



VIABILITY OF SOLAR PANELS EXPORT FROM COLOMBIA TO THE REGION OF ANTOFAGASTA IN NORTHERN CHILE

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To God be our guide in every moment of this stage of life that is about to finish.

To our families for believing in our capabilities and give us their continued support throughout our career, and our teachers, those that marked each stage of our university way; and they helped us advice and questions presented to enable us to become better professionals.

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Summary

Currently in Latin America, most countries now have laws to implement non-conventional renewable energy (ERNC), a situation that will allow growth of these energies in the short term, coupled with high energy demand by developing countries Latin American and major climate changes. To implement the use of these energies the most important thing is to have the resources to do so, an example of far-reaching in its application is Chile, a country with high growth and energy demand, with shortages of fossil fuels, but has a particularity by geography, it is the country with the highest solar radiation on the planet, allowing you to use the sun to develop photovoltaics. an extensive analysis of this geographical advantage with scientific information and experts in the field is done, and it is evident that Chile is a country with great potential market for the sale of photovoltaic panels, in addition to have treaties with several countries, including Colombia facilitates relations, marketing and export of photovoltaic panels for solar projects.

Keywords: Photovoltaic solar panels, solar energy, non-conventional renewable energy, solar radiation, export.

Abstract

Currently in Latin America, most countries now have laws to implement non-conventional renewable energy (NRDC), a situation that will allow growth of these energies in the short term, coupled with the high energy demand for the development of Latin American countries and major climate changes. To implement the use of these energies the most important thing is to have the resources to do so, an example broader in its application is Chile, a country with high growth and energy demand with fossil fuel shortages, but it has a special feature by geography is the country with the highest solar radiation on the planet, which allows you to use the sun to develop photovoltaic. An extensive analysis of this geographical advantage with scientific information and experts is done on the subject and evidence that Chile is a country with great potential market for the sale of photovoltaic panels further by having treaties with several countries, including Colombia facilitates relations marketing and export of photovoltaic panels for solar projects

Keywords:

Photovoltaic panels, solar energy, non-conventional renewable energy, solar radiation, export.

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List of Symbols and Abbreviations

List of Symbols

USD. Indicates the symbol of dollar currency

US\$. Indicates the symbol of dollar currency

\$. Indicates the currency symbol pesos

%. Percentage. Represents a given as a fraction of 100 parts amount.

List of Abbreviations

ERP. It indicates the planning system material requirements.

M³. Cubic meter

MWh. Megawatt hour. It is a unit of measurement of electricity, equivalent to one million watt-hours.

MW. Megawatt. It is a power unit in the International System equivalent to one million watts

ACE. Economic complementation agreement.

USP. Universal superpower Technology.

SENA. National Learning Service.

BL. Bill of lading

Introduction

In a globalized economy it takes much relevance competitiveness of countries against their ability not only to achieve its macroeconomic goals if not to generate appropriate to achieve development in the years ahead conditions.

To the extent that the population grows, increased energy demands arise hence the relationship between energy and economic growth and social growth. Thus potentiate takes great importance on the market for the generation of energy that supply the energy needs of a growing population.

Energy consumption in Chile has presented a growing trend in recent years, which is why this country is facing a great challenge in approach its national energy strategy, therefore the challenge facing Chile is to have enough energy resources will enable supply the demand of a growing population. It is noteworthy that Chile is a country with a deficit of natural resources so they are forced to be a highly importer of energy resources country, this dependence on fossil fuels directly influences the marginal costs and the price of electricity, considering that currently the fossil fuel prices in the world are high and volatile.

Photovoltaic solar systems are systems using a photovoltaic cell convert solar radiation into energy, this technology has been gaining much strength as more and more countries focused on caring for the environment and energy generation from renewable sources. Photovoltaic solar systems depend for their operation on the intensity of solar radiation that come to their cells, so the geographic location

becomes a determining factor for evaluating projects focused on the use of these technologies factor.

This paper aims to assess the feasibility of exporting solar photovoltaic systems from Colombia to the Chilean market based primarily on the geographical advantage with that country account for the use of these systems and secondly of its current energy needs, even has led the government to pass laws that encourage the population in the use of these technologies has been granted the right consumers of energy companies to generate their own energy, consume and sell their surplus.

Energía & Potencia Colombian company is a pioneer in the development of sustainable projects throughout the country, has developed projects in partnership with Colciencias (Administrative Department of Science, Technology and Innovation) where they installed solar panels on guajira and obtained very good results, in view of the company to achieve greater recognition and more competitive is to assess the feasibility of exporting solar photovoltaic systems to the Chilean market, it may be obvious to think that with the fluctuation of the dollar is not economical to perform an import of these products and then export them and they make it easier for companies interested to import directly from the provider country however is considered important to have added value associated with learning experiences and training of personnel enabling to provide customers of Chile and any company the best advice to potential obstacles, difficulties and unforeseen events that may occur during the process. Is imprecise ensure the viability of the project, it is why using a structured methodology where expert interviews some Chilean companies that are expected to obtain relevant for the diagnosis of the situation information will be held on the issue and surveys.

1. Project Formulation

1.1 Background

1.1.1 State Of The Art

Development model based on the implementation of a sustainable energy matrix.

"The future of humanity depends on the generation of renewable energy" (...)
"Renewable sources are those that have the characteristics of being inexhaustible, environmentally friendly and can be used in the same bind that occur." In the search for alternative energy, solar energy is the most promising and competitive by allowing savings of fossil fuels and lessen the impact they generate in the environment. (Martínez, 2014)

Solar energy is developed after World War II and has 3 applications: solar thermal (Solar radiation is concentrated and transmitted by mechanical elements), Photovoltaic Solar Energy (radiation is transformed or produced by impinging sunlight on semiconductors), and solar thermal energy (Produces electricity by high temperature fluids solar radiation heater). The application of these alternatives has been slow for their costs, but long term is a very profitable alternative. The sale of solar panels has growth potential in developing countries because they can be installed in remote homes and save energy for use in night hours. (Martínez, 2014)

Renewable sources of energy could conquer the world in a single assault

Renewable energy sources conquer the world. By 2000 33% of US energy sources would come from non-perishable; However between 1990 and 2012 the world production of energy from fossil fuels alone fell from 88% to 87%, for 2011 renewables only contributed with 10% to energy supply in the US. (Smil, 2014)

At the sight of non-compliance of belief in the large-scale deployment of renewable sources, Smil performs an analysis on to do to achieve effective transition to these alternatives, as evidence evaluation only found a good solution to large scale, building a vast system of wind and solar farms over a large area, this network would maximize the possibility that always had plants supplying power to a grid. (Smil, 2014)

Clean energy innovation in Latin America

The technological development of clean energy in Brazil, Mexico and Chile are among Latin American countries with the greatest potential to expand the research and commercialization of clean energy. These three countries are part of the "Mission Innovation" launched in Paris in 2015; and they pledged to double its research and development efforts in clean energy by 2020. (Visicdi & Miller, 2016)

Chile is facing a bill for imports of natural gas and an opposition to new hydroelectric dams. It also has great incentives for power generation using unconventional renewable sources and have been implemented although sources such as biomass, ocean and solar energy, Chile still backward compared with Brazil and Mexico. Because of this small market incentives have been reduced but has import facilities for its low level of investment. To catch up with the stated goal of clean energy, Chile should encourage and purchase policies to increase the total investment and the private sector to penetrate much more through partnerships; because there are many economic advantages and opportunities for

small markets like Chile to import this type of clean energy technologies. (Visicdi & Miller, 2016)

Solar energy in northern Chile: Enormous Potential

Chile has a great advantage for deploying solar panels because of its geographical location, specifically in northern Chile where there are about 80,000 km² with over 5.5 hours of direct radiation per day; which receives the order of 1.32×10^7 month GWh solar energy, 226 times the total electricity consumption of Chile in 2009. With this application the author is intended to imply that the best alternative to transform that energy emitted by the high levels of radiation are solar panels. In its analysis evaluates alternative energy production such as: storage hydroelectric, solar chimneys, hot water pumping through pipelines for seawater. Each of these alternatives are carried out by the cost-efficiency, where it is argued that the most viable alternative is solar panels to have greater efficiency in power generation and although the cost is a bit high is the option least expensive of the evaluated. The proposal would stabilize energy prices and long-term decrease domestic production of panels, however this would involve large costs and investments at the beginning which makes this option distant. (Gray, 2011)

The Chilean electricity market

Chile now faces the challenge of becoming a developed country within the next two decades and therefore the demand for sufficient and competitive energy will result in an increase in demand in line with economic growth. Given this growth Chile should cover the expected demand of 6% or 7% for 2020, the major obstacle is that imports 75% of the energy for its large fossil fuel shortages and dependence on imported coal, oil and especially the Argentina gas. Country since 2004 50% restricted their exports to Chile regardless of previous contracts. Faced with this problem weaknesses in the electrical system were exposed Chile forcing the government to take measures with renewable energy. (Silva, 2012).

Chile has a huge opportunity to develop renewable energy projects due to its unique geography, the length of the country is over 6000 kilometers and the country's capacity to generate electricity using alternative technologies is beyond doubt (Silva, 2012).

Chile: Towards the boom of solar energy?

The approval of a project in Chile PV represents great opportunities for the country's development and in turn becomes a good business opportunity.

This argument is based primarily on the price of electricity in Chile is very high now which makes photovoltaic energy the best option, plus Chile has a great advantage because its market is open, has free trade agreements with a variety of countries such as China, European union, Germany, USA where solar panels are produced. As Chile is not a manufacturer-producer in this industry their only means of supply is imported. But it is worth noting that these countries are long distances which can be an opportunity to export to Chile from Latin American countries.

Furthermore, the author expounds on a new law defined in Chile on NCREs which indicates that by 2025 20% of the energy sold in the country must come from NCRE and currently in Chile only reach 6%; This highlights the need for Chile stock up on solar panels which is your best choice as NCREs (Dannemann, 2013)

Chile, energy and development

The use of various indicators shows that Chile's development is closely associated with energy consumption, there is a strong dependence on fossil fuels, whose use is associated with significant environmental impacts. This situation will worsen due to increased use of fossil fuels in power generation and the costs associated with externalities, in addition to lessen these effects is mainly stimulate the use of

abundant solar energy and sustainable development of the country will be compatible with environmental restrictions and catering. (Pastén, 2012)

Chile has abundant sources of solar, and marine energy, and its use depends largely on substantial initial investment, but although its initial cost is high can be saved in the construction of transmission systems, through the use of energy stores with large-scale plants. The contribution of this type of energy is not significant in the short term, but must invest heavily in its development starting, for example, the mining industry whose location coincides with the areas of greatest radiation in the country. Investment in alternative energy sources could represent enormous benefits for sustainable development in Chile, even more so if one considers the current heavy reliance on imported fossil fuels. (Pastén, 2012)

Study of the development potential of renewable energy and energy efficiency in Chile

Photovoltaic solar energy is a mature technology, although manufacturers are very focused on improving conversion efficiencies ranging from 10 to 20%. This energy has not had a strong presence in Chile so far the government to the need to seek alternatives approved a 250MW solar power plant capacity.

In Chile have other projects of photovoltaic plants, where the investment is estimated at around 240 million, and a period of return on investment between 15 and 20 years is projected. Which makes this alternative is not very attractive, so should encourage and facilitate connection to the network, buying power generated at a higher price than the market price as is done in other countries, considering that when the investment would return it at the best level of production in Latin America. (Torrelles, 2011)

Implementation of Photovoltaic Solar Energy for Industry in Chile

Some companies have the need to incorporate sustainable processes, hence the evaluation of using alternative energy sources friendly to the environment. Chile has an advantage mainly in the central and northern area for the use of these technologies by its geographical position and high exposure to solar radiation, growth and economic stability of the country and its interest in generating trade agreements that allow them to continue also highlights potencializando your economy. On the other hand Chilean exporters are heading to be "sustainable exporter", considering that many consumers in the world are changing their perception about caring for the environment. (Soto, 2013)

Energy policies and environmental taxes in Chile

Technologies for energy production are affected to environmental taxes on coal, LNG and diesel. The cheaper alternative is coal, followed by the gas, and if these alternatives projects alone would not make diesel which cost 128% more than coal and 75% more than LNG. The new generation alternatives are solar photovoltaic panels at a cost of (US \$ 164.3 / MWh) and wind (US \$ 174.7 / MWh), both are more expensive than coal and LNG and cheaper than diesel. However it should be noted that before the new law Chile indicating that by 2025 20% of energy should be with non-conventional renewable energies and these energies would not pose increased environmental taxes such as coal, diesel, LNG and what makes them viable and necessary long term.(Muñoz & Galetovic, 2014)

Policies promoting non-conventional renewable energy (NCRE) in Chile

In March 2008, Chile was enacted in law or Law URE 20,257 to the need for greater impetus to investments in NCRE and accelerate the development of this market in Chile.

In Chile there are technical, economic barriers, financial and political to be of a high penetration of NCRE, ideally to pass these barriers it is to implement policies

as other countries that already have greater development of solar energy for example do: the introduction of a system of special rates for small generators for a limited time (2-3 years) to keep the credibility of investors or underfunding. a system of small subquotas for specific technologies, so the installation of small pilots that will advance the development of innovations NCREs be incentivized can also be set. (Sauma, 2012)

Evaluation of Sustainable Housing Project for Northern Chile

Sustainable housing with ability to make efficient use of water and the use of solar panels, economic savings for households and contribute to sustainable economic development of the country, while stressing the characteristics possessed the northern region of Chile concerning solar radiation. the scenario of the country is analyzed to 20 years and a possible imbalance in its energy matrix, based on an increase in the annual rate of energy demand arises, 6% - 7% per year by 2020 and 4% - 5% between 2020 and 2030, corresponding GDP growth resulting from economic development

TLC: Colombia-Chile

Colombia has had a relationship of rapprochement with Chile for several years. In 2008 they signed a Free Trade Agreement for certain countries, the Pacific Alliance supplemented it including all products and services and incorporating the ACE (Economic Complementation Agreement).

Colombia's bilateral trade with Chile has increased significantly, especially in recent years; 1993 71 exports to Chile were made and 745 by 2013 exports are presented. The research department of Proexport Colombia, indicates a list of products with potential to export to Chile with competitive advantages such as metallurgical products, steel, electronic equipment, process outsourcing, engineering services sector, among others. This represents an advantage to the

good relations that handle today where you can innovate new products for mutual benefit. (Berghe, 2013)

Formulation of a marketing plan to promote urban electrification with photovoltaic solar systems.

The marketing plan photovoltaic systems for urban electrification is profitable and feasible with the figures raised in the investigation. The industry environment shows that the level of developed countries growth is constant, and the Latin American case, although not fail to see such positive growth figures, as in the case of Colombia, whose market is around 300 KW. Another interesting detail in the environment is the growing interest of all consumers using different technologies and services increasingly environmentally friendly. (Guerreo, Fidel, & Danies, 2011)

1.2 Problem

Today we face global environmental problems caused by global warming and high demand for natural resources this due to rapid population growth and lack policies to control the exploitation of these resources.

Given the energy demands of a growing population is considered as an important business opportunity potentiate market products for electric power generation using different sources to those used in thermoelectric (oil, natural gas, uranium and coal) and hydro considering that resources are used in these limited, they tend to disappear over time and cause great environmental impact.

Chile is a country with a large deficit of natural energy resources to meet their needs and has been obliged to import fossil fuels from other countries, with the following percentages:

- ✓ Oil 99%
- ✓ Natural gas 71%
- ✓ Carbon 80%

The absence of these resources can directly affect the country's economic growth is why energy for Chile has become an essential input for the progress of society. In northern Chile an additional problem exists and is environmental saturation which are subject provinces and municipalities, which has high levels of pollution but because of its geographical location would be ideal to implement initiatives focused on the use of solar energy.

Questions to problematize the object of study:

- ✓ ¿Will it be viable export of solar panels from Colombia to the Chilean market?

1.3 Justification

Northern Chile receives one of the levels of the world's highest radiation that is considered of great importance to implement projects related to the use of solar energy, first because it can contribute to the deficit of energy in the country and second because it is a contribution to sustainable economic development which the country is highly committed within its National Energy Strategy 2012-2030 "Energy for the future: clean, safe, economical"

Importantly, Chile is a country with few trade barriers, has with 58 countries 21 trade agreements, so it becomes very feasible to do business in that country. Chile has no policy to prevent the commercialization of solar panels as well as the

feasibility of exporting solar panels to this country becomes a promising new plan in a market that is still not as explored.

Energy & Power is a company that has acquired knowledge and experience in the market of solar photovoltaic systems because it is one of the lines that have within their business and because it has participated in projects to install these technologies in Northern Colombia the focus of these projects has been social and experimental, since in the country many barriers to trade in these products still exist and also there is no awareness of the population towards the use of these alternatives is why it is considered important take advantage of business opportunities offered by a country like Chile that has a favorable geographical location with respect to solar radiation perceived and perception businesses and individuals to use these systems.

1.4 Objectives

1.4.1 General objective

Analyze the feasibility of exporting solar photovoltaic systems as an alternative power generation for the Antofagasta region located in northern Chile.

1.4.2 Specific objective

- ✓ Document related information on the use of renewable energy in Chile, expressing the benefits that involves the implementation of photovoltaic solar systems.
- ✓ Identify the costs associated with the export of solar panels from Colombia to Chile.

- ✓ Gather information Chilean companies involved in the commercialization of solar photovoltaic systems in order to select the most appropriate for this proposal solar panels.

1.5 Methodological Framework

1.5.1 Method

The research is descriptive and inferential method to use, as a starting point is analyzed generally Chile's electricity sector and then surveys the Chilean companies involved in the market will take place.

1.5.2 Methodology

Information on energy consumption in Chile will get the website of the National Energy Commission of this country, which can be evidenced studies and projections of electricity consumption by region and where growth by 2030 is estimated, the annual growth rate expected by year 2020 is between 6% and 7% and between 4% and 5% between 2020 and 2030, proportional to the increase in GDP. Other sources of specialized information that will allow an analysis of this environment will be obtained through government sources: National Energy Strategy 2012-2030.

Generate visits to the company Energy and Power, which has within its projections contribute to the use of renewable technologies in Colombia, in this visit an interview will be made to the manager of Innovation which is an expert on the subject, with which It is expected to obtain valuable information about important factors they have detected in the process of importing solar panels from

China and marketing and installation in the region of la Guajira in northern Colombia.

To know and be able to identify appropriate for the development of this proposal solar panels surveys were sent to Chilean companies solar panels you market.

1.6 Scope

The scope of this study seeks to determine the feasibility of exporting solar panels from Colombia to Antofagasta region in northern Chile and identify suitable solar panels for this proposal. Given the current energy needs of the area we believe that the work described here confirms probability of achieving fill a need with a technology of clean and sustainable supply in time, and which can be considered as an important alternative nationwide.

2. Project Implementation

2.1 theoretical framework

2.1.1 Energía y Potencia

Energia y Potencia S.A. was founded in 1988 by Juan Camilo Londoño as a commercial company exclusively distributing power products HONDA. Also, they are offering products that influence Ecomax and own brands such as Enermax, spare parts and services of the highest quality.

The headquarters is located in the municipality of Itagui including Antioquia and has direct outlets, warranty and maintenance workshops in major cities throughout the country; which is the differentiating factor from the competition. greater reliability with the service and quality provided; offering the portfolio with the aim to develop and support their own brands, also own dealer network in them marketing support and service.

The processes are governed with Quality Management System, it is an ISO 9001 certification for the assembly and marketing of equipment for power supply and for agriculture. The certification was awarded since 2002 and with a commitment to continuous improvement we have renewed until 2017.

Being certified under ISO 9001 company , it has a mission, vision and quality policy that identify their objectives and goals.

2.1.1.1 Mission

We provide the best solutions by machinery, spare parts and related energy and power to meet the needs of our customers services, generate the return expected by shareholders, happiness to employees and the maintenance of ecological balance.

2.1.1.2 View

In 2018 be the preferred company in Colombia in power solutions and alternative energy.

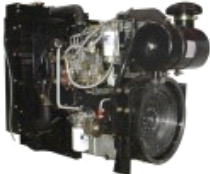


2.1.1.3 Quality politics

We provide the best solutions through products and services related to energy and power to meet the needs of our customers services, generate the happiness of employees, generate the expected return for shareholders and contribute to the ecological balance ensuring the continuous improvement of the system Quality management.

2.1.1.4 Product lines




The product lines are directed in gasoline and diesel products, electrical products, Pumping, Spraying, Agricultural, Construction and WC, solar energy generation.

Tabla 1. Portafolio de motores

| MOTORES | | |
|---|---|---|
| Motores diesel | Motores gasolina | Motores eléctricos |
| Marca Lovol | Marca Honda | Marca Leeson |
|  |  |  |

Source: (Energía & Potencia, 2016)

Tabla 2. Portafolio de generadores

| GENERADORES | | |
|--|--|--|
| Generador Industrial | Generador Industrial | Generador Doméstico |
| Marca Kipor | Marca Yanmar | Marca Enermax |
|  |  |  |

Source: (Energía & Potencia, 2016)

Tabla 3: Portafolio de Agricultura

| AGRÍCOLA | | |
|---|---|---|
| Chipiadora (Picadora) | Picadora de pasto | Picadora de pasto |
|  |  |  |

Source: (Energía & Potencia, 2016)

Tabla 4 Portafolio de Construcción

| CONSTRUCCIÓN | | |
|---|---|---|
| Apisionador | Cortadora de concreto | Vibrador de concreto |
|  |  |  |




Source: (Energía & Potencia, 2016)

Tabla 5 Portafolio de Aseo

| ASEO | | |
|--|--|--|
| Hidrolavadora gasolina | Kit de hidrolavadora | Hidrolavadora eléctrica |
|  |  |  |

Source: (Energía & Potencia, 2016)

Tabla 6 Portafolio de Motobombas

| MOTOBOMBAS | | |
|---|---|---|
| Motobomba industrial | Motobomba a gasolina | Motobomba alta presión |
|  |  |  |











Source: (Energía & Potencia, 2016)

Tabla 7 Portafolio de Fumigación

| FUMIGACIÓN | | |
|---|--|---|
| Fumigadora estacionaria | Fumigadora manual | Fumigadora de espalda |
|  A stationary fumigator with a red and black engine mounted on a black metal frame with four legs. |  A manual fumigator consisting of a blue tank with a yellow handle and a spray wand attached to the bottom. |  A backpack fumigator with a white tank, an orange engine, and a black spray wand. |

Source: (Energía & Potencia, 2016)

Tabla 8 Portafolio de Energía

| ENERGÍA | | |
|---|---|---|
| Kit solar iluminación | Kit solar iluminación | Controlador de carga |
|  |  |  |
| Panel solar policristalino de 80W | Panel solar Monocristalino de 80W | Panel solar Policristalino de 40W |
|  |  |  |
| Panel solar policristalino de 130W | Panel solar policristalino de 180W | Electrobomba solar |
|  |  |  |
| Nevera Ecomax para gas propano | | |
|  | | |

source: (Energía & Potencia, 2016)

The import of these products is from China mostly, except for agricultural products which are imported from Brazil, Italy and Mexico.

The main suppliers of China are:

- ✓ Jialing Honda Motors Co Ltd: Gasoline engines and water pumps.
- ✓ Wuxi WorldbestT Kama Machinery Co., Ltd.: home generators, diesel engines, diesel Water pumps, spare parts.
- ✓ Wuxi KiporR Power Co. Ltd. industrial generators, diesel engines, tillers, spare parts.
- ✓ Holly Foton (HK) Co Limited: industrial generators, industrial engines, spare parts.
- ✓ Universal Superpower Technology Co. (USP): Solar panels
- ✓ Yangzhou Jusheng Ropes and Cables Co., Ltd.: solar panels
- ✓ Guangzhou Future Solar Technology Co., Ltd: Solar pumps and solar kit.
- ✓ Wuxi H-Power Machinery Co., Ltd: Hidrolavadoras, bulldozers, compactors, concrete cutters, concrete vibrators, cutting brick plates.

2.1.1.6 Service

Energy and Power is characterized by providing the best after-sales service sales, thanks to this has its own outlets, workshops and specialized in the maintenance and repair of our products staff.

service both preventive and corrective maintenance to all our customers is provided.

Having its outlets ensures timely, flexible, reliable and high quality care.

2.1.1.7 Competitive advantages

Being a company with extensive experience in the market, it has customs warehouse facilities and is identified as permanent customs users (UAP), which means they have shorter delivery times compared to other suppliers.

The company has a high stock of spare parts to guarantee its customers the proper functioning, prevent deterioration and / or damage of their products.

2.1.1.8 Competition

The main competitors are:

- ✓ BARNES DE COLOMBIA, its headquarters is located in the city of Bogota, only has distributors, it has points of sale nationwide.
- ✓ GLOBAL MOTOR, its headquarters is located in the city of Bogota, only has distributors, it has points of sale nationwide.
- ✓ CONSORCIO INDUSTRIAL, its headquarters is located in the city of Medellin, it is the exclusive distributor of Briggs & Stratton. It does not have its own sales.
- ✓ EDUARDOÑO, its headquarters is located in the city of Medellin, it is the exclusive distributor of YAMAHA. It does not have points of sale nationwide.

2.1.2 solar photovoltaic systems

2.1.2.1 ¿What is photovoltaic?

It is known as solar panel, it is a way to generate electric power whose source is sunlight.

2.1.2.2 ¿How does a solar panel work?

Receives radiation from sunlight, converts photons into electrons, and the direct current into alternating current by an inverter either for own consumption or for the network.

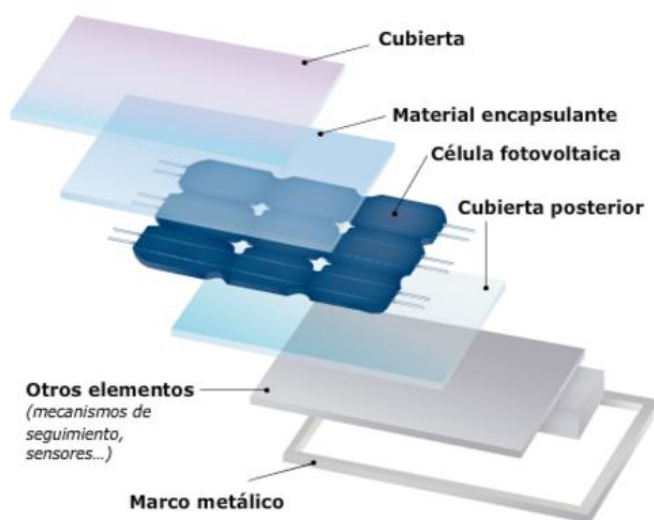
The key element of the solar panels is the solar cell. Photovoltaic solar panels are composed of cells that convert light into electricity. (See Figure 1). They produce positive and negative charges in two semiconductor, so an electric field is produced with the ability to generate power.

Other elements so to protect the solar cell and increase the maximum performance, it has a shelf life of 25 to 30 years.

The main protection is glass, which protects it from dirty air, sun and humidity.

The cell is encapsulated by polymers and has a layer called backsheet, which protects the pane moisture penetration and in turn serves as electrical insulation frame. (Energética, 2011)

Figure 1. Main components of a solar photovoltaic installation.



Source: (Ecosistemas del suroeste, 2016)

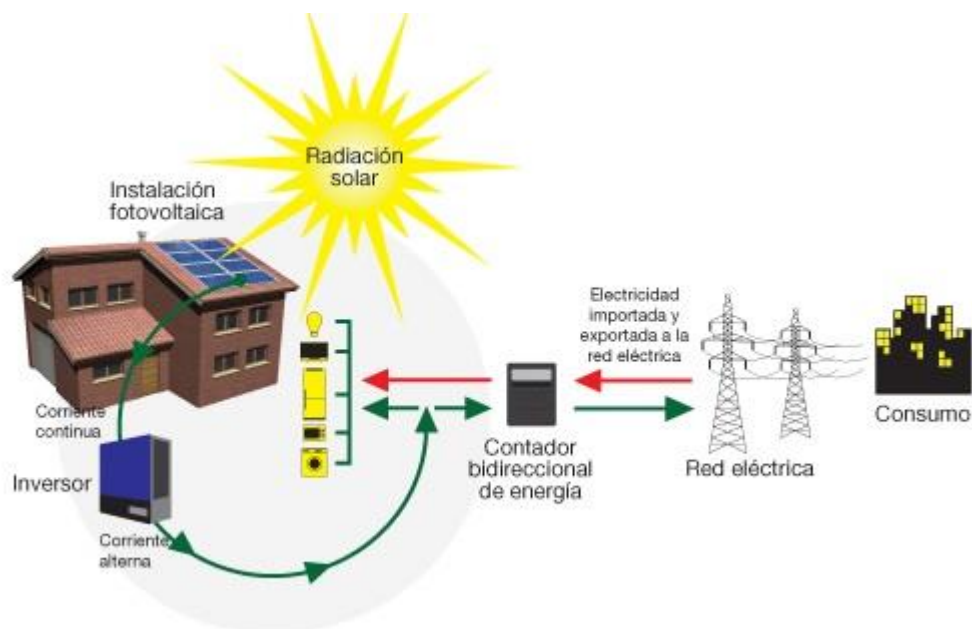
A photovoltaic solar system is a set of devices that uses solar radiation to generate electricity, it is controlled by devices equal voltage conditions or batteries. (Introduction Photovoltaic solar energy, 2012)

The following are the elements of these systems:

- ✓ Solar Generator Set solar panels responsible for receiving and converting sunlight into energy.
- ✓ Charge controller: Responsible for controlling power surges and serves to protect the entire allowing greater efficiency of the system.

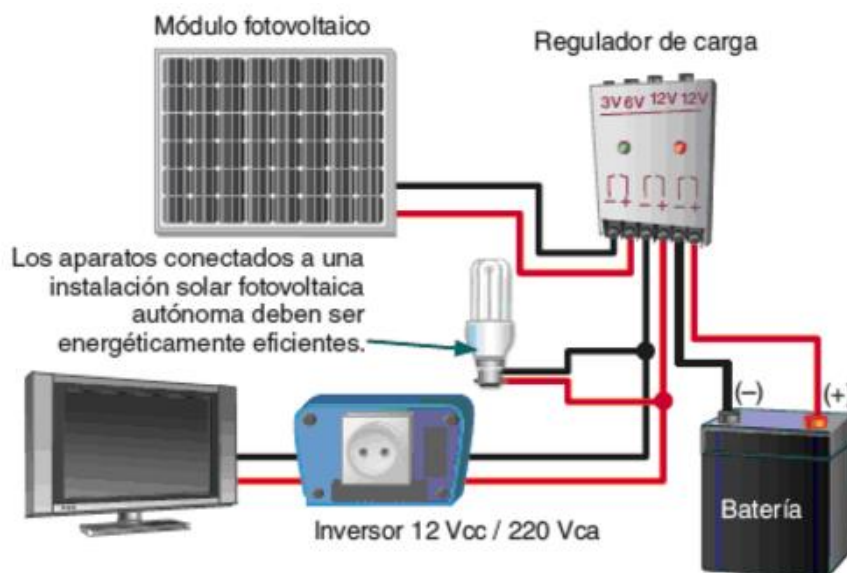
- ✓ Power Inverter: This device is responsible for transforming the direct current (DC) stored to alternating current (AC) either 120V or 220V.
- ✓ Bidirectional Counter: You can send or receive power from and to the area controlled by the suppliers of electricity network.

Figure 2. Solar Photovoltaic system connected to the network.



Source: (Photovoltaic solar system with network connection., 2016)

Figure 3. Photovoltaic solar system for their own consumption.



source: (Photovoltaic solar system for their own consumption, 2016)

2.1.2.3 Maintenance and installation

The operating efficiency of solar panels depends on the amount of sunlight it receives. This is why it is very appropriate to review the location of solar panels, analyze potential shadows that may affect throughout the day.

The shade of the trees would hurt their performance, and dirt that accumulates on the surface either by dust, bird droppings, leaves, generate less electricity. To avoid inefficiencies should be scheduled maintenance and cleaning. Cleaning the panels is essential in all cases.

Although rain can help a bit in cleaning, it is advisable to clean 3 to 4 times a year to stay in overall performance.

For cleaning of the solar panels is important to note that you should avoid using abrasive detergents and should not use harsh cleaning tools that can damage the surface, which should be used are sponges, microfiber material, among others.

Water quality is another important factor to consider if the water is well dries on the panel will leave a film of mineral salts, which decreases performance.

The most advisable to clean the panel is with a sponge or soft cloth, ensure thorough wetting of the entire panel, especially in the dirtiest parts, do not use large amounts of soap or be much more difficult to clarify the whole and could be waste.(Energías renovables, 2015)

2.2 International Photovoltaic Solar Energy Market

Photovoltaic solar energy is similar to the others in that it requires raw materials, manufacturing, sale and distribution of its products industry. This industry has shown tremendous growth in recent years which captures the attention of investors. In Figure 4 you can visualize the growth of the worldwide installed capacity, since 2007 a growing trend where it went from a capacity of 9 GW to 15GW in 2008, thereafter year comes after year growth is evident, for 2011 had already exceeded the capacity of 69GW. This capability is able to produce 85TWh each year, which is enough to meet the electricity needs of more than 20 million households worldwide. (EPIA, 2012)

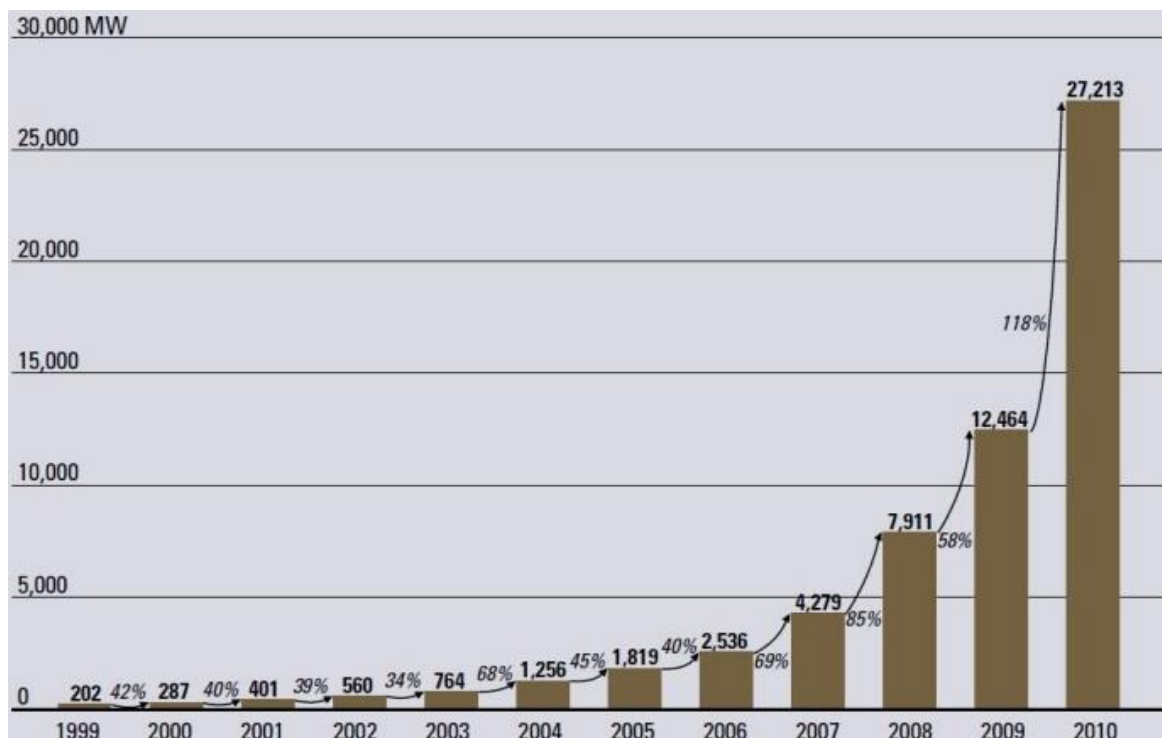
Figure 4. Installed capacity Photovoltaic Solar Energy 2000--2011



Source: (Rasero, 2011)

2.2.1 World production of solar cells

World production of solar cells is constantly growing. You may see continued growth in recent years as evidenced in Figure No. 5 in which the amount produced from 1999 to 2010, from producing 202 solar cells 27213 solar cells respectively relates.

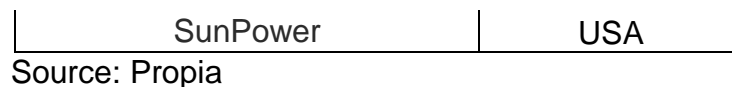
Figure 5. World production of solar cells

Source: (Rasero, 2011)

The market share of the leading manufacturers of solar panels worldwide is represented by the following companies:

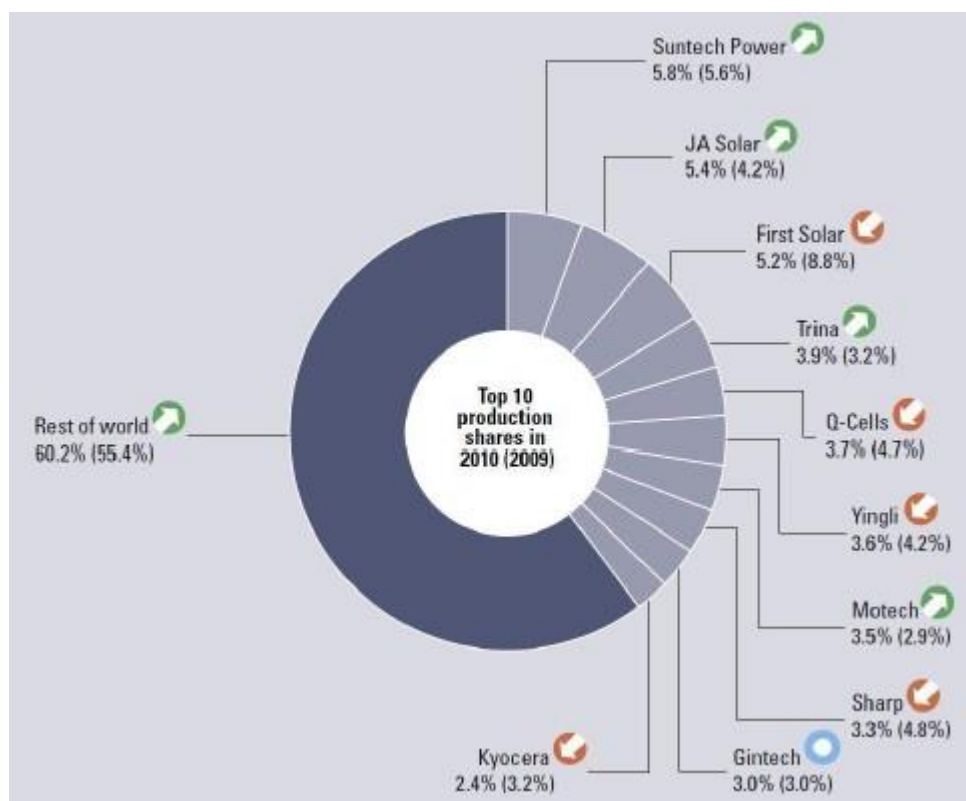
Tabla 9 Principales fabricantes de paneles solares en el mundo

| Empresa | País |
|---------------------|-------------|
| Q-Cells | Alemania |
| Suntech Power | China |
| Yingli Green Energy | China |
| JA Solar | China |
| Trina Solar | China |
| Sharp | Japón |
| Kyocera | Japón |
| Gintech | Taiwan |
| First Solar | USA |



China is the country with the largest share of companies in the market, this because of its ability to scale production and technological innovation.

Figure 6. market share

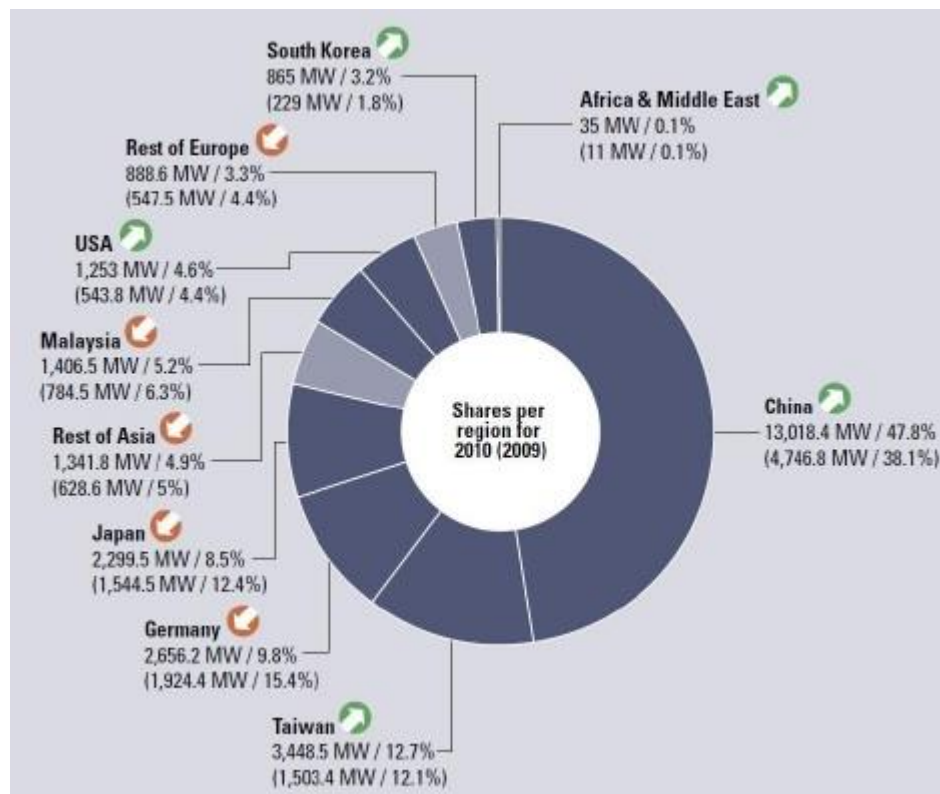


Source: (Rasero, 2011)

In Figure No. 6 could appreciate the participation rate between 2009 and 2010 according to the production of the top 10 companies producing solar cells, only these companies have a participation rate of 40%.

Most of these companies are located in China hence the country with the highest percentage of origin of solar cells worldwide.

Figure 7. Origin of Solar Cells



Fuente: (Rasero, 2011)

2.3 National Market for Solar Panels

2.3.1 Importing Solar Panels

In Colombia the manufacturing process of solar panels is not yet standardized, pilot tests are currently performed in some companies, so far the only time to have photovoltaic panels to ensure their proper functioning is importing.

Energy & Power is an import and trading company, solar panels are imported from China, specifically the city of Ningbo; where it has an ally provider called Universal Superpower Technology Co. (USP)

Import for sale and delivery to Chile photovoltaic panels could be done in two ways:

- ✓ The first option corresponds to import from Colombia with delivery in Colombia and subsequently exports to Chile would be made.
- ✓ The second option corresponds to make the purchase from Colombia but with direct delivery in Chile without going through Colombian port.

At the economic level, the second option is the most viable, decreasing costs and hence would represent offer a better price to Chile, however, the great disadvantage and risk is that the client Chile would meet our supplier and could break trade relations with us and buy the provider directly.

With the first option costs represent a disadvantage to offer a good price that allows the company to be profitable; but for a company in Chile that does not have much knowledge of suppliers would be a product warranty When performing the purchase Energía & Potencia.

In today's market although the price is one of the key factors in purchasing decisions, it is important to consider the added value of the service; which it offers Energía & Potencia.

Tabla 10 Importaciones Colombianas de Paneles Solares 2014-2015

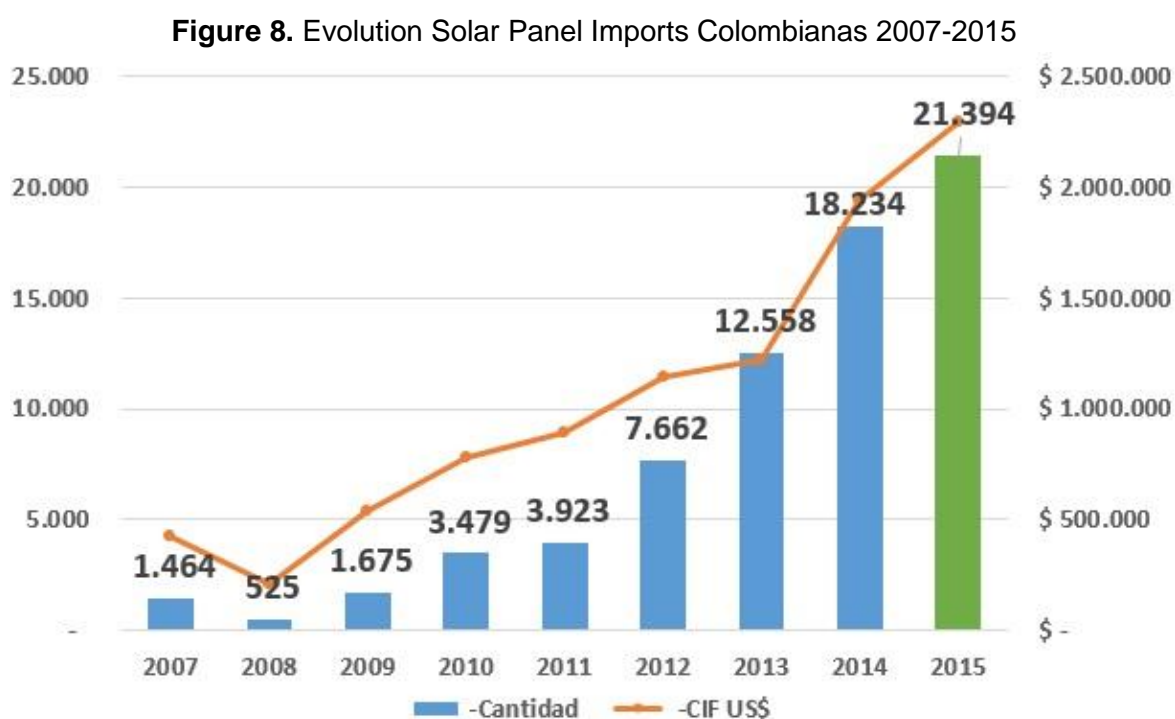
| 2015 | | | | | | 2014 | | | |
|----------------------|-----------------------------------|---------------|---------------------|--|-------------|---------------|---------------------|--|-------------|
| Número de Documento | Empresa | -Cantidad | -CIF US\$ | Promedio de Precio Cif Unitario (US\$) | % Cantidad | -Cantidad | -CIF US\$ | Promedio de Precio Cif Unitario (US\$) | % Cantidad |
| 890300225 | COEXITO S.A. | 3.714 | \$ 460.330 | \$ 127 | 17% | 1.320 | \$ 144.099 | \$ 107 | 7% |
| 800060880 | FERRAGRO S.A.S. | 3.380 | \$ 200.796 | \$ 63 | 16% | | | | 0% |
| 900181969 | HYBRYTEC S.A.S. | 2.723 | \$ 322.691 | \$ 734 | 13% | 5.774 | \$ 776.922 | \$ 133 | 32% |
| 900676667 | GREEN ENERGY LATIN AMERICA S.A.S. | 1.913 | \$ 267.040 | \$ 122 | 9% | 728 | \$ 118.300 | \$ 163 | 4% |
| 900553715 | ENERGIA Y MOVILIDAD SAS | 1.820 | \$ 156.227 | \$ 156 | 9% | 3.986 | \$ 214.463 | \$ 112 | 22% |
| 800191196 | C.I. TRADE ENTERPRISES INC. S.A. | 1.810 | \$ 58.527 | \$ 36 | 8% | | | | 0% |
| 800051319 | ENERGIA & POTENCIA S.A. | 1.625 | \$ 142.915 | \$ 101 | 8% | 4.107 | \$ 367.711 | \$ 90 | 23% |
| 830122365 | PANASONIC DE COLOMBIA S.A. | 1.333 | \$ 327.834 | \$ 239 | 6% | 471 | \$ 112.147 | \$ 251 | 3% |
| 900281887 | SUNPOWER DE COLOMBIA S.A.S | 632 | \$ 50.151 | \$ 79 | 3% | 400 | \$ 28.836 | \$ 72 | 2% |
| 900586332 | CODENSOLAR SAS | 610 | \$ 53.967 | \$ 88 | 3% | 380 | \$ 78.789 | \$ 146 | 2% |
| 900292407 | ENERGY SOLUTIONS COLOMBIA S.A.S | 480 | \$ 27.251 | \$ 55 | 2% | 319 | \$ 15.368 | \$ 48 | 2% |
| 900523912 | ENERSOLAX S.A.S | 471 | \$ 92.420 | \$ 258 | 2% | 38 | \$ 8.634 | \$ 227 | 0% |
| 900797759 | MH ENERGIA SOLAR S.A.S. | 360 | \$ 54.720 | \$ 152 | 2% | | | | 0% |
| 890914336 | DURESPO S A | 354 | \$ 66.157 | \$ 230 | 2% | 560 | \$ 58.847 | \$ 262 | 3% |
| 900314780 | ENERSOLAR E.U. | 130 | \$ 12.543 | \$ 86 | 1% | 30 | \$ 2.188 | \$ 73 | 0% |
| 900687241 | ZITROLED ENERGIA SOLAR S.A.S. | 32 | \$ 2.816 | \$ 88 | 0% | 121 | \$ 14.032 | \$ 118 | 1% |
| 900319753 | PRICESMART COLOMBIA S.A.S. | 7 | \$ 2.062 | \$ 295 | 0% | | | | 0% |
| Total general | | 21.394 | \$ 2.298.447 | \$ 247 | 100% | 18.234 | \$ 1.940.336 | \$ 152 | 100% |

Source: (Virtual Business Centre, 2016)

In Table 10 we can show that Energy & Power S.A. is in the top 10 of companies that matter most solar panels in Colombia; however making a comparison between 2014 and 2015, the latter a decrease is seen in imports of about 60% in units; This explanation have your potential customers they already made the sale, and that the useful life of the solar panels is in a range of 20 to 25 years. In this situation in 2015 and 2016 are to boost exports of this product and attracting new customers and markets.

2.3.1.2 Market developments in Colombia Solar Panels

The market for solar panels in Colombia is a growing market, in Figure 8 we can see how in recent years there has been a growth trend. In this way it could be considered as a striking market and great opportunity to market.



Source: (Virtual Business Centre, 2016)

2.3.2 Export Solar Panels

Energía & Potencia is a pioneer in the development of sustainable projects throughout the country, together with Colciencias and with the support of ISAGEN, the company participated in a mega project for the installation of solar panels in remote rural areas and little scope civilization, in areas of the Colombian Pacific where there is not electricity, and where the climate is different. It also has the experience in the implementation of these solar panels in the Guajira, the region with more solar radiation Colombia. Besides all company personnel as technicians, clerks, assemblers, among others; They are now specializing in the installation and maintenance of solar panels with the National Apprenticeship Service (SENA).

These experiences, learning and training, provide customers allow Chile and any company the best advice to potential obstacles, difficulties and unforeseen events that may occur during the installation and operation of solar power; which would Energy & Power more than a supplier an ally.

Energy & Power is a pioneer in the development of sustainable projects throughout the country, reaching inaccessible areas without electricity interconnection and contributing to the need for a sustainable future.

In conjunction with Colciencias company developing a project in Guajira where the installation of solar panels was implemented throwing favorable results as this area has favorable to the use of these technologies climatic characteristics and also because it could meet a need for a population slightly favored .

Thus consider feasible to perform an export of solar panels to the Antofagasta region in northern Chile based on the use of its climate and current characteristics energy needs, also because the company can reach an unexplored market and

trend growth and the sources of energy from natural resources are limited and tend to disappear in the future.

Tabla 11 Exportaciones Colombianas de Paneles Solares 2015-2016

| Fecha del Proceso | Empresa | Unidades de la Posición | Administración de Aduana de Embarque | País de Destino | Ciudad de Destino | Vía de Transporte | Valor Fletes USD | Seguro USD | Moneda de Negociación | Agregado Nacional de la Posición USD | Vlr. FOB US\$ | Vlr. FOB COP\$ |
|-------------------|-------------------------|-------------------------|--------------------------------------|-----------------|-------------------|-------------------|------------------|------------|-----------------------|--------------------------------------|---------------|-------------------|
| 201501 | ALUTRAFIC LED S.A.S. | 18 | Barranquilla | ECUADOR | ECUADOR | AEREO | 0 | 0 | USD | 0 | 3814,23 | \$ 9.042.585,77 |
| 201501 | ELECTROCONTROL S.A. | 1500 | Especial de Aduanas de Bogotá | EL SALVADOR | SAN SALVADOR | AEREO | 400 | 6,4 | USD | 5215,51 | 6000 | \$ 14.303.460,00 |
| 201501 | UNISYS DE COLOMBIA S.A. | 2 | Especial de Aduanas de Bogotá | USA | LOCKBOURNE | AEREO | 0 | 0 | USD | 0 | 73,96 | \$ 178.000,27 |
| 201504 | DRUMMOND LTD | 1 | Barranquilla | USA | BIRMINGHAM | AEREO | 0 | 0 | USD | 0 | 1265 | \$ 3.259.158,65 |
| 201504 | CORPORACION AMBROSIA | 48 | Especial de Aduanas de Bogotá | PERU | MARCONA | AEREO | 0 | 0 | USD | 0 | 5760 | \$ 14.234.169,60 |
| 201507 | ELECTROCONTROL S.A. | 6000 | Ipiales | ECUADOR | QUITO | TERRESTRE | 100,57 | 0 | USD | 15061,46 | 18199,43 | \$ 48.100.547,51 |
| 201507 | ELECTROCONTROL S.A. | 2000 | Cartagena | EL SALVADOR | SAN SALVADOR | MARITIMO | 305,23 | 7,91 | USD | 6554,01 | 7600 | \$ 20.086.572,00 |
| 201509 | MAVELEC E. U. | 18 | Especial de Aduanas de Bogotá | ECUADOR | GUAYAQUIL | AEREO | 0 | 0 | USD | 0 | 1908,3 | \$ 5.982.844,91 |
| 201510 | ELECTROCONTROL S.A. | 5100 | Ipiales | ECUADOR | QUITO | TERRESTRE | 32,02 | 0 | USD | 0 | 3537,98 | \$ 10.103.551,00 |
| 201510 | ELECTROCONTROL S.A. | 12100 | Ipiales | ECUADOR | QUITO | TERRESTRE | 314,66 | 0 | USD | 28447,1 | 34775,34 | \$ 99.309.329,45 |
| 201510 | GOOGLE COLOMBIA LTDA | 1 | Especial de Aduanas de Bogotá | USA | CALIFORNIA | AEREO | 0 | 0 | USD | 0 | 634 | \$ 1.870.851,58 |
| 201511 | ELECTROCONTROL S.A. | 1200 | Ipiales | ECUADOR | QUITO | TERRESTRE | 140,83 | 0 | USD | 0 | 1347,17 | \$ 4.175.890,20 |
| 201511 | ELECTROCONTROL S.A. | 100 | Ipiales | ECUADOR | QUITO | TERRESTRE | 8,74 | 0 | USD | 0 | 108,26 | \$ 332.829,13 |
| 201601 | ELECTROCONTROL S.A. | 3000 | Ipiales | ECUADOR | QUITO | TERRESTRE | 25,72 | 0 | USD | 0 | 2074,28 | \$ 6.839.855,32 |
| 201601 | ELECTROCONTROL S.A. | 8000 | Ipiales | ECUADOR | QUITO | TERRESTRE | 274,28 | 0 | USD | 17941,76 | 22125,72 | \$ 72.958.676,67 |
| 201602 | ELECTROCONTROL S.A. | 6300 | Ipiales | ECUADOR | QUITO | TERRESTRE | 180 | 0 | USD | 14165,13 | 17460 | \$ 59.222.050,20 |
| 201602 | ELECTROCONTROL S.A. | 12000 | Ipiales | ECUADOR | QUITO | TERRESTRE | 200 | 0 | USD | 27124,06 | 33400 | \$ 110.904.366,00 |
| 201602 | ELECTROCONTROL S.A. | 10700 | Ipiales | ECUADOR | QUITO | TERRESTRE | 80 | 0 | USD | 24283,95 | 29880 | \$ 99.277.495,20 |

Source: (Virtual Business Centre, 2016)

Table 11 we can identify that the vast majority of exports of solar panels are heading to Ecuador, followed by USA, El Salvador and finally Peru. Yet to cover a large market, there are many opportunities to reach new countries, it has great potential in the closest to Colombia and Latin America for ease of transport. There is a good reference to exportarle to USA because it brings credibility and confidence for companies to seek new export alternatives.

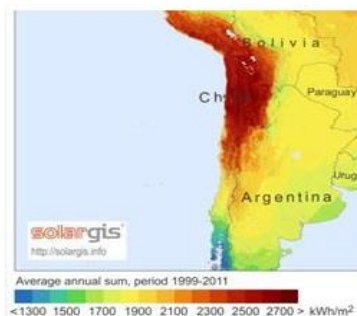
2.4 Renewable energy in Chile and Electric

According to the national energy strategy 2012-2030, energy consumption has tended to growth in recent years, which is why this country is facing a great challenge in approach its national energy strategy, therefore the challenge Chile has is to have enough energy resources to enable it to meet the demand of a growing population.

Photovoltaic solar systems depend for their operation on the intensity of radiation that come to their cells, so the geographic location becomes a determining factor for evaluating projects focused on the use of these technologies factor. (Benjamin & Vacarezza)

Chile has a unique position worldwide and is the country with the greatest solar resource on the planet. Northern Chile is the area of the country that perceives higher levels of radiation, these are around 2,500 Kw / h, Figure 4 shows more clearly these indices (Benjamín & Vacarezza).

Figure 4. Levels of Radiation in northern Chile.



Source: (Solar Gis , 2016)

2.4.1 Poll

Energy and Power is a marketer of products gasoline and diesel for electronic generation, pumping, Fumigation, Corte, Construction and WC, with a view to entering the process of exporting solar panels, especially when globalization is a well-known concept in all companies and at all levels, in addition to the number of companies that already have long been moving at this level; for it is considered important to gather information from some Chilean companies through this survey to assess the feasibility of the Project

1. **¿Nombre de la empresa? ***

.....

2. **¿Número de empleados de la empresa? ***

Marca solo un óvalo.

- 1-10
- 10-50
- 50-200
- 200 o mas

3. **¿Su empresa esta interesada en vender paneles solares fotovoltaicos? ***

Marca solo un óvalo.

- Si
- No

4. **¿De los siguientes paneles solares cual estaría interesado en importar su empresa? ***

Marca solo un óvalo.

- Monocristalino (tiene un solo Cristal)
- Policristalino (Tiene varios cristales)
- Amorfo (Forma del Cristal)
- Ninguno de los Anteriores

5. ¿cuáles son las potencias que estaría interesado en vender? **Marca solo un óvalo.*

- 0W - 40W
 41W - 80W
 81W - 130W
 130W - 200W
 Mayor de 200W
 No Aplica

6. ¿Cuál es el voltaje nominal de los paneles fotovoltaicos que usted desea vender? **Marca solo un óvalo.*

- 12 Vol
 24 Vol
 Otro
 No Aplica

7. ¿Cuál es el presupuesto de ventas de paneles fotovoltaicos al mes? **Marca solo un óvalo.*

- 1-100
 101 - 300
 Más de 301
 No Aplica

8. ¿Su empresa vende controladores de carga? **Marca solo un óvalo.*

- Si
 No

9. Seleccione la corriente nominal de controlador que vende su empresa. **Marca solo un óvalo.*

- 5 Amp
 10 Amp
 20 Amp
 50 Amp
 Otro
 No Aplica

10. **¿Su empresa necesitaría vender baterías para los sistemas de energía solar fotovoltaica? ***

Marca solo un óvalo.

- Si
 No

11. **¿Su empresa vende inversores? ***

Marca solo un óvalo.

- Si
 No
 No Aplica

12. **¿Su empresa estaría dispuesta a pagar un precio especial por soluciones en kit? ***

Marca solo un óvalo.

- Si
 No

13. **¿Su empresa necesita que los paneles fotovoltaicos para la venta tengan un branding diferente al genérico? ***

Marca solo un óvalo.

- Si
 No

14. **¿Su empresa posee certificaciones internacionales? ***

Marca solo un óvalo.

- Si
 No

15. **¿Su país tiene normas para la venta de sistemas solares fotovoltaicos? ***

Marca solo un óvalo.

- Si
 No

2.4.2 Presentation of results

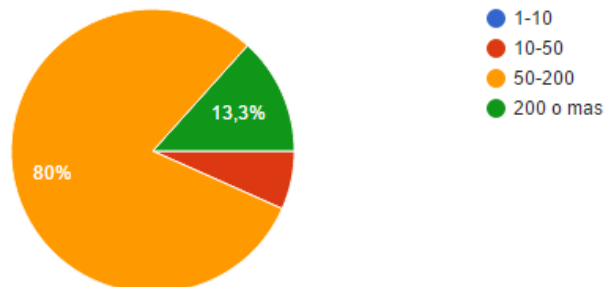
50 Chilean companies directly related to the business of photovoltaic solar systems, of which only 15 were sent surveys responded.

The surveys were conducted at the following companies:

- ✓ Christof Horn y Cía. Ltda.
- ✓ Innovasolar
- ✓ Chisol energía solar
- ✓ SumSol Chile Ltda
- ✓ Solenergy
- ✓ Riovalle Ltda
- ✓ Puntos Solar
- ✓ Solenergy
- ✓ Saxamar
- ✓ Panelsol Chile
- ✓ Yingli Green Energy Chile
- ✓ Ecoplus Chile
- ✓ Naturaenergy
- ✓ Kuhn s.a
- ✓ Ecoenergías

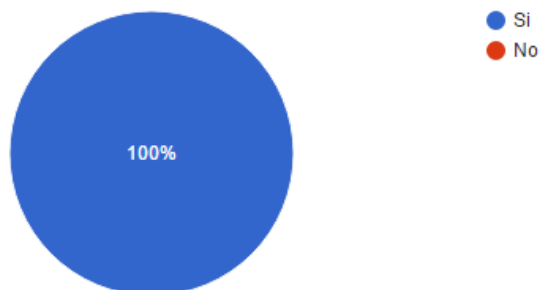
The surveys were designed in the tool Google Drive and sent to contacts registered on the websites of these companies.

1. ¿ Employees of the company?



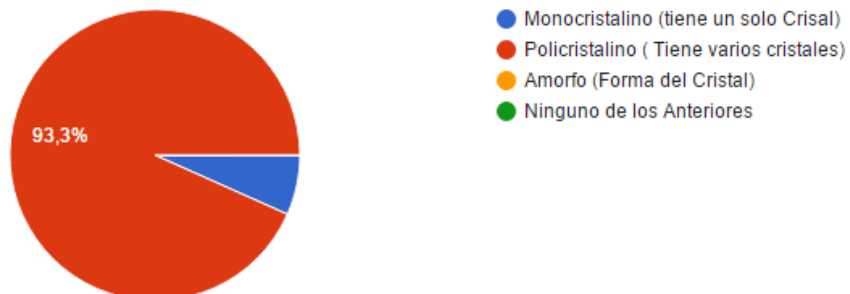
80% of surveyed companies have between 50 and 200 workers.

2. ¿interested in selling photovoltaic solar panels? Your company is



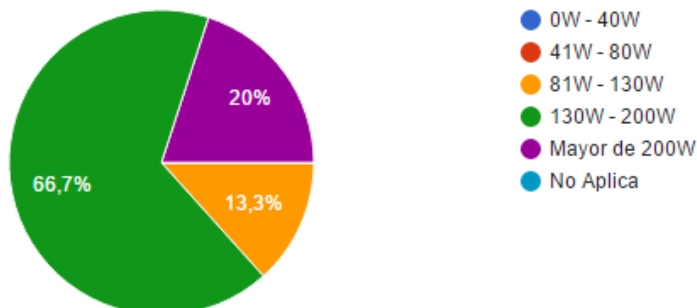
100% of the sample expressed interest in selling photovoltaic solar panels.

3. ¿In the following solar panels which would be interested in importing your company?



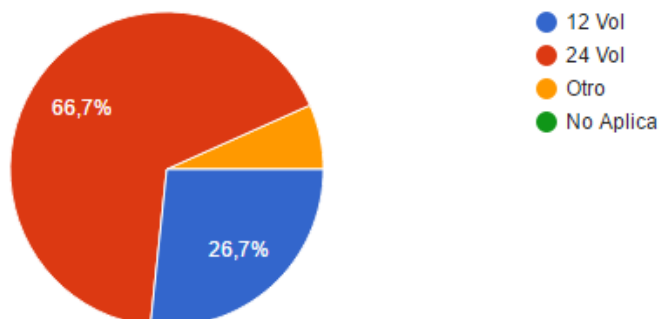
93% of respondents interested in selling Polycrystalline solar panels (have several crystals).

4. ¿What are the powers that be are interested in selling?



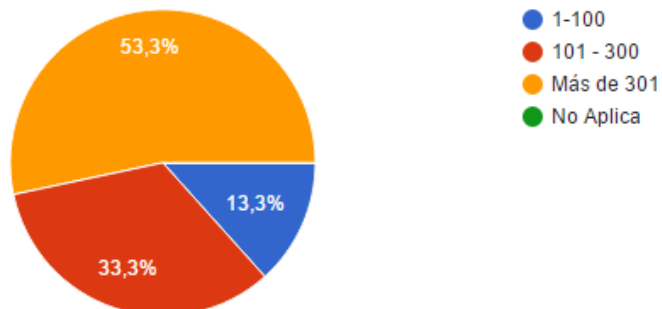
Of the companies surveyed, 66.7% show interest in selling powers between 130w and 200w a 20% greater powers to 13.3% 200w and 81w and 130w between.

5. ¿What is the nominal voltage of the photovoltaic panels you want to sell?



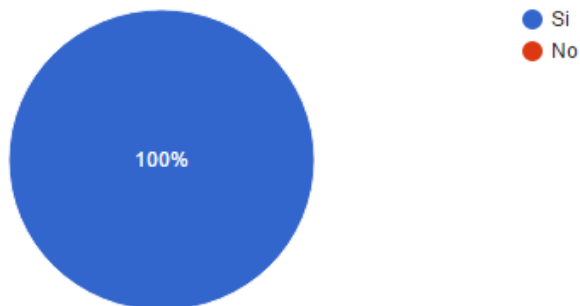
For 66.7% of the sample rated voltage that is 24 Vol sold and 26.7% is 12 Vol.

6. ¿What is the sales budget of photovoltaic panels per month?



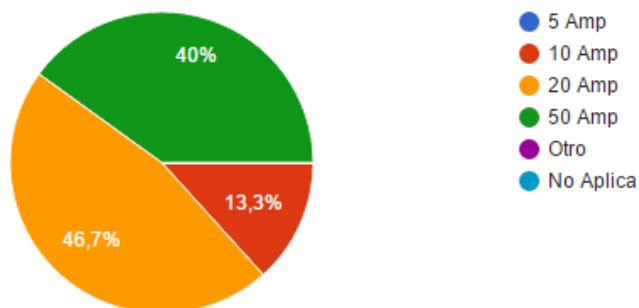
For 53.3% of companies surveyed the sales budget of solar panels exceeds 301 units while for 33.3% only represents a budget between 101 and 300 and 13.3% between 1 and 100 units

7. ¿Does your company sells charge controllers?



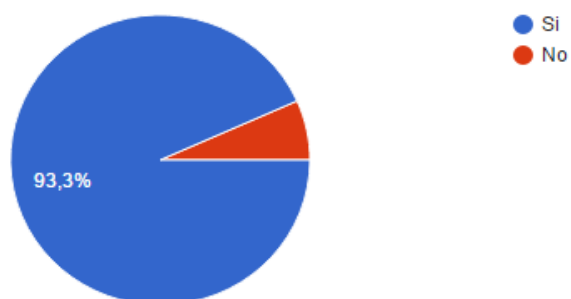
100% of companies sold charge controllers.

8. Select the nominal current controller that sells your company.



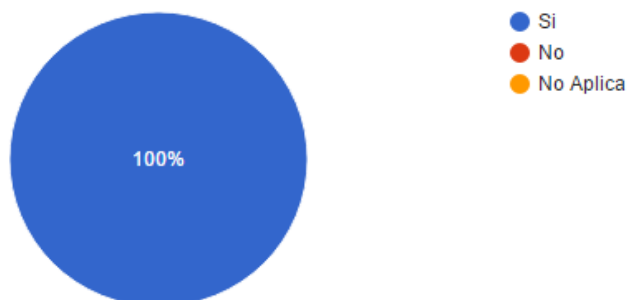
46.7% of surveyed companies sell controllers 20A, 40% sell controllers and 13.3% 50amp drivers 10Amp.

9. ¿Does your company need to sell batteries for solar photovoltaic systems?



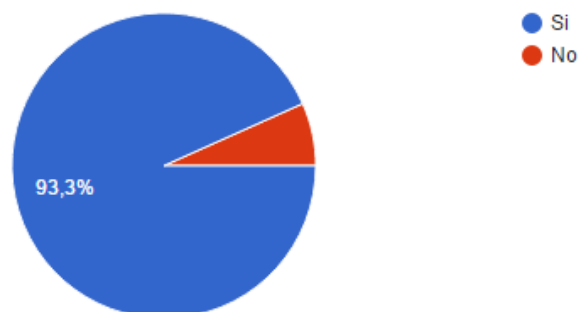
93.3% of companies agree that they need to sell batteries.

10. ¿ Does your company sells investors?



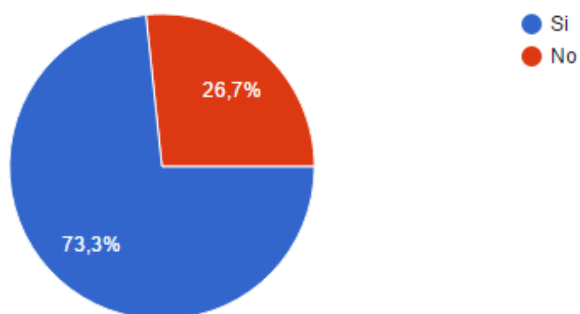
100% of companies sell investors.

11. ¿Does your company would be willing to pay a premium for solutions kit?



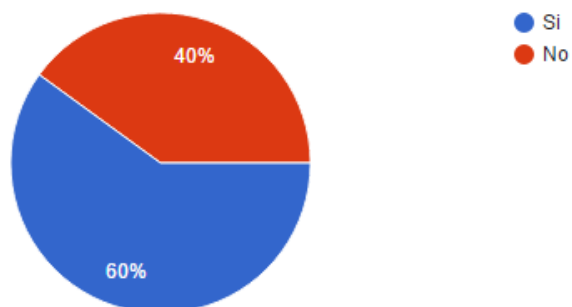
93.3% of companies would be willing to pay a premium for solar photovoltaic systems in kit.

12. ¿ Does your company need that photovoltaic panels for sale have a different generic branding?



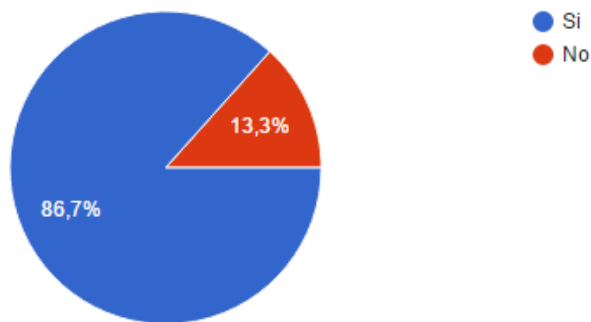
73.3% of surveyed companies need a different generic branding and 26.7% do not consider it necessary.

13. ¿ Does your company has international certifications?



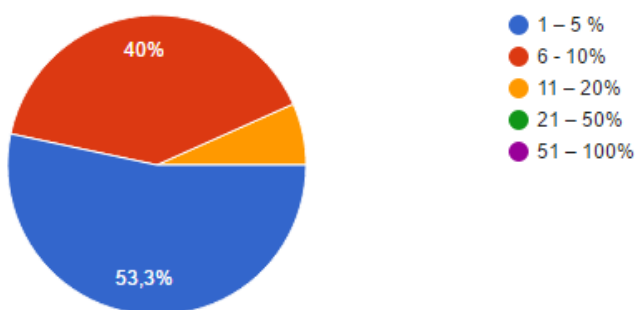
Of the companies surveyed, only 60% has international certifications.

14. ¿Does your country have policies to promote non-conventional renewable energies?



86.7% of respondents say that Chile has policies to promote renewable energies and 13.3% indicates that he does not possess.

15. Locate the percentage represented for business selling solar photovoltaic systems



53.3% of the companies surveyed places a percentage of sales of solar panels from 1 to 5%, 40% located percentages of 6 to 10% and 6.7% rates of between 11 to 20%.

2.4 Economic Comparison of Import and Export of solar panels

To analyze the feasibility of exporting economically analyzing import costs quoted the company "blulogistic" is performed (see Table 13) taking as reference a container of 20 ", with a total weight of 9000kg, 147 packages with a volume of 29.75 m3.

Units and references to import or export for the analysis are:

Table 12 units and export products References

| Referencia | Unidades | Bultos | Cantidad por bultos | Volumen | Valor Total Volumen | Peso por unidad (KG) | Peso total KG |
|--------------|------------|------------|---------------------|-------------|---------------------|----------------------|---------------|
| 130 W | 600 | 120 | 5 | 0.19 | 22.8 | 12 | 7200 |
| 180 W | 50 | 25 | 2 | 0.15 | 3.75 | 17 | 850 |
| 200 W | 50 | 2 | 25 | 1.6 | 3.2 | 19 | 950 |
| Total | 700 | 147 | 32 | 1.94 | 29.75 | 48 | 9000 |

Elaboration: (Aguiar & Pavas, 2016)

130W panels are the most in demand this according to the results of the surveys, the packaging unit is 5 units per package, for a total of 120 packages; 180W panels are designed packing unit 2 units per package, for a total of 25 packages; and 200W panels are designed packing unit 25 units per package in a crate.

After learning about the units and product specifications, it proceeds to perform the costing or quotation according to different alternatives:

Table 13 Comparison of import and export costs

| Costos | Opción 1 | | Opción 2 | | Opción 3 | |
|--|---------------------------|--------------------|----------------------|--------------------|----------------------|--------------------|
| | Exportación EYP | Medellín- | Exportación EYP | | Importación | |
| | Puerto Antofagasta | | Ningbo - Antofagasta | | Ningbo - Antofagasta | |
| | Term Neg: CFR Antofagasta | | Term Neg: FOB Ningbo | | Term Neg: FOB Ningbo | |
| | USD | COP | USD | COP | USD | COP |
| VALOR F.O.B. | 83,300.00 | 258,230,000 | 75,000.00 | 232,500,000 | 57,000.00 | 176,700,000 |
| FLETE MARITIMO | 1,034.00 | 3,205,400 | 2,022.00 | 6,268,200 | 2,022.00 | 6,268,200 |
| PESO BRUTO | 9,000.00 | 8.70 | 9,000.00 | 4.45 | 9,000.00 | 4.45 |
| BULTOS | 147.00 | | 147.00 | | 147.00 | |
| VOLUMEN | 29,75 | | 29.75 | | 29.75 | |
| GRAVAMEN | | 0 | | 0 | | 0 |
| IVA 16% | 0 | | 0 | | 0 | |
| TRANSPORTE Y ACARREO | | 4,700,000 | | 0.00 | | 0.00 |
| DECLARACION DE EXPORTACION | | 25,000 | | 0.00 | | 0.00 |
| REGISTROS DE IMPORTACION | | 0 | | 0.00 | | 0.00 |
| COMISION AGENTE | | 786,000 | | 0.00 | | 0.00 |
| GASTOS PROVEEDOR | | 0 | | 0.00 | | 0.00 |
| BODEGAJE | | 150,000 | | 0.00 | | 0.00 |
| GASTOS MONTACARGA | | 0 | | 0.00 | | 0.00 |
| GASTOS EN PUERTO (INSPECCION, USO, PESO) | | 450,000 | | 0.00 | | 0.00 |
| SEGUROS | | 147,378 | | 147,378 | | 147,378 |
| OTROS GASTOS | | 103,000 | | 0.00 | | 0.00 |
| TOTAL | | 267,796,786 | | 238,915,582 | | 183,115,582 |

Source: (Aguiar & Pavas, 2016)

Option 1 corresponds to export from Energy & Power in Medellin - Colombia to the port of Antofagasta in Chile, where the result of the contribution is \$ 267,796,786 for a container.

Option 2 corresponds to the export that Energy & Power solar panels from Ningbo - China with direct delivery to the port of Antofagasta Chile, where the price indicates a value of \$ 238,915,582. Compared to Option 1, Option 2 is 10.7% cheaper.

Option 3 shows the performance of the import of solar panels when performed directly Chile. The results show the total value price in Colombian pesos: \$ 183,115,582. Which shows us that option 1 is 31.6% more expensive, this means that we could not be competitive with the importers of Chile if we maintain the profit margin of 30%; the option to bid would be a minimum gain of 10%.

3. Findings

The production of solar panels worldwide is concentrated in 10 companies of which most have their location in China, these companies have a high production capacity, so that the economy of scale directly influences this industry. It was found that Energía & Potencia not have this capacity, nor in Colombia there is still a company that can manufacture large-scale solar panels to be competitive in the market with large producers; and also the only option to enter the process of exporting solar panels on the Chilean market is necessary to have an external supplier; was selected the best optioned and reliable supplier is one of the Chinese, with whom the company has already made imports for the development of projects developed and implemented in conjunction with Colciencias and Isagen country.

Surveys were conducted to Chilean companies involved in the market of solar photovoltaic systems, they were sent to 50 companies of all kinds, of which response 15. was obtained Although the sample is small, companies that contributed to the development of the proposed methodology, they are companies with experience and recognition in the market, which generates credibility and confidence against the answers given, since according to them was determined that adequate and more demand for this proposal panels are polycrystalline solar panels with power between 130w and 200w, since 93.3% and 66.7% of respondents respectively provided these responses under this selection and the price of the product and the costs of import and export was performed.

The price of the costs Import and export with the shipper Blulogistic was performed in the following scenarios: Option 1 corresponds to export from Energy & Power in Medellin - Colombia to the port of Antofagasta in Chile, Option 2 corresponds to export ago energy & power solar panels from Ningbo - China with direct delivery to the port of Antofagasta, Chile and option 3 import solar panels when performed directly Chile. When analyzing the 3 options is evidence that exports from Energy & Power (Colombia) to Chile (Option1) economically is not competitive, to have very high costs, which added to the profit margin of 30% make the price is high.

Option 2 exported from Ningbo with direct delivery to the port of Antofagasta in Chile, but is cheaper than option 1, still is not competitive, and it is not feasible for the BL (Bill of lading) or document shipping as this implies that the client knows who the supplier of the product and continue to negotiate with directly.

Option 3, which represents the import of solar panels when performed by Chile directly gives us a much more economical than other options result, which brings the conclusion that it is not viable economically, but with the added value offered the company's knowledge and experience in solar panel installations is feasible and making some adjustments on profitability initially allow fair competition.

4. Conclusions and recommendations

4.1 Conclusions

- ✓ Renewable energies have become a major alternative to solve the problem of energy deficit to the high demand currently present in the world, Latin America and specifically in Chile.
- ✓ Chile is the country with the largest geographical advantage to implement renewable energy systems using solar energy with photovoltaic panels, its deficit of fossil fuels make solar power your best alternative.
- ✓ Colombia has excellent trade relations with Chile, which makes possible the export of solar panels to this country. However not being manufacturer of these products may have a disadvantage cost level.
- ✓ Energy and Power has the necessary resources and photovoltaic panels to export to Chile and to advise on installation and deployment experience.
- ✓ The viability level of trade and regulatory bodies photovoltaic panels from Colombia to Chile is feasible, however when analyzing the economic alternatives, the company is not competitive if you keep a profit margin of 30%, the option to become a possible trader to Chile is to reduce the profit margin of 10%; in order to penetrate new markets and strengthen trade links, so it could achieve offer and sell other products in Chile initially; also

on offer should highlight the experience and qualified with which the company has in the installation and implementation of solar panels staff, this becomes the value-added service and advice provided by the company to its customers.

- ✓ The manufacture of solar panels in the world is limited in few countries, and most highly developed countries; this is due to the costs and constantly changing technologies; It is difficult to expect that in countries like Colombia panels occur in the short term. However, the elements and components supplementing photovoltaic systems are available in the country without difficulty, allowing marketing is normally proceed smoothly

4.2 Recommendations

Taking into account the results of this work, some recommendations relate described in relation to:

- ✓ Although surveys yielded valuable information that allowed us to advance the development of this work it is important to gather information in a much more significant sample that allows to have more complete information.
- ✓ To be competitive in a new market Energy and Power must provide added value and in this case this factor must be given, for consulting, installation and after-sales service.

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