</sup> <http://www.sontor.com/en/company/index.html>

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

The company produces wafer, solar cells and solar modules, with the goal of reducing the costs and Sovello is among the 15 largest solar module producers worldwide with approximately 1200 employees. Their production capacity last year was 84,9 MWp, further is the production capacity expected scaled up to 180 MWp during 2009.

All their three plants are located in the so-called Solar Valley in Bitterfeld-Wolfen, Germany.

### **Solibro Gmbh**

Solibro Gmbh is a JV between Q-Cells (67.5%) and Solibro AB Sweden (32.5%)<sup>8</sup>, it was founded in December 2006 and delivered its first modules in august 2008.

The goal of the JV is to commercialize the technology of copper indium gallium diselenid (CIGS), thin film solar modules. The CIGS technology has the highest efficiency potential among thin-film solar cell materials and the combination of Solibro Abs technology and Q-Cells ability to mass production, has great future potential.

The JV has facilities in Bitterfeld-Wolfen in Germany, where the main production takes place, and a R&D center in Uppsala, Sweden<sup>8</sup>.

In total the JV employs 183 people, with a current production capacity of 30 MWp, however there are plans of expanding the plant in Bitterfeld-Wolfen from 30 MWp up to 45 MWp, and in addition build a new plant with a production capacity of 90 MWp in the same area.

### **SilQ PV Energy S.L.**

SilQ PV Energy S.L. is a JV with Silicon S.A., Paterna, in Spain, which was established in Q3 2008, and where both parties hold a 50 % stake. This company will construct solar power plants, and the first project is now completed<sup>9</sup>.

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<sup>8</sup> <http://www.solarheadlines.com/content/solibro-expands-thalheim>

<sup>9</sup> Q-Cells: "Q3 report 2008"

### **2.5.1.3 Associated companies**

Q-Cells associated companies; Calyxo, CSG Solar and Solaria, are major players in the solar industry.

#### **Calyxo Gmbh**

The company was established in 2005 and is operating within the thin-film technology, and Calyxo Gmbh is a result of a joined force between the American company Solar Field which had the technology and Calyxo Gmbh which had the mass production facilities.

The technology is based on the conversion of radiant energy into electrical energy, and the company has one facility in USA, Calyxo USA Inc., focusing on the R&D development and one facility in Germany, named Calyxo Gmbh currently completing its pilot facility to reach a production capacity of 25 MWp.

They are also working on a parallel project with a production capacity of 60 MWp, located in the Solar Valley.

Calyxo has the lowest investment costs compared with other thin-film technologies in Q-Cells portfolio, with less than € 1 million per MWp capacity. Hence, is Calyxo a significant contributor to Q-Cells goal of mass production within the thin-film technology area.

#### **CSG SOLAR**

CSG Solar is located in Thalheim, Saxony-Anhalt in Germany, and it currently employs 137 people<sup>10</sup>.

It was founded in June 2004 and started their production started in March 2006.

The production capacity is 25 MWp yearly, however the company has experienced delays in optimizing their production facilities to full production of 25 MWp, and currently CSG Solar's research and development department is working on optimizing the production process.

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<sup>10</sup> <http://www.tradevibes.com/company/profile/csg-solar>

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Q-Cells current share in the company is 18.63 %, a decline from 21.71 % from the previous year.

CSG Solars' main goal is according to their webpage;

- *to reduce the energy and material consumption whilst retaining the strengths inherent in crystalline silicon: the ability to withstand decades of exposure to bright sunlight in a harsh environment<sup>11</sup>.*

### **SOLARIA**

Solaria was founded in 1998, and today the company design, develop and manufacture Photovoltaics (PV) products.

The company has developed a PV technology that offers enormous potential regarding cost reduction, which is in great interest of Q-Cells goal of profitable mass production.

Solaria is located with manufacture facilities in the Philippines, they have their R&D headquarters in Silicon Valley, USA and their sales office in Berlin, Germany.

Solaria's total production will be 25 MWp during 2009 and Q-Cells current stake in the company is 32%.

### **2.6 Products**

Q-Cells specialize in development, making and sales of Monocrystalline and Polycrystalline silicon-based solar cells<sup>12</sup>.

Their solar cells products are currently; Q6LM, Q6LTT, Q6LTT3 and Q6LEP3.

Q-Cells products are under constant development, within an industry that has a fast technology growth. Hence, the range of product developments has been significant the last years as figure 2.7 shows.

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<sup>11</sup> <http://www.csqsolar.com/pages/technology.php>

<sup>12</sup> <http://www.google.com/finance?q=FRA%3AQCE>



**Figure 2.1: Product milestones**



**Source: Q-Cells annual report 2008**

Q-Cells are also producing and developing a range of thin film modules; Calyxo CX 35-65 and Solibro SL1.

### **Q6LM**

Q6LM is the oldest solar cell in today's production line, with a sale of € 36.5 m in 2007, and it has been proven to have a mean efficiency of 16.6%, and is one of the most powerful solar cells worldwide.

### **Q6LTT**

This solar cell was the most profitable of their products in 2007 with a revenue of € 749.6 million. It has a high efficiency and stands for higher mechanical stability when the cell is processed into a module.

### **Q6LTT3**

This is Q-Cells latest development, with a technology based in anti-reflective finish of the surface of the cell which help the cell absorb impacting light better, which again results in a better efficiency.

### **Q6LEP3**

This product is the latest enhancement by Q-Cells and has the best energy payback time for crystalline material achieved. It further has a efficiency level up to 16 %

## **2.7 Markets**

The solar industry has experienced an annual growth of 40 % the last eight years. A significant growth that is a result of robust capital investment, coupled with the rising cost of conventional energy<sup>13</sup>.

This makes solar energy a booming sector with an attractive future market.

Another advantage with the solar energy compared to other energy sources, is that it is truly modular, whereas energies like coal, nuclear, natural gas, and even wind farms have to be centralized because they don't reach cost efficiency unless they are operating at several hundred MW, solar energy can effectively deliver anything from a few kW to 250 MW or more<sup>13</sup>.

The industry consists of several companies worldwide, with a concentration of few large players large on upstream part, and with significant increase in players further downstream in the value chain<sup>14</sup>.

Q-Cells became the global market leader in the manufacturing of solar cells for the first time in 2007, after exceeding the Japanese corporation Sharp.

Presently, Q-Cells supply 80 customers in 40 countries around the world. Europe is by far the largest market and Germany, which is the company's most important single country, now actually constitutes for approximately 29 % of their sales, after increasing each year for several years, but declining from 2007 to 2008.

In the rest of Europe, which has an approximately 45 % share of the total market sales, including both EU and non-EU countries, there is Spain that is their second most important market, but Q-Cells themselves state that Italy, France and Cyprus were the most important drivers behind the sharp growth in revenues the company experienced during 2007.

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<sup>13</sup> <http://www.solaria.com/index.php>

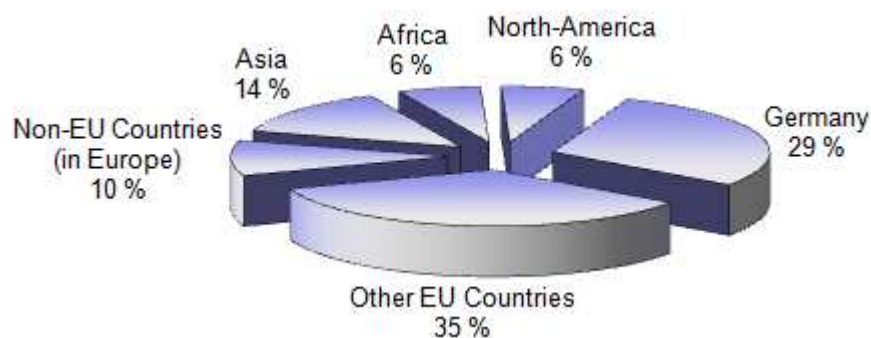
<sup>14</sup> [http://www.recgroup.com/default.asp?V\\_ITEM\\_ID=440](http://www.recgroup.com/default.asp?V_ITEM_ID=440)

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Asia is the second most important market after Europe, despite the decline from previous years, caused by reduction in deliveries to large countries like Japan and Taiwan, and their most important single countries in Asia are now China, Korea and India, and Asia in total constitutes about 14 % of Q-Cells sales.

Africa and North-America has about the same share of sales, both at an excessive 6 % share, and in America it is particularly USA, Mexico and Canada that are important contributors to sales, while in Africa the country of South-Africa was the most important market.

**Figure 2.2: Market sales in percentage of total sales**



**Source: Own creation**

Q-Cells expect that Germany will remain the most important market for photovoltaics in the upcoming years. However, growth rates outside Germany are also expected to be higher and the company announces they expect USA to eventually overtake and exceed the German market.

### 3 Strategic Analysis

The strategic analysis is essentially about;

- *Identifying strategic opportunities and threats in the organization's operating environment that will affect how it pursues its mission<sup>15</sup>.*

The analysis is a step towards understanding the structure and competitive dynamics of the industry, and its surroundings, the macro environment, and how it can affect the performance and profitability of the corporation.

In our strategic analysis we include a PEST analysis, which is used to analyze the macro environment, the Porters' Five Forces model, which is used to determine the competitive intensity, and thereby the attractiveness, of the industry Q-Cells is in.

We sum up the chapter with a SWOT analysis, which is used to point out the strengths and weaknesses of the corporation, and reveal the threats and opportunities in its surroundings.

#### 3.1 Environment: PEST Analysis

In order to analyze the macro environment we make use of a PEST analysis, which is developed to say something about the future trends of the Political, Economic, Social and Technological factors within a firm's macro environment.

The model is usually in "present time", with the goal of finding the key factors of change and to understand how these influence the industry, market or organizations within the chosen region<sup>16</sup>.

We will use the PEST analysis to analyze the external macro factors that influence Q-Cells.

We believe this is important in order to get a picture of the external factors that have to be considered when forming a strategy for Q-Cells.

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<sup>15</sup> Hill, Charles W.L. and Jones, Gareth R.: "Strategic Management Theory – An Integrated Approach"

<sup>16</sup> Johnson, Gerry, Scholes, Kevan and Whittington, Richard: "Exploring Corporate Strategy"

**Table 3.1: The PEST framework**

<b>Political factors</b>	Government stability. Regulations. Environmental protection. International trade.
<b>Economic factors</b>	Business cycles. Interest rates. Inflation. Currency.
<b>Social factors</b>	Population. Demographics. Unemployment. Lifestyle changes. Income. Consumption.
<b>Technological factors</b>	R&D level. Speed of technology transfer.

**Source: Own creation**

### **3.2 Industry: Porters' Five Forces**

The framework known as the Porters' Five Forces is developed by the well-known Harvard professor Michael E. Porter and it is used to analyze an industry in order to determine opportunities and threats via the strength of the five forces.

A strong force acts as a threat. In the opposite case an opportunity is spotted.

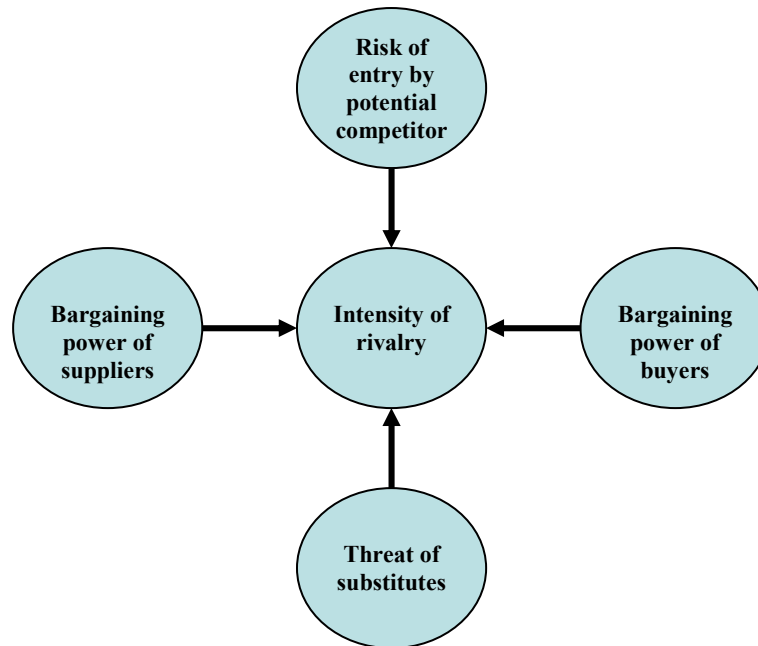
The five forces are<sup>17</sup>;

- 1. Risk of entry by potential competitors*
- 2. Intensity of rivalry among established companies within an industry*
- 3. Bargaining power of buyers*
- 4. Bargaining power of suppliers*
- 5. Closeness of substitutes to an industry's products*

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<sup>17</sup> Hill, Charles W.L. and Jones, Gareth R.: "Strategic Management Theory – An Integrated Approach",

**Figure 2.1: Porters Five Forces**



**Source: Own creation**

The essential part for companies is to recognize how changes in the forces can create new opportunities, but also threats, and to, in response to these changes, adapt the company's pursuing strategy.

### **3.3 Corporation: SWOT Analysis**

The SWOT analysis is designed to;

- *Identify the strategies that will create a firm-specific business model that will best align, fit, or match a company's resources and capabilities to the demands of the environment in which it operates*<sup>18</sup>

The goal of the analysis is to identify the strategies that will best fit the company given its resources and capabilities in the environment it operates within<sup>18</sup>.

SWOT can work as a foundation of gaining competitive advantage and hence it is one of the most important tools when shaping the strategy of the company.

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<sup>18</sup> Hill, Charles W.L. and Jones, Gareth R.: "Strategic Management Theory – An Integrated Approach

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The analysis is divided into two parts, internal and external analysis. The aim of the internal analysis is to reveal the company's strengths and weaknesses in its different business areas, while the external part focuses on opportunities and threats within the company's surroundings<sup>19</sup>.

The SWOT analysis can work as a foundation in the shaping of a strategy, it is important however that the analysis is not only focused on historical happenings. The historical factors are usually already taken into account and will probably not have a significant impact on the future<sup>19</sup>.

**Table 3.2: The SWOT framework**

Strengths	Core competence or competitive advantage to build its strategy upon.
Weaknesses	What makes the company vulnerable and what efforts are made to prevent this from happening.
Opportunities	What opportunities exist within its surroundings and can the company utilize these with its resources.
Threats	What threats in its surroundings are dangerous for the existence of the company?

**Source: own creation**

### **3.1 PEST Analysis**

#### **3.1.1 Political Factors**

The political environment Q-Cells is placed under are of great importance for the company, it is actually a contributor to their great success the past years.

Q-Cells headquarter is located in Bitterfeld-Wolfen, the so-called "Solar Valley" in Germany, and the analysis will have its origin in the German political system tightly linked together with the European Union (EU) regulations.

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<sup>19</sup> Roos, Göran & Krogh, George von: "Strategi som konkurransefortrinn"

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The political issues in Germany are of great importance for Q-Cells, since the solar industry still is at an early stage and to some extent dependent on subsidies from the government.

Q-Cells state it as important, as a way of achieving their goals, to have political contacts so that the corporation can execute lobby activity and educate the politicians, on the corporations' opinions regarding political issues within the matters of renewable energy<sup>20</sup>.

### **The Domestic political scene**

Germany has a stable government, with Chancellor Angela Merkel as the political head.

The 17th German federal election is scheduled for September 27 in 2009.

We believe however that the outcome of this election is of no consequences for the solar industry in the country.

In Germany there are currently 250,000 workers within the renewable energy sector<sup>21</sup>, and of them 57,000 within the PV sector, which is a significant number. This number is expected to increase and Germany is looked upon as the leader in the field of solar energy.

One of the political issues for the German government with regards to the solar industry is the financial crises and the fear of high inflation due to the rescue packages from the government<sup>22</sup>. However, we believe that this will not have significant impact on the solar industry, since the German government has proven that they will protect the solar industry.

One example of this is the German government effort of securing the roof-top market of solar cells, against the financial crises. The government has done this by providing a guaranteed loan scheme, which contributes to maintain the demand of the products mentioned.

By acting in this fashion the government does not let the demand decrease due only to the banks' difficulties of providing credit<sup>20</sup>.

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<sup>20</sup> Q-Cells: "Annual Report 2007"

<sup>21</sup> [http://www.bmu.de/english/current\\_press\\_releases/pm/42824.php](http://www.bmu.de/english/current_press_releases/pm/42824.php)

<sup>22</sup> Internet newspaper E24, 27th of January 2009 : "Tyskland får rekordunderskudd på statsbudsjettet i 2009"



Based on examples like this, of how the government protect and support the industry, we view the political risk in Germany as low.

### **EU**

The EU represents a great market area for solar energy, currently existing of 27 member states, and in line with the current financial crisis, the union decided to compose a specific EU climate package, which is based on the belief that focus on renewable energy can save the economy.

The union has the advantage of proposing and processing legislations for the members relatively fast, and another clear advantage is the common currency of the Euro (€), which makes it easier to trade among different nations.

The EU has taken a leading role in the climate protection and stated that within 2020 around 20 % of the EU's final energy consumption will come from renewable energy sources<sup>23</sup>.

This means that Germany for instance will have to increase its share of renewable energy from today's 6 % to a share of 18 % within 2020<sup>24</sup>.

These resolutions are of great importance for Q-Cells, since it will increase the demand for alternative energy and thereby solar energy as one of those.

### **Regulations**

The construction of the Renewable Energy Sources Act (EEG) has boosted the solar energy in Germany, making it the world leader in this field<sup>25</sup>. The EEG is a plan to make Germany the leader of renewable energy and has already created several jobs.

The great success of the act has so far made Germany raise their targets for the share of renewable energies in electricity generation to at least 27 % for 2020 and at least 45 % for 2030<sup>26</sup>, compared to the mentioned goals given by EU of 18% in 2020.

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<sup>23</sup> [http://ec.europa.eu/energy/renewables/index\\_en.htm](http://ec.europa.eu/energy/renewables/index_en.htm)

<sup>24</sup> [http://www.bmu.de/english/current\\_press\\_releases/pm/42824.php](http://www.bmu.de/english/current_press_releases/pm/42824.php)

<sup>25</sup> <http://spie.org/x17246.xml?ArticleID=x17246>

<sup>26</sup> <http://www.worldwatch.org/node/5430>

Estimates like this make the future look bright for Q-Cells, but on middle short term the financial crises is crucial for most of the industries operating globally, however, when the low conjuncture has past the future look rather bright.

### 3.1.2 Economical factors

The global economy is facing huge challenges these days and prospects for growth have deteriorated dramatically. The challenges seem to be a general slump in international demand as well as the more specific crisis on financial markets all over the world.

Inflation is slowing. Commodity prices are down. Personal consumption has lessened. Housing prices have been declining for some while now, and still are.

Other important factors of the economy now falling are gross domestic products (GDP), real disposable income and business investments in general, as well as more intangible factors like for example trust<sup>27</sup>.

Beneath is for example a figure showing the decline in share prices in the Euro area, illustrating to some extent that business investments are performing poorly. The stippled line is for the financial sector, while the complete line is for the non-financial sector.

**Figure 3.2: Share prices in the Euro area (share price indices, 1 January 2007 = 100)**



**Source: OECD Economic Outlook No. 84 - 2008**

<sup>27</sup> OECD: "Economic Outlook No. 84 – 2008"

A recovery from this situation is for most countries not expected until sometime in 2010 according to calculated projections<sup>28</sup>.

The figure below shows some key figures on the economic temperature, both actual historic figures and calculated, projected figures.

**Table 3.3: Economic key figures**

	Average 1996-2005	2006	2007	2008	2009	2010	2008 q4	2009 q4	2010 q4
	Per cent								
<b>Real GDP growth<sup>1</sup></b>	2.7	3.1	2.6	1.4	-0.4	1.5	0.2	0.2	2.2
United States	3.2	2.8	2.0	1.4	-0.9	1.6	0.1	-0.3	2.3
Euro area	2.1	3.0	2.6	1.0	-0.6	1.2	0.0	-0.1	1.9
Japan	1.1	2.4	2.1	0.5	-0.1	0.6	-0.4	0.3	0.9
<b>Output gap<sup>2</sup></b>	-0.2	0.8	1.0	0.0	-2.6	-3.3			
<b>Unemployment rate<sup>3</sup></b>	6.6	6.0	5.6	5.9	6.9	7.2	6.3	7.2	7.2
<b>Inflation<sup>4</sup></b>	3.2	2.3	2.3	3.3	1.7	1.5	2.9	1.5	1.4
<b>Fiscal balance<sup>5</sup></b>	-2.2	-1.3	-1.4	-2.5	-3.8	-4.1			

1. Year-on-year increase; last three columns show the increase over a year earlier.

2. Per cent of potential GDP.

3. Per cent of labour force.

4. Private consumption deflator. Year-on-year increase; last 3 columns show the increase over a year earlier.

5. Per cent of GDP.

**Source: OECD Economic Outlook No. 84 - 2008**

The German economy seemed to be in good shape during 2008, however, and might therefore be able to tackle the economic situation better than some other countries.

In 2008 the country achieved a record-high employment figure, as more than 40 million people were under employment, and in October 2008 the unemployment rate actually fell below three million for the first time in over 15 years<sup>29</sup>.

Due to Germany's disciplined fiscal policy the last years as well, budgets can now be adapted to better suit the challenges of economic downturn, as there is room for extraordinary measures.

<sup>28</sup> OECD: "Economic Outlook No. 84 – 2008"

<sup>29</sup> <http://www.bmwi.de/English/Navigation/Press/press-releases,did=274668.html>

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The German government intends to take short-term measures to instantly affect the situation of today, as well as more long-term measures, that are aimed more to deal with the next few years.

In fact, this is an approach the German government intends to make continuously in the future, in order to meet the cyclical conditions the economy in recent history is known for.

All in all it seems that Germany, with its total measures towards overcoming the unfavorable times summing to € 80 billion, has a government of strong encouragement.

This is also demonstrated by introducing the *Pact for employment and stability in Germany*<sup>30</sup>, which is designed to address five core areas:

1. *Public investment*
2. *Supply of credit*
3. *Employment and skills*
4. *Tax reduction*
5. *Sustainable fiscal policy*

Another aspect is the federal governments' focus on cost-efficient and sustainable energy supply. The German government works to improve competition in electricity and gas sectors, as well as they intend to reduce greenhouse gas emissions, in order to all in all reduce both cost and consumption of energy, and lessen their dependence on imported fossil fuels.

In addition Germany has for the first time in their history introduced government measures to support research and innovation into a national strategy.

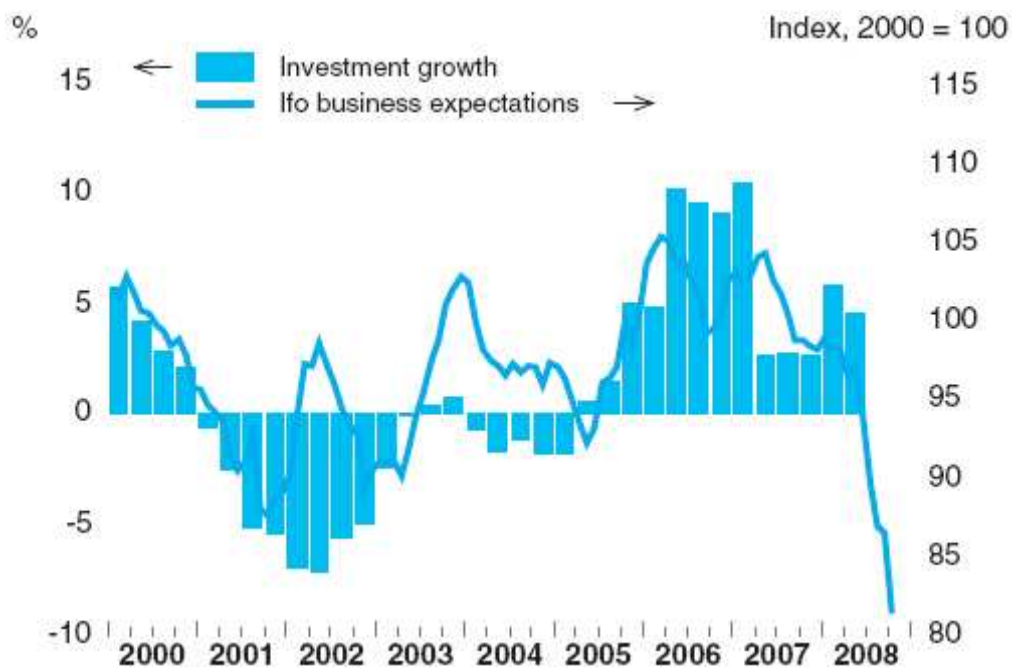
Still, Germany, as well as other countries, will feel, and already has begun to feel, the economic decline, now, and in the years to come.

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<sup>30</sup> <http://www.bmwi.de/English/Navigation/Economy/economic-policy,did=211552.html>

The illustration below shows how the expectations for future business have plummeted:

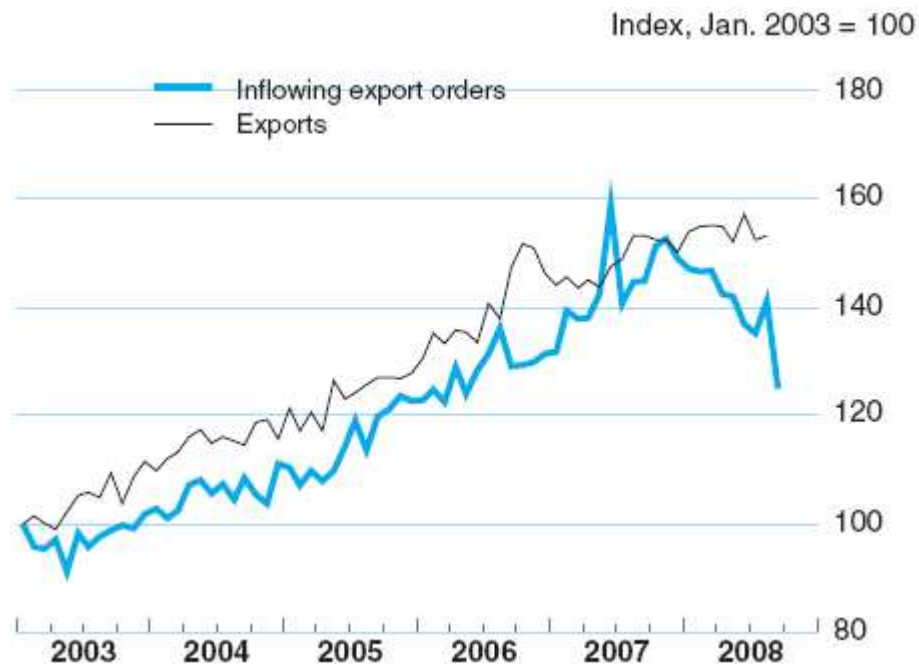
**Figure 3.3: Business expectations in Germany**



**Source: OECD Economic Outlook No. 84 - 2008**

Especially unfortunate is perhaps the very sharp decline in export orders as the figure below shows and the decline in exports is very much driven by the slowdown in large markets like the United States and the United Kingdom.

**Figure 3.4: German export orders**



**Source: OECD Economic Outlook No. 84 - 2008**

The appreciation of the euro currency, especially in the first half of 2008, has also contributed to the export decline. In recent time however, the euro has depreciated relatively much, perhaps helping the export situation to some extent.

Also, the interest rate is now going down, and the short-term interest rate is expected to be around a little more than 2.5 % for the next couple of years (respectively projected to 2.7 % in 2009 and 2.6 % in 2010)<sup>31</sup>.

<sup>31</sup> OECD: "Economic Outlook No. 84 – 2008"

**Table 3.4: Demand and output in Germany**

	2005	2006	2007	2008	2009	2010
	Current prices € billion	Percentage changes, volume (2000 prices)				
Private consumption	1 323.0	1.2	-0.3	-0.6	0.2	1.2
Government consumption	420.0	0.6	2.2	1.9	1.0	1.3
Gross fixed investment	388.9	8.5	4.5	3.6	-2.8	1.2
Public	30.9	3.8	4.4	6.5	3.0	3.1
Residential	116.4	6.5	0.4	1.2	-1.1	1.0
Non-residential	241.6	10.1	6.5	4.4	-4.3	1.0
Final domestic demand	2 131.9	2.4	1.1	0.7	-0.3	1.2
Stockbuilding <sup>1</sup>	- 11.4	-0.1	0.1	0.9	0.4	0.0
Total domestic demand	2 120.4	2.3	1.2	1.7	0.1	1.2
Exports of goods and services	918.6	13.1	7.7	4.2	0.7	3.9
Imports of goods and services	799.7	12.2	5.2	5.4	2.8	4.4
Net exports <sup>1</sup>	118.9	1.0	1.4	-0.2	-0.9	0.0
GDP at market prices	2 239.3	3.2	2.6	1.4	-0.8	1.2
<i>Memorandum items</i>						
GDP without working day adjustments	2 243.2	3.0	2.5	1.7	-0.9	1.3
Investment in machinery and equipment	186.5	11.4	7.4	5.0	-3.5	1.3
Construction investment	202.3	5.8	1.9	2.4	-2.2	1.1

Source: OECD Economic Outlook No. 84 - 2008

### 3.1.3 Socio Cultural Factors

When thinking about socio cultural factors we mainly focus on demographics, lifestyle, education level, attitudes towards work and consumption.

With regards to solar energy we will focus on the trends of environmental energy solutions, income and unemployment rates, and the impact from the worldwide financial crises.

Germany has along with other European countries evolved in population, from 1990 the growth has been 3.33 %, however compared to for instance Spain and Norway with respectively 13.17 % and 9.67 %, their growth has been small<sup>32</sup>.

However, with a population of more than 82 millions<sup>32</sup> Germany is heavily populated and thereby represents a great market for solar energy product.

<sup>32</sup> <http://stats.oecd.org/wbos/viewhtml.aspx?queryname=464&querytype=view&lang=en>

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A growing trend on world basis is the increased focus on the global heating issue and the negative effect CO<sub>2</sub> emission has on the earth is now common knowledge and the threat is taken more serious than ever. An example of this is the Noble Piece Price Award given to Al Gore and his associates for their effort towards climate changes.

The world focus is now on utilizing the great potential of alternative energy solutions, to replace energy sources that create CO<sub>2</sub> emission.

Another important factor driving the demand for alternative energy solutions is the last year's record high oil prices, which make company's look around for other, cheaper energy solutions.

Even though the oil prices are considerably lower at present time, the cost of extracting oil is increasing and will continue to do so in the future<sup>33</sup>, which of course also will increase the price customers have to pay.

One drawback though, especially existing in the time of these financial crises, is the fact that investments in alternative energy at this stage are more expensive than the investment in current sources like oil and gas. Still, we believe that on middle to long term basis, the renewable energy sources, and especially the solar energy, will be significantly cheaper and more available for consumers.

The growth in the cost of CO<sub>2</sub> emissions is another factor influencing the increase of the oil price, as well as the current economic downturn is contributing to an increased focus on cheaper energy sources, which in sum favors the solar energy industry.

There are several efforts put together to address the climate challenges, initiatives like the Green New Deal and the EU climate package.

Germany is asserted to be in the front seat when it comes to the making of the renewable energy source solar power<sup>34</sup>.

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<sup>33</sup> <http://www.offshore.no/nyheter/sak.aspx?Id=20943>)

<sup>34</sup> <http://www.gtai.com/homepage/info-service/press-releases/press-releases-2007/jan-apr-07/photovoltaic-technology-show-2007/?backlink=Back%20to%20Archive%20%20Press%20Releases%202007>



Germany has been subsidizing alternative energy solutions for house-holdings, which certainly benefits the industry. This shift towards environmental energy solutions is a positive trend for the solar sector, on both short and long term basis.

Germany is facing a growing gap in income inequality and growth in poverty compared to for example the middle of the eighties<sup>35</sup>. Poverty rates are high in Germany, however people do not stay poor for very long, and compared to other OECD countries they only stay poor for an average of three years which is half of the OECD average.

The unemployment rate in Germany in the beginning of 2009 is 7.3 %, which is actually 0.4 % less than the same period last year. However, it is slightly more than the average of 6.9 % in the OECD region and that indicates challenges for Germany.

The solar energy sector has already contributed to several jobs and we believe that further investments in solar energy will contribute to even more jobs.

The trends towards consumption of solar energy installations must come from economical benefit, which the German government has worked hard for and can already see results of owing to their already mentioned EEG.

We believe that on middle to long term the consumption of solar energy installations will increase in line with the development of cheaper solutions such as thin film modules, which will make it more affordable.

### 3.1.4 Technological factors

- *Photovoltaics have the highest proven technical potential of all renewable energy sources in the field of electricity generation from renewable energies in Europe<sup>36</sup>.*

A solar photovoltaic cell converts the sunlight directly into electricity. In that way solar cell energy generation is perhaps the simplest form of power generation, but the solar cells requires high technology manufacturing processes.

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<sup>35</sup><http://www.oecd.org/dataoecd/45/25/41525346.pdf>

<sup>36</sup> Q-Cells: "Annual report 2008"

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

For the time being this makes solar energy generation one of the most expensive sources of all renewable electricity<sup>37</sup>.

A solar cell is based on a specific type of material called a semiconductor, and the most common type of semiconductors used is silicon. The device generates a current by absorbing a photon light which makes an electron in the so-called energy band of the semiconductor jump from one position to another. It thus converts the light energy into electrical energy<sup>37</sup>.

Polycrystalline silicon solar cells are the most common among the solar cells in the market today, even though a form of silicon called amorphous silicon, which is deployed as a layer on a surface of for example glass, so-called thin-film, is even cheaper. Thin-film solar cells also use a simpler and cheaper structure than more traditional solar cells do<sup>37</sup>.

The best efficiency measures achieved with polycrystalline solar cells in production is about 15 %. This is just a few percent below the more expensive single crystal solar cells, achieving around 17 % in production. The cheaper amorphous silicon thin-film solar cells offer much lower efficiency measures, as they in production only achieve an efficiency measure of 7 %<sup>37</sup>.

New types of cells are entering the market, however, that are based on this thin-film technology, but uses non-silicon semiconductors, which seems to be more efficient.

The majority of these cells are based on the material called cadmium telluride, which gives low cost modules with exploitation efficiency around 10 %<sup>37</sup>.

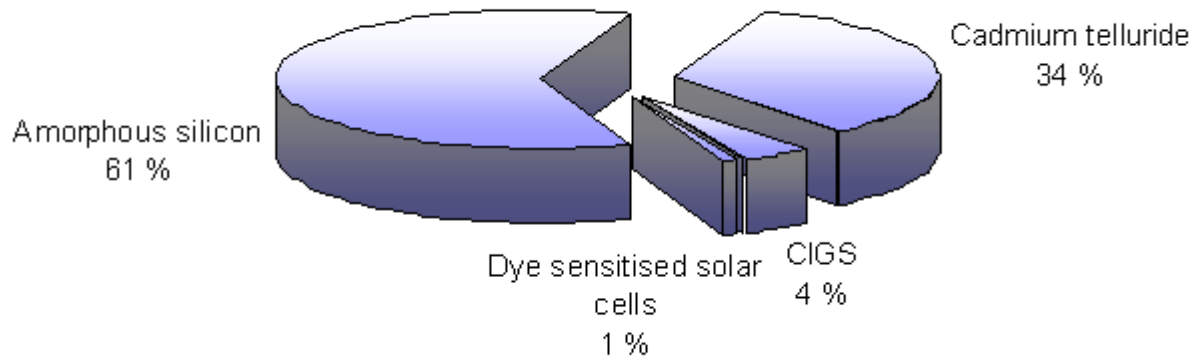
Another material, that could be even more significant in the future, is copper indium gallium selenide (CIGS), which recently achieved an efficiency measure, in a laboratory that is, around 20 %<sup>37</sup>.

The figure below illustrates the market shares in 2007 of the different materials used in thin-film cells<sup>37</sup>.

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<sup>37</sup> Business Insights: "The future of Solar Power"

**Figure 3.5: Market share among thin film technologies**



**Source: own creation based on numbers from US Department of Energy**

The market for these thin-film solar cells is for the time being relatively small, but it is growing, and may play a larger and more important role in the future.

An important difference between more traditional silicon cells and thin-film cells is the size. Silicon cells are small in size, limited often to sizes around 10 cm square, which entails that one solar cell module has to be put together by many individual solar cells.

Thin-film cells, however, can be ten times the size, making it possible to use one single solar cell as a module, reducing overall costs.

Q-Cells possesses all the technologies available in today's market of photovoltaics. As their core business they manufacture monocrystalline and polycrystalline solar cells. Their monocrystalline solar cell achieves a very competitive level of efficiency as it measures 17 %.

Through the subsidiary Calyxo GmbH the corporation also produces the cheapest form of solar modules, from the use of the silicon free semiconductor called cadmium telluride, and through the joint venture with Solibro GmbH the corporation deploys thin-film solar modules based on semiconductors made from CIGS.

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Q-Cells research and development is based on four pillars, as according to themselves are:

1. *Research and Development;*  
*One of the most outstanding teams put together*
2. *Universities and Institutes;*  
*Joint projects and close cooperation*
3. *Strategic Partnerships;*  
*On the supplier and customer side*
4. *Future Technologies;*  
*Through selective investments and participations*

This is to ensure that the corporation always is up to date on promising technologies.

### **3.1.5 Summary of the PEST analysis**

The political environment Q-Cells operate within is stable and we believe that regulations regarding the climate challenges are of great importance for Q-Cells and will strengthen their position further. We believe that within a couple of years the solar energy in Germany will not need to be subsidized by the government, making the industry's political dependence less.

Q-Cells increased their export ration to 70.1 % for 2008, which indicates that they have been able to further detach themselves from the German market, which makes the international market even more important.

The financial crisis have made the banks less able to provide credits, but this have not however influenced the German smaller roof-top market of solar cells, since government guaranteed loan schemes are available in this sub-market.

The economic growth, in Germany as well as in most other countries, is as illustrated declining, and the prospects for the next one or two years does not necessarily look good.

Economic decline like this can pose as a threat for Q-Cells as it can lead to a reduction in customer expenditures and thereby increase the competitive pressure within the industry<sup>38</sup>.

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<sup>38</sup> Hill, Charles W.L. and Jones, Gareth R.: "Strategic Management Theory – An Integrated Approach"

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The currency rate, for Q-Cells case that of most relevance is the euro versus the dollar, has for some time been rather unfavorable, but recently the euro has depreciated relatively much, which has an impact on Q-Cells competitiveness in the global market. With the depreciation of the euro Q-Cells' products are relatively cheaper to foreign customers and the opportunities for global sales should improve.

Another opportunity for Q-Cells is in the decline of the interest rate, both now recently and in the future, as it is expected to be around 2.5 % until at least 2010<sup>39</sup>. The decline means that the cost of capital has gone down, for Q-Cells and their customers, and that could lead to an increase in investments and purchases.

The socio cultural trends of environmental friendly initiatives and alternative energy are believed to prevail because it is such significant issues that have to be dealt with. We believe therefore that the solar sector has a positive prospect, as the demand certainly is there and will grow in line with the mentioned trend of environmental focus.

Germany is the market leader in photovoltaic solar energy, and it looks like the country can continue to lead in this field for some years, so the sector could contribute to reduce the unemployment rate and to secure economic growth.

Q-Cells seems to be in good control of the technological factors that shape the solar energy industry, as the corporation possesses all the technological know-how required to produce the solar cells in which there is a demand for in today's market, as well as in the future market, as far as anyone knows by now.

This means that the technological factors work as an opportunity for Q-Cells, as the somewhat advanced technology works as a rather high barrier of entry to other participants not invested so heavily in these technologies as Q-Cells is.

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<sup>39</sup> OECD: "Economic Outlook No. 84 – 2008"

## 3.2 PORTERS FIVE FORCES

### 3.2.1 The risk of entry by potential competitors

*The risk of entry by potential competitors is in part a function of the height of barriers to entry, that is, factors that make it costly for companies to enter an industry<sup>40</sup>.*

There are five important sources of barriers to new entry:

1. *Brand loyalty*
2. *Absolute cost advantages*
3. *Economies of scale*
4. *Customer switching costs*
5. *Government regulation*

#### **Brand loyalty**

The industry of solar energy generation would not necessarily be the first to think of in terms of a high level of brand loyalty. The industry has been blessed with excess demand so far, making the companies pay little or no attention to creating brand loyalty.

However, Q-Cells seems to make some arguments, in order of superior quality and efficiency, of why customers should choose their specific photovoltaic products, not only making the argument of why customers should choose photovoltaic products in the first place.

Q-Cells also focus a lot on reliable service and quality consulting, perhaps as an effort to differentiate themselves from competitors.

The question is whether that is enough to create any significant brand loyalty from the customers or if they choose solely by factors like availability and price, which has been the case in previous years.

#### **Absolute cost advantages and economies of scale**

An established corporation like Q-Cells has some cost advantages in comparison with potential new entrants.

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<sup>40</sup> Hill, Charles W.L. and Jones, Gareth R.: “Strategic Management Theory – An Integrated Approach”

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The corporation has over years developed effective and cost-efficient production methods. They have also gained some control over important resources through their acquisitions of, and joint ventures with, other corporations. In addition they have gained valuable technological know-how since they started doing business. This know-how could be hard for new entrants to acquire.

Q-Cells is also the largest solar energy corporation in the world, which makes them benefit from significant economies of scale, as they enjoy cost reductions from mass producing their standardized solar cell modules, discounts on purchases of parts, advantages of spreading fixed costs over large production volumes and the advantage of spreading marketing and advertising costs over a large volume of output.

### **Customer switching costs**

When it requires considerable time, effort and money to switch from the products offered from one corporation to the products offered from another, switching costs occur. High switching costs means high barriers to entry for a new company in the industry.

Photovoltaic products are rather comprehensive installations, and the purchase and installation of such modules are associated with relatively high costs.

This means that customers already using Q-Cells products, or any other corporations' products, will continue to do so unless they see a substantial advantage in shifting to another corporation's products. Since photovoltaic products do not differ that much from each other in terms of efficiency levels and quality this is less likely to occur.

### **Government regulation**

Regulations and rules from the government or for example unions and other legislators can play a huge role regarding the height of the barrier to entry by new corporations.

In Q-Cells case however there is little from the government or other legislator's side that helps to raise the barrier to entry.

There are heavy incentives from the German government to increase the production of energy from solar power, but Q-Cells is not the only corporation receiving support and benefits.

## **Summary**

The industry of solar energy generation has a very low degree of brand loyalty and Q-Cells are not considered to be remarkably better than the other actors in the industry on creating brand loyalty.

The industry does however have some rather large players and Q-Cells is on the top, enjoying substantial absolute cost advantages as well as economies of scale.

High switching costs also benefits Q-Cells, while government regulation makes no difference between Q-Cells and other corporations in the industry.

All in all the risk of entry by potential competitors is considered to be rather low, but should not be considered as completely unthinkable.

### **3.2.2 The intensity of rivalry among established companies within an industry**

#### **Competitors**

The industry Q-Cells compete within is a fragmented industry, since the solar cell products are hard to diversify, and this makes the competition concentrated on efficiency, technology development and prices. The industry consists of several small to medium sized companies, with the ten biggest companies in the industry counting for more than 50 % of the PV production<sup>41</sup>.

Q-Cells compete on an international area, with their largest market share within Europe, with sales in Germany of 29 %. Within Germany they are especially competing against First Solar and Solar World, which both are on the list of the top ten solar cell producers.

The industry has experienced significant growth the past years, however, recently the times has been tougher especially in time with the financial crisis and the rivalry has therefore been intensified.

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<sup>41</sup><http://dic.academic.ru/dic.nsf/enwiki/6299870>



### **Demand conditions**

The industry in general is under great pressure in reducing the cost of its production, since the technology at this point is very expensive, and do not generate much profits without subsidies in different forms.

The financial crisis reduces the demand of the solar energy industry's products, however, the demand on longer term is not affected, as the fundamental part of the PV industry is still the same and the world will need its products, so the demand can be said to be great in a longer perspective.

In an industry with large demand, the rivalry is reduced since the companies can sell more without taking market shares from each other.

### **Exit barriers**

The degree of exit barriers within the industry is high and the investments made in production facilities, technology and R&D, are significant and would most likely have limited use elsewhere.

Several of the companies are not good diversified, like Q-Cells, Solar World and First Solar, however on the other hand you will find Sharp which is well diversified. Low diversification means that the companies are dependent on success within this industry, making the exit barriers high.

Within this category the emotional aspects also play a vital role, since Q-Cells is one of the first movers within the industry and they take great pride in their business.

This industry is profitable so far and the outlooks are promising, so even though the exit barriers are high it does not represent a threat at this point for Q-Cells.

### **3.2.3 The bargaining power of buyers**

The solar energy industry and the segment of photovoltaic products has for some time, as pointed out earlier, enjoyed an excessive demand from customers.

This makes the power of buyers less than if it was an excessive supply instead, a situation which in practice means that buyers have little to say when it comes to the levels of prices, quality and service. Instead they pretty much have to settle for what is offered and profits can thereby remain at a high level.

It could very soon be that the reality for the industry is an excessive supply, as investments the last years have been enormous. This would definitely increase the power of buyers as they could be much more selective in which corporations they buy from, choosing of course the lowest prices or the best quality and service.

This would naturally lower the overall industry profits, making the industry less feasible, with more intense competition.

### **3.2.4 The bargaining power of suppliers**

The input material in solar cell production is largely crystalline silicon, a material which actually has been in shortage the recent years, despite its commonality in nature, restricting production and availability to some extent<sup>42</sup>.

Considering the importance of crystalline silicon for producers of photovoltaic products and considering also crystalline silicon's very few substitutes in this setting, this is a factor that gives power to the supplier, the makers of crystalline silicon, over the customer, in this case Q-Cells and other corporations in the industry.

Another factor making the suppliers more powerful in dealing with corporations within the industry of solar energy generation is that other industries than solar energy also in large scale uses crystalline silicon. The semi-conductor industry is one example, but crystalline silicon is also used widely in other electronics.

Still, the solar energy industry has become so large the past years that it constitutes a relatively large part of the suppliers of crystalline silicon's business, making it lucrative for them to serve the industry.

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<sup>42</sup> Business Insights: "The future of Solar Power"

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Given the fact that silicon is a raw material to be found in nature, and that the method of commercial preparation is relatively simple, it is hard for the different suppliers to be unique in any way. This makes the switching costs of their customers, the solar energy industry, among others, relatively low, which of course weakens the bargaining power of the supplier.

Another factor that weakens the suppliers bargaining power is the opportunity for their customers, large and well-financed solar energy corporations, like Q-Cells, to enter their industry of extracting and producing crystalline silicon themselves.

Summing up the factors shows that the importance of crystalline silicon for the solar energy industry, as well as the large use of crystalline silicon in other industries as well, strengthens the bargaining power of the supplier.

Factors reducing suppliers bargaining power is that the size of the solar energy industry makes it attractive to serve, silicon is a naturally raw material which is quite easily prepared for commercial use and companies in the solar energy industry could choose to vertically integrate and secure control over its own extraction and preparation of crystalline silicon.

All in all the bargaining power of suppliers is relatively low, which is more of an opportunity than a threat towards the solar energy corporations, and of course Q-Cells among them.

### **3.2.5 The closeness of substitutes to an industry's products**

The industry of solar energy serves in almost every aspect the customers' need of electricity. That makes the range of substitute products rather large as electricity also can be generated by for example gas turbines and nuclear power plants.

Even though they are not renewable energy sources they are still rather close substitutes as they serve the very same customer need of electricity.

Many other renewable energy sources in addition to solar serve the customers need of electricity. Examples of these are wind-, hydro- and marine energy generation, industries which are all about providing the customer with electricity.

The closeness of many other energy generation industries, which serves as substitutes for the solar energy industry, even though not all of them come from renewable energy sources, poses as a clear threat for solar energy generation.

### **3.3 SWOT Analysis**

#### **3.3.1 Internal analysis**

When analyzing the internal factors of Q-Cells we will divide them into strengths, with the underlying factors being; financial resources, physical resources and human resources, technology resources, reputation and marketing, and then weaknesses, with the underlying factors being political dependence and the financial crisis.

##### **3.3.1.1 Strengths**

###### **Financial Resources and Size**

Q-Cells is a strong company with significant financial muscles, and their liquidity is solid with an equity ratio of above 60 % the last five years, and a current equity ratio of 66.2 %. This puts the company in a strong position for hard financial times, a good position of investment opportunities and it has provided the company with the ability to tackle an eventually decrease of subsidies from the German Government.

Q-Cells' earnings have been good for a long period, with an annual average growth of 130 % the past five years. The sales of 2008 have grown to € 1,251.3 million which was an increase of € 392.4 million from 2007. Further emphasis on growth and development of their production capacity will probably secure continuous growth.

###### **Physical-, Technological- and Human Resources**

Q-Cells have production facilities and R&D centers located in the Solar Valley in Germany, an area where the main part of Germany's PV sector is located, so this represents a good environment for knowledge sharing.

The company also has different facilities worldwide, Malaysia and USA to mention some, so it has access to several markets.

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Q-Cells is an innovator in the industry and has significant technology both within the company, and through its associated companies and JV's.

In February 2008 Q-Cells was awarded the "Germany's Best Employer" by the magazine Capital, which witness of a company with satisfied employees, which most certainly is a valuable asset when recruiting new employees.

The corporation is also constantly attracting skill-full employees from the acquisition of companies with significant technology, and last year the whole group employed a total of 861 new employees.

The management of the company has been there from the start and has significant knowledge about the industry.

### **Reputation**

Q-Cells is the biggest solar cell producer in the world, and has put a large effort in its reputation worldwide, as a professional and serious company who has taken the climate challenges in their own hands.

From their annual rapport one can read;

*Q-Cells advances photovoltaics as an environmental friendly and future proof technology. Today we are the world's largest manufacturer of solar cells.*

Q-Cells is one of the pioneers in the industry, and they possess the first mover advantage, in addition to having established a strong brand. The corporation also has a strong position in an industry with very promising future growth potential.

Q-Cells looks robust today and we believe it has the ability to take its already outstanding growth further. The world will always need energy and the prospect for the PV sector is very promising.

### **3.3.1.2 Weaknesses**

The PV industry has for a long time been subsidized from the German government, mainly through the EEG. This can represent a weakness, since it contributes to false safety.

The time for Q-Cells and other solar energy generating companies to stand on their own feet are approaching and the company's needs to tackle this when it comes.

The company has with its large production made itself dependent on large sales volumes to be profitable. This can represent a weakness because a drop in sales due to for instance the ongoing financial crises would influence the profitability of the company significantly.

Another weakness is the company's dependences on constantly cost reduction to still be profitable. In addition to a reduction in subsidies from the government, a failure in further cost reduction could have a major effect on the company.

### **3.3.2 External factors**

The external analysis, as a part of the SWOT framework, includes revealing the opportunities and the threats of the corporation, as a result of favorable or unfavorable factors in the external, or macro, environment<sup>43</sup>.

With regards to opportunities we find the market potential, the environmental focus and once more the Renewable Energy Sources Act (EEG) worth mentioning. The main threats for the company are low oil and gas prices and expensive production costs.

#### **3.3.2.1 Opportunities**

##### **Market potential**

With regards to the market potential we will focus on a plan developed by the German government, the so called Grid Parity, and the impact of the growth rate.

The idea of the grid parity is that PV systems will cost less, or at least no more than the average household electricity from the power socket. Q-cells is working on this through their cornerstone of their business; cost cutting efforts in their value chain.

This target is believed to be reached within the next year in Southern Europe and the great idea behind this is that the plant operator will use the energy itself has generated; the PV system will start to pay off immediately.

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<sup>43</sup> Hill, Charles W.L. and Jones, Gareth R.: "Strategic Management Theory – An Integrated Approach"

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The market potential of this grid parity is great for the small and medium-sized PV systems. Every household will then operate its own power station. Tests are made of so called smart houses which is producing all the energy for its own use.

A problem that needs to be addressed is the impact from clouds on such a network, it is said that they need an intelligent network to be able to control or predict such events. The answer to this is how the Danish company Energinet.dk communicates with its windmills, so the problem with weather conditions can be addressed.

The growth rate in the industry has been significant the past years and with the current trends towards alternative energy, the growth rate of the industry represents an opportunity for Q-Cells, when there are more market shares to struggle for.

### **Environmental focus**

Due to various incentives around the world, coming from an increased environmental focus, an expectation of increased demand for renewable energy has been created, and solar energy generation is one of the segments expected to lead the way, so investments in corporations generating solar energy are now, and has been for the recent years, on the rise.

Given this background it should not be too surprising that the areas experiencing the most growth are the ones who also can show to the most incentives from the government.

Germany, Japan, Spain and the state of California in the United States are all areas experiencing significant growth, and they have become central players in the industry of solar energy generation exactly because of the generous incentives in place there.

The production and installation of photovoltaic modules are already increasing rapidly. Recently the annual growth has been almost 45 % and if this development continues the capacity could, based on estimates, in 2020 reach as much as 241 GWP (giga watt peak)<sup>44</sup>.

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<sup>44</sup> Greenpeace and EPIA: "Solar Generation IV – 2007"

This constitutes an opportunity for Q-Cells, who already are the largest solar energy corporation in the industry, as it is very likely to take part in, and contribute to, this increase of capacity in solar produced electricity.

### Renewable Energy Sources Act

The Renewable Energy Sources Act (EEG) came into act on 1. April 2000 and was amended in 2004.

The goal of the EEG is to:

- *Speed up the market launch of technologies for electricity production from wind power, solar radiation, biomass, geothermal power and hydropower, as well as mine gas.*

And the core element of the legislation is that:

- *The duty of grid operators to give priority to electricity from renewable energy sources, and to pay for it according to fixed tariffs<sup>45</sup>.*

The feed-in tariff system thus works as a very strong incentive for renewable energy production and might be at least some of the reason why Germany today is leading within the renewable energy sector, with a global market share of around 15 % already in 2006<sup>45</sup>.

That it is an example to follow has been given proof by the 18 other EU countries now introducing feed-in tariffs as well, all based on the German model (EEG).

Even more important is perhaps the estimation that investments' in such German electricity-generating equipment will reach an amount around 9 billion €<sup>45</sup>.

It is also worth noting that the tariffs are under constant adjustment and that the tariffs for photovoltaics have been increased appreciably, illustrating the desire at least from the German government to increase the share of electricity generated from this segment of renewable energies.

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<sup>45</sup> [http://www.gtai.com/uploads/media/EEG\\_Brochure\\_03.pdf](http://www.gtai.com/uploads/media/EEG_Brochure_03.pdf)



This would definitely pose as an opportunity for Q-Cells, who could benefit from these investments.

### **3.3.2.2 Threats**

In comparison with other technologies, solar energy generation is relatively expensive, the cost of installing solar photovoltaic electricity generators is the very highest among the different power generating technologies<sup>46</sup>, as table 3.6 on the next page illustrates.

Most competitive among renewable energies with regards to costs is electricity generation by wind-energy, who is only beaten by the conventional combined cycle and the advanced combined cycle, two technologies that uses fossil fuels to generate electricity, and is found in for example gas-fuelled power plants.

These ways of power generation, with fossil fuels, even though they are not renewable, also works as a threat for Q-Cells as a solar energy corporation, especially in the short-term, as gas and oil prices has declined dramatically and now appears exceptionally low.

**Table 3.5: Instant installed costs for power generation technologies (\$/kW)**

	<b>Capacity (MW)</b>	<b>Instant Cost (\$/kW)</b>
Conventional combined cycle	500	781
Advanced combined cycle	800	766
IGCC	575	2198
Advanced nuclear	1000	2950
Concentrating pV	15	5156
Parabolic trough	64	4021
Utility photovoltaic (single axis)	1	9611
Solar dish	15	6187
Wind	50	1959

**Source: California Energy Commission**

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<sup>46</sup> Business Insights: “The future of Solar Power”

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This high cost of solar energy production and utilization could most certainly post as a threat for solar energy corporations, and of course Q-Cells among them, as investors could be reluctant to choose solar energy rather than wind energy, or even more traditional non-renewable energy generation technologies, like gas-fuelled power plants as previously mentioned, which requires less of an investment.

The financial crisis has according to Q-Cells' CEO Anton Miller made an impact on the market, and the main drawback of this is the fact that the market is relatively new, with higher price levels and lower customer loyalty compared to other sectors like for instance the oil and gas industry.

### 3.3.3 Summary SWOT and part conclusion of the strategic analysis

Figure 3.6: Summary SWOT (prioritized in accordance with importance)

Strengths	Weaknesses
<ol style="list-style-type: none"><li>1. Financial resources</li><li>2. Economies of scale</li><li>3. Technology</li><li>4. First mover advantage: experience and knowledge of the industry</li><li>5. Strong brand</li><li>6. Reputation</li></ol>	<ol style="list-style-type: none"><li>1. Subsidies from the government</li><li>2. Dependent on large sale volume</li><li>3. Dependent on constantly cost reduction</li></ol>
Opportunities	Threats
<ol style="list-style-type: none"><li>1. The Renewable Energy Sources Act</li><li>2. Great focus on environmental friendly energy solutions</li><li>3. Grid Parity</li></ol>	<ol style="list-style-type: none"><li>1. Expensive production and products</li><li>2. The financial crisis</li><li>3. Low oil and gas prices</li></ol>

Source: own creation

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

Q-Cells has several advantages, or strengths, as a company. The corporation has a very sound and strong economy, with relatively large financial resources, as well as it enjoys substantial economies of scale, being the largest solar energy corporation in the industry.

The company possesses all the technological know-how required to be an industry leader, throughout all of the different, major product types.

Finally, the solar energy corporation has already gained unique experience and knowledge of the industry and created for itself a strong brand and good reputation.

The corporation does have some weaknesses. For the time being it is heavily subsidized from the German government, which for now favors the corporation relative to its foreign competitors, but with lowered subsidies it could work as a disadvantage, as it would be harder to compete against the nearest competitors and be as profitable as it is now.

A reduction in subsidies also put further pressure cost reduction, which already is significant and the company's dependence of large sales volume to be profitable is also a weakness.

There are several opportunities ahead for Q-Cells and the solar energy industry. In Germany the government has launched an initiative called the Renewable Energy Sources Act which gives great opportunities for Q-Cells and other German companies in the industry of solar energy generation.

There is also a great focus worldwide on the environment and on environmental friendly energy solutions. This focus attracts both investors and customers to the industry which undoubtedly rewards Q-Cells, as the leading corporation, as well as other corporations in the industry.

As a last opportunity is the goal of grid parity.

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

The financial crisis and the expensive production are both main threats for Q-Cells and the solar energy industry. Q-Cells has experienced reduction in sales after the crises set in, and its expected sales estimates for 2009 are reduced from a level between € 1.7 to 2.1 billion down to € 1.3 billion and 1.6 billion<sup>47</sup>.

In addition do low oil and gas prices, as opposed to high production costs in the solar energy industry, make the latter industry less competitive, which can of course make both customers and investors choose solutions based on fossil fuels instead of renewable energy.

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<sup>47</sup> Internet newspaper, Reuters 12th of May 2009 :” UPDATE 3-Solar gloom overshadows Q-Cells, Solon”

## **4. Financial analysis: Accounting principles and key figure analysis**

### **4.1 Introduction**

One of the purposes of a financial analysis is to give decision takers outside the corporation information about the economic situation and development of the corporation. Stakeholders can be customers, suppliers, public authorities, employees, credit-institutions, management and owners<sup>48</sup>.

It comes natural to believe that the financial analysis also is of interest to those contemplating on joining one of those stakeholder categories, as for example potential shareholders or potential credit institutions. The financial analysis thereby serves as valuable information for all those involved, or thinking about being involved, with the corporation.

This chapter begins by introducing the concepts and principals of the International Financial Reporting Standards (IFRS), which is the accounting, measurement and consolidation methods that Q-Cells now uses.

Up to 2004 the corporation used another accounting and measurement system, called the German Commercial Code (HGB), and the introduction of concepts and principals of the IFRS system is therefore followed by the presentation of differences between the two systems and the implications it had on Q-Cells' figures in the fiscal year 2004.

Furthermore this analysis looks at the historical development of the key figures in a period of the last five years, which builds a fundament for the rest of the analysis in this thesis. With the historical facts in hand we are able to predict the future development and determine the factors that influence the corporation's operations.

The key figures we apply are aimed at presenting the solidity, profitability and liquidity of Q-Cells, which will give us a pointer of the company's financial condition. In the end of this section we also benchmark some of Q-Cells' key figures with key figures from a competing German corporation called Solar World.

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<sup>48</sup> Banken, Kjell and Busch, Tor: "Analyse av Regnskapet"

## ***4.2 Concepts and principals of the IFRS methods and their differences with the HGB methods***

### **The IFRS methods**

The IFRS are issued by the International Accounting Standards Board (IASB), who has the authority to set and approve interpretations of the standards.

The system is considered a principles-based set of standards in that they establish broad rules as well as dictate specific treatments. It is designed with the general purpose financial statements of profit-oriented entities in mind, but it may also be useful for non-profit oriented entities, as it gives information useful for making economic decisions by a range of users<sup>49</sup>.

According to the IFRS a complete set of financial statements includes a balance sheet, income statement, a statement showing either all changes in equity or changes in equity other than those arising from capital transactions with owners and distributions to owners, a cash flow statement, a list of accounting policies and notes to the financial statements.

In this system protection is given to a wide range of stakeholders, not just the creditors, and instead of valuation based on prudence the aim is to give a fair and true value of the corporation and its potential, and there is no correlation between tax and commercial reporting.

It can be said in a summary that this system is about giving information on the corporations' assets, financial position and its earnings performance, and also changes in these over time, so that the development of the corporation is easier to reveal.

### **Differences between the IFRS and the HGB**

There are some major differences between the IFRS and the HGB and the following section will highlight these.

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<sup>49</sup> PricewaterhouseCoopers: "International Financial Reporting Standards – Pocket guide 2009"

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

One of the main objectives of the HGB is first and foremost to protect the creditors, such as banks and private investors, which is in contrast to the IFRS methods' purpose of serving a wide range of stakeholders.

It is focused on earnings minimization, through the so-called prudence principle, which is based more on historical figures, instead of giving *a true and fair value*, like in the IFRS, which is more future-oriented. This makes the risks concerning the on-going of the corporation more limited using the HGB methods.

The HGB methods also have a single correlating system for tax and commercial reporting and in a short summary it can be said that the HGB methods are developed towards giving investor protection and that they are very much influenced by the tax-law provisions of being used for tax purposes as well.

### **Implications of the change from IFRS to HGB**

From the fiscal year 2004 to the fiscal year 2005 Q-Cells stopped using the HGB as its accounting, measurement and consolidation methods and shifted to the IFRS instead. This change came as a consequence of the corporation going public on the German stock exchange during the year 2005 and it created some differences in the reported financial figures.

However, in the annual report of 2004 both methods are represented, and in our key figure analysis later on we have therefore employed figures in line with the IFRS methods only. The change in Q-Cells' accounting methods does therefore not influence the continuity of our key figures.

### **Conclusion**

The change from the HGB methods to the IFRS methods caused some changes in the reported numbers of the fiscal year 2004. The difference was € 7.434 million in the balance sheet and € 0.668 million in the income statement. Since we have only employed numbers processed by the IFRS methods however, we do not see this as a problem in our further analysis.

Q-Cells has with the exception of year 2004 employed the IFRS reporting standards in their annual reports. The audits have been made without any reservations during the entire period of our analysis.

We have worked through the reports and their notes, in an effort to reveal any flaws or shortcomings. We have failed to find any of such kind and believe that the reported numbers are reliable. We therefore agree with the auditor's reports throughout our period of analysis.

### **4.3 Key figure analysis**

Before we present the key figures we find it necessary to mention two significant shifts in total assets during this period from 2004 until 2008. Q-Cells' introduction to the stock market with their first IPO, had a major effect on the total assets, which rose by approx € 378.41 million, followed by a huge increase from 2006 to 2007 from € 634.47 to € 2,588.3 million.

The last increase was due to an increase in financial assets, which rose from € 3.1 million to € 1,207.3 million from 2006 to 2007, much due to an increase in the capital reserve of € 1,212 million.

#### **4.3.1 Solidity**

Solidity is of great importance because it says something about the company's ability to endure losses and the future potential of further growth.

To illustrate solidity we will first of all look into the shareholders equity ratio of the company, but we will also take a closer look at the share of short and long term liabilities, the debt/equity ratio and the interest coverage ratio.

The shareholder's equity ratio is one of the most common key figures, and it is of great importance since it says something about the opportunities the company has. With a high shareholder's equity ratio the company has greater potential for growth since it for instance can borrow more. The lower the ratio is the less solid becomes the corporation.

The debt/equity ratio is meant to illustrate the corporations' financial leverage and indicates how it finances its assets through equity and debt.

A high debt/equity ratio reveals that the corporation has used a relatively large proportion of debt in financing its growth.



## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

The debt/equity measure often varies from industry to industry, but a rule of thumb is that a ratio between 1 and 3 is good<sup>50</sup>. Still, lower the number, better the solidity, since it then means that the corporations debts are less. All in all it's a matter of consideration and balance between solidity and profitability, as some financial leverage can help boost the shareholders' investments.

The interest coverage ratio illustrates the company's ability to pay interests on its outstanding debt and thereby also says something about its ability to handle increased interest expenses<sup>2</sup>.

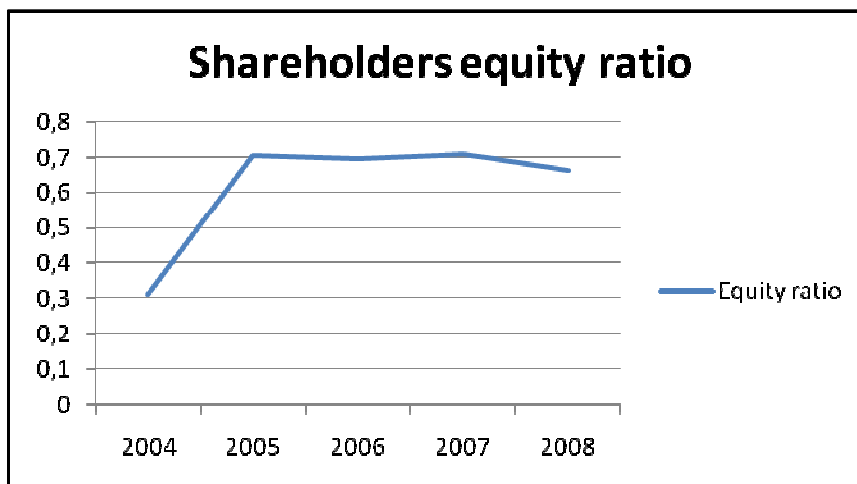
The ratio is calculated in such a manner that the lower the number is, the more burdened the company is by debts. According to Investopedia, an interest coverage ratio below 1.5 signals a questionable ability to meet interest expenses and a ratio below 1 signals the corporations' inability to generate sufficient revenues to satisfy interest expenses.

**Table 4.1: Historical development of Q-Cells' solidity**

	2004	2005	2006	2007	2008
<b>Equity ratio</b>	31,0 %	70,4 %	69,3 %	70,8 %	66,2 %
<b>Short term debt</b>	23,2 %	17,4 %	18,5 %	7,8 %	13,6 %
<b>Long term debt</b>	28,2 %	12,2 %	12,1 %	21,4 %	20,2 %
<b>Debt/Equity ratio</b>	1,678	0,420	0,442	0,411	0,511
<b>Interest coverage ratio</b>	15,34	19,30	39,50	7,94	6,35

Source: Own creation

**Figure 4.1: Development of Q-Cells' shareholder's equity ratio**



Source: Own creation

<sup>50</sup> <http://www.bizweb.no/RegnskapForklaring.aspx>

Q-Cells' shareholder's equity ratio illustrates a high level, above 50 %, the last four years, which is strong in an industry with such growth the last years, and this witness of a company with a robust economy and bright future outlooks for further growth.

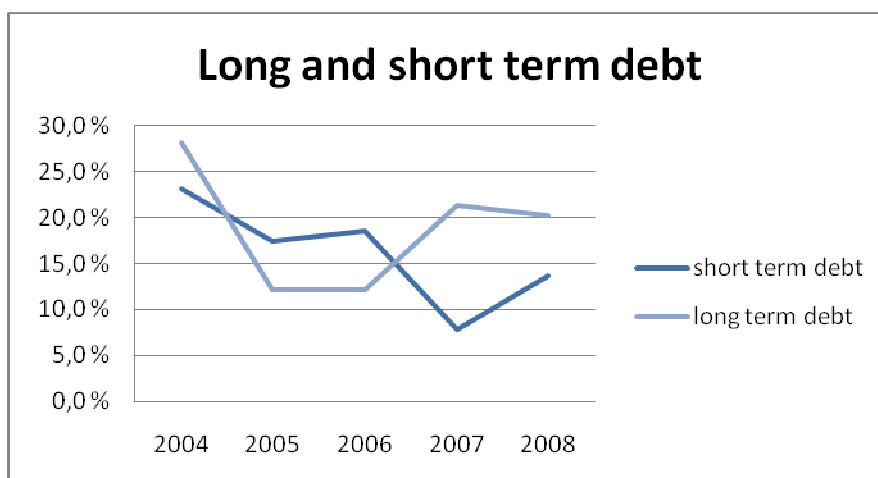
The significant increase in equity from 2004 to 2005 can very much be attributed to the company's entrance on the stock exchange in October 2005, as the IPO had a value of approximately € 240 million, which increased the shareholders equity ratio by some 40 percentage points.

From 2006 to 2007 Q-Cells issued 34.32 million new shares as part of financing the investment in REC and 2.21 million new shares to the corporations' employees, making the total issuance of new shares 36.53 million, which increased the equity substantially. In this period the liabilities increased significantly as well though, keeping the shareholder's equity ratio relatively unchanged.

The liabilities are at a relatively low level, and with a debt/equity ratio of 0.51, the financial risk can be characterized as relatively low, regarding the high proportion of equity.

Furthermore is the long-term debt at a higher level than the short-term debt, which is a good sign, since short-term liabilities are said to be more expensive than long-term liabilities.

**Figure 4.2: Q-Cells' short and long term debt**



**Source: Own creation**

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

Q-Cells' long-term debt decreased considerably from 2004 to 2005, as it came down to around 12 % of total liabilities, from more than the double, around 28 %, and the corporation held the same 12 % level of long-term debt throughout 2006, before taking on a bigger amount of debt again, as the share of long-term debt was around 21.5 % in 2007 and 20 % in 2008.

The increase from 2006 to 2007 came due to the 17.9 % stake taken in the Norwegian wafer company REC, which, in addition to the issuance of shares, was financed with a convertible bond of € 492.5 million.

Q-Cells has had a good development in its short-term debt, as the corporation has managed to decrease its short-term borrowings from around 24 % of total liabilities in 2004 to as little as around 7 % of total liabilities in 2007.

The short-term debt has fluctuated in line with the increase in total assets, especially from 2006 to 2007, where the amount of current liabilities rose, but the share in percent fell, because the total assets rose even more. Still, the corporation almost doubled its debts again, from 2007 to 2008 due to an increase in current financial liabilities to € 226.8 million.

This increase is because of Q-Cells' utilization of a credit line of € 220 million and the credit is due in one year.

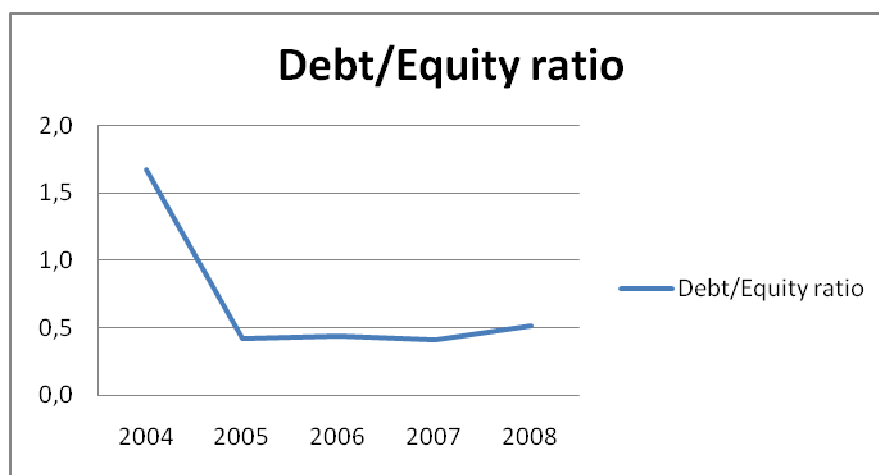
Q-Cells' development in the debt/equity ratio from 2004 to 2005 witnesses of a significant increase in equity relative to debt, but changes very little from 2005 and on to 2008. The increase in equity during the year of 2005 came as a consequence of the IPO the corporation went through with.

In regards of solidity the development of the ratio illustrates a very good trend indeed. It could rather be argued that Q-Cells perhaps could finance its assets a little more through some long-term debt, in order to gear up the shareholders' investments and expose the corporation more to debts and less to equity.

Gearing up the investment means that the company could generate more earnings than it would have without the same level of debt financing and if the amount of debt could increase earnings by a greater amount than the debt costs, through interest expenses, then the shareholders would benefit, as more earnings are being spread among the same amount of shareholders<sup>51</sup>.

However, the cost of such debt financing could quickly end up in outweighing the return generated, and become too much for the company to handle, which thus could lead to financial distress and in the worst case scenario lose all of the shareholder's money.

**Figure 4.3: Development of Q-Cells' debt/equity ratio**



**Source: Own creation**

The development in Q-Cells' interest coverage ratio from 2004 to 2006 reveals an increased and very sound ability to pay off debts and it indicates that the corporation could endure interest expenses of higher levels, given that it remains its' income<sup>52</sup>.

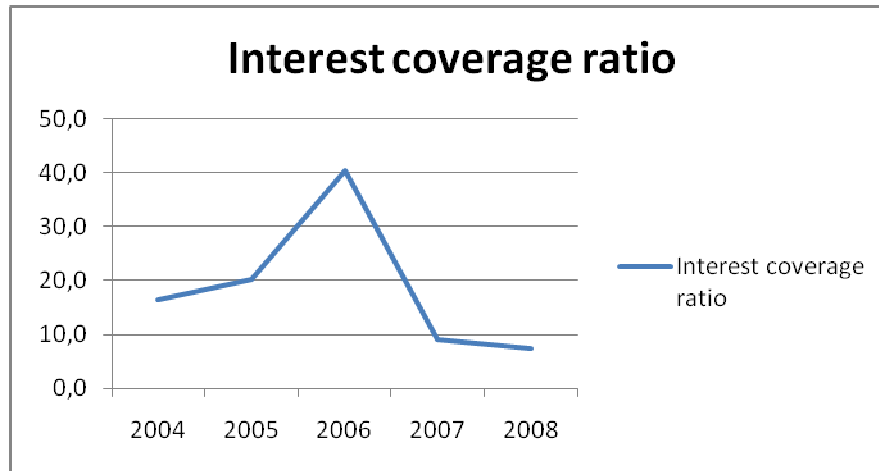
Especially in 2006 are the interest expenses very low relative to the income, which gives the extraordinary high ratio.

For the last two years the interest expenses has clearly increased and the ratio has gone down, but it is still far above what is thought of as safe and solid, as it is common to operate with a ratio of 1.5 as the lowest limit<sup>52</sup>.

<sup>51</sup> <http://www.investopedia.com/terms/d/debtequityratio.asp?viewed=1>

<sup>52</sup> <http://www.investopedia.com/terms/i/interestcoverageratio.asp?viewed=1>

**Figure 4.4: Development of Q-Cells' interest coverage ratio**



**Source: Own creation**

### 4.3.2 Profitability

Profitability affects the company's financial structure, self finance, possibility of additional equity and the foundation of granting more loans. It also affects investors desire to invest in the company and shareholders desire to buy Q-Cells' stocks.

It is expensive to be poor and bad profitability influences the company's credit dignity and it might be more expensive to borrow money.

The profitability will be expressed with three key figures; the profit margin, the return on total capital and the return on capital employed (ROCE).

**Table 4.2: Development of Q-Cells' profitability**

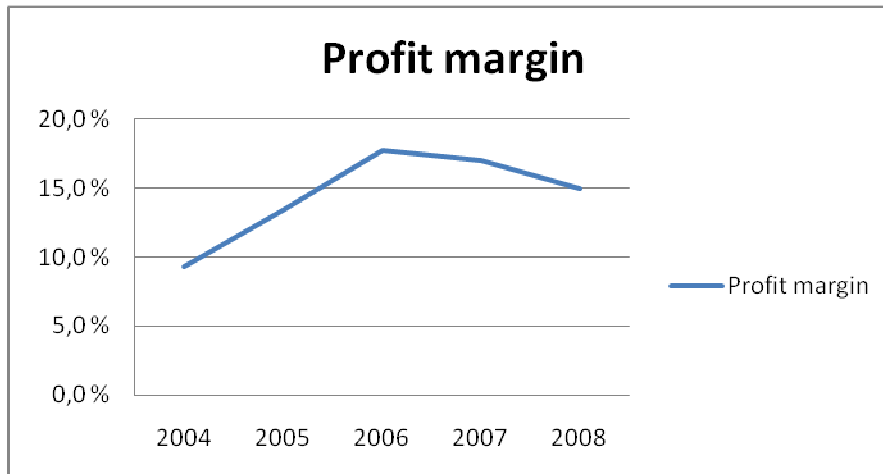
	2004	2005	2006	2007	2008
<b>Profit margin</b>	9,3 %	13,3 %	17,8 %	17,0 %	15,0 %
<b>Return on total capital</b>	25,8 %	23,1 %	26,0 %	16,7 %	9,2 %
<b>ROCE</b>	22,6 %	16,8 %	25,0 %	8,3 %	8,4 %

**Source: Own creation**

The profit margin is a measure of how much the company will actually keep from each euro of its' revenues, it is a key figure which fluctuates from industry to industry.

A high profit margin indicates a more profitable company that has better control over its costs compared to its competitors<sup>53</sup>. Profit margin is imposed because it reveals that increased sales not necessary means increased profitability since it says something about the costs too<sup>54</sup>.

**Figure 4.5: Development of profit margin**



**Source: Own creation**

The company has experienced a drop in their profit margin from 2006 to 2008 of 2.7 percentage points, due to a relatively larger increase in the costs than the revenues.

The drop in profit margin from 2007 and 2008 specifically was approximately 2 percentage points, despite a growth in sales of 45 % from last year, which is due to increased costs related to depreciations and costs of materials.

According to CEO Anton Miller the first three quarters of 2008 were very strong, however, the fourth quarter was a setback due to the global economic situation, but in the end they reached their forecasted sales of € 1,200 millions.

Return on total capital measures the return of the normal operation of the company, and it is a very useful key figure for investors to illustrate the dividend yield the company generates.

Q-Cells' return has been falling the whole period from almost 26 % in 2004, down to 9 % in 2008, a significant fall of approximately 17 percentage points.

<sup>53</sup> <http://www.investopedia.com/terms/p/profitmargin.asp>

<sup>54</sup> Banken, Kjell and Busch, Tor: "Analyse av Regnskapet"

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

The reason for this is the great growth of the company, as a larger growth in total assets compared to the net profit generated decreased the ratio.

From 2007 to 2008 the growth in sales was 45 %, however, due to the increase in costs, the increase in sales only contributed to a growth in net income from the operating activities of 4.11 %, and this definitely has an impact on the return on total capital.

ROCE is a measure of the returns that a company is realizing from its capital and the resulting ratio represents the efficiency with which capital is being utilized to generate revenue<sup>55</sup>.

The measure uses the corporations' debt liabilities, in addition to equity, that is the capital employed, and thereby also illustrates how the corporation is impacted by the use of leverage<sup>55</sup>.

The development in ROCE has not been too fortunate for Q-Cells the last years, as it has decreased quite significantly from 2006 to 2007, from 25 % to 8.25 %. As a general rule of thumb the ratio should at least be at the corporations' average borrowing rate<sup>55</sup>.

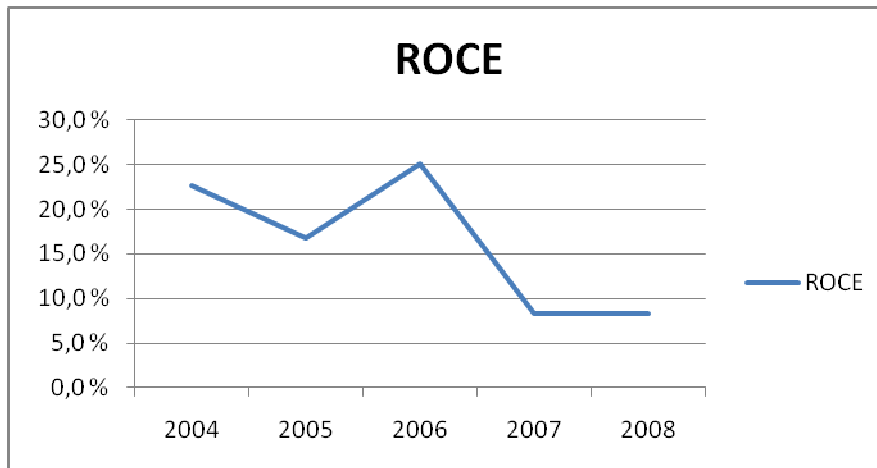
The interest rate in Germany in 2008 was around an excessive 4 %<sup>56</sup>, so there is no doubt that Q-Cells still generates a positive return on its capital employed, but the decline is significant and should be noted.

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<sup>55</sup> <http://www.investopedia.com/terms/r/roce.asp>

<sup>56</sup> OECD: Economic Outlook No. 84 – 2008

**Figure 4.6: Development of Q-Cells' ROCE**



**Source: Own creation**

### 4.3.3 Liquidity

Liquidity is a measure of the capability of the company to fulfill its short-term debt obligations, that is, to turn assets into cash in order to cover debts of high importance if creditors seek payment<sup>57</sup>.

It can be measured in several ways, but we have focused on the following key figures; the financing ratio, the current ratio and the working capital.

**Table 4.3: Development of Q-Cells' liquidity**

	2004	2005	2006	2007	2008
<b>Financing ratio</b>	0,8763	0,3357	0,5352	0,712	0,8533
<b>Current ratio</b>	1,7	4,2	3,0	4,4	1,9
<b>Working capital (in 1000)</b>	€ 23 421'	€ 58 133'	€ 117 920'	€ 159 100'	€ 318 300'
<b>Working capital % of sales</b>	18,20 %	19,40 %	21,90 %	18,50 %	25,40 %

**Source: Own creation**

The financing ratio is basically a measure of to which degree the fixed assets are long term financed. The ratio should be under 1, since fixed assets should be financed with long-term capital.

<sup>57</sup> Banken, Kjell and Busch, Tor: "Analyse av Regnskapet"



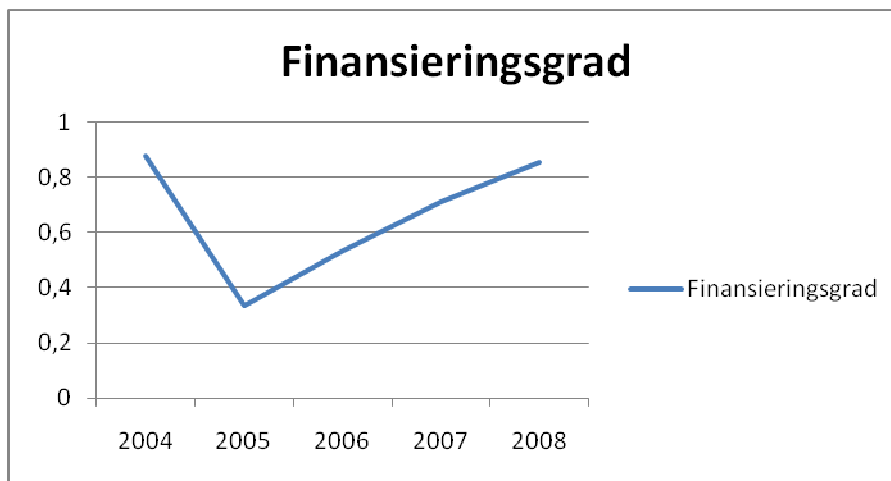
## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

The reason for this is that if the ratio is above 1 the fixed assets are financed with short-term debt, which is more expensive than financing it with long term debt.

Q-Cells' ratio has fluctuated from 0.87 in 2004, down to 0.33 the following year, before it rose again up to 0.85 in 2008.

The ratio is under 1, so it is not unhealthy. The reason why it is at the level of 0.85 is mainly because it is influenced by the low share of fixed assets compared to long-term financing.

**Figure 4.7: Development of Q-Cells' finance degree**



**Source: Own creation**

### Current Ratio

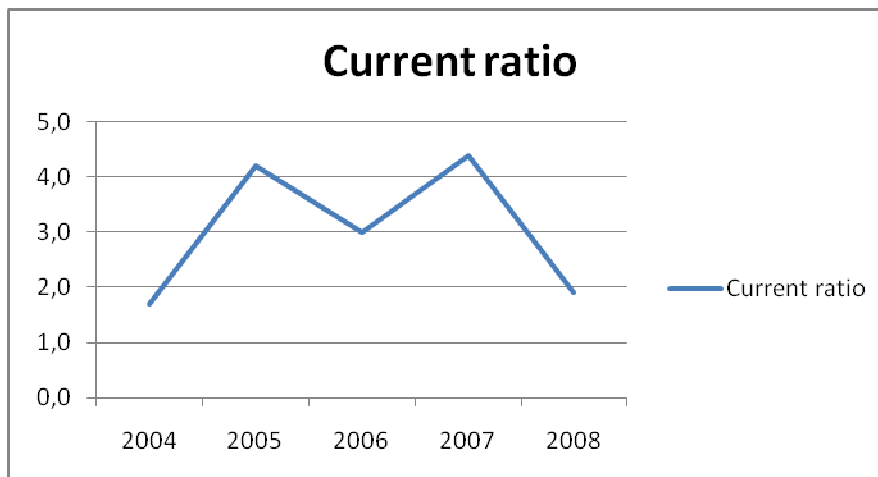
This measure is aimed at illustrating how much of the current assets that are financed with current liabilities. This ratio should normally be above 2, but it depends on the industry<sup>58</sup>.

With a recommended ratio above 2, which means that half of the current assets should be financed with current liabilities, Q-Cells is doing good, with a ratio above 4 in 2005 and 2007.

This high ratio can again be explained by Q-Cells' low degree of current liabilities, it has been a healthy ratio for a long time, even though the ratio dropped by 2 in 2008. The drop in 2008 is not critical since a ratio close to 2 is still good.

<sup>58</sup> Banken, Kjell and Busch, Tor: "Analyse av Regnskapet"

**Figure 4.8: Development of Q-Cells' current ratio**



**Source: own creation**

### **Working capital**

The difference between current assets (trade account receivable and inventories) and current liabilities (trade account payable) is the same as working capital<sup>59</sup>. The working capital should not be negative under any circumstances, if it is the daily operations are hard to fulfill and the company would experience trouble.

Q-Cells' working capital has increased substantially since 2004, as it was around € 23 million that year, while it in 2008 was around € 318 million.

A measure of a healthy working capital can be found when dividing the working capital on sales, and this ratio should as a rule of thumb be up to 10-15 %<sup>60</sup>.

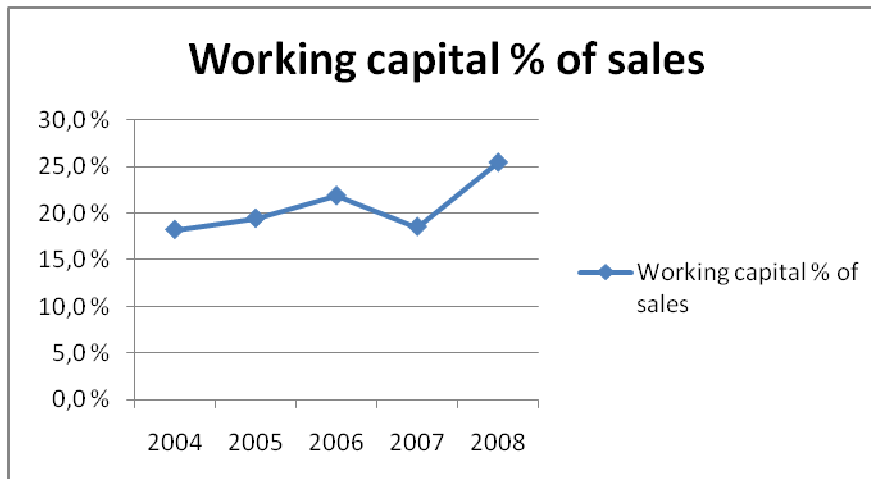
Q-Cells has a current ratio proven to be above 1, thereby cannot the working capital be negative. The working capital ratio, expressed in percentage of sales, has fluctuated between 18 % and 25 % in this period, which is a good ratio, as according to the rule of thumb.

The most important thing regarding the working capital is that it is positive and that it has been positive for the last five years, and a ratio of 25.4 % is still healthy.

<sup>59</sup> <http://www.investopedia.com/terms/w/workingcapital.asp>

<sup>60</sup> Banken, Kjell and Busch, Tor: "Analyse av Regnskapet"

**Figure 4.9: Development of Q-Cells' working capital in % of sales**



**Source: Own creation**

#### **4.4 Comparative Analysis**

It is important to compare Q-Cells with other companies in the industry to better view how it actually is performing related to the industry standard. We have chosen to compare Solar World<sup>61</sup> with Q-Cells, as the company is listed on the same stock exchange as Q-Cells, has approximately 1,800 employees and had a production of about 170 MWp last year.

We will compare the two corporations on their solidity, profitability and liquidity, and illustrate the differences graphically with some belonging comments.

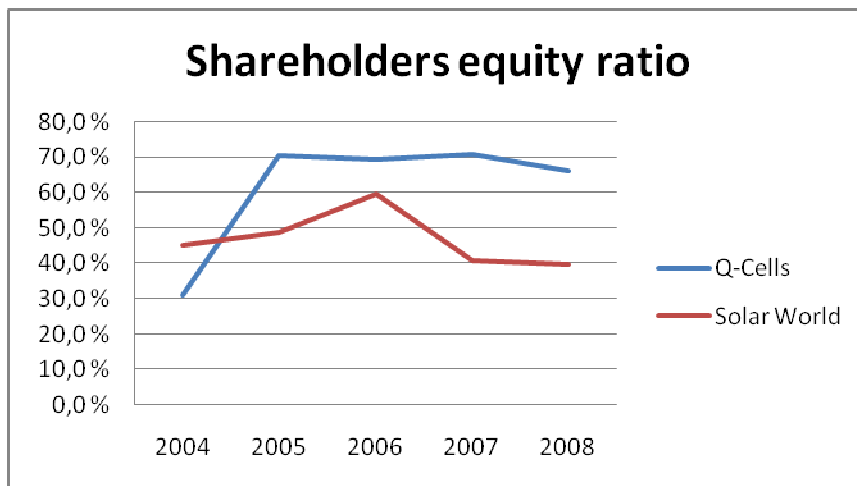
##### **4.4.1 Solidity**

The shareholder's equity ratio is a good measure to use in the comparison since it reveals the financial robustness of the companies and their future potential for further growth.

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<sup>61</sup> See Appendix 2

**Figure 4.10: Shareholder's equity ratio**



**Source: Own creation**

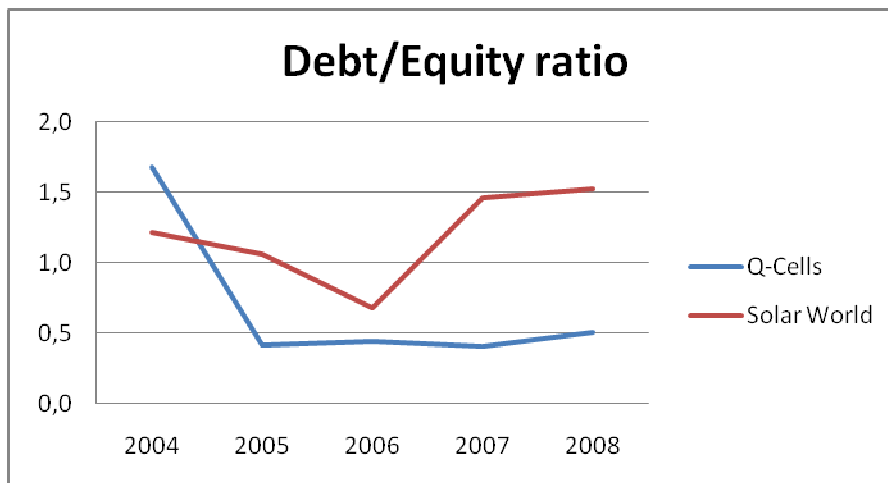
The shareholder's equity ratio comparison illustrates that during the past five years Solar Worlds' ratio has been between 40 % and 60 %, while Q-Cells' ratio has been above 60 % the last four years.

Both the companies has a high degree of equity ratio, which can be attributed to the great growth in the industry in general the past years, which again has lead to large investments in the companies, made possible through IPO's.

The high equity ratio is promising for future growth in the industry and is vital when increased costs and hard financial times is the reality for the next couple of years.

The debt/equity ratio and the interest coverage ratio are also key figures we want to employ to illustrate the solidity of the two companies.

**Figure 4.11: Debt/equity ratio**



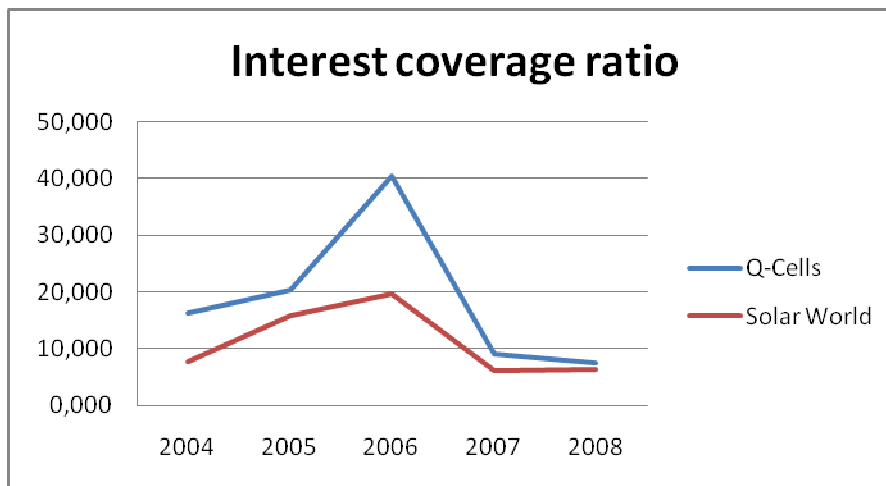
**Source: Own creation**

As the figure illustrates Solar World has decreased its debt/equity ratio, from a high of an excessive 1.5 in 2004, to a low in 2006 of approximately 0.7, ending up at around 1.2 in 2008. All in all it has decreased its debts relative to its equity since 2004 and the ratio today indicates the story of a solid corporation.

Q-Cells, in contrast to Solar World, has had a really low debt/equity ratio ever since 2004 and up to 2007, where it suddenly rose substantially, ending up at a high in 2008 of almost 1.7.

Rather than being alarming for the solidity, which still is at a satisfying level, it can be good news for the corporations' shareholders wanting a larger return on their investment by gearing up with some debt, as discussed previous in this section.

**Figure 4.3: The interest coverage ratio**



**Source: Own creation**

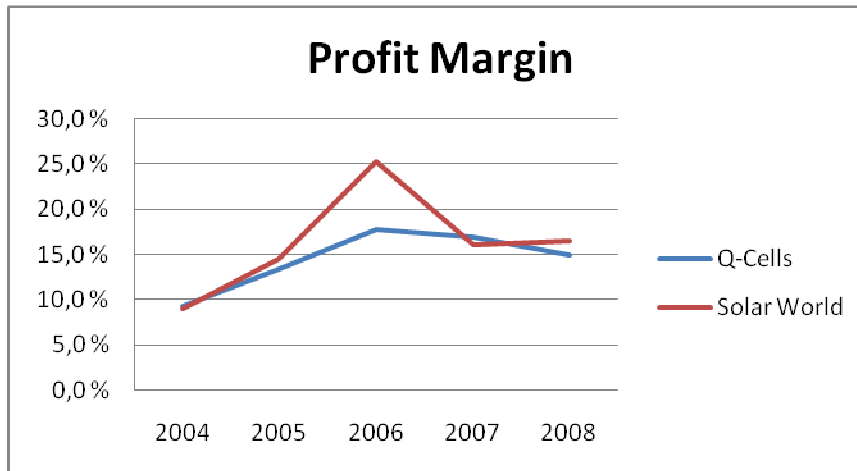
Q-Cells and Solar World have had quite similar developments in the interest coverage ratio, though at slightly different levels, as Q-Cells has a better coverage ratio than Solar World, which indicates that it can endure larger interest expenses than Solar World.

Worth noting anyway is that for both companies the coverage ratio has come significantly down from its high peaks in 2006, signaling that both corporations has taken on larger debts and thereby experienced larger interest expenses relatively to their EBIT.

#### **4.4.2 Profitability**

To compare the profitability we will use the profit margin and the return on total capital, and thereby see how the companies have performed the last five years relatively to each other.

**Figure 4.4: Profit Margin**

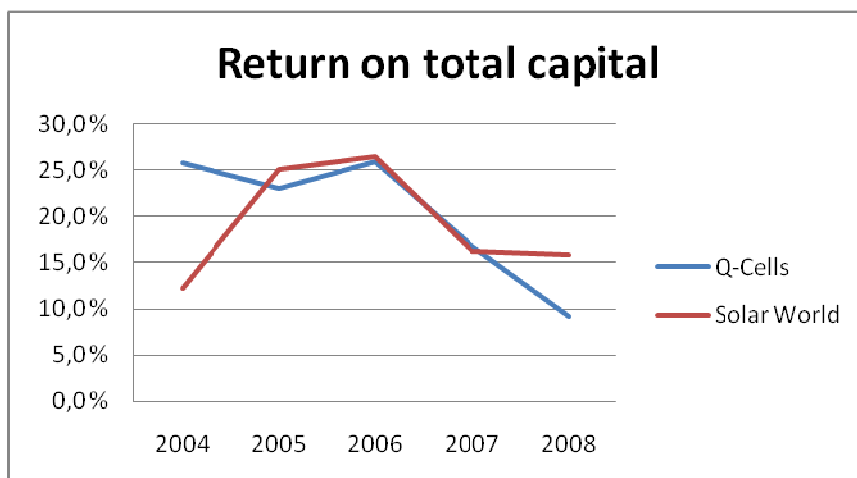


**Source: Own creation**

Solar World has during this period a slightly better profit margin than Q-Cells, especially in 2006, with a margin 7.6 percentage points better than Q-Cells. With the exception of 2006, they have been similar in this margin, so it is no crucial calling for Q-Cells.

It's worth mentioned that despite a production in 2007 of 200 MWp more than Solar World, Q-Cells margin dropped from 2007 to 2008, while Solar World's ratio increased in the same period. Hence, Q-Cells has not been able to take advantage of their economies of scale.

**Figure 4.5: Return on total capital**



**Source: Own creation**

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

The return on total capital has been falling since 2006 for both companies, however Solar World has managed a bit better than Q-Cells the last year, and the gap between them is critical for Q-Cells, since an investment in Solar World would give 6.6 percentage points higher return than an investment in Q-Cells.

Despite the fact that both companies have experienced an increase in sales, the return has been falling, which indicates that the industry is going through tougher times. The growth in costs are one of the main contributors to this, however the impact from the financial crises is prevailing with reduction in demand and a larger degree of uncertainty.

### **4.5 Conclusion**

The solidity of the company is irreproachable with a shareholder's equity ratio above 60 %.

The company could actually gear up its debts somewhat, in an effort to generate a larger return to its shareholders.

The profitability has been influenced by an increase in costs the recent years, so the profit margin, the return on capital and the ROCE has all experienced falling trends. This could also be attributed to the industry in general, as Solar World has experienced almost the same development.

Both companies are influenced by the financial crisis. Q-Cells' CEO expressed concerns in the 2008 annual report and the corporations' recently disposal of the entire stake in REC, along with further reduced sales estimates for 2009, do certainly witness of harder times.

The liquidity of the company has been strong and healthy for the whole period and the company has no problem in paying its short-term obligations.



## 5 Forecasting

The next step in the valuation of Q-Cells is to compose a forecasting budget for the years to come, by employing the findings from our strategic analysis and our financial analysis.

By forecasts we mean future expectations that are based on historical as well as current information and figures about the corporation.

In the same way as we have included a five year period in our financial analysis we will estimate figures for the next five years to come. The estimation period will therefore be from 2009 to 2013.

There are some central posts in the financial statements that are of specific relevance when it comes to forecasting:

- Net sales revenue
- Costs
- Financial posts
- Investments and Depreciation
- Taxes

Estimates of all these post are needed in the calculation of the forecasted income statement and the forecasted balance sheet, which will be presented in the end of the chapter.

### ***5.1 Forecasting of future sales***

Q-Cells' main products, solar cells, are sold to specialized solar module manufacturers, customers that are far smaller than Q-Cells.

Small companies could be more exposed to the financial crisis than larger companies, and the customers' ability to finance their purchase of solar cells could be weakened, at least in the near future<sup>62</sup>.

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<sup>62</sup> Q-Cells: "Q1 report 2009"

According to the news provider and internet forum *PV Industry Forum*, the dynamic expansion of production capacity within the PV industry has increased the availability of modules in the market, resulting in a reduction in prices and a shift from a seller's market to a buyer's market<sup>63</sup>, which will have impact on Q-Cells further sales growth.

On this background we believe that 2009 will be a tough year for the industry. Q-Cells has already lowered their production estimates for 2009 three times<sup>64</sup>, and currently the company believe in a total sale of somewhere between € 1.3 billion and € 1.6 billion for 2009, which corresponds to a growth rate of somewhere between 3.9 % and 27.9 % for 2009 compared to sales for 2008.

### 5.1.1 Markets

Q-Cells has in the period from 2004 until 2006 only reported their export rate of sales, and not specified from which markets the sales are born. However, from 2006 they started reporting sales per market, so from that year and on it is possible to say something about the development within the markets.

The markets are divided into the following regions; Germany, Europe, Asia, Africa and America.

#### Germany

Q-Cells' home country is the biggest individual country, with a sale of € 374.5 million in 2008, a growth of 10.83 % since the previous year.

The growth in sales in Germany has on average been 44.03%<sup>65</sup> during the last four years. The significant growth in sales from this region is due to the political conditions in Germany which has favored commitment to alternative energy.

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<sup>63</sup>[http://www.pvindustry.de/index.php?id=23&L=1&tx\\_ttnews\[tt\\_news\]=250&tx\\_ttnews\[backPid\]=2&cHash=9c158ad124](http://www.pvindustry.de/index.php?id=23&L=1&tx_ttnews[tt_news]=250&tx_ttnews[backPid]=2&cHash=9c158ad124)

<sup>64</sup> <http://www.forbes.com/2009/05/12/solar-qcells-germany-markets-equity-energy.html>

<sup>65</sup> See appendix 1

Germany are the market leaders within PV technology, and is expected to receive the goal of Grid Parity within 2012, therefore we estimate the German market as a strong market in the future, despite the current financial turbulence.

### **Europe**

Europe is Q-Cells largest market, with the single countries Spain, France, Italy, Czech Republic, Cyprus, Greece, Bulgaria and Portugal, being the countries with greatest potential. Bulgaria and Czech Republic have grown from a low base and are showing good potential, while France, Greece and Italy have potential due to their attractive conditions for renewable energy sources.

Spain was their second largest market until 2008, but a significant fall in sales have now made Italy the second largest individual market, only exceeded by Germany.

The drop in sales in Spain recently is due to the Spanish government's reduction in incentives schemes to the PV-industry. From being a country in strong growth they have now expected the industry to be able to go on without too many subsidies<sup>66</sup>.

The debate is going on in Europe of whether or not this is the right action, and several voices are complaining that this is not the right way to ensure continued growth in the PV industry, even though it has grew significantly and should be able to be more independent of governmental subsidies. The fear is now that Italy is going to suffer the same destiny as Spain when their growth has reached a high level<sup>67</sup>.

Ernesto Macías, president of the European Photovoltaic Industry Association (EPIA) claims that PV providers are working on cost cutting efforts, but without further growth, through continued government incentives, they will not make it<sup>3</sup>, as the growth in Europe is still to a large extent dependent on subsidies from the governments.

Especially Spain, but also Italy, is an important country for Q-Cells, as the company has a great deal of subsidiaries in those areas. So government regulation in these areas will therefore impact Q-Cells sales.

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<sup>66</sup> <http://www.semiconductor.net/article/CA6591790.html>

<sup>67</sup> [http://www.pv-tech.org/editors\\_blog/\\_a/is\\_italy\\_the\\_next\\_spain/](http://www.pv-tech.org/editors_blog/_a/is_italy_the_next_spain/)

### Asia

Asia had a great growth in sales from previous years' € 54.2 million to € 172.4 million in 2008, a growth of 218 %, mainly driven by the regions' greatest market, India, but also to some extent South Korea.

Other significant players in this region are China, Malaysia and Japan, which also have shown positive tendencies for the future. The Chinese government has for instance carried out an incentive system for its PV industry<sup>68</sup>.

Asia among the other sales regions experienced a drop in sales of the first quarter for 2009, a reduction from 11.8 % to 7.3 % compared to last year's Q1, which mainly is due to a drop in sales in India and China.

### Africa

The geographical location of Africa makes it very attractive for solar cell installations, and the sales within the region grew from 2006 to 2007. However, the market of the large continent experienced a drop in sales in 2008, but it has been followed by an increase in sales in the first quarter of 2009.

### America

Q-Cells has several subsidiaries in America and promising projects in action. The sales have been increasing the past three years, and America is one of the markets with greatest potential.

There are two factors which can trigger the sales; the *Investment Tax Credits* and the stimulus packages passed by Congress, which is helping the deployment of PV products. According to a report from the United States Department of Energy the lowest estimates for the global PV demand was 6 GWp in 2010<sup>69</sup>.

This support our estimates of a strong growth in market share for Q-Cells within this market.

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<sup>68</sup> <http://www.renewableenergyworld.com/rea/news/article/2009/03/china-announces-new-solar-incentives>

<sup>69</sup> [http://www.eere.energy.gov/solar/solar\\_america/pdfs/solar\\_market\\_evolution.pdf](http://www.eere.energy.gov/solar/solar_america/pdfs/solar_market_evolution.pdf)

### Sub conclusion

According to Q-Cells, it expects a boom in China, India and USA, and a decline in the European markets' relative significance. So far the expectations of a boom in China, India and USA have not been redeemed, when all three countries have shown a drop in sales first quarter 2009.

We believe 2009 is going to be a setback, and this is supported by forecasting's provided by the news center Greentech media, which claims that the industry market size will contract 15 % to \$ 12 billion in 2009, which will be the weakest growth year since 1994<sup>70</sup>. Based on this and the reports of sales in the first quarter of 2009 we believe the growth in revenues for 2009 to be low.

A future decline in growth in sales for Q-Cells could also be influenced by the growth in alternative energy sources in general, especially within wind-energy and bio-energy. Further will a reduction in governmental subsidies to the PV industry slow down the growth; however this is not likely to happen in the near future in Germany.

Increased competition in the industry could also have negative impact, however, we believe Q-Cells will handle this due to the high quality of their products, and the bad start on 2009 does not necessarily reflect the rest of the year or the years to come.

The production capacity and the price of Q-Cells' products are significant factors for further growth in the corporation's sales. The production capacity has been growing tremendously since the startup in 2002, with an average of 107.4 % growth per year<sup>71</sup>.

The price of crystalline solar cells are expecting to decline in the near future, however, the price on the raw material, silicon, is expected to decline too<sup>72</sup>. This will work preventive and ease the reduction of the contribution margin in the sale of crystalline solar cells, as raw material is by far the largest expense of production.

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<sup>70</sup> Internet newspaper, Reuters 3 th of March 2009 :” Greentech Media Forecasts PV Industry Market Size Will Contract 15% to \$12B in 2009

<sup>71</sup> Q-Cells: “Annual report 2008”

<sup>72</sup> <http://www.greentechmedia.com/articles/read/new-energy-finance-predicts-43-solar-silicon-price-drop-1288/>

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Q-Cells has several contractual commitments of further expansion of their production capacity. In addition, it is claimed that the market share of thin-film modules will rise up to around 25 % within 2010, from the current level of approximately 10 %<sup>73</sup>, and promising prospects for thin-film modules is beneficial for Q-Cells, as the corporation is well positioned in this segment.

The increase in market share of thin-film modules will therefore make Q-Cells increase sales rather than reduce it.

The financial crisis has not changed the fundamentals of the PV industry and we believe that Q-Cells will work its way through this poor conjuncture due to their economies of scale, high quality on their products and strong efforts on cost reductions, while price pressures will force uncompetitive companies out of the industry<sup>74</sup>.

We estimate the growth for 2009 to be 3.89 % which corresponds to a sale of € 1.3 billion, in line with the lowest estimate Q-Cells operates with in its 2009 first quarter report.

The growth in sales for 2010 is estimated to be 10 % from 2009E, we believe that sales will start to make it up from 2009, nevertheless due to contractual sales this year of 547 MWp.

From 2011 to 2013 we estimate the growth rate to increase up to an average of 12 % annually and this is based on the expected development in the different sales markets mentioned earlier and the events mentioned below.

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<sup>73</sup> [http://pvindustry.de/index.php?id=23&L=1&tx\\_ttnews\[tt\\_news\]=250&tx\\_ttnews\[backPid\]=22&cHash=160839d175](http://pvindustry.de/index.php?id=23&L=1&tx_ttnews[tt_news]=250&tx_ttnews[backPid]=22&cHash=160839d175)

<sup>74</sup> Internet newspaper, Reuters 3 th of March 2009 :” Greentech Media Forecasts PV Industry Market Size Will Contract 15% to \$12B in 2009...”

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- The Grid parity is expected to be achieved in at least 5 % of the European electricity market within 2012.
- The contractual sales have a total output of 3,847 MWp until 2019.
- The expansion of Q-Cells international increased capacity of 150 MWp just in 2008.
- The EEG's goal of making the share of renewable energies at least 27 % of total electricity generation by 2020 in Germany.
- In 2008 the worldwide capacity of installed solar power nearly doubled to 4 GWp and with a world market share of 20 percent Germany maintains its high levels of capacity and its position among the market leaders.

When determining the terminal value, we calculated the average growth in GDP for countries within the OECD in the period of 1971 until 2006. The average annually growth rate was 2.95 %<sup>75</sup>, which can work as a roof for our estimation of terminal value.

In the long-term it is not usual that a company has a higher growth than the GDP. We are therefore estimating Q-Cells future growth rate to be 3.5 % from 2013. The estimates are illustrated below.

**Table 5.1: The forecasting of growth in sales**

	2008	2009E	2010E	2011E	2012E	2013E
Sales (million €)	1 251,3	1 300,0	1430	1601,6	1793,8	2009,0
Growth in %	45,69	3,89	10,00	12,00	12,00	12,00

**Source: own creation**

## 5.2 Costs

In order to calculate and estimate the net income from operating activities we need to calculate and estimate the relevant costs as well.

In Q-Cells' consolidated income statement there are many specified costs. We have chosen to focus on the production costs, in which we include the cost of materials and personnel expenses, and the sales- and distribution costs, which are two of many posts included in Q-Cells' other operating expenses.

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<sup>75</sup> OECD: "Economic Outlook No. 84 – 2008"

For the rest of the expenses under other operating expenses we make no comments or estimates, other than calculating the average of the previous years and adjust the total with the estimates we do make and comment on in the section to come.

The reason we choose to focus on the specific costs, like we do, instead of other costs, is that we believe to have the necessary prerequisites, through our previous analysis, to make well-stated reasons for the estimates of these costs, which we do not necessarily have for the other costs.

### **5.2.1 Production costs**

#### **Introduction**

Ever since the beginning of our period of analysis Q-Cells' has had a stated goal of reducing production costs through the optimization of production processes and technologies, and minimize the use of raw materials, and especially the consumption of silicon.

The corporation has therefore expressed that it will make constant efforts towards a leading position in its industry on costs and has made it an important part of its strategy. As a result of the corporations' focus on costs it expects the goal of grid parity to be reached, to some extent at least, meaning 5 % of the European electricity markets, within 2012.

#### **Material expense**

Q-Cells states that its main cost item is material expense and that this comes from the procurement of wafers<sup>76</sup>. There are reasons to believe that the cost of materials will be less in the years to come.

A research company in the field of renewable energy, called New Energy Finance, claims that the price of solar silicon, which is silicon used in the production of wafers, on contract, is likely to drop with 67 % by 2013 in comparison with 2008 prices<sup>77</sup>.

The company also found that the median price for contracted polysilicon for delivery in 2009 is 43 % lower than the median price for contracted deliveries in 2008.

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<sup>76</sup> Q-Cells: "Annual Report 2005"

<sup>77</sup> <http://www.greentechmedia.com/articles/read/new-energy-finance-predicts-43-solar-silicon-price-drop-1288/>



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This view is backed by a report that focuses on how the supply of silicon, the raw material that has been in shortage the last years, will develop.

According to the Prometheus Institute, a specialized provider of information within PV and solar energy, the supply of silicon will reach as much as 261.742 metric tons within 2012, more than five times as much as what was produced worldwide in 2007, more than ending the shortage and thus decreasing the price significantly<sup>78</sup>.

We support the view that prices on raw material will decrease and that it will decrease the most from 2008 to 2009.

The case is, however, that Q-Cells already has made some purchase contracts with suppliers.

With Elkem Solar, from which it has agreed to buy certain quantities of metallurgical silicon until 2018, the price for the year 2009 quantities is fixed, for 2010 and 2011 half of the quantities are fixed and half are negotiable and depends on the market price, and for 2012 and 2013 all quantities are negotiable on price and will depend on the market price<sup>79</sup>.

The corporation has also made contracts with Bécancour Silicon Inc. and LDK Solar, until 2013 and 2018 respectively, and while the terms of these contracts are not specified in Q-Cells' annual reports, we bear in mind in our forecasting that Q-Cells cannot fully take advantage of price falls on silicon in the years from 2009 to 2013.

In order to sustain the estimated sales figures that we believe are credible, total output must increase in percentage more than sales, since reduced silicon prices will yield reduced solar cell prices as well, giving less revenue for the same amount of solar cell output as previously.

We have taken this into consideration and developed calculations on the cost of materials in relevance to the produced output to assist the estimates of cost of materials. Our estimates are illustrated in the table below and the calculations behind it are showed in the appendices.

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<sup>78</sup> <http://www.greentechmedia.com/articles/read/new-research-predicts-end-to-silicon-shortage-1055/>

<sup>79</sup> Q-Cells: "Annual Report 2007"

**Table 5.2: Cost of materials**

	2008	2009E	2010E	2011E	2012E	2013E
Cost of materials (million €)	895,6	830	890	930	950	1,000
Growth in %	67,56	-7,32	7,23	4,49	2,15	5,26

**Source: own creation**

### **Personnel expense**

Personnel expenses are also significant parts of the production costs and it consists of wages and salaries, social security contributions and expenses for pensions, and expenses relating to stock options.

Statistics show that the growth in personnel expense has been on an average of 69 % since 2004, while the growth in employees has been on an average of 83 % in the same period.

**Table 5.3: Personnel expense**

	2004	2005	2006	2007	2008	Average
Personnel expense in relation to sales	12,2812	28,1158	43,4622	66,4	93,1	
Growth in %	9,54	9,39	8,06	7,73	7,44	8,432

**Source: own creation**

Total personnel expenses, in relation to sales, have been rather stable with an average of 8.43 % in the period from 2004 to 2008, and we will employ that figure in our estimation.

### **5.2.2 Sales costs**

Costs related to sales, posted as selling expenses under other operating expenses in Q-Cells income statement, have for the last three years, 2006, 2007 and 2008, changed very little, with a high of € 3.7 million and a low of € 3.6 million. This is even though sales have increased significantly each of the last three years.

This reflects, according to our understanding, the excessive demand that has taken place during these last three years, demanding less effort from Q-Cells to acquire customers for their products. Part of the conclusion is that decreased demand gives increased selling expenses.

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

However, from 2004 to 2005, selling expenses increased significantly, from € 0.5 million to € 2.1 million. It also increased quite significantly from 2005 to 2006, ending at € 3.6 million.

This period also had the sharpest increase in sales, illustrating in our opinion that the sales expenses also relates to the sales volume, making the other part of the conclusion that increased sales gives increased sales costs.

We therefore believe that with a reduced relative demand for solar cells, demand relative to supply that is, caused by different factors previously discussed, more efforts, and thus money, must be put into sales and the expenses increases.

As demand is expected to increase again, from late 2010 and early 2011, sales costs are expected to decrease again. This will, however, be offset by the fact that sales volumes will increase as well.

On the basis of these discussions our estimates are illustrated in the table below.

**Table 5.4: Sales expenses**

	2008	2009E	2010E	2011E	2012E	2013E
Sales expenses (in million €)	3,70	6,00	7,00	9,00	11,00	13,00

**Source: own creation**

### **5.2.3 Distribution costs**

Costs related to the distribution of goods, called freight costs in Q-Cells' income statement, have had a steady increase, along with the sales volumes and produced output, which we believe it is related to, and gone from a low of € 0.57 million in 2004 and increasing each year to a high of € 2.7 million in 2008.

Since we believe that the distribution costs are closely linked to the sales volumes and produced output the forecasts are based on the percentage increase in those posts (from which the calculations can be seen in the appendices) and is illustrated in the figure below.

**Table 5.5: Distribution costs**

	2008	2009E	2010E	2011E	2012E	2013E
Freight costs (million €)	2,7	3	3,5	4,5	5,7	7,2

Source: own creation

### **5.3 Financial posts**

Financial posts include income from financial assets, income from the sale of shares and net finance results and they all affect the income before tax.

#### **Income from financial assets**

Income from financial assets accounted for using the equity method contains of income attained from associated companies and joint ventures. Ever since 2006 Q-Cells has had positive net contributions from those assets and in 2008 six different corporations were accounted for in the income statement.

All corporations, associated and joint ventures, has been presented in part two of our thesis. In relevance to the estimation of future contributions it is important to focus on the corporations' core competences and the future demand for their products and as a starting point for the estimation we also look at the corporations expected output capacity for 2009.

The result from Q-Cells associates and joint ventures in 2008 was very much affected by an income of € 52.3 million from REC, but in May 2009 Q-Cells sold its entire share in the company, so with the exception of the result from the sale of its' shares and the large negative income contribution of € 382 million already made in the first quarter of 2009, REC will not contribute to Q-Cells income anymore.

Q-Cells' joint venture Solibro and associate CSG Solar are both companies within the thin-film technology. This segment shows promising results and Q-Cells expects to have a production capacity of around 250 MWp at the beginning of 2010<sup>80</sup>.

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<sup>80</sup> Q-Cells: "Q1 report 2009"

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We have estimated positive contributions from both companies from the year 2010 and 2011 and throughout our estimation period. The largest contributions do we believe will come from Solibro, which is expected to have a larger production capacity than CSG Solar, and which by now also has better technology.

The three other corporations are more traditional in the sense that they produce and sell crystalline solar cells, in comparison with the majority of Q-Cells' business. Their estimations are based much on expected production capacity and previous achievements.

The estimations for the associates and joint ventures are illustrated below.

**Table 5.6: Joint ventures and associated corporations (in million €)**

		2008	2009E	2010E	2011E	2012E	2013E
Associated	REC	52,3	-382,3	0	0	0	0
	CSG Solar	-7,5	-5	0	5	5	5
	The Solaria Corp.	-8,5	-6	-1	4	4	4
JV	Sovello	5,6	7	12	15	15	15
	SilQ PV Energy	2,7	3	6	8	8	8
	Solibro	-10,1	-5	2	10	12	12

**Source: own creation**

This gives the following estimates on the income from financial assets accounted for using the equity method:

**Table 5.7: Income from financial assets**

	2008	2009E	2010E	2011E	2012E	2013E
Income financial assets (million €)	34,5	-388,3	19	42	44	44
Growth in %	225,47	-1225,51	104,89	121,05	4,76	0

**Source: own creation**

### Income from the sale of shares

The corporation also sold off some shares in REC in 2007, making a profit from sale of shares of € 44 million. These to events are the only ones that have occurred under this financial post. In the years to come we therefore believe in no gains or losses from the sale of shares.

### **Net finance results**

Q-Cells' net finance results include interest and similar income, interest and similar expense and results from financial instruments.

Over the period from 2004 to 2008 the net finance result has varied significantly and shows no specific trend in either way. It shows, however, rather small negative results for 2004 and 2005, € 1.3 million and € 1.5 million respectively, and a rather small positive result for 2006 of € 1.6 million.

In 2007 a rather large negative net finance result of € 41.8 million was reported. The two main expense contributors to this were the loss on REC put options of € 36.4 million and the interest expense of € 20.9 million on the convertible bond of € 492.5 million the corporation took on in the beginning of 2007.

In 2008 a negative net finance result of € 14.4 million was reported and the main expense contributor to this was the interest expense of € 26.1 million on the convertible bond.

Our estimation of the net finance results is based on the assumption that interest and similar income and interest and similar expense not will change much throughout our estimation period. It is also based on the assumption that large positive or negative contributions from options not will occur, as previously, now that the shares in REC are sold off.

There is one exception though. With the funds attained from the sale of the entire REC holding Q-Cells made a large repayment on a drawdown of its syndicated credit facility, decreasing its interest expense in 2009 with up to € 20 million<sup>81</sup>. This will of course enhance the net finance result significantly for that year.

The following table illustrates our beliefs of the future net finance results.

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<sup>81</sup> Q-Cells: "Q1 Report 2009"

**Table 5.8: Net finance result**

	2008	2009E	2010E	2011E	2012E	2013E
Net finance result (million €)	-14,4	10	-2	-2	-2	-2
Growth in %	65,55	169,44	120	0	0	0

**Source: own creation**

## ***5.4 Investments and Depreciation***

The post investment is classified by capital expenditure on property, plant and equipment (PPE), acquisitions of equity investments and acquisitions of operations. Capital expenditure therefore works as a good indicator on the level of investments, which has increased significantly, especially the last two years.

The financial turbulence in the market will have impact on the level of capital expenditure, as indicated in the end of 2008 and strengthened by the first quarter report from 2009.

Q-Cells stated in the report that it has made efforts in adjusted the planning of the production capacity, concentrated the capital expenditure program to the core divisions, renegotiated supply agreements and considerably intensified the cost-reduction efforts.

Further it is natural that a company operates with high levels of investments in growth periods. However, due to the present financial turbulence and the corporations' large investments previously, we believe in a decrease in the investments in the years to come.

We further believe that the level of investments will pick up the paste again, because of the great potential for further growth in the PV industry, and we forecast that it will happen from 2011.

A company cannot grow on forever, therefore we find it right to believe that the level of investments will decrease from 2013.

**Table 5.9: Capital expenditure**

	2009E	2010E	2011E	2012E	2013E
Total capital expenditure including investments in financial assets	145,06	193,13	297,45	368,69	441,45

**Source: own creation**

The depreciation of the intangible assets and the PPE has developed in line with the increase in investments. The depreciation ratio, which can be found by dividing total depreciation on PPE and intangible assets, has been fluctuating between 6.15 % and 10.94 % the last five years.

It is important to notice however that some of the assets will start to be amortized in the future, in 2008 those assets were related to the Calyxo technology and VHF Technology, which will start to be amortized when they are commissioned.

Calyxo is expected to be commissioned during the year and we believe the same will happen with the VHF Technology, since it already produced MWp during the first quarter of 2009.

Goodwill is not amortized on a scheduled basis, but subjected to an impairment test annually. It has so far not been any change in goodwill due to amortization, so we will assume the same for the forecasting.

We believe that the depreciation will make it up to an average of 7.5 % period of the intangible assets and PPE, in the forecasting period, a number that is adjusted for an increase in depreciation and amortization, when Calyxo and VHF technologies are commissioned

## **5.5 Taxes**

The corporation tax rate has fallen from 25% to 15% from 2007 to 2008.

**Table 5.10 Income tax rate**

	2004	2005	2006	2007	2008
Income tax rate in %	33,08	33,38	30,58	30,51	<b>16,83</b>

**Source: own creation**



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It is hard for an external person to predict the further tax rate for a company, therefore are we relying on a future income tax rate of 16.83 % in the years to come, which is slightly higher than the stated 15 % corporate tax rate.

### 5.6 The Estimated Future Income statement and Balance sheet

Based on the above discussion and estimation of selected financial income posts, we have developed the future income statement and the future balance sheet.

In the left column there are notes to the calculations of the specific posts, which is located in the appendix 3.

**Table 5.11: Future income statement and balance sheet**

Notes	Estimation of income statement in millions €		2009E	2010E	2011E	2012E	2013E
1	Sales revenues	1 251,30	1 300,00	1 430,00	1 601,60	1 793,79	2 009,05
1,2-1,4	Cost of production	(938,20)	(923,62)	(994,58)	(1 049,05)	(1 085,25)	(1 153,40)
	<b>Contribution margin</b>	<b>313,10</b>	<b>376,38</b>	<b>435,42</b>	<b>552,55</b>	<b>708,54</b>	<b>855,64</b>
3	Other operating income	44,10	82,95	91,25	102,20	114,46	128,20
4	Depreciation and amortization	(45,70)	(52,37)	(62,70)	(75,25)	(90,29)	(108,35)
2 - 2.1	Other operating expense	(106,40)	(206,40)	(248,38)	(298,76)	(358,81)	(430,03)
	<b>Net income from operations</b>	<b>205,10</b>	<b>200,57</b>	<b>215,58</b>	<b>280,75</b>	<b>373,90</b>	<b>445,46</b>
	Financial income	52,40	(526,80)	19,00	42,00	44,00	44,00
	Financial costs	(32,30)	(14,40)	(5,00)	(2,00)	(2,00)	(2,00)
	<b>Income before taxes</b>	<b>225,20</b>	<b>(340,63)</b>	<b>229,58</b>	<b>320,75</b>	<b>415,90</b>	<b>487,46</b>
5	Income taxes	(37,90)	-	(38,64)	(53,98)	(70,00)	(82,04)
	<b>Net income</b>	<b>187,30</b>	<b>(340,63)</b>	<b>190,95</b>	<b>266,77</b>	<b>345,90</b>	<b>405,42</b>

	The Balance sheet in millions of €						
	<b>Assets</b>						
	<b>NON-CURRENT ASSETS</b>						
11	Goodwill	3,80	4,03	4,18	5,02	6,02	7,22
4	Intangible assets	48,40	51,14	52,50	63,00	75,60	90,72
4	Property, plant and equipment	664,60	702,18	720,86	865,03	1 038,04	1 245,65
16	Financial assets	1 125,00	145,40	245,45	300,45	378,19	470,49
6	Other non-current assets	247,50	250,00	242,00	232,00	220,00	206,00
	<b>Total non-current assets</b>	<b>2 089,30</b>	<b>1 152,75</b>	<b>1 264,99</b>	<b>1 465,50</b>	<b>1 717,84</b>	<b>2 020,08</b>
	<b>CURRENT ASSETS</b>						
1.3	Inventories	216,8	300,47	316,47	332,47	348,47	364,47
12	Trade account receivable	181,2	179,00	196,90	220,52	246,99	276,63
7	Cash and cash equivalents	347,8	360,30	477,64	501,87	548,11	602,27
	<b>Total current assets</b>	<b>745,8</b>	<b>839,77</b>	<b>991,01</b>	<b>1 054,87</b>	<b>1 143,57</b>	<b>1 243,37</b>
	<b>TOTAL ASSETS</b>	<b>2 835,10</b>	<b>1 992,52</b>	<b>2 256,00</b>	<b>2 520,36</b>	<b>2 861,41</b>	<b>3 263,45</b>

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8	Equity and Liabilities						
	SHAREHOLDER'S EQUITY						
	Subscribed capital	113,50	114,50	115,50	116,60	117,50	118,50
	Capital reserve	1 733,50	1 192,14	1 383,08	1 649,85	1 995,75	2 401,17
	Minority interest	29,70	28,40	28,40	28,40	28,40	28,40
	<b>Total</b>	<b>1 876,70</b>	<b>1 306,64</b>	<b>1 526,98</b>	<b>1 794,85</b>	<b>2 141,65</b>	<b>2 548,07</b>
9	NON-CURRENT LIABILITIES						
	Convertible bond	422,20	427,30	435,00	440,00	445,00	450,00
	Deferred investments grants and subsidies	88,40	86,00	80,00	72,00	64,00	54,00
	Other non-current liabilities	61,10	-	32,00	30,00	28,00	26,00
	<b>Total</b>	<b>571,70</b>	<b>513,30</b>	<b>547,00</b>	<b>542,00</b>	<b>537,00</b>	<b>530,00</b>
14 10	CURRENT LIABILITIES						
	Current financial liabilities	226,80	-	12,00	14,00	16,00	18,00
	Trade accounts payable	79,70	93,27	100,02	104,51	106,76	112,38
	Other current liabilities	80,20	79,30	70,00	65,00	60,00	55,00
	<b>Total</b>	<b>386,70</b>	<b>172,58</b>	<b>182,02</b>	<b>183,51</b>	<b>182,76</b>	<b>185,38</b>
	<b>TOTAL EQUITY AND LIABILITIES</b>	<b>2 835,10</b>	<b>1 992,52</b>	<b>2 256,00</b>	<b>2 520,36</b>	<b>2 861,41</b>	<b>3 263,45</b>

**Source: own creation**

From the estimations we can see that year 2009 will have significant impact on the company, especially due the sale of all the shares in REC, but also because the growth in revenues are reduced compared to earlier.

The sale of REC also contributes to a reduction in the liabilities since € 360 million of the funds from the sale is used on erasing debt.

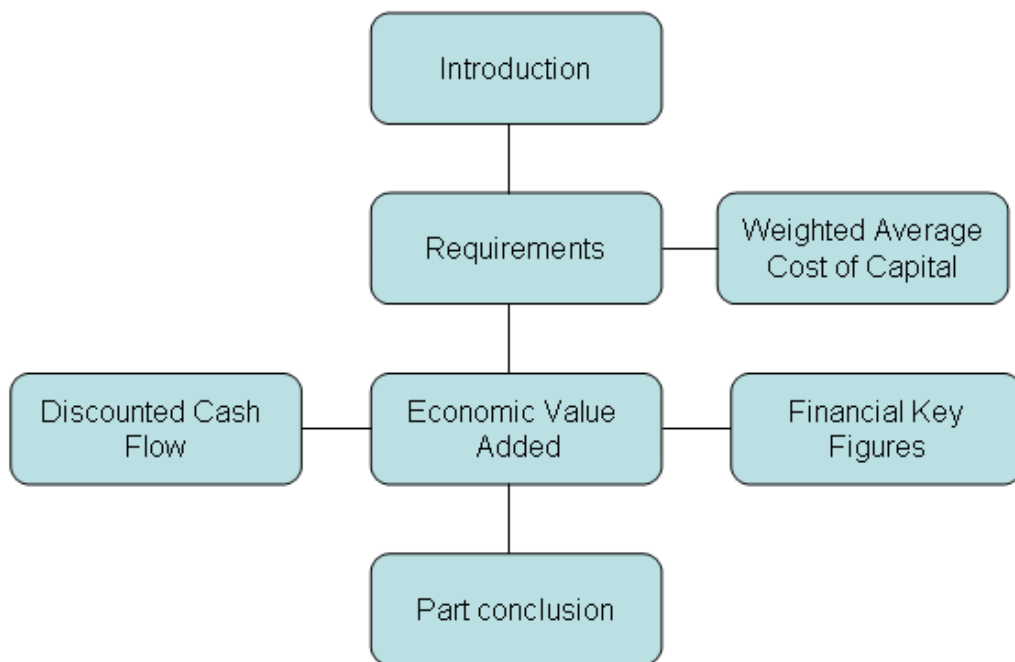
From 2010 we can see that the company is improving, and they continue to do so in the rest of the period, which is in line with the future strategic outlook for the company.

## 6 Valuation

### 6.1 Introduction

The figure below is an overview of the structure and framework we deploy in our valuation chapter.

**Figure 6.1: Overview of valuation chapter**



**Source: own creation**

## 6.2 Requirements of the valuation models

### 6.2.2 Weighted Average Cost of Capital

#### Introduction

The critical part of the valuation is the estimation of the corporations' capital cost, the so-called Weighted Average Cost of Capital (WACC).

The return from the corporations' operating activities is discounted with the cost of capital that reflects the risk of the returns, and the estimation of the WACC can be summed up in the following formula:

$$WACC = r_d(1 - T_c) \frac{D}{V} + r_e \frac{E}{V}$$

where;

$E$  = market value of the equity

$D$  = market value of net interest-carrying debt

$V$  = market value of net operating activities

$r_e$  = owners' required rate of return

$r_d(1 - T_c)$  = costs of debt after tax

The formula shows that the owners' required rate of return is a weighted average of the owners' and lenders' required rate of return, where the weights is defined by the relative value of equity and net debt in relation to the total value of the corporation.

#### Capital structure

In the determination of the capital structure market values of the equity and debt should be deployed. This constitutes a problem, however, since the market values not yet are known. In fact, arriving at the market value is the main purpose of the entire valuation.

## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

The problem is often solved by making a rough estimate of the long-term capital structure, which is not necessarily like the actual structure for the time being, but is more of an estimate of the structure the corporation through continuous rebalancing aims towards<sup>82</sup>.

To get as correct estimates as possible, it is recommended to employ market values on the debt and on the equity. The market value on equity is rather straight-forward to calculate on companies with stable growth with shares that are traded daily on a stock exchange; we could in that case just use the stock price to determine the value.

Q-Cells however is a company with strong growth the past years, and it will therefore not be correct to employ historical figures, since it is not likely that the growth will continue forever, and we therefore need an estimate.

Estimating the market value on debt is not as easy as estimating the value on equity, since it is not traded in the market. To determine the future capital structure for Q-Cells, we have therefore employed the forecasted book value of both debt and equity.

The average of the forecasted period was an equity ratio of 70.6 % and a debt ratio of 29.4 %. We believe the average equity ratio to be too high to employ as a terminal value for the future however, as we expect Q-Cells to take on more debt within the next years, so we have decided to use an estimate of 67 % on the equity ratio and 33 % on the debt ratio.

**Table 6.1: Estimation of capital structure**

	<b>2008</b>	<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
Equity	1876,7	1306,6	1527,0	1794,8	2141,7	2548,1
Debt	958,4	685,9	729,0	725,5	719,8	715,4
Total assets	2835,1	1992,5	2256,0	2520,4	2861,4	3263,4
Equity ratio	66,20 %	65,60 %	67,70 %	71,20 %	74,80 %	78,10 %
<b>Average Equity ratio</b>	<b>70,60 %</b>					
Debt ratio	33,80 %	34,40 %	32,30 %	28,80 %	25,20 %	21,90 %
<b>Average Debt ratio</b>	<b>29,40 %</b>					

**Source: Own creation**

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<sup>82</sup> Elling, Jens O. And Sørensen, Ole: ”Regnskabsanalyse og værdiansættelse”

### Estimation of capital costs on debt

According to Investopedia the cost of debt is the effective rate that a company pays on its current debt. A company will however use various bonds, loans and other forms of debt, so it is crucial to employ a good estimate on the average cost of debt<sup>83</sup>.

The costs of borrowing can also be found by calculation in accordance with the following formula:

$$R_d = (r_f + r_s)(1 - T_c)$$

where;

$r_f$  = risk-free interest rate

$r_s$  = company-specific risk added

$(1 - T_c)$  = company tax rate

Theoretically, the risk-free interest rate equals the rate of return on zero-coupon obligations, where there is no risk of bankruptcy or re-investments, and where the time-horizon matches with each of the returns that are to be discounted.

In real life however, it is recommended to use the 10-year government bond as an estimate of the risk-free rate<sup>84</sup>. According to data collected from Thomson Datastream, the interest rate of a 10-year zero-coupon bond in Germany as of 17 June 2009 is 3.47 %.

Q-Cells' company-specific risk added, the additional risk that the bank charges when lending to the company, is hard to measure from an external viewpoint, it could, however, be possible to measure it if credit ratings were available on Q-Cells, but we have failed to find any.

We have therefore found it necessary to calculate Q-Cells' cost of debt with figures from the annual reports.

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<sup>83</sup> <http://www.investopedia.com/terms/c/costofdebt.asp>

<sup>84</sup> Elling, Jens O. And Sørensen, Ole: Regnskabsanalyse og værdiansættelse

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Q-Cells does not state their interest rate on debt, so we find the estimate by dividing interest expense on interest carrying debt. According to Brealey, Mayers & Allen the latest up-to-date interest rate should be employed<sup>85</sup>, we will therefore focus on figures from the annual report of 2008.

From Q-Cells notes in the annual report we make the assumption that the interest carrying debt are the post; *liabilities to banks* and *other liabilities*. A major part of the debt is also the convertible bond, so we have to employ that as well. Even though these debt classes are not the same, we find it correct to employ them together in the calculation of cost of debt, since we believe it is the only common measurement on the total cost of debt for Q-Cells.

The convertible bond is specified with several values, but we use the book value of 31.12.2008 in our calculations. The calculation of cost of debt is based on the following figures:

**Table 6.2: Interest carrying debt**

<b>31.12.2008</b>	<b>Million €</b>
Convertible bond	422,2
Liabilities to banks	222,5
Other liabilities	12,1
<b>Total interest carrying debt</b>	<b>656,8</b>

**Source: own creation**

The calculation was conducted in the following manner:

$$R_d = \frac{\text{Interest and similar expense}}{\text{Total interest carrying debt}} = \frac{\text{€ 32.3 million}}{\text{€ 656.8 million}} = 4.918 \%$$

The average interest rate of German banks was 4.895 % during 2008<sup>86</sup>, hence is the estimate of 4.918 % for Q-Cells cost of debt a reliable estimate.

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<sup>85</sup> Brealey, Richard A., Myers, Stewart C, and Allen, Franklin, "Corporate Finance"

<sup>86</sup> [http://www.bundesbank.de/statistik/statistik\\_zeitreihen.en.php?graph\\_diff=relative&graph\\_begin=2008&graph\\_end=2008&open=zinsen&func=row&tr=sud119&showGraph=1](http://www.bundesbank.de/statistik/statistik_zeitreihen.en.php?graph_diff=relative&graph_begin=2008&graph_end=2008&open=zinsen&func=row&tr=sud119&showGraph=1)

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

The financial crisis has contributed to a reduction in the interest rate, and we have therefore reason to believe that it will drop in year 2009E and perhaps 2010E. We further believe that the interest rate will pick it-self up again in the years after that, so we have found it reasonable to estimate the cost of debt to 5.15 %.

With a risk free rate of 3.474 % the company-specific risk added can be calculated to 1.676 %, which we believe is a reasonable figure for a corporation like Q-Cells.

### **Estimation of owners' required rate of return**

In the estimation of the owner's required rate of return it is recommended to use the Capital Asset Pricing Model (CAPM)<sup>86</sup>.

Under the assumption that investors requires a compensation, a premium, for taking on additional risk, CAPM looks at the connection between the rate of return on the specific corporations' stocks and the rate of return on the entire stock market, the market portfolio. It then follows that differences in rate of returns reflect differences in required market risk premiums.

CAPM is based on certain assumptions; investors choose a portfolio of stocks which each has different qualities, but such that they together take full advantage of diversification.

This assumption makes the sole purpose of the stock market pricing to determine the market risk premium of the inevitable risk, which is explained by general market movements, and cannot be eliminated by diversification. This risk is called the systematic risk or the market risk. The part of the stocks' risk that can be eliminated by diversification is called the unsystematic risk.

CAPM prices the systematic risk only<sup>87</sup> and the connection between the expected rate of return (owners' required rate of return) and the market risk can, according to CAPM, be summed up in the following formula:

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<sup>87</sup> Elling, Jens O. And Sørensen, Ole: Regnskabsanalyse og værdiansættelse



$$R_e = r_f + \beta[E(r_m) - r_f]$$

where;

$R_e$  = owners' required rate of return

$r_f$  = risk-free interest rate

$\beta$  = systematic risk

$E(r_m)$  = expected rate of return of investing in the market portfolio

$E(r_m) - r_f$  = the market risk premium

The market risk premium, which is investors' required additional return of investing in stocks instead of risk-free assets, can be estimated in at least three ways<sup>88</sup>:

1. Calculating an estimate which is based on the average of a certain number of investors' own opinions of the risk award. These calculations are done by for example PricewaterhouseCoopers.
2. Calculating the risk award based on historical data (ex-post).
3. Calculating the risk award based on present stock quotes (ex-ante) through the use of for example the residual income model.

The methods above all have their advantages and disadvantages, so it is recommended<sup>87</sup>, whatever method one chooses to use, to conduct an analysis which illustrates the valuations' sensitivity of different risk awards.

We choose to calculate the market risk premium based on historical data. We have gathered yearly returns on the German DAX Index from 1979 (using Thomson Datastream), going 30 years back in time, and calculated the average of them.

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<sup>88</sup> Elling, Jens O. And Sørensen, Ole: Regnskabsanalyse og værdiansættelse

## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

There are two different ways of calculating the average of the yearly returns though; the arithmetic average and the geometric average (also called the compound annual return).

These methods yield different results. We have calculated the arithmetic average return on the DAX Index since 1979 to 13.52 % and the geometric average return in the same period to 8.26 %. In deciding which of the two methods to use, the argument is that if the cost of capital is estimated from historical data the arithmetic average should be used<sup>89</sup>.

Knowing now that the risk-free interest rate is 3.474 % we can calculate the market risk premium according to the formula illustrated above.

$$E(r_m) - r_f = 13.52 \% - 3.474 \% = 10.046 \%$$

The estimate of the market risk premium seems rather high, compared to other existing estimates:

- A survey, from the previous Yale University professor (now Brown University) Ivo Welch, which is based on the consensus of over 200 academic financial economists (with data from the U.S. though) estimates the market risk premium to be 6-7 % over one- and five-year horizons<sup>90</sup>.
- In Denmark, for example, the average risk premium has been rather constant around 4 % in the time period from 1998 to 2005, as calculated by PricewaterhouseCoopers<sup>91</sup>.

We have failed to find other yearly estimates than our own of the market risk premium in Germany and estimations based on historical data will vary with the time period. In our time period there has been two periods in significance with large declines, but there have also been several significant up-swings, so it is not unthinkable that this time period also can reflect the years to come.

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<sup>89</sup> Brealey, Richard A., Myers, Stewart C, and Allen, Franklin, "Corporate Finance"

<sup>90</sup> Welch, Ivo: "Views of Financial Economists on the Equity Premium and on Professional Controversies"

<sup>91</sup> PricewaterhouseCoopers: "Prisfastsættelsen på aktiemarkedet 2005"

## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

Finding the correct estimate for the future with certainty however is impossible, so we have to state what we believe based on our findings and arguments above. We choose to use a market risk premium for the years 2009E to 2013E of 8 % in our WACC.

Under the previous mentioned assumptions about CAPM it applies for all stocks that greater risk is compensated for through greater risk premiums, meaning that higher risk should yield higher return.

Beta is a relative risk measure which is to be interpreted in the following manner:

$\beta = 0$	Risk-free investment
$0 < \beta < 1$	Investment with less risk than the market portfolio
$\beta = 1$	Risk is equal to the market portfolio
$\beta > 1$	Investment with more risk than the market portfolio

The beta thus measures how sensitive a stock is to market movements and the statistical way of defining beta is summed up in the following formula<sup>92</sup>:

$$\beta = \frac{\sigma_{im}}{\sigma_m^2}$$

where;

$\sigma_{im}$  = the covariance between stock  $i$ 's return and the market return

$\sigma_m^2$  = the variance of the market return

In principle we are of course interested in the future beta, since we use it together with the future cash flows, but in practice we think historical data gives a good enough estimate.

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<sup>92</sup> Brealey, Richard A., Myers, Stewart C, and Allen, Franklin, "Corporate Finance"

## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

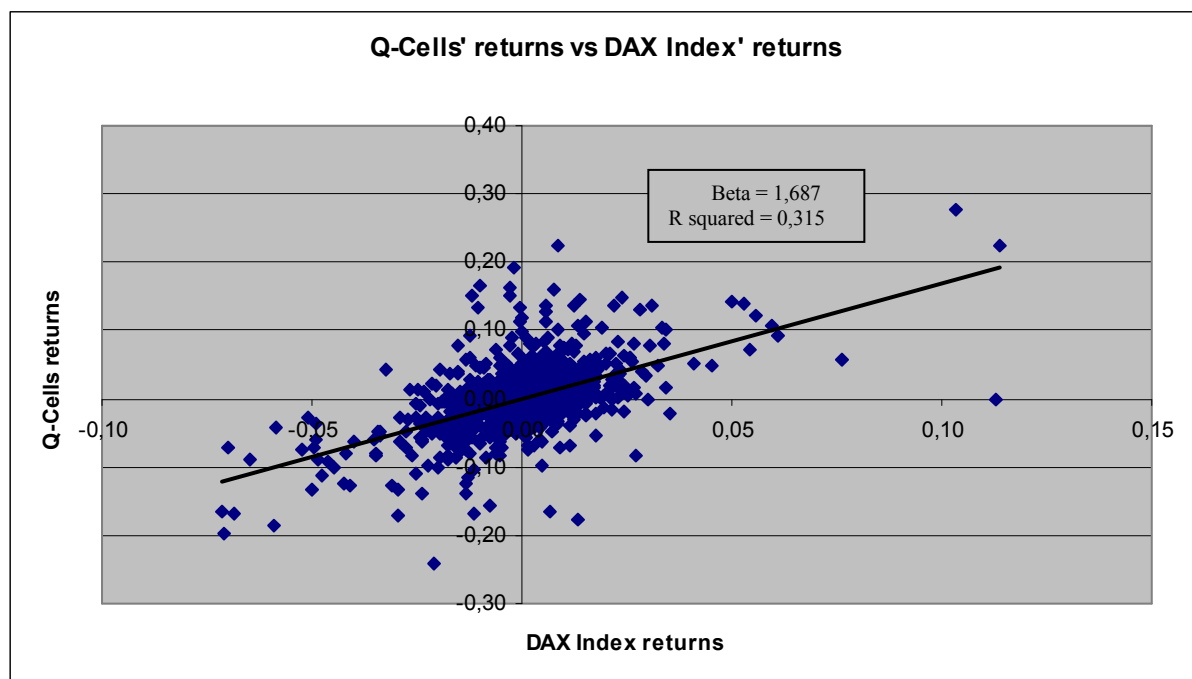
Only a small portion of each stock's total risk comes from the movements in the market<sup>3</sup>. The R-squared ( $R^2$ ) figure gives us the part of the stock's risk, in percentage, that actually comes from market movements, the systematic risk, and the remaining part is contributed to the un-systematic risk, or the unique risk, of holding the corporations' share.

We used linear regression in Excel, with daily returns on both Q-Cells and the German DAX Index, going back to the first day the corporation went on the Frankfurt Stock Exchange (collected from Thomson Datastream), to estimate the beta value and the  $R^2$  value of Q-Cells.

With this period as the parameter we found that the Q-Cells' share had a beta of 1,687. This means that an investment in the Q-Cells' share is riskier than an investment in the German market portfolio.

We also found that the R squared has a value of 0,315, which means that 31.5 % of the stock's total risk is explained by market movements, the systematic risk, and that the remaining portion, that would be 68.5 %, is the stock's unique risk, the unsystematic risk.

**Figure 6.2: Q-Cells' estimated beta with the DAX Index as market index**



Source: own creation based on data from Thomson Datastream

We now have all the inputs needed to calculate the owners' required rate of return through the CAPM model:

$$R_e = r_f + \beta[E(r_m) - r_f] = 0,03474 + 1,687 \times 0,08 = 0,1697$$

We have summed up our calculations in the two tables below.

**Table 6.3: Summary of calculations**

<b>Capital Asset Pricing Model</b>		<b>Weighted Average Cost of Capital</b>	
Risk free rate (Rf)	3,474 %	Debt ratio (D)	0,33
Beta of the security (B)	1,687	Equity ratio (E)	0,67
Market risk premium (MRp)	8 %	Enterprise value (V)	1
		Return on equity (Re)	16,97 %
		Cost of debt (Rd)	5,15 %
		Corporate tax (Tc)	16,83 %
<b>Return on equity (Re)</b>	<b>16,97 %</b>	<b>WACC of Q-Cells</b>	<b>12,78 %</b>

Source: own creation

## **6.3 Discounted Cash Flow (DCF)**

### **6.3.1 Theoretical background**

The Discounted Cash Flow model (DCF) is an indirect model based on the principal of discounting future free cash flows for a given estimation period complemented with a terminal-value concerning the rest of the corporations' lifetime<sup>6</sup>.

An indirect model bases the valuation on estimating the capital value of the corporations' net operating activities, while thereafter subtracting the market value of the net interest-carrying debt, so that the capital value of the shareholder's equity is what remains<sup>93</sup>.

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<sup>93</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

The value of the corporations' net enterprise value is found by discounting the residual income, the free cash flow that is, that devolves lenders and owners, with a discount factor, which includes average capital costs of both debt and equity, which is the previously mentioned WACC.

The direct model estimates, in brief, the shareholder's equity directly, by discounting future profits devolving the owners, with a discount factor, representing the owners' minimum required rate of return.

Most analysts prefer an indirect model to a direct model since it focuses on the operating activities as the only drivers of value, disregarding financial activities, and the DCF model is today widely used among investors and analysts<sup>94</sup>.

Under the assumption of constant capital costs the general DCF model can be summed up in the following formula:

$$V_0 = \sum_{t=1}^{\infty} \frac{\overline{CF}_t}{(1+WACC)^t}$$

where;

$V_0$  = estimated value of the net operating activities at time 0

$\overline{CF}_t$  = expected cash flow in period t

$c_{WACC}$  = weighted average cost of capital

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<sup>94</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

**Table 6.4: Free Cash Flow Estimate**

<b>Year</b>	<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
Net income	-340,63	190,95	266,77	345,9	405,42
+ Depreciation	52,37	62,7	75,25	90,29	108,35
- Change in working capital	-67,89	-27,16	-35,13	-40,22	-40,02
- Capital expenditure on increase in PPE	-37,58	-18,68	-144,17	-173,01	-207,61
+ Financial expense after tax	11,98	4,16	1,66	1,66	1,66
- Financial income after tax	526,8	-15,8	-34,93	-36,59	-36,59
<b>Free Cash Flow</b>	<b>145,04</b>	<b>196,17</b>	<b>129,44</b>	<b>188,04</b>	<b>231,21</b>

**Source: own creation**

### 6.3.2 Q-Cells' value with the DCF model

In order to employ the DCF model on Q-Cells we first need to determine the terminal value of the company. This is the most crucial input in the model since it decides the future growth rate of the company into infinity.

The Gordon formula is a widely used tool to calculate future value based on an estimated growth rate<sup>95</sup>.

We have adjusted the Gordon's formula to this purpose:

$$Gordon_{Formula} = \frac{FCF_t \times 1}{(WACC - g)(1 + WACC)^t}$$

We calculated the terminal Cash Flow (CF) by taking the CF in year five multiplied with the growth rate (g) and then discounted the output with the discount factor for year 5.

<sup>95</sup> Brealey, Richard A., Myers, Stewart C, and Allen, Franklin, "Corporate Finance"

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

The estimation of the future growth rate ( $g$ ) is based on the following expectations and argumentations:

- Q-Cells are market leaders, with significant core-competencies and economies of scale, and will benefit from this in the future as well.
- Good future prospect for the industry look good in both middle and long term
- The company has experienced significant growth in the past and there is still more potential to take out.
- OECD operates with a growth in GDP of 3 % annual in the future and we believe Q-Cells to exceed that ratio in the future as well.

Based on this we estimate the terminal growth to be **3.5 %** in infinity for Q-Cells.

In the calculation of the terminal value we use the  $(1+WACC)^t$  as the discount factor for the different future cash flows and a discount factor of  $(1+WACC)^5$  for the terminal value.

Before we arrive at the value of the equity we have to make a deduction of the debt, since the share price traded on the exchange is the value of the equity only.



**Table 6.4: DCF Valuation of Q-Cells**

Weighted average cost of capital	12,78 %				
Estimated infinite growth	3,00 %				
	<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
Estimated Free Cash Flow	145,04	196,17	129,44	188,04	231,21
Discount factor	1,13	1,27	1,43	1,62	1,83
Discounted FCF	128,60	154,23	90,24	116,23	126,72
Total discounted FCF	616,02				
Total discounted terminal value	1 334,59				
Ordinary shares (in millions)	82,93				
Preference shares (in millions)	30,57				
Total shares (in millions)	113,50				
Net Present Value	1 950,61				
Cash	347,80				
Market value debt	656,80				
Value Equity	1 641,61				
<b>Estimated share value of Q-Cells</b>	<b>14,46</b>				

Source: Own creation

### 6.3.3 Advantages and disadvantages of the DCF model

#### Advantages

It is argued that one of the best reasons to use the DCF model is that it produces the closest thing to an intrinsic stock value, that is the actual value of a company or an asset based on an underlying perception of its true value.

It includes all aspects of the business; in terms of both tangible and intangible factors, helping investors not only spotting inexpensive companies, but staying clear of companies that appear inexpensive just because they are in an overpriced sector<sup>96</sup>.

Second, the DCF model, unlike relative valuation measures, relies on free cash flows, which is a more trustworthy measure than just looking at reported earnings, sales or other reported financial metrics, as it tracks the money left over for investors whether the cash outlay is counted as an expense or turned into an asset on the balance sheet<sup>97</sup>.

<sup>96</sup> <http://www.investopedia.com/university/dcf/dcf5.asp>

<sup>97</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

A third advantage of the DCF model is that it makes the valuation more transparent, as it makes explicit the assumptions of the different market expectations, the forecasts that is, and by doing so it allows the analyst to question the certainty of each of the input variables used<sup>98</sup>.

The DCF model also has its disadvantages. The first, and perhaps the most obvious one, is that the model only is as good as the input assumptions made. So if the inputs of free cash flow forecasts, discount rates and perpetuity growth rates turn out to be way off the real development; then the fair value will not be accurate and it will not be useful when assessing the stock price<sup>96</sup>.

Another disadvantage is that the DCF model is not suited for short-term investments and only focuses on long-term value<sup>96</sup>.

## **6.4 Economic Value Added (EVA)**

### **6.3.1 Theoretical background**

The Economic Value Added model (EVA) values the residual income from the operation of the corporation.

The EVA model is based on the same idea as the DCF model, but the difference is that the intrinsic value of the corporation is broken into two components; invested capital and the present value of future economic profits, whereas in the DCF model intrinsic value is only equal to the present value of future economic profits<sup>99</sup>.

Under the assumption of constant capital costs the general EVA model can be summed up in the following formula:

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<sup>98</sup> French, Nick and Gabrielli, Laura: "Discounted Cash Flow – Accounting for Uncertainty"

<sup>99</sup> Investopedia <http://www.investopedia.com/university/EVA/EVA6.asp>

$$V_0 = NOA_0 + \sum_{t=1}^{\infty} \frac{\overline{EVA}_t}{(1 + WACC)^t}$$

where;

$V_0$  = estimated value of the net operating activities at time 0

$NOA_0$  = book value of net operating activities at time 0.

$\overline{EVA}_t$  = expected residual income from operations at time t.

$c_{WACC}$  = weighted average cost of capital

According to Stephen H. Penman the EVA model, also called the residual operating income model, charges the operating income with a cost for using the net operating activities<sup>100</sup>.

The first step on the way to arriving at the final value when using the EVA model is therefore to calculate these net operating activities.

In the table below the calculated book value of the net operating activities is illustrated (specified calculations are enclosed in the appendix):

**Table 6.5: Net operating assets**

	<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
Net operating assets	1482,8	1528,7	1713,0	1929,1	2183,5
Net operating debt	599,9	637,0	639,5	639,8	643,4
<b>Net operating activities</b>	<b>882,9</b>	<b>891,7</b>	<b>1073,5</b>	<b>1289,3</b>	<b>1540,1</b>

**Source: own creation**

Now the operating income needs to be deducted with the cost of capital, the charge as mentioned above (which is the WACC), and the EVA amount will be revealed, allowing us to continue the complete valuation of Q-Cells' with the EVA model.

<sup>100</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

### 6.3.2 Q-Cells' value with the EVA model

In order to arrive at the final EVA value we need to determine the terminal value; which takes account of the going-concern of the corporation after the year 2013E.

The same procedure as used in the DCF model, meaning that we have made use of the same set of arguments and discussions on the future, and thereby arrived at the same growth rate, is used to arrive at the proper terminal value in the EVA model as well.

**Table 6.6: EVA valuation of Q-Cells**

Weighted average cost of capital	12,78 %				
Infinite growth	3,5 %				
	<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
Operating income after tax	168,17	180,77	235,41	313,51	373,52
Net operating activities	882,91	891,71	1073,51	1289,34	1540,08
Discounted WACC	1,13	1,27	1,43	1,62	1,82
EVA	76,76	67,93	121,45	176,32	208,74
Discounted EVA	68,06	53,41	84,66	108,99	114,40
Total discounted EVA value	429,52				
Terminal value	2249,34				
Discounted terminal value	1232,81				
Value total net operating activities	2377,63				
Value of debt	-656,80				
Value Equity	1720,83				
Number of shares	113,50				
<b>Value each stock</b>	<b>15,16</b>				

Source: own creation

### 6.3.3 Advantages and disadvantages of the EVA model

The EVA model applies a capital charge which corrects the key deficiencies of price multiples; that they do not incorporate the balance sheet.

The model recognizes through the capital charge that growth purchased with capital is not free and the capital used to purchase the growth is therefore assigned with a cost<sup>101</sup>.

<sup>101</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

A disadvantage with the model is that if not all cash adjustments are made it can be subject to accrual distortions, as profits can be boosted by what is called harvesting the assets; not reinvesting capital to maintain plant and equipment in order to improve its accrual bottom line through declining depreciation and amortization<sup>101</sup>.

Since the EVA model relies on invested capital it can in fact be less suitable for high-growth, new-economy and high-technology corporations, as Q-Cells, where there is larger risk of assets being intangible and uncorrelated with the market value of assets<sup>101</sup>.

### **6.5 Relative Valuation Measures**

#### **6.5.1 Theoretical background**

Relative valuation measures, or price multiples, is the term used on any ratio that uses the stock price of a listed corporation in conjunction with some specific per-share financial metric in order to evaluate the corporations' financial situation<sup>102</sup>.

Some common price multiples are the price-earnings ratio (P/E), the price-to-book ratio (P/B) and the price-to-sales ratio (P/S).

The ratios are often used in the conjunction with other fundamental metrics, such as for example the EBITDA, to give an impression of the corporations' value relatively to other corporations in the same sector or that in another manner are comparable<sup>102</sup>. Matches are usually made on industry, products, size and risk<sup>103</sup>.

In the multiples a high relative value indicates that the market is willing to pay a high price relative of the underlying fundamental value, such as earnings, book value or sales revenues. A corporation might trade at a high multiple because of its growth prospects or expected future earnings being higher than in the past.

A low multiple indicates that the stock is low valued. It could be for reasons like low growth prospects or high risk compared to similar corporations, or it could be that the stock is undervalued by the market.

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<sup>102</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

<sup>103</sup> <http://www.investopedia.com/terms/p/pricemultiples.asp>

A low multiple is therefore thought of as better than a high multiple when comparing similar corporations against each other.

### **6.5.3 Q-Cells' value with relative valuation measures**

**Table 6.7: Q-Cells and Solar World's Price Multiples**

	Trailing multiples: financial figures from last four quarters (2008)		
	Price-earnings ratio (P/E)	Price-to-book ratio (P/B)	Price-to-sales ratio (P/S)
Q-Cells	11,38	1,1658	1,70
Solar World	16,62	3,0588	2,74

**Source: own creation**

The price-to-earnings ratio (P/E) is the company's current share price compared to its earnings per share (EPS). When the EPS is taken from the last four quarters it is referred to as trailing P/E<sup>104</sup>.

The EPS figure can also be based on the estimates of earnings expected for the next four quarters, so-called projected P/E, but as we have not made any estimates of Solar World's future incomes we use the trailing P/E ratio.

With a P/E ratio of 11.38 Q-Cells is perceived as undervalued in comparison with Solar World and its P/E ratio of 16.62. We need to bear in mind though that this is given the assumption that the companies are similar with regards to the previously mentioned factors.

Another way of putting it is that Q-Cells only requires 11.38 times its earnings to reach the total market value, compared to Solar Worlds' 16.62 times of earnings to reach its total market value, indicating that Q-Cells is more profitable than Solar World.

The price-to-sales ratio (P/S) values the corporations' past performance and it is designed as such that the lower the ratio the more attractive the investment. In an easy and understandable way the P/S basically shows how much one has to pay for one euro of the corporations' sales.

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<sup>104</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

In the comparison with Solar World, Q-Cells outperforms, with a ratio of 1.70, compared to Solar Worlds' ratio of 2.74. It would therefore be a better investment to buy shares in Q-Cells than in Solar World, based solely on the P/S price multiple.

The price-to-book ratio (P/B) represents the share price relative to the theoretical value per common share one might expect to receive from the corporations' tangible book assets if liquidation should take place<sup>105</sup>.

It is given from this definition that when investing in a company with a higher P/B ratio than a comparable company the investor is paying a higher price for what would be left if the company went bankrupt, than investing in a company with a lower P/B ratio<sup>106</sup>. It is therefore favorable with a low value of this price multiple when comparing corporations.

Q-Cells is thus perceived as a better investment than Solar World, with a ratio of 1.17 compared to a ratio of 3.06.

### **6.5.2 Advantages and disadvantages of relative valuation measures**

An advantage of using relative valuation measures is the low costs, in terms of the limited time and effort, needed to perform an analysis<sup>107</sup>.

However, the price multiples method is very dependent on finding the right corporations to do comparisons of, in terms of similarities on a number of factors, such as industry, products, size and risk. Comparisons between corporations that do not match one another are in fact useless, as the same multiples vary considerably from industry to industry.

Finally, the relative valuation measures do not take future estimates into account, but only gives a picture of its value based on what has been, thus ignoring what might come.

## **6.6 Sensitivity analysis**

There are great uncertainty about the estimated input factors used in the valuation methods of both the DCF model and the EVA model.

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<sup>105</sup> Internet newspaper BusinessWeek February 2009: "Stock Screen: Using the Price-to-book ratio"

<sup>106</sup> <http://www.investopedia.com/terms/p/price-to-bookratio.asp>

<sup>107</sup> Penman, Stephen H.: "Financial Statement Analysis & Security Valuation"

## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

We have therefore made a sensitivity analysis, focusing on how changes in the WACC and changes in the growth rate, will affect the per share value of Q-Cells, in the DCF model and the EVA model respectively.

The sensitivity analysis is based on changes up to +/- 2 % and the results are illustrated in the two tables below:

**Table 6.8: Sensitivity analysis on the stock price, DCF model**

	-2 %	-1 %	<b>0 %</b>	1 %	2 %
WACC	20,36	17,44	<b>15,16</b>	13,32	11,82
Growth rate	12,75	13,84	<b>15,16</b>	16,80	18,89

**Source: own creation**

**Table 6.9: Sensitivity analysis on the stock price, EVA model**

	-2 %	-1 %	<b>0 %</b>	1 %	2 %
WACC	22,16	18,23	<b>15,16</b>	12,71	10,70
Growth rate	13,24	14,10	<b>15,16</b>	16,47	18,15

**Source: own creation**

The isolated results of each model are not very surprising as it is logical that a decrease in the WACC for example is positive for the stock price, since a lower discount factor, which is the opportunity cost of capital, always should make the net present value of an investment worth more.

What is worth noting though are that the changes has different implications on the two valuation models. According to J.O. Elling and O. Sørensen this is due to the differences in how much emphasis the models put on the terminal value<sup>108</sup>.

In the DCF model the terminal value contributes to a larger part of the total value than in the EVA model. A problem therefore arises when not following the proper assumptions about the forecasts.

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<sup>108</sup> Elling, Jens O. And Sørensen, Ole: Regnskabsanalyse og værdiansættelse



When using for example a random growth rate which is not consistent with the assumptions of the forecasts in the calculation of the terminal value, the DCF model will deviate more from the “true value” than the EVA model will<sup>109</sup>, as observed in our sensitivity analysis.

### **6.6 Part conclusion**

This chapter values Q-Cells; using the Discounted Cash Flow model, the Economic Value Added model, and the Relative Valuation Measures. It also reveals some of the models’ strengths and weaknesses and we present a short summary of this chapter’s findings in the following part conclusion.

The DCF model starts more at scratch than the EVA model, by transforming the periodic financial statements into simple in- and out-payments. While the estimation period often is the same whether using EVA or DCF, the terminal value will usually contribute to a larger share of the value with DCF.

This is not saying that EVA is more accurate though, as the two models always should give the same value estimation.

The problem arises when internal assumptions of the forecasts are not being followed; should a random growth rate, not consistent with future statements, be used calculating the terminal value, then the DCF model deviates more from the “true value” than the EVA model do.

When comparing the final DCF and EVA per share value of Q-Cells, which is € 15.16, with the stock price at the beginning of week 26, the 22. June 2009, which was € 14.70<sup>109</sup>, it is implied that the stock is traded with some discount.

This is in fact supported to some extent by the relative valuation measures as well, even though the price multiples, on the background of our discussion on their disadvantages, should not be emphasized to strongly.

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<sup>109</sup> <http://finance.yahoo.com/q?s=QCE.DE>

## **7 Conclusion**

In our Master's thesis we decided to do a company analysis and a valuation of the German solar cell producer Q-Cells SE. The thesis includes a presentation of the company, a strategic analysis, a financial analysis, forecasts of the future operations and a valuation.

In the following section we will summarize our findings from the different parts of the thesis.

Q-Cells was founded in 1999 and went public on the Frankfurt Stock Exchange in 2005. The company is now the world's largest solar cell producer and includes five joint ventures and associates and three fully consolidated companies.

Q-Cells is an international company serving customers in 40 countries, where Germany and the rest of Europe is its most important markets, followed by Asia, and then Africa and North-America.

In the strategic analysis we first looked at the environment; using a PEST analysis.

In summary we found in our analysis that Q-Cells can benefit from political regulations focused on environmental-friendly solutions, but that the decline of the economy in Germany, as well as in most other countries the company serve, pose as a threat, at least for the next year or two.

In addition we came to the conclusion that Q-Cells has good control and knowledge of the technology that is likely to form the future of solar cell production.

Continuing the strategic analysis we discussed the industry of solar cell production using the well-known Porter's Five Forces model.

We stated that the risk of entry by potential competitors were rather low, but not unthinkable. With regards to the intensity of rivalry among the established companies in the industry we discussed the situation of competitors, demand conditions and exit barriers.

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

In regards of competitors we point out that competition has increased, which is unfavorable. Further we believe that the demand will fall for the next year or two, increasing the rivalry, but then improve itself again, easing the situation once more. Finally, when it comes to exit barriers, they are high, due to the specialized investments in particular, which increases the intensity of rivalry.

The bargaining power of buyers is likely to increase for the next year or two, making it less feasible for Q-Cells, but the bargaining power of suppliers is found to be low, which is an opportunity for Q-Cells to negotiate on prices.

The closeness of substitutes to Q-Cells' products, which is all kinds of other electricity producers, is argued to be a large threat for the company.

To sum up our strategic analysis and to analyze the qualities of Q-Cells we made use of a SWOT analysis.

Completing the analysis we found that Q-Cells has several strengths as a company.

The company has a strong economy with large financial resources and it enjoys economies of scale in its operations, as well as having secured a solid base of technological know-how.

We also revealed some weaknesses though. The company benefits from large subsidies in different forms so it is hard to fully identify how it would manage and compete without.

In addition, being the world's largest solar cell producer, Q-Cells has become dependent on large sales volumes to be profitable.

The SWOT analysis also helps identify opportunities and threats in the market and the most central opportunities we found for Q-Cells were the initiative called the Renewable Energy Sources Act and the general worldwide focus on environmental-friendly energy solutions.

The most serious threats we revealed were the financial crisis and the low oil- and gas-prices, on a short-term that is, and the expensive production of solar cells.

## **A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE**

In the financial analysis we presented the accounting, measurement and consolidation methods used by Q-Cells since 2004, the International Financial Reporting Standards, and continued by looking at the development of the company's key figures, focusing on profitability, solidity and liquidity.

The solidity and the liquidity were both found to be at satisfying levels; Q-Cells had an equity ratio of 60 % in 2008 and there is nothing that implies that the corporation has problems in paying off short-term obligations. It was noted though that the company experienced falling profitability trends, as it influenced our forecasts in the next part.

The forecasts were based on the financial analysis and the strategically findings, as well as arguments and discussions performed in the forecasting part. The result was the future income statement and the future balance sheet illustrated at the end of the chapter, in addition to their notes, enclosed in the appendix.

In the final part of the thesis we used arguments, discussions and findings from the previous parts to calculate the input variables needed to do a valuation of Q-Cells.

The company was valued with the Discounted Cash Flow model and the Economic Value Added model and we also compared Q-Cells to the competing company Solar World using Relative Valuation Measures (also called Price Multiples).

The two models resulted in the same value and Q-Cells was priced to € 15.16 per share. This is higher than our last reported share price of € 14.70 and it indicates that the stock at that moment was traded at a discount, which is to some extent supported by the price multiples, which all rank Q-Cells as a better investment than Solar World.

Our recommendation on the stock is HOLD, since we believe that the differences between the two values are not significant.

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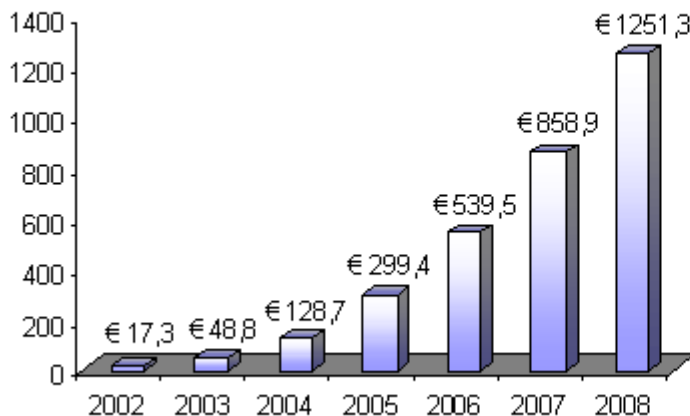
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## Appendix

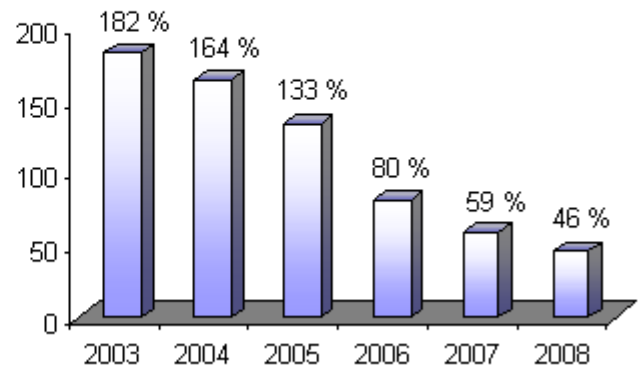
### Appendix 1: Calculations and figures used in part 2

	2002	2003	2004	2005	2006	2007	2008
<b>Sales revenues (in million €)</b>	17,3	48,8	128,7	299,4	539,5	858,9	1251,3
Growth in sales revenues		182,1 %	163,7 %	132,6 %	80,2 %	59,2 %	45,7 %
<b>Total assets (in million €)</b>	26,6	52,6	113,1	456,1	634,5	2588,3	2785,4
Growth in total assets		97,7 %	115,0 %	303,3 %	39,1 %	307,9 %	7,6 %
<b>EBIT (in million €)</b>	0,9	5,3	19,6	63,2	129,4	197	205,1
Growth in EBIT		488,9 %	269,8 %	222,4 %	104,7 %	52,2 %	4,1 %

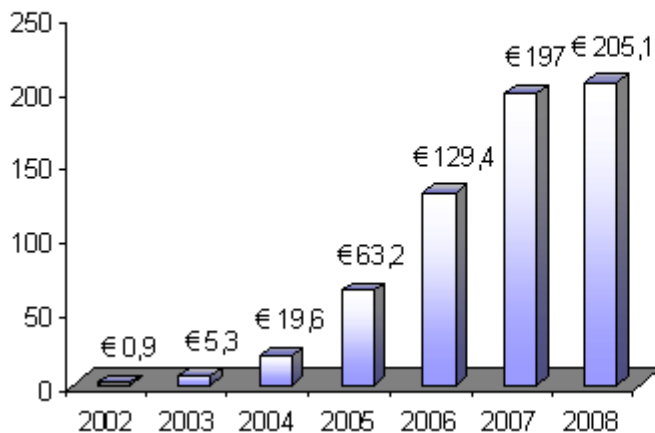
Sales Revenues (in millions)



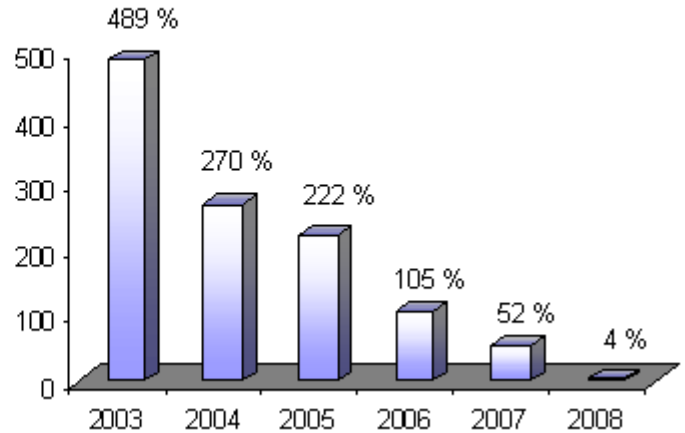
Sales Revenues' Percentage Change from Previous Year



EBIT (in millions)

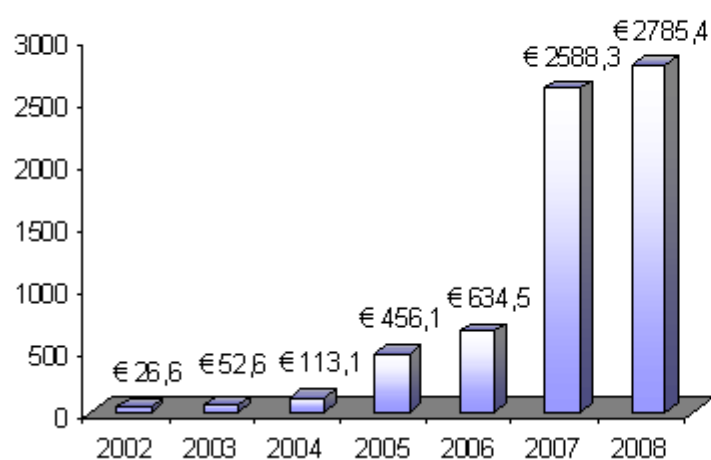


EBIT's Percentage Change from Previous Year

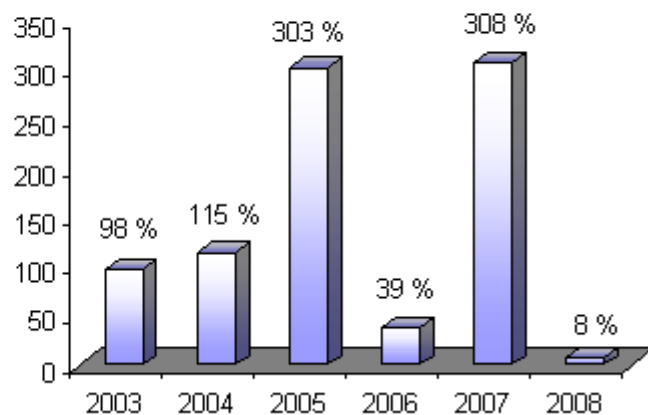


## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

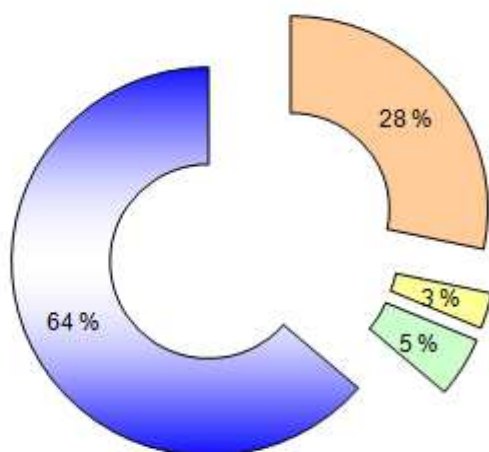
**Total Assets (in millions)**



**Total Assets' Percentage Change from Previous Year**



**Appendix 2: Presentation of ordinary shares**



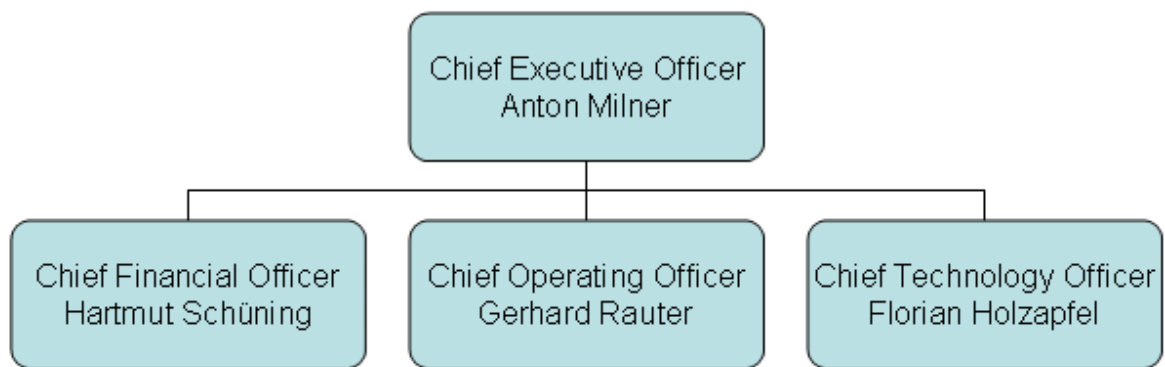
□ Good Energies Solar Investments (23,466,513)

□ Baillie Gifford (4,158,122)

□ Taube Hudson Stonex (2,251,505)




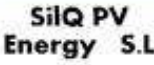


□ Other (52,782,905)

**Appendix 3: Q-Cells Management**



## Appendix 4: Presentation of the organization

Figure 2.6 Q-Cells the organization

Associated companies	Key contribution	Ownership
	Crystalline silicon on glass	18,63 %
	Low concentration PV technology	32 %
Joint Ventures	Key contribution	Ownership
	String Ribbon technology	33,33 %
	JV with REC and Evergreen Solar	
	CIGS technology	67,5 %
	JV with Silicon S.A., Paterna	50 %
Full consolidated companies	Key contribution	Ownership
	Cadmium telluride technology	93 %
	Micromorph silicon technology	100 %
	Amorphous silicon on plastic foil ("flexcell")	58,1 %

Source: Own creation



## Appendix 5: Calculations to part 4

Key figure	Definition	2004	2005	2006	2007	2008
<b>Solidity</b>						
Equity ratio	$\frac{\text{Equity} \times 100}{\text{Total Assets}}$	30,96 %	70,44 %	69,34 %	70,85 %	66,20 %
Long term debt	$\frac{\text{Non-current liabilities}}{\text{Total Assets}}$	28,16 %	12,18 %	12,12 %	21,38 %	20,17 %
Short term debt	$\frac{\text{Current liabilities}}{\text{Total Assets}}$	23,20 %	17,37 %	18,53 %	7,77 %	13,64 %
Debt/Equity	$\frac{\text{Debt}}{\text{Equity}}$	1,678	0,420	0,442	0,411	0,511
Interest coverage ratio	$\frac{\text{EBIT}}{\text{Interest expense}}$	15,34	19,30	39,50	7,94	6,35
<b>Profitability</b>						
Profit margin	$\frac{\text{Net profit (after taxes)}}{\text{Revenue}}$	9,26 %	13,34 %	17,77 %	16,98 %	14,97 %
Return on capital	$\frac{\text{Net income operating + financial income}}{\text{Average total assets}}$	25,85 %	23,11 %	25,98 %	16,74 %	9,17 %
Return on capital employed	$\frac{\text{Net income from operating activities}}{(\text{Total assets} - \text{current liabilities})}$	22,59 %	16,76 %	25,03 %	8,25 %	8,38 %
<b>Liquidity</b>						
Financing ratio	$\frac{\text{Non-current assets}}{(\text{Non-current liabilities} + \text{Equity})}$	0,876	0,336	0,535	0,712	0,853
Current ratio	$\frac{\text{Current assets}}{\text{Current liabilities}}$	1,7	4,2	3	4,4	1,9
Working capital (In million €)	$\frac{(\text{Inventories} + \text{Trade accounts receivable}) - \text{Trade accounts payable}}{\text{Sales}}$	23,421	58,133	117,92	159,1	318,3
Working capital in % of sales	$\frac{\text{Working capital}}{\text{Sales}}$	18,20 %	19,40 %	21,90 %	18,50 %	25,40 %

Solar World	2004	2005	2006	2007	2008
Equity ratio	45,05 %	48,61 %	59,46 %	40,57 %	39,66 %
Debt/Equity ratio	1,22	1,06	0,68	1,46	1,52
Interest coverage ratio	7,59	15,83	19,72	6,17	6,32
Profit margin	9,06 %	14,60 %	25,34 %	16,21 %	16,51 %
Return on total capital	12,21 %	25,04 %	26,45 %	16,20 %	15,80 %

## Appendix 6: Notes to estimation of Income statement and Balance Sheet

Note

1		2008	2009E	2010E	2011E	2012E	2013E
	Development in sales revenues	1251,3	1300	1430	1601,6	1793,792	2009,047
	Annual growth in %		3,89 %	10,00 %	12,00 %	12,00 %	12,00 %

1.2	Calculation of Personnel expense	2004	2005	2006	2007	2008	Average
	Wages	10,05	21,77	31,75	50,50	75,30	
	Social security	1,89	3,87	5,46	11,90	13,90	
	Stock option	0,35	2,48	6,25	4,00	3,90	
	<b>Total personnel expense</b>	<b>12,28</b>	<b>28,12</b>	<b>43,46</b>	<b>66,40</b>	<b>93,10</b>	
	<b>Total sales</b>	<b>128,70</b>	<b>299,40</b>	<b>539,50</b>	<b>858,90</b>	<b>1251,30</b>	
	<b>Total personnel expense/sales</b>	<b>9,54 %</b>	<b>9,39 %</b>	<b>8,06 %</b>	<b>7,73 %</b>	<b>7,44 %</b>	<b>8,43 %</b>

1.2 The estimated future personnel expense will be **8,43 %** of total estimated sales

1.3		2004	2005	2006	2007	2008	Average
	Change in finished and unfinished products	(1,20)	11,90	18,70	(0,30)	50,50	<b>16,00</b>
	We will employ the average of <b>16,00</b> as the future change in finished and unfinished products						
	In million €	2008	2009E	2010E	2011E	2012E	2013E
	Cost of materials	895,60	830,00	890,00	930,00	950,00	1 000,00
1.2	Personnel expense	93,10	109,62	120,58	135,05	151,25	169,40
1.3	Change in finished and unfinished products	(50,50)	(16,00)	(16,00)	(16,00)	(16,00)	(16,00)
1.4	<b>Total cost of production</b>	<b>938,20</b>	<b>923,62</b>	<b>994,58</b>	<b>1 049,05</b>	<b>1 085,25</b>	<b>1 153,40</b>
	Sales expenses	3,70	6,00	7,00	9,00	11,00	13,00
	Freight costs	2,70	3,00	4,50	5,50	6,70	7,70
	Other operating expense	100,00	197,40	236,88	284,26	341,11	409,33
2	<b>Total other operating expenses</b>	<b>106,40</b>	<b>206,40</b>	<b>248,38</b>	<b>298,76</b>	<b>358,81</b>	<b>430,03</b>
	We expect the other operating expense post to grow in line with growth in total sales from 2010						

3		2008	2009E	2010E	2011E	2012E	2013E
	<b>Total other operating income</b>	<b>44,1</b>	<b>82,95</b>	<b>91,25</b>	<b>102,20</b>	<b>114,46</b>	<b>128,20</b>
	Annual estimated growth		88 %	10 %	12 %	12 %	12 %

4	Depreciation and amortization (in million €)	2008	2009E	2010E	2011E	2012E	2013E
	Intangible assets	48,40	54,69	56,75	68,10	81,73	98,07
	Property Plant and Equipment (PPE)	664,60	751,00	779,31	935,17	1 122,21	1 346,65
	Depreciation in %	6,41 %	6,50 %	7,50 %	7,50 %	7,50 %	7,50 %
	Depreciation	(45,70)	(52,37)	(62,70)	(75,25)	(90,29)	(108,35)
	Intangible assets adjusted for depreciation	48,40	51,14	52,50	63,00	75,60	90,72
	PPE, adjusted for depreciation	664,60	702,18	720,86	865,03	1 038,04	1 245,65

## A Company Analysis and Valuation of the Solar Energy Corporation Q-Cells SE

5	<b>Income taxes in %</b>	<b>16,83 %</b>
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6	<b>Other non-current assets (in million €)</b>	<b>2008</b>	<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
	Deferred taxes						
	<b>Total other non-current assets</b>	<b>247,50</b>	<b>250,00</b>	<b>242,00</b>	<b>232,00</b>	<b>220,00</b>	<b>206,00</b>
	We expected a slightly decrease after E2009						

7	<b>Cash and cash equivalents (in million €)</b>	<b>2008</b>	<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
	Other receivable and assets, contains of loans to participating companies and receivable tax from subsidies. We expect this post to decrease in the future						
	Cash and cash equivalents	176,60	55,00	177,94	210,87	261,11	319,27
	Financial instruments	5,30	5,30	7,70	5,00	5,00	5,00
	Financial assets	-	170,00	170,00	170,00	170,00	170,00
	Other receivable and assets	165,90	130,00	122,00	116,00	112,00	108,00
	<b>Total Cash and cash equivalents</b>	<b>347,80</b>	<b>360,30</b>	<b>477,64</b>	<b>501,87</b>	<b>548,11</b>	<b>602,27</b>

8	<b>Capital reserve (in million € )</b>					
		<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
	Subscribed capital	10,09	36,91	74,70	111,30	113,50
	Capital reserve	12,41	240,69	247,70	1 459,60	1 466,70
	Revenue reserve	12,24	44,11	104,00	252,40	442,10
	Other reserve	(0,00)	(0,45)	(0,10)	(0,40)	(175,30)
	Total historical capital reserve	34,73	321,26	426,30	1 822,90	1 847,00
		<b>2009E</b>	<b>2010E</b>	<b>2011E</b>	<b>2012E</b>	<b>2013E</b>
	Subscribed capital	114,50	115,50	116,50	117,50	118,50
	Capital reserve	1 165,37	1 165,37	1 165,37	1 165,37	1 165,37
	Revenue reserve	101,47	292,41	559,18	905,08	1 310,50
	Other reserve	(74,70)	(74,70)	(74,70)	(74,70)	(74,70)
	<b>Total estimated capital reserve</b>	<b>1 306,64</b>	<b>1 383,08</b>	<b>1 649,85</b>	<b>1 995,75</b>	<b>2 401,17</b>

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9	<b>Other non-current liabilities</b>	2008	2009E	2010E	2011E	2012E	2013E
	Other non-current liabilities	32,2	We expect this post to decrease since Q-Cells will try to reduce short term debt, as part of healthy business operation				
	Profit participation capital	14,8					
	Non-current financial liabilities	1,4					
	Provision	7					
	Deferred taxes	5,7					
	<b>Total other non-current liabilities</b>	<b>61,1</b>	<b>60</b>	<b>58</b>	<b>56</b>	<b>54</b>	<b>52</b>

10	<b>The different post used in total current liabilities:</b>	2008	2009E	2010E	2011E	2012E	2013E
		65,7	We expect a decline in subsidies and grants from the government in the years to come. We expect this post to decline since Q-Cells get more efficient in the years to come				
	Other current liabilities						
	Tax liabilities	0					
	Deferred investments grants and subsidies	13,3					
	Market value of financial instruments	0					
	Provision	1,2					
	<b>Total other current liabilities</b>	<b>80,2</b>	<b>79,304351</b>	<b>70</b>	<b>65</b>	<b>60</b>	<b>55</b>

11	Goodwill: same growth as Intangible assets	2008	2009E	2010E	2011E	2012E	2013E
	<b>Goodwill</b>	<b>3,800</b>	<b>4,028</b>	<b>4,180</b>	<b>5,016</b>	<b>6,019</b>	<b>7,223</b>
	Annual growth		6,00%	3,77%	20,00%	20,00%	20.00%

12	<b>Trade accounts reciveable</b>	2004	2005	2006	2007	2008	<b>Average</b>
	Trade accounts reciveable	17,371	33,8025	83,5	121,1	181,2	
	Total sales	128,7	299,4	539,5	858,9	1251,3	
	Trade accounts receivable in % of total sales	13,50 %	11,29 %	15,48 %	14,10 %	14,48 %	<b>13,77 %</b>
	The trade accounts receivable will be 13,77 % of future estimated sales						

13	<b>Deferred investments grants and subsidies</b>						
	We expect this post to decline slightly in the future						

14	<b>Trade account payable</b>	2004	2005	2006	2007	2008	<b>Average</b>
	Trade account payable	8,6489	24,6315	44,3	64,6	79,7	
	Material expenses	86,1824	197,8939	348,2156	534,5	895,6	
	Trade account payable/ mat expense	10,04 %	12,45 %	12,72 %	12,09 %	8,90 %	<b>11,24 %</b>
	Estimated trade account payable will be <b>11,24 %</b> of material expense in our forecasting period						

15	<b>Current financial liabilities</b>						
	Funds from the sale of REC are used to erase the debt for 2009 according to Q-Cells statements, we expect however this post to increase slightly in the future						

16	<b>Financial assets</b>						
	The total share in REC was sold during Q2 2009, resulting in a large drop, however we believe the share of financial assets will increase in the future, because of investments and increase in value						

## Appendix 7: Notes to EVA

Calculations to EVA	2008	2009E	2010E	2011E	2012E	2013E
<b>Assets</b>						
Intangible assets	48,4	51,1	52,5	63,0	75,6	90,7
Property, plant and equipment	664,6	702,2	720,9	865,0	1038,0	1245,7
Other non-current assets	247,5	250,0	242,0	232,0	220,0	206,0
Inventories	216,8	300,5	316,5	332,5	348,5	364,5
Trade account receivable	181,2	179,0	196,9	220,5	247,0	276,6
<b>Net operating assets</b>	<b>1358,5</b>	<b>1482,8</b>	<b>1528,7</b>	<b>1713,0</b>	<b>1929,1</b>	<b>2183,5</b>
<b>Liabilities</b>						
Other non-current liabilities	61,1	0,0	32,0	30,0	28,0	26,0
Trade accounts payable	79,7	93,3	100,0	104,5	106,8	112,4
Other current liabilities	80,2	79,3	70,0	65,0	60,0	55,0
Convertible bond	422,2	427,3	435,0	440,0	445,0	450,0
<b>Net operating debt</b>	<b>643,2</b>	<b>599,9</b>	<b>637,0</b>	<b>639,5</b>	<b>639,8</b>	<b>643,4</b>
<b>Net operating activities</b>	<b>715,3</b>	<b>882,9</b>	<b>891,7</b>	<b>1073,5</b>	<b>1289,3</b>	<b>1540,1</b>
<b>Net income from operations after taxes</b>	<b>172,0</b>	<b>168,2</b>	<b>180,8</b>	<b>235,4</b>	<b>313,5</b>	<b>373,5</b>

## Appendix 8: Notes to Price multiples

Price-earnings ratio (P/E)			
	EPS	Stock price per 01.06.2009	P/E
Q-Cells	1,65	18,78	<b>11,380</b>
Solar World	1,33	22,1	<b>16,617</b>

Price-to-sale ratio (P/S)			
	Revenue per share	Stock price per 01.06.2009	P/S
Q-Cells	11,02	18,78	<b>1,70</b>
Solar World	8,06	22,10	<b>2,74</b>

Price-to-book ratio (P/B)					
Book (B) = $\frac{\text{Total assets} - \text{Intangible assets} - \text{Liabilities}}{\text{Total shares}}$					
	Total assets	Intangible assets	Liabilities	Total shares (million)	Book (B)
Q-Cells	2835,1	48,4	958,4	113,50	16,108508
Solar World	2120,6	33,861	1279,547	111,72	7,2251343
Price (P) = Stock price per 01.06.2009					
Q-Cells	18,78				
Solar World	22,1				
	<b>P/B</b>				
<b>Q-Cells</b>	<b>1,166</b>				
<b>Solar World</b>	<b>3,059</b>				