Markus Väisänen

CASE STUDY ON EXPANDING VALOE PLC PV TECHNOLOGY BUSINESS INTO GCC COUNTRIES

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ABSTRACT

This thesis was completed for a Finnish technology company, Valoe PLC (Valoe Oyj in Finnish) specialising in solar technology. The commissioner is an international small-medium sized enterprise, its operations take place in Mikkeli and Juva Finland, and Vilnius Lithuania. The goal of the thesis was to contribute to understanding of a new potential international market, in this case the Gulf Cooperation Countries of the Arab States and analyse the challenges and the financial potential of expanding.

The main theoretical concepts covered in this thesis are related to the marketing environment of the GCC region, with the focus on external environment analysis with the political, economic, socio-cultural, technological, legal, and environmental framework and market analysis.

The data collection was conducted in two phases. In the first stage, the research began by archival data. A close examination presented repeated patterns and themes, implemented in the second phase of the study. The second phase of the study was conducted as semi-structured interviews, providing primary data for the research. Individuals, organisations, and consultants involved actively in the solar power industry in Finland and GCC region were interviewed.

The result of the research process provided evidence that most of the discussion participants see potential in the pitched business idea. There is a clear need for such products in the GCC market, mainly driven by government initiatives and the rapidly growing population. The main conclusions signify that there is a high interest in solar technology and solar power in the region, which can provide opportunities in other markets, such as the automotive field within the area. Solar energy is likely to contribute to the diversification of fuel-based transport within the GCC through the electrification of private public and industrial vehicle fleets utilising clean power sources.

Keywords: case study, international expansion, GCC, photovoltaic business

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APPENDICES

1 INTRODUCTION

In this study the expansion of Valoe photo-voltaic business into the Gulf Cooperation Countries of Arab States was evaluated through the form of a case study. The main goal of this study was to identify and analyse the challenges and the potential financial benefit of Valoe expanding in to GCC countries.

The introductory segment of this study consists of four segments. In the first segment the commissioner and the background of the study is presented. In the second segment the development setting is defined. In the third segment the research methods of the study are presented and justified. In the last segment the framework and the limitations of the study are visualised.

1.1 Commissioning party and the background of the study

Valoe PLC (later referred to as Valoe) is a Finnish high-tech company founded in 1978. Over the years, Valoe (ex. Cencorp) has been known as one of the most innovative providers of automated robotic solutions for a wide range of industries. Valoe has extensive experience in mass production of flexible antennas for the mobile phone industry. The flexible circuit technology was leading the way to new innovations for solar module manufacturing and the back-contact technology according to Valoe (2021).

The high degree of automation inherent in the back contact photovoltaic technology developed by Valoe produces efficient, consistent, and durable solar modules. Valoe (2021) states that their business model is based on generating solar electricity near the user, whether is a geographical area or an electric appliance. Photovoltaics is most environmentally friendly when it is produced in a distributed manner, close to the user, with high-quality and long-lasting modules and systems.

The background of the study is formed due to Valoe unique position in the market. Valoe has been developing its own integrated photovoltaic solutions since 2018 and has gained a substantial head start compared to the other competitors

in the market. Valoe is now transitioning from a traditional solar module manufacturer into being one of the leading solar technology providers in the world.

Valoe (2021) states that one of the core elements of their strategy is built around forming manufacturing licensing agreements, in which new solar panel manufacturers are committed to both Valoe production technology and the use of components related to the back-contact technology.

The recent interest in GCC countries towards Valoe unique technology, which is proven by the recent revealment of Valoe establishing a joint venture with Salem Balhamer Holding, in the Kingdom of Saudi Arabia, has motivated Valoe to study other possibilities in the GCC market, more specifically the implantation of vehicle integrated photovoltaics in the cold supply chain, where solar modules will be utilised to control temperatures in reefer trucks and trailers.

1.2 Development setting

Energias Market Research (2019) stated that *the considerable shift towards electric vehicles is to create growth prospects for the vehicle-integrated solar panel market*. Photo-voltaic panels that are integrated into vehicles are likely to compete with the grid-supplied power, giving extra benefits such as temperature control, increased driving range as well increasing overall driving comfort.

GMI Research (2021) stated that the key variables driving the development of the GCC cold storage market showcase growing demand for perishable products, packaged food, increasing automation refrigerated warehouses, and fast expansion of the retail and logistics sector. The rise in government activities for food preservation due to the developing concerns related to expanding population and food wastage in nations like Saudi Arabia is surging the development of the GCC cold storage market.

The objective of the study was to analyse the possible challenges and financial potential of expanding Valoe vehicle integrated photo-voltaic business into GCC

countries. The study focuses on the cost structure of the investment, and market analysis. The study justifies the investment from both technical and financial point of view.

To fulfil the objective of the study, the following research question was formed:

1. What are the challenges of the international expansion for Valoe in the GCC market?

To assure that the topic in question in covered substantially enough, the following **sub-questions** were formed to provide various point-of-views into the research:

1. What does the initial investment cost?
2. What are the predictions for the solar energy market in GCC countries?

1.3 Research methods

According to Benedictine University (2022) primary data can be described as information that has been created by the analyst him/herself, consisting of e.g., surveys, interviews, experiments commonly outlined for understanding and tackling the research question on hand.

According to QuestionPro (2021) archival data can be described as a research method that utilises as of now existing data. Existing information is summarised and collated to extend the general viability of the research. Archival data incorporates research materials distributed in research reports and comparable records. These records are accessible libraries, websites, data obtained from as of now filled in surveys etc. Government and non-government organisations also store information, that can be utilised for research purposes and can be retrieved from them.

To complete this study, the author used a mix of primary and archival data. Primary data was collected from several sources consisting of individuals and institutes in the GCC region and Finland through discussion and interviews. Archival

data, which was already easily accessible in the form of materials on hand provided by the case company about the products, services, previous ventures, and feasibility studies conducted throughout the history of the company. Accompanied using alternative sources widely available in the world wide web such as books, journals, and magazines quickly translated into extensive amount of reliable and applicable information about the subject in question.

The vast amount of gathered data was analysed thoroughly using the qualitative method, content analysis. According to XAMK (2021) content analysis is the process of categorising verbal or behavioural information to classify, summarise and arrange the information and discourse analysis is the process of analysing naturally-occurring spoken interactions and written content that is concerned with the social setting in which the communication took place. It centres on how dialect is utilised in daily life and looks at how individuals express themselves.

These two methods were chosen specifically to identify frequencies and patterns in the data collected to create a deeper understanding of underlying interpretations as well as to identify differences in the language or debate of the specific subject in the collected data based on culture and society. The chosen research methods complimented and shared qualitative characteristics.

1.4 Framework and limitations of the study

The framework for the study has been designed and composed in such manner, that it will provide the commissioning party extensive insights into the research question in hand. The study is to be conducted in such manner that the commissioning party can come to decisive decision whether to proceed with the specific investment. The study must justify the investment from both technical and commercial point of views.

The theoretical framework of the study is built around three core components, these three core components are macro-environmental analysis (outside marketing environment), market analysis of the GCC countries and lastly, the general trends in the photovoltaic market.

To evaluate the feasibility and commercial potential of the proposed project, the investigation of the foreign market must take place. Investigation of the market consisting of; market size, market growth, market trends, customer segmentation, competitor analysis, business environment and going forward strategy are all vital elements of this segment and will provide essential information for the feasibility study in terms of financial point-of-view, as well formulating the cost structure of the development project. The market analysis of the market has a substantial weight on the study, providing outcomes to the sub-questions stated above, which will later be described and analysed in depth in Section 2.1 of the study.

To answer the main question of the study, what are the challenges of expanding Valoe photo-voltaic business in GCC countries, it is crucial to understand the external environments that may affect the sustainability of the new development project. To analyse and to understand the external factors, the use of PESTEL analysis is implemented. CFI (2021) describes PESTEL analysis as the key framework utilised to assess the outside environment of a business by breaking down the opportunities and risks into political, economic, social, technological, environmental, and legal factors. PESTEL analysis is a viable framework to utilise in corporate strategy planning and for identifying benefits and disadvantages of business strategy, the PESTEL analysis of the development project can be found in the Section 2.2 of this study.

Limitations of the study are related to the data collection and analysis of the data. Interaction with the potential customers of this new venture was limited during the period this study was conducted, thus limiting the interaction with key-personnel in the new foreign market, which would have provided deeper understanding of the market and complimented the market analysis of the study.

Lastly, the use of content analysis was used to find patterns in the collected data, and differences in the language or debate based on culture and society provide data that is applicable for a very specific timeline, the data is reliable during a specific timeframe, neglecting the future possibilities and events that may occur after this study is complete.

2 MARKETING ENVIRONMENT

The theoretical background of this study is built around two core theoretical components which are utilised to enhance the understanding of the preface on which this study is based on. The two core theoretical components are:

i. External environment analysis
ii. Market analysis
iii. General trends in PV market

The core components of the theoretical background are presented in the exact order as presented here above.

2.1 External environment analysis, PESTEL framework

According to PA (2014) PESTEL analysis or is a framework or device utilised by marketers to dissect and screen the macro-environmental (outside marketing environment) variables that influence an association. The result of which is utilised to recognise dangers and shortcomings which are utilised in a SWOT analysis.

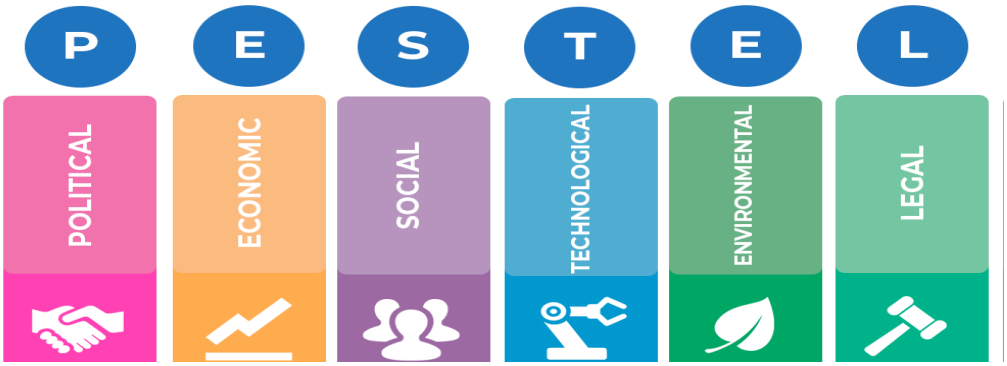

Figure 1. PESTEL (PA, 2015).

Political factors

According to PA (2014) these are all around how and to what degree a government mediates within the economy. This could incorporate – government arrangement, political solidness or flimsiness in abroad markets, remote exchange arrangement, charge policy, labour law, environmental law, and trade restrictions.

Economic factors

Bush (2014) describes the economic factors as the financial variables that have a critical effect on how an association does trade conjointly and how productive they are. Variables include – economic growth, interest rates, exchange rates, inflation, disposable income of consumers and businesses.

These variables can be further broken down into macro-economic and micro-economic variables. Macro-economic components bargain with the administration of request in any given economy, Governments utilise intrigued interest rate control, taxation policy and government expenditure as their main mechanism.

Micro-economic components are all about the way individuals spend their income. This features an expansive effect on B2C associations in specific.

Social factors

PA (2016) refers to social factors are the socio-cultural components, that are the areas that include the shared belief and attitudes of the populace. These variables include – population growth, age dissemination, health consciousness and career demeanours. These variables are of specific interest as they have a direct impact on how marketers understand clients and what drives them.

Technological factors

Bush (2016) stated that the innovative scene is known for rapid changes, and it impacts the way we showcase our items. Technological variables influence showcasing and the administration thereof in three distinctive ways including the following new ways of creating products and services, new ways of conveying merchandise and services and new ways of communicating with target markets.

Environmental factors

PA (2014) indicates that environmental factors have risen in the past decade. Environmental factors have become imperative due to the expanding shortage of raw materials, pollution targets, composing commerce as an ethical and sustainable company and carbon footprint targets set by governments. Increasingly buyers are requesting that the items they purchase are sourced ethically, and in, if possible, from a sustainable source.

Legal factors

Bush (2016) declares that legal factors incorporate – wellbeing and security, equal opportunities, promoting measures buyer rights and laws, product naming and product safety. It is obvious that companies must know what is not legal to exchange effectively. If an association exchange universally, this gets to be a very precarious are to induce right as each nation has it possess set of rules and regulations.

2.1.1 Process of conducting PESTEL analysis

CIPD (2020) suggest PESTEL analysis is ought to begin with thinking and planning through the process. This implies following these steps:

Recognise the scope of the research. It should cover present conceivable future scenarios and apply to areas of the world in which the business operates. Decode how the data will be collected and by whom. Information accumulated is frequently richer in substance when more than one individual collects it.

Identifying relevant sources of data. These can be shareholders trying to find individuals experts to address issues or current arrangements that require updating. Gather the data – it is valuable to utilise a format as the premise for recording data and analyse the findings.

Recognise which of these components recorded over are most critical or seem to cause issues. Identify the specific choices to address the issues and type in a dialogue report for all stakeholders.

Disseminate and examine the discoveries with stakeholders and choice makers and lastly, decide what activities must be taken, and which patterns to screen on progressing basis.

CIPD (2020) states that to be compelling, PESTEL analysis ought to do on a regular or ongoing basis. Associations that frequently and methodically conduct such analysis regularly spot trends and patterns before others, in this way giving competitive advantage.

2.1.2 Process of conducting PESTEL analysis

According to CIPD (2020) PESTEL analysis is regularly utilised as wide fact-finding action. It helps an organisation establish the outside variables that might affect the choices made inside the organisation. An organisation in its own cannot influence these components – nor can these components specifically influence the profitability of an organisation. By understanding these outside component's, it is conceivable to expand opportunities and limit dangers to the organisation. Conducting a strategic analysis implies checking the external environment to identify and get wide, long-term trends. A PESTEL analysis is a suitable system

and action to utilise in an extent of trade arranging circumstances. These can encompass strategic business planning, workforce planning, marketing planning, product development, organisational change, people strategies and lastly, reports and projects.

PESTEL analysis was chosen due to its value for understanding the overall market environment. The more threats or risks within the advertising, the more troublesome it is to do trade. By analysing the market strengths at play, the more vital one will be able be in arranging and decision-making. Additionally, PESTEL analysis makes a difference in organisation ability to deliberately arrange ventures and activities so merely as it were centre on ventures that have the most noteworthy chance of success. It also gives you the devices to figure changes, so you will develop your organisation with those changes rather than working against them.

2.1.3 Swot analysis

Woodruff (2019) stated that once you are trying to decide if an idea for your business is feasible, you ought to look at all the components that can influence its success or failure. It is time to do a SWOT or PESTEL analysis, preferably both.

Woodruff (2019) highlights that SWOT and PESTEL analysis are valuable tools for decision-making when assessing the pros and cons of a venture or activity. While the two framework share similarities, there are substantial differences between the two approaches. The main difference between the two frameworks is that SWOT analysis focuses on the actions one can take internal to one’s business, and PESTEL analysis distinguished external variables that are primarily exterior of one’s control.

What is SWOT analysis?

Woodruff (2019) describes that SWOT analysis as the process of examining four specific areas in the business environment which are strengths, weaknesses, opportunities, and threats.

Strengths can be described as the act to recognise the preferences that your business has over the competition. Weaknesses refers to fare judgment about the shortcomings in your operations.

Opportunities refers to the ability to recognise the outside patterns that you can take advantage of and lastly Threats is the survey the exterior conditions that will be obstacles and have a negative a negative effect on your business.

Creately (2012) indicates that by working through each of these four elements stated above it is conceivable to recognise any internal drawbacks or preferences which may benefit or ruin the result of an arranged venture. In expansion to assessing the state inside, this method is additionally able to recognise the outside components which may moreover make a difference to the success or failure of a project.

Using the information

By knowing this data, it can be conceivable to arrange an effective extend that is prepared to work around certain issues successfully and to avoid failure. It could be a great idea, and excellent to work through the SWOT analysis along with your team within the early stages of project planning. Conceptualising could be a great way of presenting all the significant internal and external factors for each section of the analysis according to Creately (2012).

PESTEL and SWOT analysis are often paired together to form a deeper understanding of the business environment in question. The two frameworks complement each other even they are distinctive and apply to different levels of the business analysis.

SWOT framework was chosen to combine these macro- and micro-level analyses of the trade to assist and to create a total picture of the photo-voltaic market and to showcase Valoe business’s unique openings to moderate risks and viably plan.

2.2 Market analysis

Parsons (2021) describes market analysis as the thorough qualitative and quantitative evaluation of the current market. Guiding companies to understand the value and esteem of the market, potential customer segments and their buying patterns, the position of your competition, and the overall financial environment, counting barriers to entry, and industry regulations.

Parsons (2021) stated that market analysis is an essential tool that withholds great strategic value, when utilised in the correct manner it can be used to build a successful strategy for growing your business. Market analysis provides companies with in-depth information about their market, positioning them in a superior situation where they can create items and services that their clients will favour. Market analysis can be divided into four main components:

1. Industry overview – portraying the current state of your industry and where it is headed.

2. Target market – who are your genuine clients? You'll detail how many of them are there, what are their needs, and portray their socioeconomics

3. Competition – depict your competitor's positioning, qualities, and shortcomings.

4. Pricing and forecast – your pricing will help decide how you position your own company within the market, and your forecast will show what portion of the market you trust to induce.

How to conduct a market analysis

Parsons (2021) declared that whereas conducting a market analysis is not a complicated process, it does require committed research, be prepared to commit significant time to the process. In the next stage the four main components of market analysis are taken into closer inspection.

Industry overview

Parsons (2021) affirmed that in this step companies will depict the industry in question and describe the direction that it is headed. Incorporation of key industry metrics such as: size, patterns and anticipated growth are essential in this stage. To support this statement, to successfully analyse an industry, it is important to gauge the overall market size, its growth, sales cycles, and profits (Lehmann & Winer 2008, 63).

Industry overview showcases investors that the business in question understands the larger scene in which they are competing in. More importantly, it helps companies estimate the future demand for their products and services, as well understand the level of competition within the market.

Target market

The second step in a market analysis is identifying the target market. Parsons (2021) expressed that target market is the most important aspect of industry analysis. In short, target market describes and visualises the ideal customer. Defining target market can be broken down to the following five segments:

Market size referring to the number of potential clients, who they are, where they come from and what may affect their purchase decision.

Demographics and location referring to your customers age, gender, education, income, needs and interest and the specific location – where are your clients located? A particular country, state, city, or province. One may discover that your client base is segmented based on location which may assist in determining where you will conduct business in.

Behavior and trends referring to the – expansion of psychographic data, clarifying your customer purchase process. Customer behavior is continuously changing. In

case there are trends that you've taken note along with your target market, detail them here.

Competition

The third step in market analysis is competition. Beyond knowing who you are competing against, a great competitive analysis will point out competitors' shortcoming that you can take advantage of. With this information, you can separate yourself by providing products and services your competitors have not tended. According to Parsons (2021) the following four segments are worth consideration when composing competitive analysis.

The first segment is competition which can be divided into direct and indirect. Direct competition refers to companies that are already in the market offering products or services like the application that you possess. Indirect competition on the other hand refers to alternative solutions that are solving the problem your products or services are aimed at solving.

The second segment is differentiation, which can be described as making sure to talk about how your company, product or service creates value to your clients, what sets you apart from the competitors.

Third segment is Barriers to entry, which depict what assurances you have in place to avoid companies from competing against you. Perhaps you have great location, disruptive technology, patents, or licenses to help in securing your business.

Pricing and forecast form the fourth and last segment on market analysis. In this step the aim is to frame the pricing for your products or services and to estimate sales forecast to gain an understanding of the market share you are aiming to gain.

According to Parsons (2021) client's interface high prices to quality. If you are placing your product or service on the high-end of the spectrum, create beyond any doubt the understanding that the rest of the marketing is signaling that you are conveying a high-quality product or service. From what your business looks like to from its logo to customer service encounter, high prices ought to come with a high-quality experience amid the entire purchasing process. On the other end of the range, possibly you're competing as a low-priced elective to other items or businesses. On the off chance that that's the case, make sure you're marketing, and other messaging are too conveying that same, bound together message.

2.3 General trends in the photo-voltaic market

The automotive industry is currently under transition, converting from traditional fuel-based vehicles to vehicles powered by renewable energy.

Solar vehicles are electric vehicles, which are fueled by solar energy as a type of fuel for their propulsion. Solar vehicles are equipped with photovoltaic cells and are capable of converting the sun-based energy to electrical energy, which is directly stored in the battery of the vehicle.

IRINA (2019) stated that the electrification of transport could offer an opportunity. Solar energy is likely to contribute to the diversification of fuel-based transport, through the electrification of private, public, and industrial vehicle fleets utilising clean power sources. The availability of a few mass-market electric vehicle models, alongside later progress in dragging out battery range, may well be the diversion changers. Approaches to assist materialising the numerous potential benefits of electrifying transport include infrastructure improvement (charging stations), money-related motivations, and the extension of electrified trains and tram systems to transport a growing number of day-by-day commuters as an alternative to private cars.

Singh et. (2020) stated that the introduction of electric vehicles over the globe had expanded the request for a better and more proficient charging framework to

be prepared in electric vehicles to overcome the issue of rapid discharging of electric vehicles during operations. In addition, the need of an appropriate framework for charging vehicles during longer distances has paved the way for introducing solar panels in vehicles, which has supplemented the solar vehicle market development.

The political atmosphere is very friendly towards solar energy. Targets for the development of solar energy are implemented through various government projects and policies. Solar energy plans and the status of deployment have come a long way. Differences in market size, ambitions and readiness can be seen between countries, yet the overall picture is dynamic.

3 DATA COLLECTION AND METHODS

3.1 Development setting

The data collection for this study was conducted in two phases. In the first phase, the use of archival data was implemented to create a broader understanding of the environment of the case study. Archival data provided necessary insight into the case study by providing information related to the technology and products also referred to as technology package by Valoe.

To gain a more precise picture of Valoe in relation to their current situation and future ambitions, a semi-structured interview was conducted with the Senior Vice President of Valoe, who is responsible for international affairs. Followed by this, another semi-structured interview was conducted with a respectable consulting firm within the GCC region, which has been involved in analysing the GCC renewable market for the past decade to understand the current situation and future of the market.

The interview with Valoe SVP was held face-to-face on 25 August 2021. The interview took place at Valoe headquarters in Mikkeli, Finland. The interview was not recorded, meeting notes were created on the key points of the interview.

The collected data was analysed in thematic manner, searching across data set to identify, analyse and report repeating patterns. Valoe operations were analysed internally and externally with SWOT analysis to identify and understand any areas of the business that may negatively affect the proposed investment. The desired market, GCC region was analysed through PESTEL analysis to understand the external environment and the possible effect it may have on Valoe intention to expand into the GCC region.

3.2 Data collection

The first interview was with the Valoe Senior Vice President. He is the key personal at Valoe for technology partner cooperation. He has several decades of experience in establishing and ramping-up new ventures all over the world, most recently he is responsible for the newly announced joint-venture in Saudi Arabia. The interview was initially built around the following themes:

1. Valoe strategy
2. Valoe interest in GCC countries
3. Current and future opportunities in the photo-voltaic market

These themes for the interview were chosen to gain a deeper understanding of Valoe previous and current ambitions for international expansion. Valoe SVP was chosen as the candidate for the interview due to his vast experience of establishing and running new ventures for Valoe throughout his career.

The second interview was with Arthur D Little's Global Head Energy & Utilities. Dr. Arthur D Little is a globally recognised consulting firm, with its history dating back to 1886. Specified team of consultants have composed excessive research of the solar energy market in the GCC countries, which have acquired a lot of visibility and recognition. The interviewed was held due to their extensive knowledge and experience of researching the solar energy market in GCC countries. The team of consultants have had an abundance of resources at their disposal, which have granted them to produce thorough research of the market.

1. Solar energy in GCC countries
2. Government policies/initiatives for green energy
3. Challenges foreign companies face expanding to GCC countries

The interview with Arthur D Little's Global Head Energy & Utilities consulting firm took place on 10 September 2021. The interview took place in an online meeting room. The interview was accompanied by Valoe SVP. The meeting was not recorded, meeting notes were created on the key points of the interview.

In addition to the interviews, additional sessions with Kova PMC consulting company specialising in the Middle Eastern market were held to discuss the financial side of the venture. These discussions were shared with the proposed client, this phase shared mutual co-operation between all parties.

Communication with KOVA PMC consulting firm took place throughout the length of the study beginning from 25 August 2021. The main form of communication was via email, with occasional online meetings, to go through key financial figures in detail.

The themes of the interview were conducted in such a manner that it would provide insight into Valoe ambitions in the future and the solar energy market in GCC countries.

The objective was to establish the current stage of utilising solar energy, future initiatives and government policies that will support these goals, as well as the general attitude of the public in general about the use of alternative energy sources.

3.3 Case study approach

Herrera S & Cisternas L. (2016) described the case study approach as a learning procedure in which the student is confronted with a specific issue, the case. The case study encourages the investigation of a real issue inside a characterised setting by employing an assortment of information sources. In general terms, the

case study analyses a defined problem consisting in a real situation and uses real information as methodological tool.

This case study provides the reader with comprehensive information about high-end solar cells and solar modules. The study justifies the PV module factory investment in terms of both technical and business aspects.

4 VALOE PLC – CASE DESCRIPTION

Valoe is using IBC (Interdigitated Back Contact) single crystal cells in its back contact modules. The contacts are on the backside of the cell, allowing the cells to be automatically and reliably connected to an electrically conductive back-sheet. The choice of cells is aimed at the highest possible electricity generation capacity and long service life. The amount of electricity produced over its lifetime and the level of production cost (LCOE) determine the profitability of the investment. The IBC cells will be produced at Valoe cell manufacturing facility located in Vilnius, Lithuania.

4.1 Background of Next Generation PV Module

In 2011, Valoe began its ambitious project related to solar power by, first securing Avery Dennison's conductive back-sheet business and, afterwards, Solland Solar's MWT solar module technology. At the end of 2014, Valoe sold its conventional industrial automation business to concentrate completely on the improvement of the next generation silicon-based PV-solar technology. Valoe wide know-how of high-tech and its involvement in fruitful conveyances to the leading world-wide companies in different business areas gave Valoe an unique advantage on designing back solar contact modules and their control circuits. In 2017, Valoe included the most recent feature to its commerce concept and began to develop its own solar cells.

Valoe is now ready to introduce to its partners a vertically integrated technology package comprised of IBC cell, module and manufacturing technology which all

are based on Valoe proprietary technologies. When Valoe partner buys a manufacturing plant, where Valoe not only delivers the manufacturing machinery but a full transfer of technology including certified recipes for standard and bifacial IBC modules.

Valoe technology package will provide its partners with a complete toolset for building power plants with the lowest production cost of electricity now and in the future.

4.2 IBC - Integrated Back Contact

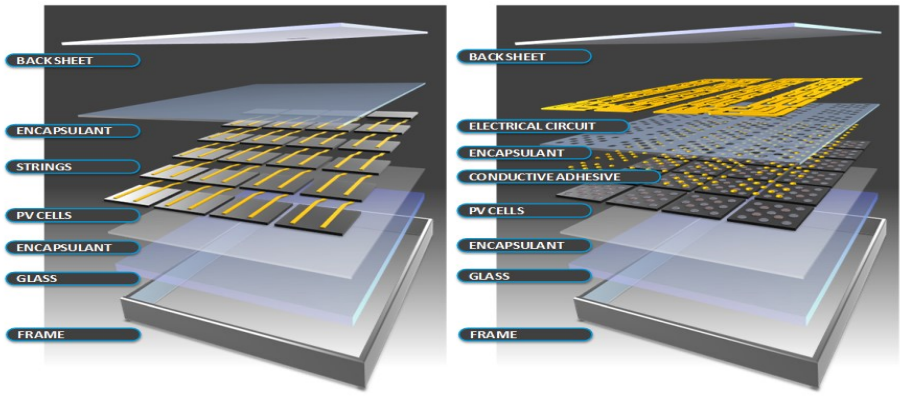

Figure 2. IBC - Integrated Back Contact (Valoe, 2022).

Standard module construction is displayed above on the left with strings (yellow) that are soldered onto the solar cells (dark grey). Valoe module construction on the other hand is displayed on the right, where cells are connected to the flexible circuit (yellow circuit element) using conductive adhesive. No soldering is required.

All Valoe VIPV (IBC) modules are made with Valoe own IBC cells that have one of the highest energy production capacities in the market. This guarantees a long lifetime and low operating and maintenance requirement.

Extreme protection for harsh conditions

Valoe provides the best protection against UV-radiation, humidity, wind, and other environmental factors in fluctuating outdoor conditions. Suitable for extreme

conditions such as deserts, oceans, chemical factories, and heavily polluted areas. In dusty environments there are many challenges for PV production:

1: Higher operating temperatures

- Reduced PV efficiency
- More stress on components in module, reduced lifetime
- More stress on BOS components

2: Higher UV exposure

- More stress on components in module, reduced lifetime
- More stress on BOS components

3: Dust

- Lower electricity production
- Higher maintenance costs
- Possible damage to modules / or coatings
- Damage to BOS components

Valoe VIPV (IBC) - Designed for hot climates

- Frameless design maximises cooling effectiveness
  - Lower operating temperature
  - Better energy yield
  - Longer lifetime
  - Better ROI

- Heat & UV tolerant design
  - No loss of performance even at very high temperatures
  - No UV degradation
  - Interconnection using conductive adhesive, no thermal cycle induces stresses

- Designed for higher irradiation
    - Back contact design allows for more metal in cell-to-cell interconnection
    - Shorter current distance, more contact points

Figure 3. Valoe VIPV IBC (Valoe, 2022).

Lower degradation

Back contact structure with advanced thermoplastic encapsulation leads to very low degradation – less than 0.3% degradation per year is way below industry standards. This enables over 90% of the initial efficiency even after 25 years of power generation.

Higher power density – lower balance of system cost

High power density brings you savings in the system cost as you need fewer materials (mounting fixtures, cabling, inverters etc.) and less work to set up the system.

The IBC cell technology has the highest efficiency compared to other cell technologies available now. The situation is not expected to change in the next few years (Figure 5).

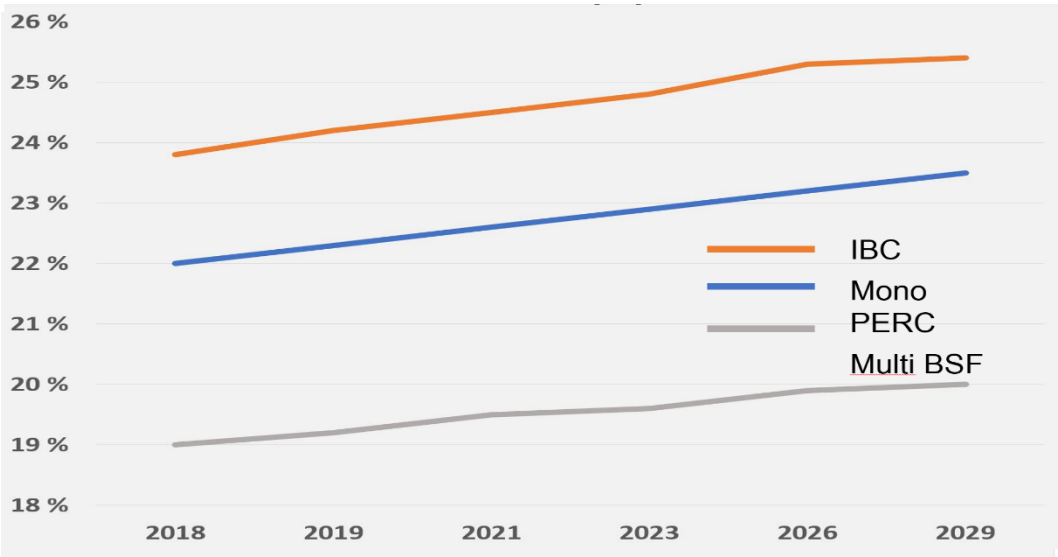

Figure 4. IBC cells compared to Mono PERC and Multi BSF (ITRPV, 2018).

4.2.1 Immaterial Property Rights

Valoe has covered its IPR with patents. That is because the product and production methods are superior compared to competitors.

NL2001958 - Method of monolithic photo-voltaic module assembly
NL2005811 - Method and apparatus for soldering contacts in a solar panel
NL2007935 - A method and a system for assembling a photovoltaic module, a sub-assembly for use in this method, and an assembled photovoltaic module
NL2007591 - Method for manufacturing a photovoltaic module
NL2008714 - A method of and a system and soldering station for electrically connecting an electric contact terminal to an electric contact patch of a photovoltaic device
FI125116 - Method and system for assembling a photovoltaic module (pending)
FI124969 - Photovoltaic module assembly

The customer gets a full technology package included in the shipment.

4.3 PV Module Factory

The high degree of automation inherent in the back contact PV technology developed by Valoe produces efficient, consistent, and durable solar panels. Valoe business models are based on generating solar electricity near the user, whether it is a geographical area or an electric appliance. Photovoltaics is most environmentally friendly when it is produced in a distributed manner, close to the user, with high-quality and long-lasting modules and systems.

Valoe provides automated module lines or whole factories. Valoe also offers module components to manufacturing partners committed to using the company's technology.

Valoe has designed next-generation module factory. All the key parts of the factory are Finnish design. Module factory is very compact and needed labour is low. In the next page is presented factory layout, that can produce 120 MW yearly. Incoming material flow is marked in blue arrows and ready panels are marked with yellow arrows. The factory is very compact, it can be fitted with material storages into 2 500 m^2 of space.

All the key components come from Valoe. All the key parts are listed in the following sections. The following information about the PVC module and its components, production process is essential in order to estimate the projected cost/revenue items.

Factory’s capacity is calculated to 100 % yield
120 MW Line

365 days / a year
24 h / 7 days a week
90 % utilisation
99 % yield
Cycle time for one panel is approximately 100 seconds

Ydin Line

Valoe commercial name for line that assembles different components to solar module (Ydin). Ydin is the soul of the module production line. It has been fully designed by Valoe. PV modules are assembled within this line. PV module production line consists of all the equipment needed for finishing the panel. It is fully automated; operators are only needed for monitoring the processes and feeding necessary components to the line.

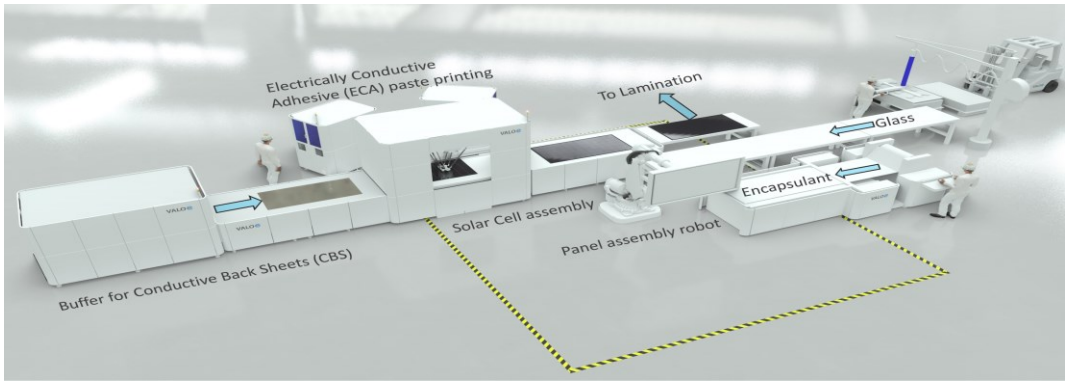

Figure 5. Ydin Line (Valoe, 2022).

Ydin consists of two electrically conductive adhesive (ECA) printers with infeed shuttles and solar cell assembly robot.

Description:

- Two VETO printing cells
- Delta robot with vision system for solar cell assembly
- Infeed conveyor
- 2- step conveyor for panel indexing
- Outfeed conveyor for panel assembly

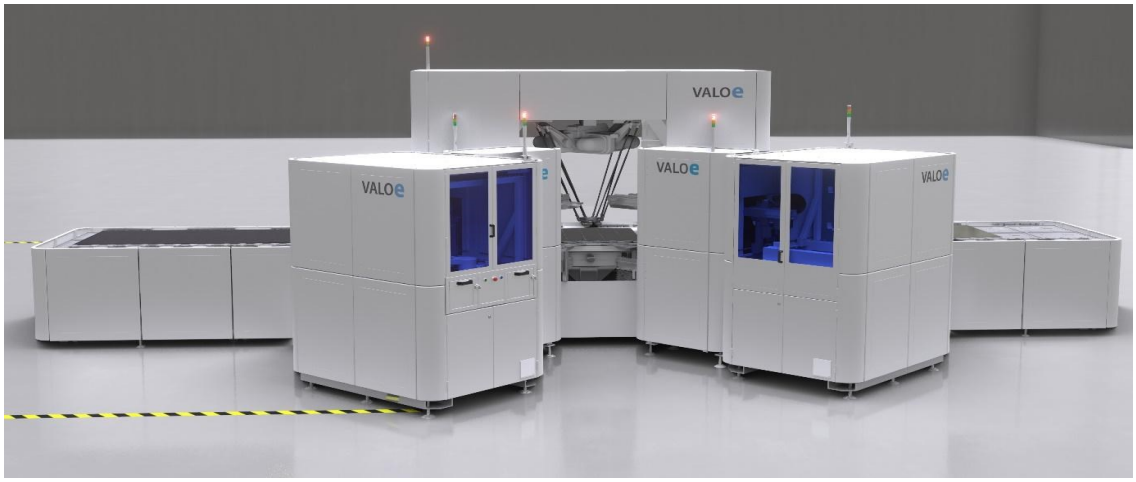

Figure 6. Ydin Line (Valoe, 2022).

Veto

Valoe commercial name for machine that prints the ECA on to the cells (Veto). With VETO machine, the Electrically Conductive Adhesive (ECA) is printed on to the solar cells.

Description:

- Two stack loading stations for solar cells
- Scara robot with vision system for loading
- 3-stage indexing table for loading, printing, and unloading
- ECA printer
- Shuttle unit for outfeed to assembly cell

Kela Line

Valoe commercial name for conductive backsheet (CBS) manufacturing line (Kela). This line produces backsheet for the solar panel. KELA line produces as many back-sheets as it is needed in the solar module line.
Kela line consists following processes:

- Back-glass and Polyolefin, encapsulant material (POE) are first laminated together. This is done prior to the KELA line.
- Conductive backsheet is then brought to the KELA line with forklift

- Laminate is lifted to the KELA line
- Reel unloader unrolls the copper and cuts them to correct length
- Assembly cells with intelligent grippers piles the CBS pieces on to the laminated glass
- Wire welding unit makes the final connections between the piled coppers

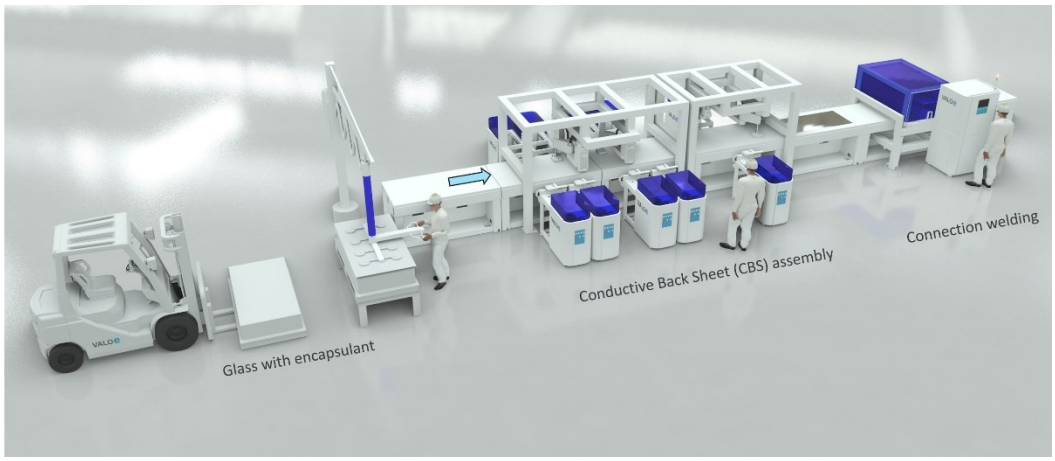

Figure 7. KELA Line (Valoe, 2022).

Wire Feeder description:

- Reel unloader for conductor wire
- Wire straightening unit
- Wire cutting and dispensing unit

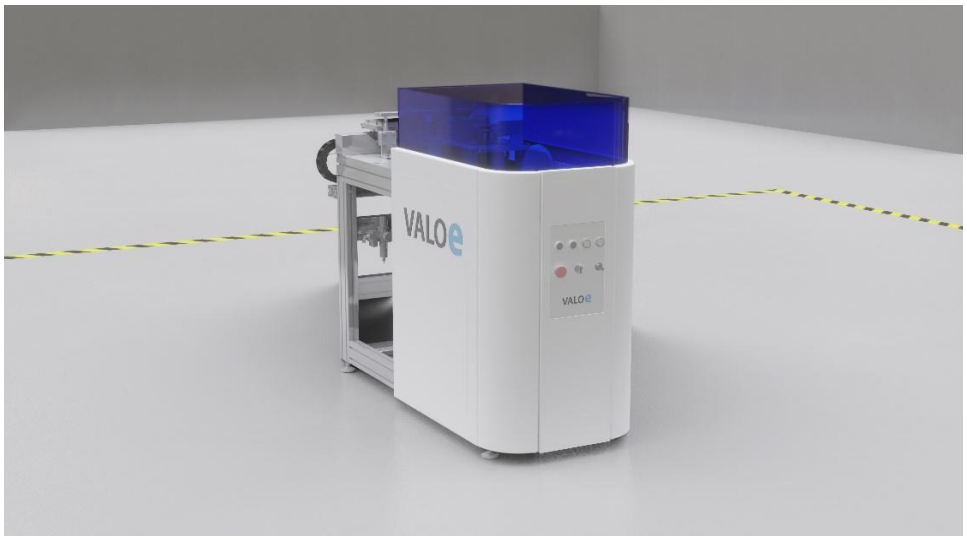

Figure 8. Wire Feeder (Valoe, 2022).

CBS Connector Wire Welding Unit description:

- Infeed conveyor
- Indexing conveyor
- X – Y – Z gantry robot for welding
- Parallel cap welding unit for J-box wire contacts
- Welding control unit with quality monitoring program

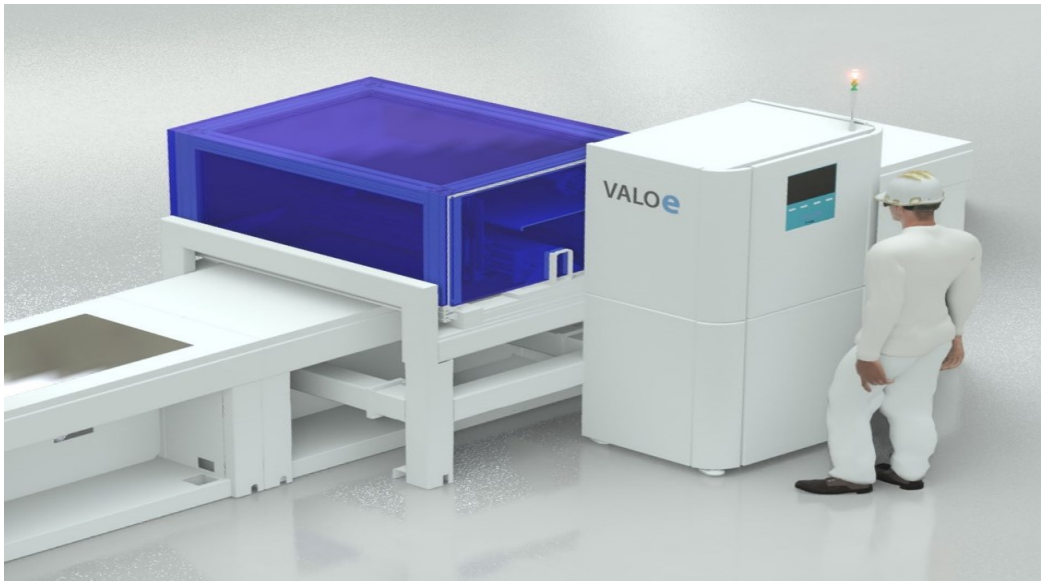

Figure 9. Wire Welding Unit (Valoe, 2022).

Tact times for PV modules 72 cell module tact time is 100 to 120 seconds. Each process step is adjusted so that every step can be done within this time. Buffers are used between machines to fill the gaps when new material is fed into the line.

Factory capacity maximum capacity of this factory is 120 MW yearly. This is absolutely the maximum of this factory. Capacity is calculated with 100 & yield and 100 % efficiency.

4.4 Investment Cost calculations based on Saudi Arabia

In the following sections the investment cost of the proposed venture is explained. The investment cost includes everything in the technology package that

Valoe offers to its new partners. The projections have been determined together with Valoe key personnel and Middle Eastern specialised consultant firm KOVA PMC, with the presence of the proposed partner.

Total project cost will be 12,75 M€. Valoe will deliver a key-turn solution. All the necessary items are listed on the budget. The customer gets the whole technology package at once including technology transfer from Valoe to customer. The knowledge that Valoe has gained during the past years can benefit the customer immediately.

Production equipment comes from Valoe. All the key parts are presented previously in this case study.

Investment costs that are included (Table 1):

- Building
- Production equipment
- Ramp-up costs
- Working capital for first year
- Materials
- Salary

Table 1. Equipment costs (Väisänen, 2022).

1 . Project funding			
Fixed assets			
Building	€	0.%	-
Production equipment	€	94.%	12 000 000
Initial raw materials	€	4.%	500 000
Other equipment	€	1.%	150 000
Vechiles	€	0.%	50 000
Office Equipment		0.%	50 000
Initial Funding Requirement	€		**12 750 000**

Profitability calculations presented all the calculations are based on European products and high-quality VIPV (IBC) modules. Calculations are based on 36 cell panels. The assumption is that revenue is generated though the sales of VIPV

(IBC) modules and charge controllers designed for utility vehicles, in this case targeting the reefer trucks operating in the region.

Table 2. Revenue assumptions (Väisänen, 2022).

Mod. Type	Wpe		215	215	230	230	240	240	250	250
Mod.	MW		3	5	10	15	15	30	30	30
Charge controller	MW		1	4	8	12	15	30	30	30
Total Mod. Sold	#		18 605	41 860	78 261	117 391	125 000	250 000	240 000	240 000
4,2 **Sales Prices**										
Price per Wp (Mod.)	€ / Wp		1,00	0,97	0,94	0,91	0,89	0,86	0,83	0,81
Escalation rate	%			-3 %	-3 %	-3 %	-3 %	-3 %	-3 %	-3 %
Price per Mod.	€ / Mod		215,00	208,55	216,41	209,91	212,47	206,10	208,24	202,00
Price per Wp (EPC Mod.)	€ / Wp		0,95	0,92	0,89	0,87	0,84	0,82	0,79	0,77
Escalation rate	%			-3 %	-3 %	-3 %	-3 %	-3 %	-3 %	-3 %

The table above (Table 2) presents the assumed revenue of the venture for the first nine operating years. The first year is not displayed in the table, as there is no production during that time, instead it is used to ramp-up the production. The sales volume grows steadily during the first nine years of operation from 3 mega-watt to 30 megawatts.

Table 3. Revenues (Väisänen, 2022).

Revenues	Period reference									
	Operational year No.		1	2	3	4	5	6	7	8	9
	Start of period		1-tammi-2022	1-tammi-2023	1-tammi-2024	1-tammi-2025	1-tammi-2026	1-tammi-2027	1-tammi-2028	1-tammi-2029	1-tammi-2030
	End of period		31-joulu-2022	31-joulu-2023	31-joulu-2024	31-joulu-2025	31-joulu-2026	31-joulu-2027	31-joulu-2028	31-joulu-2029	31-joulu-2030
Construction Flag			1	0	0	0	0	0	0	0	0
Operation Flag			0	1	1	1	1	1	1	1	1
Modules (only)	Euro 000		-	3 000 000	4 850 000	9 409 000	13 690 095	13 279 392	25 762 021	24 989 160	24 239 485
Charge Controller	Euro 000		-	950 000	3 686 000	7 150 840	10 404 472	12 615 423	24 473 920	23 739 702	23 027 511
			-	3 950 000	8 536 000	16 559 840	24 094 567	25 894 815	50 235 941	48 728 862	47 266 996

In the table above (Table 3) the estimated module sales are displayed. The table showcases the amount of revenue generated through the sales VIPV (IBC) modules, and the charge controllers. Revenue shows steady growth during the first nine years of operation, increasing from a modest 4 million to 47 million.

The VIPV (IBC) modules designed for the reefer truck are 1 square meter in size, one truck will be equipped with 30-modules which is equivalent to 7.5 kilowatts. The power generated will be directed to supply the cooling units of each truck through the charge controller designed and manufactured by Valoe.

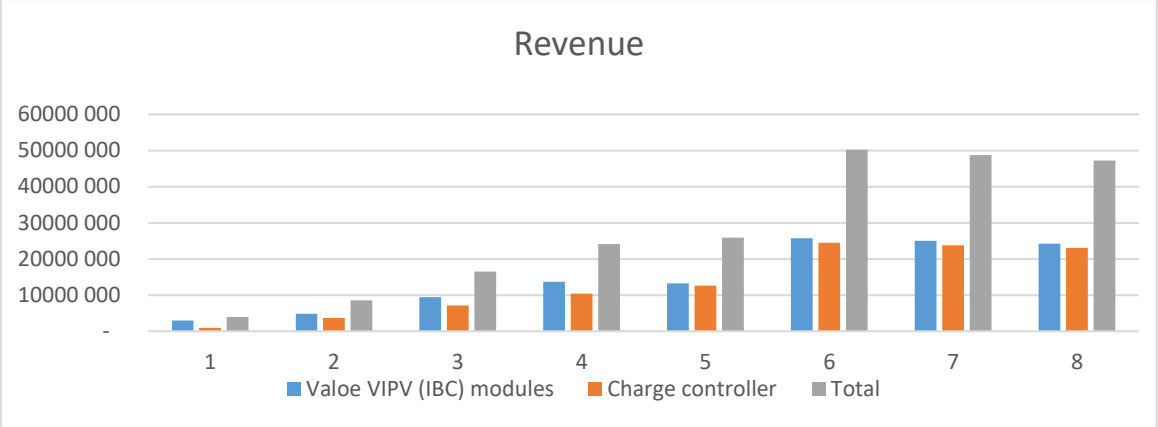

Figure 10. Revenue (Väisänen, 2022).

In the figure above (Figure 10) the assumed revenue is displayed for the first nine operating years. The first year is not displayed in the table, as there is no production during that time, instead it is used to ramp-up the production. The revenue has been divided into three-groups. The blue columns represent the sales generated from the sales of charge controller, orange columns represent the sales of the solar modules, and the grey columns represents the total revenue. In the first nine-operating years the revenue grows roughly from 4 to 47 million Euros.

Table 4. Income statement (Väisänen, 2022).

Operational year No.	1	2	3	4	5	6	7	8	9
Start of period	##########	##########	##########	##########	##########	##########	##########	##########	##########
End of period	##########	##########	##########	##########	##########	##########	##########	##########	##########
Construction Flag	1	0	0	0	0	0	0	0	0
Operation Flag	0	1	1	1	1	1	1	1	1
Revenues									
Modules (only)	-	3 000 000	4 850 000	9 409 000	13 690 095	13 279 392	25 762 021	24 989 160	24 239 485
Charge Controller	-	950 000	3 686 000	7 150 840	10 404 472	12 615 423	24 473 920	23 739 702	23 027 511
Total revenues	-	**3 950 000**	**8 536 000**	**16 559 840**	**24 094 567**	**25 894 815**	**50 235 941**	**48 728 862**	**47 266 996**
Operating expenses									
Raw Materials	-	1 973 581	5 012 307	9 430 458	13 951 093	15 470 047	30 542 091	29 387 567	29 020 616
Production Workers	-	346 752	707 374	721 522	858 611	1 313 674	1 339 948	1 366 747	1 394 082
Rent	75 000	150 000	150 000	150 000	150 000	150 000	150 000	150 000	150 000
Electricity	-	12 480	28 080	56 160	84 240	93 600	187 200	187 200	187 200
Equipment service and Maintenance	-	10 600	10 812	11 028	11 249	11 474	11 703	11 937	12 176
Total Direct Expences	**75 000**	**2 493 413**	**5 908 573**	**10 369 168**	**15 055 193**	**17 038 795**	**32 230 942**	**31 103 451**	**30 764 074**
Gross Profit	**(75 000)**	**1 456 587**	**2 627 427**	**6 190 672**	**9 039 374**	**8 856 020**	**18 004 998**	**17 625 411**	**16 502 923**
Gross Profit Margin	*0%*	*37%*	*31%*	*37%*	*38%*	*34%*	*36%*	*36%*	*35%*
Overhead expenses									
Research & Development (R&D)	-	68 544	69 915	142 626	145 479	148 388	151 356	154 383	157 471
R&D Equipment	40 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000
Sales and marketing expenses	59 520	121 421	123 849	126 326	193 279	197 145	201 088	205 109	209 211
Admin expenses - Managers	74 400	151 776	154 812	157 908	161 066	164 287	167 573	170 924	174 343
Admin expenses - Employees	14 880	37 944	38 703	39 477	40 266	41 072	41 893	42 731	43 586
Others (Travelling, Advertizing, Office Consumables)	-	180 000	230 000	230 000	230 000	230 000	230 000	230 000	230 000
Total Overhead Expenses	**188 800**	**609 685**	**667 278**	**746 337**	**820 090**	**830 892**	**841 910**	**853 148**	**864 611**
EBIDTA	**(263 800)**	**846 902**	**1 960 148**	**5 444 335**	**8 219 284**	**8 025 128**	**17 163 088**	**16 772 263**	**15 638 311**
Depreciation	-	1 225 000	1 225 000	1 225 000	1 225 000	1 225 000	1 225 000	1 225 000	1 225 000
EBIT	**(263 800)**	**(378 098)**	**735 148**	**4 219 335**	**6 994 284**	**6 800 128**	**15 938 088**	**15 547 263**	**14 413 311**
Interest Cost	-	608 507	502 694	389 473	268 327	138 700	-	-	-
Corporate tax	-	-	-	-	-	-	-	-	-
Net Profit	**(263 800)**	**(986 606)**	**232 455**	**3 829 862**	**6 725 957**	**6 661 428**	**15 938 088**	**15 547 263**	**14 413 311**

In the table above (Table 4) the income statement of the new joint-venture is displayed for the first nine-operating years. The first year of operation is used to

ramp up the production. The costs during the first year of operation mainly consists of operating expenses (rent) and overhead expenses (R&D, equipment, and admin expenses) which translates to 263 800 Euros. Over the years, we can see steady growth in revenue, which also translates accordingly in the increasing net profit. The income statements table compliments the new venture, showcasing its self-sufficiency obtained throughout the years.

4.4.1 Cashflow Calculations

In the table below (Table 5) the joint ventures cashflow over the first nine-years of operation is displayed. The calculations show steady growth in cash flow and the bottom stays out of red. This indicates that the joint venture is mastering its core activities and it is generating reliable revenue while growing its customer base, these are all positive indicators for the future of the joint venture.

Table 5. Cashflow (Väisänen, 2022).

Cf	Period reference								
	Operational year No.	1	2	3	4	5	6	7	8	9
	Start of period	1-tammi-2022	1-tammi-2023	1-tammi-2024	1-tammi-2025	1-tammi-2026	1-tammi-2027	1-tammi-2028	1-tammi-2029	1-tammi-2030
	End of period	31-joulu-2022	31-joulu-2023	31-joulu-2024	31-joulu-2025	31-joulu-2026	31-joulu-2027	31-joulu-2028	31-joulu-2029	31-joulu-2030
	Construction Flag	1	0	0	0	0	0	0	0	0
	Operation Flag	0	1	1	1	1	1	1	1	1
	Interest Cost	-	608 507	502 694	389 473	268 327	138 700	-	-	-
	Working Capital									
	Accounts Payable	9 247	298 161	421 047	549 936	577 729	244 554	1 873 005	(139 006)	(41 841)
	Accounts Receivables	-	(486 986)	(565 397)	(989 241)	(928 939)	(221 948)	(3 000 961)	185 804	180 230
	Cash from Operating Activities	**(254 553)**	**658 076**	**1 815 798**	**5 005 031**	**7 868 074**	**8 047 733**	**16 035 132**	**16 819 061**	**15 776 700**
	Capital expenditure	(12 250 000)	-	-	-	-	-	-	-	-
	Cash from Investing Activities	**(12 250 000)**	-	-	-	-	-	-	-	-
	Equity Injection	4 680 827	-	-	-	-	-	-	-	-
	Debt Draw downs	8 692 964	-	-	-	-	-	-	-	-
	Principal repayments	-	(1 511 625)	(1 617 439)	(1 730 660)	(1 851 806)	(1 981 433)	-	-	-
	Interest Payments	-	(608 507)	(502 694)	(389 473)	(268 327)	(138 700)	-	-	-
	Cash from financing activities	**13 373 790**	**(2 120 133)**	**(2 120 133)**	**(2 120 133)**	**(2 120 133)**	**(2 120 133)**	-	-	-
	Net Cash flow for the year	869 237	(1 462 057)	(304 335)	2 884 898	5 747 941	5 927 600	16 035 132	16 819 061	15 776 700
	Opening Balance	-	869 237	(592 820)	(897 155)	1 987 743	7 735 684	13 663 284	29 698 417	46 517 478
	Closing Balance	**869 237**	**(592 820)**	**(897 155)**	**1 987 743**	**7 735 684**	**13 663 284**	**29 698 417**	**46 517 478**	**62 294 178**

4.4.2 Raw materials and components

In the figure below (Figure 12) the materials needed for the solar module productions are presented with percentages in relation to the total material cost of the module. The individual materials and components are not named, instead presented with numbers, with the corresponding percentage presented next to them.

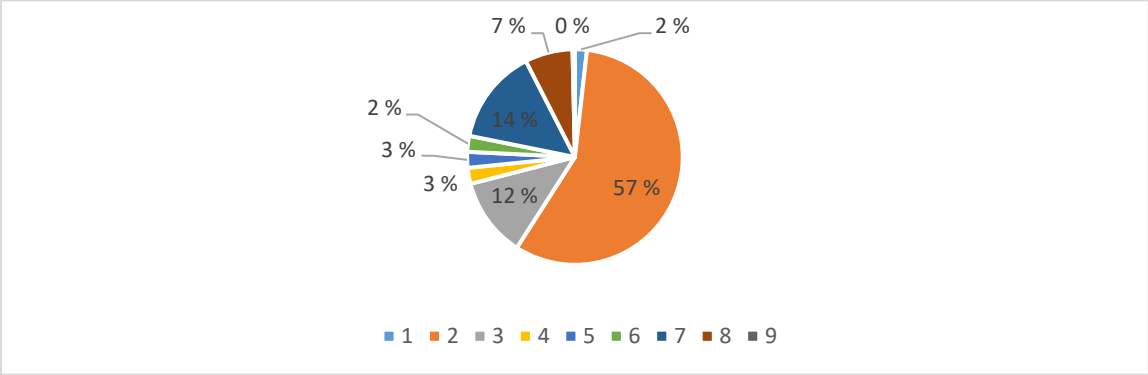

Figure 11. Module BOM (Väisänen, 2022).

Wages (Based on Sauri Arabia)

Assumption for different positions:

- Blue-collar worker/operators: 860 €/ month
- R&D engineer: 5 000 €/ month
- Salesman: 4 000 €/ month
- Admin Managers: 2 500 €/ month

Salary is expecting to rise 2 % per year.

Year 1 only one shift is needed because of the ramp-up period.

Table 6. Cost of staff (Väisänen, 2022).

6,1 **Research & Development (R&D)**												
Staff salary	€/month/employee	5 000	5 000	5 100	5 202	5 306	5 412	5 520	5 631	5 743	5 858	5 975	6 095
Average Monthly Salary	%	2,0%											
Salary growth	%	12,0%	600	612	624	637	649	662	676	689	703	717	731
Number of R&D employees			-	1	1	2	2	2	2	2	2	2	2
6,2 **R&D Equipment**													
Equipment (not considered investment)	€/year		40 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000	20 000
Materials (consumables)	€/year		-	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000
Other (3rd party research)	€/year		-	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000	15 000
6,3 **Sales and marketing expenses**													
Average Monthly Salary including benefits	€/month/employee	4 000	4 000	4 080	4 162	4 245	4 330	4 416	4 505	4 595	4 687	4 780	4 876
Salary growth	%	2,0%											
Fringe benefits	%	12,0%	480	490	499	509	520	530	541	551	562	574	585
Personnel costs	% of salary	12,0%	480	490	499	509	520	530	541	551	562	574	585
Number of S&M employees			1	2	2	2	3	3	3	3	3	3	3
6,4 **Travelling + Advertizement + Etc.**			-	150 000	150 000	150 000	150 000	150 000	150 000	150 000	150 000	150 000	150 000
6,5 **Admin expenses**													
Managers	€/month/employee	2 500	2 500	2 550	2 601	2 653	2 706	2 760	2 815	2 872	2 929	2 988	3 047
Salary growth	%	2,0%											
Fringe benefits	%	12,0%	300	306	312	318	325	331	338	345	351	359	366
Personnel costs	% of salary	12,0%	300	306	312	318	325	331	338	345	351	359	366
Number of Managers			2	4	4	4	4	4	4	4	4	4	4
Supporting Activity Employees	€/month/employee	500	500	510	520	531	541	552	563	574	586	598	609
Salary growth	%	2,0%											
Fringe benefits	%	12,0%	60	61	62	64	65	66	68	69	70	72	73
Personnel costs	% of salary	12,0%	60	61	62	64	65	66	68	69	70	72	73
Number of Admin Employees			2	5	5	5	5	5	5	5	5	5	5

4.4.3 Financing costs

To fund the joint venture a loan of 8 692 964 euros will be withdrawn summing up to 65% of the initial investment. The rest of the joint venture (35%) will be funded by other means of equity. There will be one year of grace period during which only interest will be paid. The loan has a 7% annual interest rate, and the pay-back time has been calculated to be five years as presented in the table above (Table 7).

Table 7. Loan (Väisänen, 2022).

Year of pay	Payment No.	Payment Date	Payment	Principal	Interest	Balance
						8 692 964
2023	1	31-joulu-2023	2 120 133	1 511 625	608 507	7 181 338
2024	2	31-joulu-2024	2 120 133	1 617 439	502 694	5 563 899
2025	3	31-joulu-2025	2 120 133	1 730 660	389 473	3 833 239
2026	4	31-joulu-2026	2 120 133	1 851 806	268 327	1 981 433
2027	5	31-joulu-2027	2 120 133	1 981 433	138 700	(0)

5 RESULTS

In this chapter, the results of the case study are presented. As the study was conducted using a mix of primary data and archival, the results are also presented with such differentiation.

The objective of the data analysis was to understand the internal and external environments that may affect Valoe expansion in the GCC region. External macro environment and internal factors were carefully analysed to fulfill the objective of the study.

The conducted interviews were dissected through thematic analysis which is a data-driven method of qualitative research to group findings (Vilkka, 2007).

Figure 12. Pestel analysis (Väisänen, 2022).

The results of the data analysis were converted to the above visualised PESTEL framework (Figure 12). The PESTEL analysis allowed to understand and elevate the external environment and its contribution to the success of the venture. The completion of the PESTEL analysis contributed to identifying the recognised challenges that Valoe may face in its attempt to expand into the GCC countries.

Figure 13. Swot analysis (Väisänen, 2022).

To deepen the understanding of the possible challenges Valoe may face in its attempt to expand into the GCC market, internal factors were also taken into consideration. The data analysis was converted into the below visualised SWOT-analysis of the organisation and its current stage (Figure 13).

Recognized challenges

Careful data analysis and conversion of unified findings into the PESTEL and SWOT analysis framework, guided the process of recognising challenges related to Valoe pursuing in expanding into the GCC countries (Figure 14).

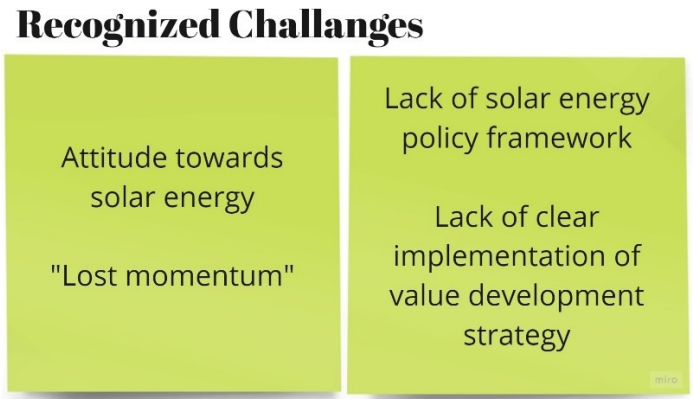

Figure 14. Recognized challenges (Väisänen, 2022).

The above-mentioned recognised challenges, provide the answer to the research question of this thesis: *What are the challenges of international expansion of Valoe PLC in the GCC market?*

The general attitude towards solar energy is not on the level it should be, due to abundance of fossil-fuel available in the region. Nearly all the GCC nations have declared plans to deploy significant volumes of solar-power generation capacity within the following decade. Saudi Arabia is extraordinary to be the single most important showcase in the solar-power era, with its target of conveying 41 GW of solar energy within the long term. Be that as it may, despite major plans reported within the past by the region's governments to kickstart the segment, the real deployment is still at its early stage.

Lack of solar energy policy framework meaning, the need for a clear approach framework is one the main reasons for the currently limited solar movement in the GCC countries. Most of the developments up to date has been state-supported. In any case, going forward, if the GCC countries are serious about creating an

economical solar-energy market that draws significant investment form the private segment, at that point a clear and straightforward solar-energy policy must be communicated to construct market certainty within the industry. Besides, there's an intense need for clarity with respect to the part of the open sector control industry partners to motivate private sector investor's confidence.

Other variables that ought to be instantly tended to, incorporate a clear implementation of value chain development strategy, human capital development and innovative solutions through centered R&D on technical challenges such as unforgiving climatic conditions, water scarcity, and control supply inconstancy.

Investment cost

The investment cost includes everything in the technology package that Valoe offers to its new partners. The projections have been determined together with Valoe key personnel and Middle Eastern specialised consultant firm KOVA PMC, with the presence of the proposed partner.

The total project cost will be 12,75 M€. Valoe will deliver a key-turn solution. All the necessary items are listed on the budget. The customer gets the whole technology package at once including technology transfer from Valoe to customer. The knowledge that Valoe has gained during the past years can benefit the customer immediately.

Production equipment comes from Valoe. All the key parts are presented previously in this case study in section 4.3. The key investment cost features are presented in section 4.4.

The above-mentioned quotation, provides the answer to the sub-research question of this thesis: *What is the initial investment cost?*

Predictions for the solar energy market in GCC countries

The potential for solar energy within the GCC region is indisputable. Underpinned by the intense need to discover elective energy sources to diminish the opportunity cost of burning fossil fuels, as well as the requirements to drive economic improvement, employment, and technology-intensive industries the solar industry is not a division this region can afford to ignore and not develop any longer.

Renewables proceed growing rapidly and can help greatly to boost the region's power supply in the years ahead. High interest in energy diversification and decreasing cost of installation have made solar power cost competitive with conventional energy technologies.

Careful thematic analysis of the collected data from specialist interviews, provided the answer for the second sub-question of the thesis: *What are the predictions for the solar energy market in GCC countries?*

Political atmosphere in the GCC countries is very friendly to solar energy installations. Targets for the development of solar energy are implement through various government projects and policies. Solar energy plans and status of deployment have come a long way, with recent developments being especially significant. Differences in market size, ambitions and readiness can be seen between countries, yet overall picture is one dynamic region.

Plans and targets for the advancement of solar energy are slowly being interpreted into concrete policies and ventures, and the brief and medium-term viewpoint is promising, especially with the GCC's biggest energy markets, Saudi Arabia, and the UAE.

IRENA (2019) described that in energy utilisation by division, industry is the overwhelming user of energy within the GCC, accounting for close to half (47%) of the entire demand. Transport presently accounts for just over a third (34%), with its

share developing at a steady pace. Private and commercial uses speak to smaller shares of overall final energy utilisation, mainly in the form of electricity.

Electrification of transport can offer an opportunity. Solar energy is likely to contribute to the diversification of the fuel-based transport within in the GCC, through the electrification of private, public, and industrial vehicle fleets utilising clean power sources. The availability of a few mass-market electric vehicle models, alongside later progress in dragging out battery range, may well be the diversion changers. Approaches to assist materialise the numerous potential benefits of electrifying transport include infrastructure improvement (charging stations), money-related motivations, and the extension of electrified trains and tram system to transport growing number of day-by-day commuters as an alternative to private cars.

The GCC refrigerator transport market is right now seeing a moderate development. Refrigerated transport has become necessary to the distribution process since numerous items and crude materials require control temperatures amid transportation and storage for spoilage prevention.

The GCC refrigerated transport market is essentially driven by the different activities attempted by the government of GCC nations to advance globalisation and universal exchange. With fixed safety compliance requirements over the nation's refrigerated transport coordination has become a crucial portion of the transportation of temperature sensitive merchandise. Separated from this with the expanding population and fast urbanisation the request for different basic products and solutions have been raised. This is driven arise within the requirement for refrigerated transportation system. Besides this the development of the organised retail division has initiated online nourishment retailers to obtain cold chain facilities to store and transport personal items and temperature sensitive drugs that are not available locally.

The following findings were the result of the interviews and meetings conducted.

The reefer truck market size in the Middle East and Africa in the year 2020

counted for 6567.6 million USD, and it is predicted to reach 8475.2 million USD by the year 2027, summing to a 4.3% rise in CAGR.

Key market drivers in the region are government initiatives and tightened safety compliance. The rising popularity in promotion of globalisation and international trade alongside rapidly growing population and urbanisation are also contributing positively to market growth.

6 CONCLUSIONS

The case study for the business idea shows, that most of the discussion participants see potential in the pitched business idea. There is clear need for such product in the GCC market, which is driven by government initiatives and the rapidly growing population. The high interest in solar technology and solar power in the region provide opportunities in the automotive field within the region. Solar energy is likely to contribute to the diversification of the fuel-based transport within in the GCC, through the electrification of private, public, and industrial vehicle fleets utilising clean power sources. The availability of a few mass-market electric vehicle models, alongside later progress in dragging out battery range, may well be the diversion changers.

6.1 Key results and findings

The study fulfills its objectives. The study has analysed the case study from the requested point of views, without neglecting the internal and external environments that may influence the success of the proposed venture. All the research questions were answered without biased intention with the required reasoning behind.

The study identified the following challenges that Valoe must be aware of when proceeding to expand into the GCC market. The general attitude towards solar energy is not on the level it should be, due to abundance of fossil-fuel available in the region. Lack of solar energy policy framework meaning, the need for a clear

approach framework is one the main reasons for the currently limited solar movement in the GCC countries. Other variables that ought to be instantly tended to, incorporate a clear implementation of value chain development strategy, human capital development and innovative solutions through centered R&D on technical challenges such as unforgiving climatic conditions, water scarcity, and control supply inconstancy.

As the result of the study the total project cost has been determined to be 12,75 M€. Valoe will deliver a key-turn solution. All the necessary items are listed on the budget. The customer gets the whole technology package at once including technology transfer from Valoe to customer.

The study provided detailed insight into the future predictions of the solar energy market within the GCC by determining the value of solar power in the electrification of transportation. Solar energy is likely to contribute to the diversification of the fuel-based transport within in the GCC, through the electrification of private, public, and industrial vehicle fleets utilising clean power sources. The availability of a few mass-market electric vehicle models, alongside later progress in dragging out battery range, may well be the diversion changers.'

6.2 Managerial implications

This study is a valuable tool for Valoe. They can refer to it in their future discussions with potential clients within in the GCC region. The study highlights the challenges and potential of the GCC market, which is valuable information for both parties to take on board when designing joint-ventures.

The study justifies the investment from both financial and technical point of view. The study provides an understanding of the current and future environment of the proposed new market as well the potential and challenges of the market.

6.3 Reliability discussion and future development

The areas of improvement in this study are mainly related to the initial research process, referring to the data collection and analysis of the data.

Interaction with the potential customers of this new venture was limited during the period this study was conducted, thus limiting the interaction with key-personnel in the new foreign market, which would have provided deeper understanding of the market and complimented the market analysis of the study.

The use of content analysis was used to find patterns in the collected data, and differences in the language or debate based on culture and society provide data that is applicable for a very specific timeline, the data is reliable during a specific timeframe, neglecting the future possibilities and events that may occur after the study is completed for example the current increasing global lack of microcircuits and electrical components.

To further develop the study, the potential customers, and key personnel from the GCC region need to be more involved during the initial research stage. Their information is highly valuable, and it can contribute to the level of detail in the research by providing insights into the market based on first-hand experience. To complete the study, the addition of a thorough market research would add greatly to the credibility of the study, providing guarantees for the predicted projections. The market research should be segmented by country, by application and by make or model of transportation. This would provide rich market research intelligence that would help Valoe and its partners to make important strategic decisions.

The market research should investigate the current market scenario and how it would change in the following years, what are the factors driving the market (including challenges and opportunities), what are the fastest growing segments and what are the factors attributed to their growth, who are the key market players and what their strategies are and lastly, what are the recent developments in the market. To create more credibility for the study the use of paid databases and

interviews with key opinion leaders and industry participants, along the value chain should be considered. For validation, use data triangulation could be an advantage to segment the market into sensible sub-segments according to the popular chouses of key industry participants. This would provide precise information of the market providing a clear picture of the market size and help Valoe and its partners to seize the desired market gap.

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Appendix 1

LIST OF FIGURES

LIST OF TABLES

Appendix 2

Valoc meeting 25/8/2021

Marwas + Valoc SVP present

strategy

- vehicles (VIPV) solutions development and marketing
- vertical integration

! OddForm

- many development partners
- 1st mass production agreement on sight

GCC countries

- seen as very promising market
- JV in Saudi Arabia
- Products are marketed as we speak in 4 GCC countries

1 Dubai
2 Abu Dhabi
3 Oman
4 Saudi Arabia

Future

- VIPV
- BIPV

-> custom/tailored solutions

-> light, durable modules are key drivers

Appendix 3

Arthur D'Little Meeting 10/9/2021
Head & Energy

Markus + Valoe SVP + Arthur D. consultant

Solar energy in GCC

! increasing -> more and more development visible
  L> still at 'early' stage
! other alternatives (wind, hydro)

! increasing efficiency + lower prices
  have made solar competitible
  L> increased customisation is advantage!
  L> electrification of trafick (vehicle leet)

Goverment policies

- Big plans for eg. in Dubai
  L> Dubai 2050 (net zero)
    L> massive investments in solar in the following 3-decades
- Kuwait + Saudi 2030 -> 30% of energy come from renewables
- Bahrain + Qatar 2030 -> 15% of energy comes from renewables

- goverment fonded projects (
-> big plans, will they hold? -> 'lost momentum'
-> slowly translated to actual policies

Challange

- abondance of fossil foels
  -> old habits take time to change
  -> lack of a clear, solid solar framework
    L> differences between countries
- value chain
- homan capital dulp.
- R & D