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Brazil – Photovoltaic Energy Market

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IMPRESSUM

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1. Introduction

Being one of the fastest growing's economies, part of the BRIC's group, and experiencing unprecedented political and social stability, Brazil is nowadays seen as a true land of opportunities for European and American businesses aiming to diversify their activities and avoid recession and stagnation in their national markets.

Brazil is not only a BRIC country, it is also the most stable one with an established democracy that has successfully and significantly improved living standard and reduced income inequality during the last two decades. Furthermore, the Brazilian government has been fostering the development of new industrial clusters, renewable sources of energy and actively promoting the transfer of technology.

It is namely in this context that this report aims to present an analysis of the photovoltaic industry in Brazil. The following chapters will introduce this sector, describing its major aspects and developments, and providing guidance for business and investment opportunities.

This report is organized in five chapters apart from this initial summary. The second chapter comprises an introduction to Brazil, presenting the major economic and social indicators and introducing the Brazilian energy sector.

The third chapter introduces the photovoltaic energy in the Brazilian market. An overview of current technology, market trends and cost is presented, followed by the description of Brazil's photovoltaic potential. This is followed by a short description of the photovoltaic supply chain, which shows the current development of the different photovoltaic sub-sectors in Brazil, also presenting the opportunities for investment and technology transfer that lay ahead in different areas.

The fifth chapter presents the political and regulatory environment of the photovoltaic industry in Brazil, describing the major political options and incentives, and introducing the most important regulatory frameworks.

Finally, a short conclusion overviewing major market trends and potential is presented.

2. The Brazilian Market

2.1 INTRODUCTION

Brazil is the largest country and economy in South America. With an area of 8.5 million km2 it hosts 49.7% of the entire region population and produces 57.4% of its GDP. Also, Brazil has considerable oil and scarce raw materials reserves, and the world's largest reserves of tropical forest, biodiversity and flows of fresh water (25%).

During the last fifteen years, the country has experienced unprecedented political stability and economic growth. The Plano Real economic reforms that were introduced in the last decade of the 20th century allowed the country's economy to successfully take off during the last ten years. In 2010 national GDP grew by 7.5%.

This economic boom, together with the federal government social policies, led to low unemployment rates and great social development in recent years. The fact that governments were able to successfully redistribute wealth allowed a growing number of Brazilians to increase their income, hence improving their quality of life and allowing them to move up in the social scale.

This new scenario is creating a whole new middle class with higher purchase power, thus enabling great growth potential in many market sectors. Furthermore, Brazil has a strong science and industrial base, and is considered to be a keen promoter of technology transfer. Hence, the Brazilian market presents great opportunities for foreign companies aiming to diversify their activity and invest in a fast growing market.

Next topic presents tables and charts showing general information about Brazil. Recent past evolution and next few years' forecasts are displayed. These numbers comprise information about economic and social indicators, as well as industry and technology broad trends and developments. Finally, this chapter also introduces some general information about the energy sector in Brazil. The Solar Photovoltaic Energy sector will be further developed in the next chapter.

2.2 ECONOMIC AND SOCIAL INDICATORS

This topic presents Brazil's main economic and social indicators, showing the great economic and social changes that have been taking place in Brazil during the last two decades.

The Brazilian economy had a steady growth since the implementation of Plano Real in 1994.

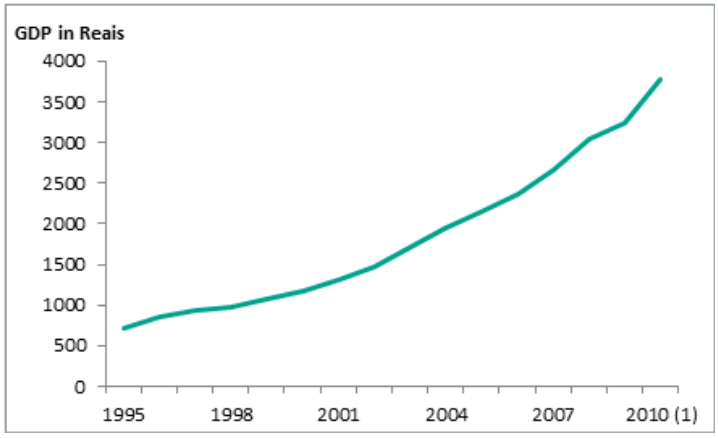
Plano Real enacted a series of contractionary fiscal and monetary policies, including the introduction of a new currency, which controlled inflation and stabilized the economy.

As a result of Plano Real, Brazil has experienced great economic changes in recent years with lower inflation and unemployment rates, and higher growth. This new scenario allowed the South American country to overtake the UK and France in 2011, becoming the world's 5th largest economy.

Furthermore, social policies employed during the last decade by the former president Lula da Silva allowed not only to sustain the economic growth enabled by the Plano Real, but also helped millions of Brazilian's to significantly improve their living standards.

Estimates show that, between 2004 and 2009, more than 26 million Brazilians were able to move up in the social scale and become part of the country's middle class. During this period, poor and extremely poor population was also reduced from more than 43 million to about 27 million. Also, average income increased by 28% and income inequality was reduced by almost 6% during this five year period.

These numbers show that social policies had a great positive impact in the improvement of Brazilians living standards. Nonetheless, the fact that 9 million people are still considered to be extremely poor shows that a lot of work still has to be done.



Considering the appreciation of the Real against the Dollar, the numbers might be different but still remarkable. The Brazilian gross domestic product rose up to US$ 2Tn in 2010. 15 years ago the country produced US$ 0,8Tn, approximately 60% less than today. GDP is expected to rise up to US$ 3Tn by 2015.

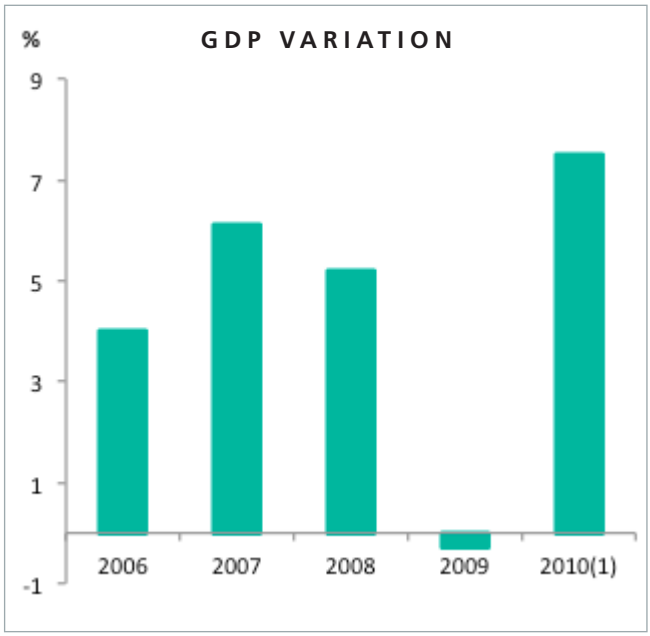
With a successful track both in wealth redistribution and general economic growth, the Brazilian economy places great opportunities for companies aiming to diversify their activities and invest in new, promising, and fast growing markets.

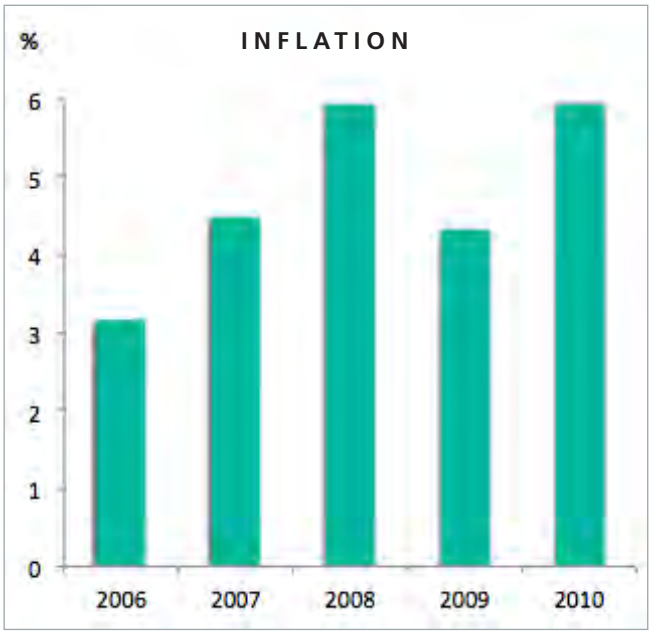
The first chart shows that the Brazilian economy had a remarkable evolution during recent years, achieving an average growth of 4,6% per year between 2006 and 2010.

Also, and even though it can still be considered high according to developed economies standards, inflation was kept between the targeted values (2,5% to 6,5%).

For the next few years, growth is expected to continue. Its largest contributor will be domestic demand, mostly due to the expected increase on families' income. Investment will also significantly contribute to this forecasted outcome due to the need of increasing industrial and services production in order to respond to domestic consumption needs.
The IMF estimates that the economy expanded by 3,8% in 2011 and forecasts a 4% growth in 2012.

"30% poverty reduction - During the past decade, former president Lula da Silva social policies reduced by almost 30% the number of poor families, enabling these people to be part of Brazil's middle class."





Excluding the effects of the global recession, in 2009, Brazilian GDP increased more than 4% a year between 2006 and 2010.

KEY FACTS

LOCATION / AREA	South America / 8.5 million km^2
POPULATION (2010)	191 million
CAPITAL	Brasília (2.5 million)
LARGEST CITIES	São Paulo (11.2 million), Rio de Janeiro (6.3 million)
LANGUAGE	Portuguese
INDEPENDENCE / CONSTITUTION	07/09/1822 (From Portugal) / 05/10/1988
GOVERNEMNT TYPE	Federative Republic (27 States)
WORKING FORCE	101.7 million
LITERACY / LIFE EXPECTANCY	90.3% / 73.1 years
GDP (NER/PPP)	US$ 2.5Tn / US$ 2.3Tn
Per Capita GDP (NER/PPP)	US$ 12.917 / US$ 11.845
GDP % (AGRICULTURE/INDUSTRY/SERVICES)	6% / 28% / 66%
EXPORTS / IMPORTS / TRADE BALANCE	US$ 202Bn / US$ 182Bn / US$ 20Bn
INTEREST RATE (BNB – April 2012)	9.5%
GDP GROWTH	7.5% (2010) / 3.8% (2011 est.)
INFLATION	6% (2010) / 6.5% (2011 est.)
EXPECTED GDP GROWTH	3.2% (2012) / 4.3% (2013)

2.3 THE ENERGY SECTOR IN BRAZIL

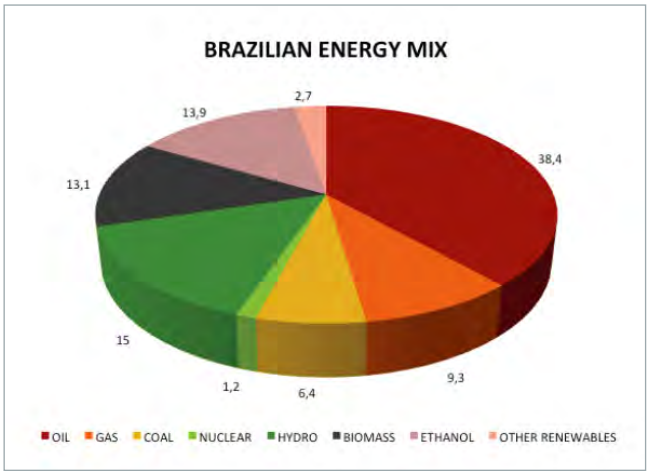
This topic introduces Brazil's energy market, providing information on its current and forecasted energy needs and energy mix.

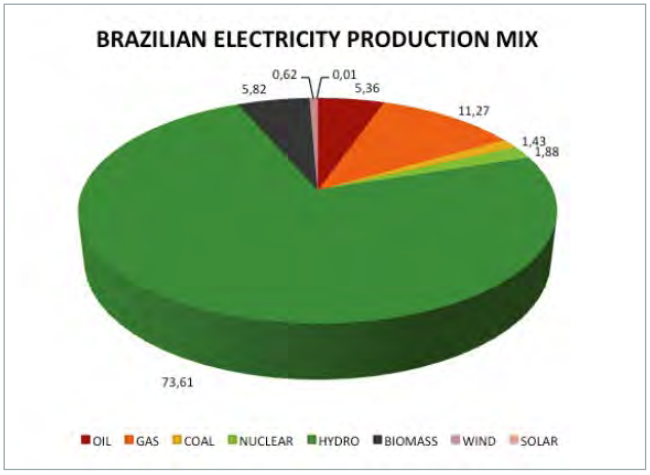
When compared with any other country in the world, Brazil has the highest contribution of renewable sources of energy to its national energy mix, with over 45.5% of its supply coming from sources such as water resources, biomass and ethanol, in addition to wind and solar energy. Worldwide energy supply mix consists of 13% of renewable sources in the case of industrialized countries, and drops to 6% among the developing nations.

However, a great share of Brazilian energy comes from one single source: hydroelectric power. In fact, hydroelectric power plants are responsible for over 75% of the electric energy generated in the country. Moreover, the country has still a great non used potential on hydroelectric production that the government plans to explore by expanding hydropower capacity by 27GW over the next ten years.

Nevertheless, in order to reduce national dependence on a single source, energy diversification is now a key objective of the federal government. Hence, in recent years the Brazilian government has been incentivizing an energy mix diversification and promoting private investments in Biomass, Wind and Solar power generation.

With these new investments on energy production, Brazil's energetic installed capacity is expected to grow from approximately 110,000 MW in December 2010 to 171,000 MW in December 2020, with priority placed on renewable sources. Also, as result of this diversification policy, the share of hydropower in the electricity production matrix is expected to decrease from 75% to 67% over the next 10-years. During the same period, generation from alternative resources will double from 8% to 16%.





Considering its water, wind and solar abundant resources, Brazil has the potential to supply up to 93% of its energy needs from renewable sources by 2050.

As a result, the share of renewable resources will remain at around 46.3% on the overall energy mix by 2020, with an investment demand of approximately US$ 120.8 billion.

The majority of these investments will support projects that have already been approved. Apart from the new hydropower power plants (55% of total), the largest approved investments are mostly focused on wind power generation.

Seventy one new wind projects, approved in December 2009 and totaling 1800MW are already driving the construction of wind-turbine assembly factories, thus contributing to the development of a national wind cluster.

In the transport sector, Brazil's ethanol demand is expected to nearly triple over the next ten years, rising up to 73 billion liters in 2020 and allowing the country to achieve a cleaner energy mix. Also, Brazil will be able to export almost 7 billion liters of this fuel by 2020.

But Brazil's greatest energetic challenge relies on electric generation rather than in the transport sector, where national ethanol and oil production will not only be able to supply the national market, but also allow the country to become a net fuel exporter.

Hence, electricity production diversification is seriously taken into account by all economic agents in Brazil, since that, in order to achieve and sustain a growing economy, energy disruption must be avoided. Disruption risks resulting from an extended drought, similar to the one in the late 1990's, or any grid problems that affect power transportation across thousands of miles between the main dams in the interior and the largest cities near the coast, must be reduced. However, a fully diversified energy mix has not been achieved yet. Whereas wind and new hydroelectric power plants got large federal incentives and promotion in the late 2000's, other sources were not seriously considered until only recently. The most important and promising source that has not boosted yet is the solar power generation.

According to international organizations reports, Brazil has the potential to produce 93% of its energy from renewable sources by 2050. In this scenario, natural gas would account for 7.3% of Brazil's energy mix, ocean energy 0.77%, hydroelectric plants 45.6%, wind power 20.3%, biomass 16.6% and solar energy 9.26%.

Hence, solar energy is a promising resource, since it accounts for less than 0.5% of current electricity supply. Moreover, solar energy has great potential to become a significant energy supply due to Brazil's geography and climate.

So far, thousands of photovoltaic systems have been installed across the country, primarily in schools, hospitals and water-pumping facilities. Some companies also began investing in pilot projects. However, the greatest opportunities are only now being created, with governmental incentives and new regulations.

Also, the new solar power legislation will be released by the federal government in the second quarter of 2012. This topic and the great potential of the Brazilian solar market are discussed in the next chapters.

"US$ 120.8 billion investment until 2020 - The measures included in Brazil's Ten-Year Energy Expansion Plan are expected to reduce projected emissions in 234 million tCO2-eq by 2020"

3. Photovoltaic Energy In Brazil

3.1 PHOTOVOLTAIC ENERGY – TECHNOLOGY, MARKET AND COSTS

Solar photovoltaic energy has been presented as the energy of the future, able to foster the development of a whole industry that can offer significant opportunities for researchers, investors, manufacturers and consumers. It is also seen as a safe, reliable, and clean technology, able to be locally produced, to reduce environmental impacts, and fossil fuels dependence. However, there are technological, market, and institutional forces that have slowed down the emergence of the photovoltaic industry.

Some of these forces, such as traditional energy sources producer's interests and higher production costs, have been clearly identified since the beginning. However, several gaps between industry players also contributed to slow down photovoltaic adoption.

Most of these gaps have already been identified in the most advanced markets, such as Germany, Spain or Japan. However, it is important to list those and to understand how to approach developing markets, namely Brazil, in order to minimize these gaps and its consequent impacts.

Hence, this topic will identify these gaps, aiming to describe the main obstacles that still exist in the Brazilian photovoltaic market. Nevertheless, two topics will be introduced before. Firstly, a short overview on the most recent technological advances in the photovoltaic industry will be presented. Secondly, current solar energy costs and competitiveness is analyzed.

PHOTOVOLTAIC LATEST BREAKTHROUGHS

Since Bell Labs patented the first solar cell based on silicon in 1954, solar energy has always been considered as a solution to energy scarcity. However, the evolution of photovoltaic cells was slow and it was not until recently that it became competitive, with real efficiency rates now reaching up to 36%.

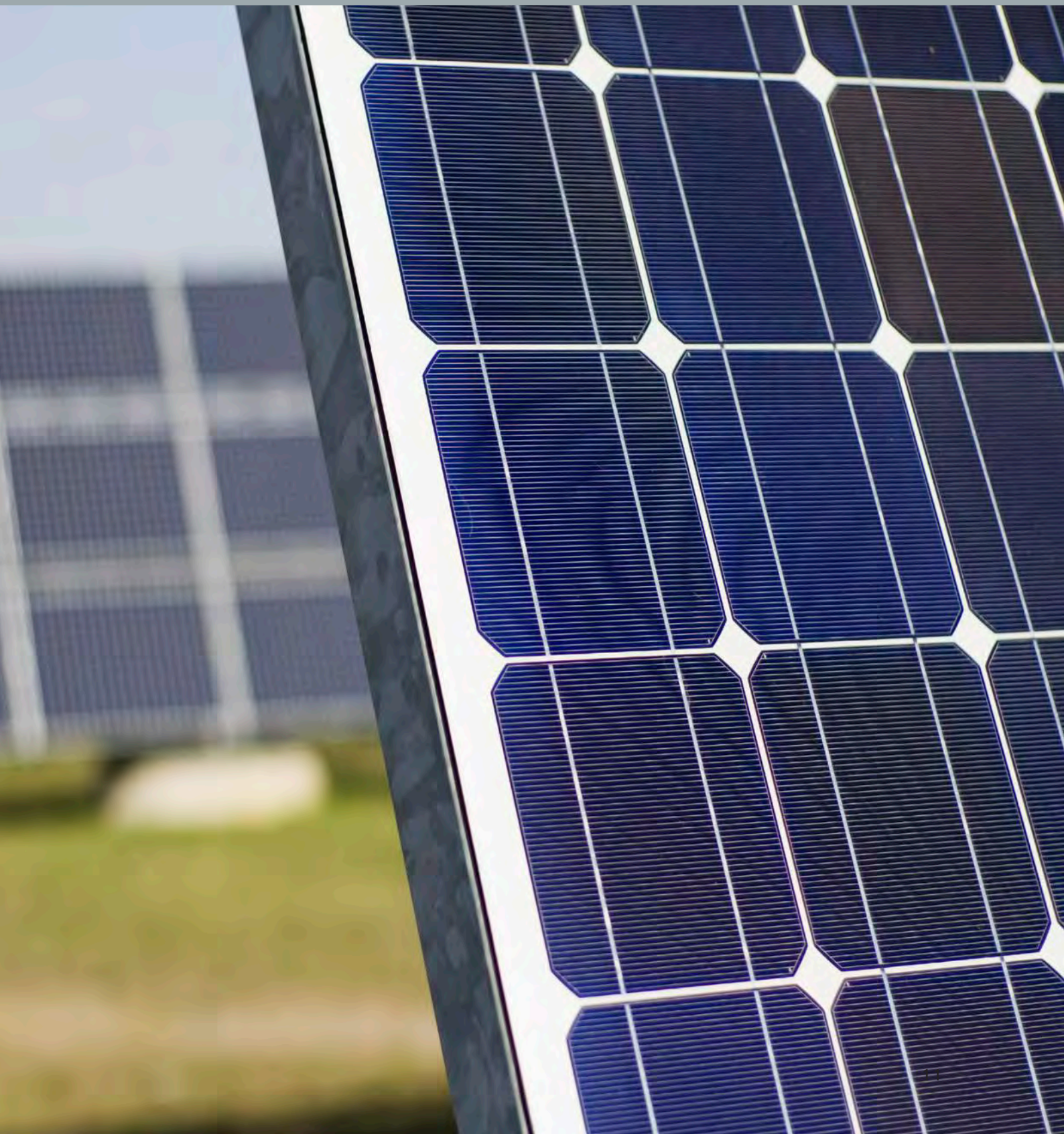
In recent experiments scientist were able to raise photovoltaic efficiency up to 44%. Nonetheless, these are not commercial solutions yet.

On the other hand, the fact that current photovoltaic systems have now reached efficiency levels above 30% made them a viable and interesting solution that can help reducing oil dependence and improving the environment. Other components, such as invertors, had great technologic developments in recent years as well. New solutions that are smaller and more efficient are now available on the market, making it easier to install photovoltaic systems in smaller places.

Furthermore, these new technological and scientific findings are not only increasing photovoltaic cells performance as they are also enabling costs to drop significantly.

"Japanese commercial photovoltaic technology delivers 36.9% record efficiency."

PHOTOVOLTAIC ENERGY IN BRAZIL



PHOTOVOLTAIC COSTS

New technological breakthroughs usually take time to develop and to achieve a market mature stage. This is true for any industry, including the energy sector. In fact, unlike most people think, this is a normal evolution that nowadays dominant sources of energy also went through, rather than being a solar energy exclusive. For example, oil and gas took more than 50 years to overtake coal and become dominant on the global energy mix.

One of the main reasons driving the adoption of a new technology is its price. In this case too, high production costs have been the greatest obstacle to photovoltaic energy expansion, since it is still considered to be significantly more expensive than traditional energy sources.

However, recent research allowed the development of new and cheaper technologies, turning this energy into a more attractive option. In fact, both companies and research institutions now agree that solar energy is already competitive with traditional sources such as oil, gas or hydroelectric power.

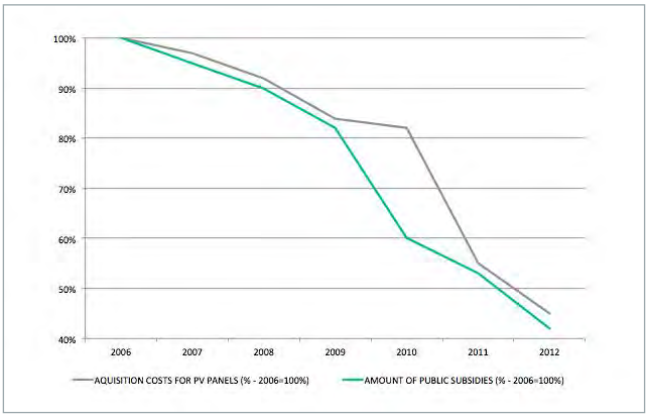
According to a study published at the Queen's University in Canada, researchers concluded that by the end of 2011 photovoltaic energy had achieved economic competiveness. By revising previous studies data and performing new market research, the team was able to figure out photovoltaic energy current costs. Considering a 30 years solar panels life cycle and a solar cells productivity reduction of 0,2% a year (the real numbers for nowadays technology) they stated that current photovoltaic costs are as low as US$ 1 per generated watt.

This study not only showed that photovoltaic energy is already competitive is many places around the world but also that it can even be cheaper than conventional sources in several countries (even without government subsidies).

A study conducted in Santa Catarina Federal University (Brazil), also supports this theory in the specific case of the Brazilian market. According to this research team, solar energy will have competitive prices in some regions of Brazil, namely the Northeast, by 2013. Other regions might need subsidies, following the European model for a short period of time until prices become in line with other energy sources. Hence, legislation is now meant to be approved during the second quarter of 2012. This topic will be further developed in this report (chapter 5).

Finally, an analysis conducted at the end of 2010 also showed that installing photovoltaic panels in building roofs in large cities – Rio de Janeiro, in this case – is already commercially viable. According to this case study, a 10% reduction of electricity costs can be achieved if photovoltaic panels are installed.

"By installing PV collectors, a standard residential building in Rio de Janeiro can save up to 10% in the electricity bill."



PV panels acquisition costs (grey)

BRIDGING THE GAPS IN BRAZIL

As mentioned above, there are always gaps disturbing either the evolution of new technologies or the entrance of mature technologies in new markets. Even though, as mentioned on the previous topic, photovoltaic energy is arriving to Brazil with competitive prices, there are still gaps to be bridged in order to assure the effective exploration of Brazil's great photovoltaic potential.

As the image below shows, there are certain stages on industries and technologies life-cycles. These range from the conception of the technology to its promotion and sustaining/ improvement stages. However, according to this life/market-cycle, there are several gaps that need to be filled in order to a technology to succeed.

In the specific case of Brazilian photovoltaic energy market, several stages and gaps have already been filled. The photovoltaic technology has been conceived and several small companies already introduced it in the market. Henceforth, the interest gap has been clearly filled.

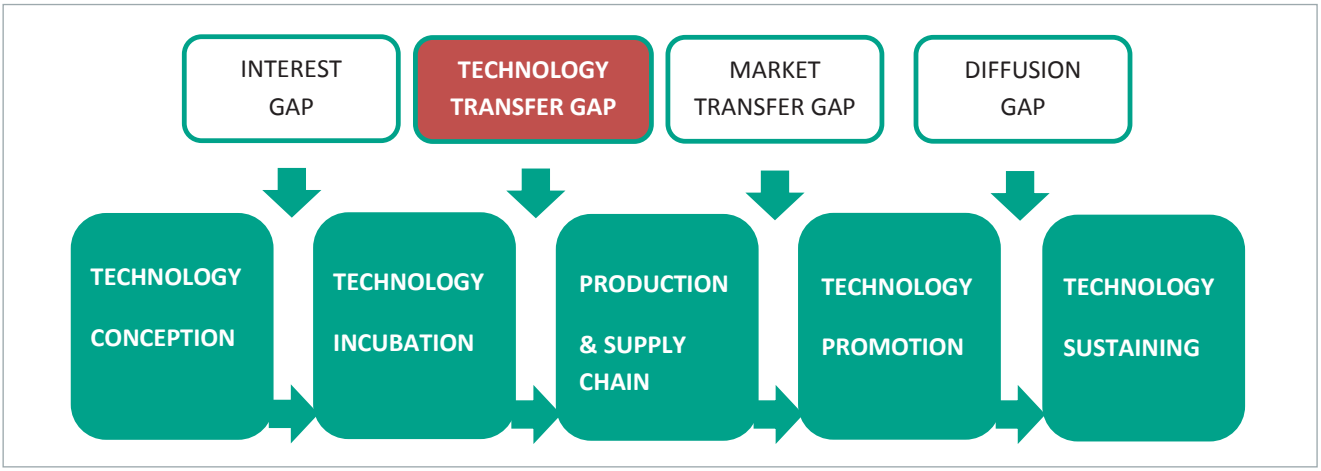
However, to use Brazil's great solar energy potential, large scale production, incentives and promotion must be developed. In order to achieve these requirements, collaboration between several actors, both from the photovoltaic industry and the energy sector in general, must be fostered.

Since the energy sector is different from most industries, due to its strategic importance and, consequently, to national government's large influence, it is necessary that the third gap is closed at the same time, or even before, the second one. Companies will only invest in technology transfer and production capacity if legislation is approved and government regulation is defined, hence enabling solar energy to take off. Solar energy legislation is now under discussion in Brazil. As previously mentioned, some legislation has already been

approved and new incentives and subsidies will be presented during the second quarter of 2012 (chapter 5).

Once this gap is closed, investments in the photovoltaic energy are likely to boost in Brazil, since there is already a great interest from local investors. This means that Brazilian companies aiming to target this potentially highly lucrative and fast growing market will need to acquire technology from abroad, since the photovoltaic know how is still small in Brazil.

Due to the high revenues that the Brazilian market is likely to offer during the next decades, technology transfer opens great investment opportunities for foreign companies aiming to support the close of this technology gap. Hence, this report will further discuss these opportunities on the following chapters.



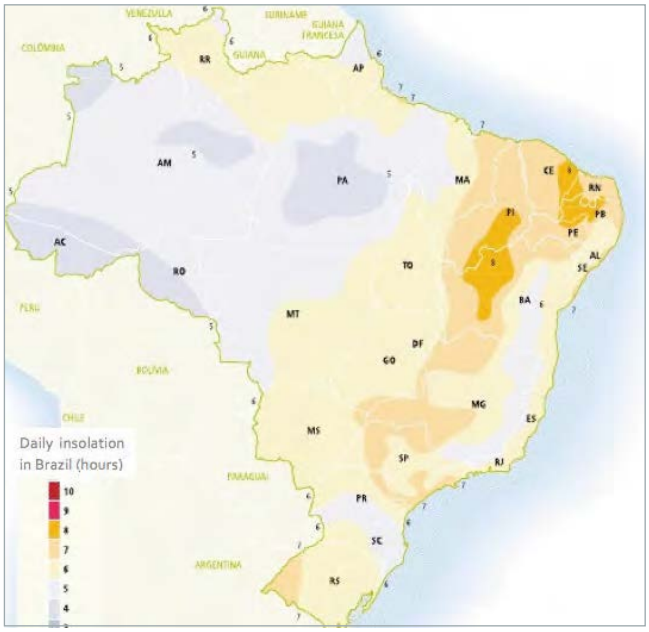
3.2 THE BRAZILIAN POTENTIAL

A booming economy, some of the largest cities in the world where the sun shines all year round, great investments in major international events, and a vast territory abundant with remote sunny areas.

Excluding the area of Amazonia where there is almost no population, Brazil has a significantly high number of sunny hours, ideal for the production of photovoltaic electricity.

The most populous areas in Brazil, such as Sao Paulo and Rio de Janeiro, which are located in the Southeast, get an average of 2200 sunny hours/year. In the Northeast these values can vary between 2500 in Salvador da Bahia and 2900 in other regions. Germany, the largest user of solar energy per capita, has an average of only 1550 sunny hours/year.

These numbers confirm the huge potential of Brazil to become a leading market in the solar energy sector. Furthermore, the size of the country and the high costs of energy transportation from the main hydroelectric power plants, located in the interior, to the largest cities by the coast, turn local solar production even more attractive.



Daily insolation in Brazil (hours)

Another great advantage relies on Brazil's mineral resources. The country can obtain all the raw materials necessary to manufacture solar panels within its borders. Moreover, Brazil has the second largest reserves of silicon, which is the key and the most expensive component of photovoltaic panels.
The abundance of raw materials guarantees a high level of independence and reliability for the national industry. It can also have a significant contribution to boost exports of high valuable solar technology, since local production and its final costs cannot be affected by external dependence on raw materials costs and availability.

Photovoltaic Supply Chain

These resources create a great competitive advantage for a future Brazilian solar cluster. However, it is also essential that the country is able to retain its high skilled engineers that often have been flying abroad in order to find a job. Also, the right incentives must be delivered in order to attract consumers and spread the technology.

Developing a national cluster is undoubtedly a key part of Brazil's solar challenge. Furthermore, the development of this cluster places great opportunities to foreign companies aiming to transfer technology, thus benefiting from the huge profits that the Brazilian market can offer.

The photovoltaic supply chain is complex and involves organizations whose businesses range from obtaining and purifying silicon until the final installation, comprising other activities such as wafers, solar cells and module manufacturing. Across all these areas, technology has to be transferred to Brazil, thus creating great opportunities to European and American companies now facing the crises in their internal markets.

Currently there are several companies operating in some stages of the photovoltaic supply chain in Brazil, whereas in other areas the country is fully dependent on imported products. Next chapter will present some of these companies and introduce opportunities lying ahead.

But there are also other factors contributing for the great potential of solar energy in Brazil. These include the Brazilian people receptiveness to renewable energies and environmentally-friendly technologies, the large territory of Brazil where remote sunny areas are abundant, thus making photovoltaic local production even more competitive, and the lack of present competition, which plays a major competitive advantage for first moving companies.

Finally, as mentioned on the previous topic, photovoltaic energy is reaching Brazil with very competitive costs, since solar cells costs dropped by more than 50% during the last decade. This reality made subsidies unnecessary in other countries, such as Germany, where photovoltaic energy is much scarcer than in Brazil. Hence, Brazil has a huge potential to become a leader on this high profitable market, taking advantage of its natural resources, skilled labour and industrial clusters.

" Up to 2900 sunny hours/year.
Twice as much as Germany's average.
Brazil has the potential
to develop an entire photovoltaic supply chain,
offering technology transfer opportunities
across the whole industry. "

4. The Photovoltaic Supply Chain In Brazil

Following the photovoltaic supply chain layout introduced in the previous chapter, this topic aims to present each area of this chain in the Brazilian context, describing its current development status.

As stated before, the Brazilian photovoltaic market is still small. The photovoltaic sectorial group of the Brazilian Electric and Electronic Industrial Association (ABINEE) comprises less than 100 companies, most of which are focused on the end of the supply chain, providing installation and consulting services, rather than manufacturing. Hence, this chapter will start describing the last stages of the photovoltaic supply chain, before presenting the manufacturing and raw materials sectors.

INSTALLATION & SERVICE

This photovoltaic supply chain area comprises companies that specialized both in designing solar solutions targeting specific client needs and in the installation of these systems. Most of these organizations are small and medium size companies that import solar panels and other components from Europe, the US and Asia, providing only the final assembly to the customer.

There are also several companies developing project management and providing engineering consulting. These are mostly micro and small enterprises that provide services such as measuring savings that clients are likely to achieve by investing in photovoltaic systems. These companies are mostly focused on residential clients and SME's, providing business advice and recommending the specific photovoltaic solutions that fit each customer.

In this specific market little technology transfer is needed, thus leaving limited opportunities for foreign investors in this field. It is also difficult for specialized foreign companies to establish in this sector, since there is already significant competition from local companies and a deep knowledge of local markets is required.

COMPONENTS

Solar inverters, wires and transformers are the major components of solar photovoltaic systems apart from the solar modules and cells themselves. The manufacturing of these components is largely a commodities business and the efficiency of these devices is already relatively high.

Brazil still has to import most of these components. However, there are plenty of electric and electronics companies aiming to develop these systems and to sell them to the photovoltaic market, since this sector is expected to boom during the next few years. Several of these organizations are actively looking for partnerships and technology transfer opportunities, and are deeply interested in the development of new photovoltaic oriented technologies, thus representing a great opportunity for companies aiming to transfer technology and profit from it in the Brazilian market.

European companies, whose expertise represents the cutting edge in this field, are likely to find in Brazilian partners a solution for shrinking domestic demand.

SOLAR CELLS AND MODULES

As stated before, a Brazilian solar cells and modules manufacturing industry has not been established yet. Whereas some trial projects have already been launched in order to manufacture solar modules with Brazilian technology, these are mostly research orientated projects, developed by small start-ups with little production capacity and financially supported by Universities and Federal programs. The investments of Tecnometal Energia Solar (a startup) of the Núcleo de Tecnologia em Energia Solar (NT-Solar) in the Rio Grande do Sul University is a good example of these ventures.

Worldwide solar cells and modules production is mostly focused in Germany, China and Japan. Whereas Chinese and Japanese firms face a huge growing potential in the Asian market, Brazil presents a great opportunity for German companies aiming to avoid the slowdown of the European market and export technology to a fast growing market that still lacks the necessary technology to supply its expected growing demand.

The fact that Brazilian public authorities are actively promoting the creation of a national cluster by providing funding in order to cover the significant capital and energy requirements for solar cells production is also a major advantage that is likely to turn technology transfer more attractive.
It is also important to highlight that, even though cells manufacturing has not taken off yet, a few modules manufacturing facilities are now under construction. However, these are still the first projects to take shape and still rely on imported key components. Also, the scale of these investments is still small and will not be able to respond to forecasted demand increase, thus leaving plenty of market opportunities for companies willing to invest in this market.

SILICON, INGOTS & WAFERS

Brazil has the second largest reserves of silicon and it is amongst the five largest exporters of this raw material. The size of the silicon industry is considerable, with metallurgic silicon production rising up to 200.000 tons a year. However, Brazil does not produce solar silicon, which is used to manufacture solar cells and panels.

Great technology transfer opportunities arise in this sector too. Partnerships between European companies and local Universities to create and support local research and micro enterprises, in order to foster local production, can also be an interesting and profitable opportunity for European companies willing to participate in the development of a Brazilian solar cluster.

There are already some attempts being developed in order to create a national industry in this sub-sector. In partnership with one of the largest metallurgic silicon producers and funded by the Development Bank of Brazil, the Public Technology Research Institute (IPT) developed a strategy to foster the adoption of the latest solar silicon production technologies in Brazil. The IPT strategy is based on the metallurgic rather than chemical approach, since it aims to take advantage of Brazilian companies' expertise in the metallurgic silicon industry and to upgrade it to the solar level.

Adding the fact that the purifying silicon technology can be used in several other industries, namely in the electronics sector, and the forecasted worldwide market expansion (100.000ton in 2009 to 200.000ton by 2020), great opportunities lay ahead for companies interested in transferring technology and supporting the emergence of solar silicon production in Brazil.

5. Government And Regulatory Frameworks

5.1 GOVERNMENT POLICY AND INCENTIVES

Following the economic stabilization in the late 1990's, the Brazilian government decided that a new energetic plan had to be designed and implemented in order to respond to the economic boom and to the subsequent increase on energy demand.

As previously stated, for many years a significant share of Brazil's energy needs has been supplied by renewable sources (mostly hydroelectric). Also, Brazilians are considered to be highly concerned about the environment. The acceptance of new and renewable fuels for transportation and the use solar energy for water heating are good examples of this environmental-friendly mentality.

Hence, it is easier for the federal government to establish new and challenging targets for the introduction or expansion of renewable energies. Nevertheless, these policies must be carefully designed, since missing the right promotion, incentives and implementation strategy might lead to great negative economic impacts due to the nature and importance of energetic policy.

Following this approach, the federal government commissioned the Center of Management and Strategic Studies (CGEE), part of the Ministry of Science and Technology, to present a study in order to support the definition of a national strategy for solar photovoltaic energy. This study was presented in May 2010 and suggested the implementation of several short and medium-term measures.

Most short-term recommendation pointed to the importance of investing in R&D centers and human resources education; promotion of national SME's and the interaction between Brazilian and foreign companies in order to promote technology transfer. Moreover, this study highlighted the importance of promptly regulate the photovoltaic market, specially the connection of these systems to the national grid.

For both short and medium-term, the CGEE recommended the promotion of Brazilian companies and research centers in international fairs and events, the divulgation of solar energy among the Brazilian society, and the spread of large-scale photovoltaic production.

These recommendations did not have a significant impact in the real figures of photovoltaic energy in Brazil so far, since regulation will not be approved before April 2012. Hence, large investments and the spread of micro scale production have been delayed until recently.

However, this scenario will change within the next two years due to the approval of the new legislation and governmental incentives, and to the competitive costs that this technology can now offer in the Brazilian context (chapter 3). Moreover, the large adoption of solar heating collectors (which are not restricted to the same legislation, since those are not connected to the national grid) in recent years, offers good prospects for the adoption of photovoltaic systems as well.

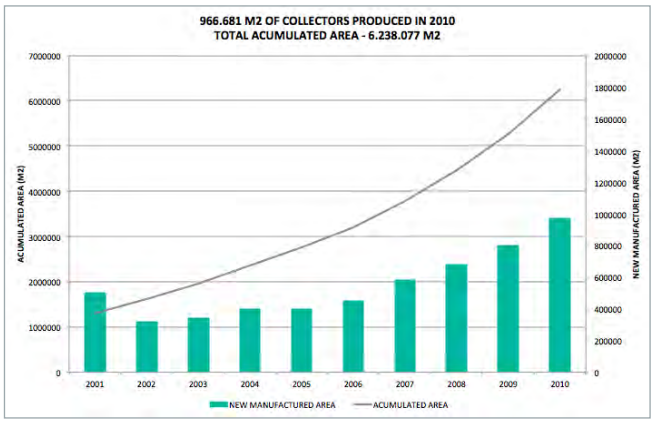
The government is likely to adopt solar heating energy incentives for photovoltaic energy during 2012. It is expected that federal housing programs like Minha Casa, Minha Vida will promote the installation of photovoltaic collectors just as they did with solar heating systems. Furthermore, just like solar heating equipment's, which may allow a 30% reduction

of electricity costs for average income families and 50% for low income ones, photovoltaic systems are likely to induce great savings on families and companies electricity costs. These advantages are also likely to boost the adoption of this technology.

According to the Brazilian National Department of Solar Heating (DASOL), the production of water heating solar collectors grew by almost 19% in 2009 and more than 21% in 2010. The annual production reached almost 970.000 m2 in 2010, and more than 6.2 million m2 are now installed across the entire country. Same results are likely to be achieved with new photovoltaic legislation and incentives, thus creating great opportunities for the emergence of a strong photovoltaic industry in Brazil.

In addition to these incentives, fiscal benefits and funding will also be given during the next few years. For example, the Development Bank of Brazil (BNDES) approved the "Fundo Clima – Energias Renováveis" (Climate Fund – Renewable Energies) with the purpose of supporting different activities regarding the implementation of renewable and sustainable sources of energy. This funding program has the objective of capturing solar radiation, amongst other renewable sources, and supports projects aiming to implement isolated energy generation systems.

"Government policies supporting the adoption of solar heating systems achieved great success in recent years."



5.2 REGULATORY FRAMEWORKS

The Brazilian Electric Regulator Agency (ANEEL) will soon approve the new photovoltaic legislation, comprising prize-tariffs values and specific legislation addressing the role of electric companies' in the photovoltaic market.
Obligation to include photovoltaic collectors in new building is also expected. This is likely to follow the model used for solar heating systems promotion under the federal housing program Minha Casa, Minha Vida.

According to Ivan Camargo, ANEEL president, the new regulation regarding the connection of small producers to national the grid will also be approved by the end of April 2012. The main obstacles delaying the new legislation were related with the tax to be paid by small producers when selling electricity to electric companies.

However, this situation has already been solved, with small producers getting fiscal benefits during a 3 years period. These benefits are mostly focused on an 80% reduction of the Tusd (grid connection tax) for all projects approved until 2017.

Furthermore, the new legislation will impose that electric companies have to buy energy from photovoltaic producers, in order to assure the profitability of these projects and, consequently, enable the development of solar energy generation.

Maurício Tolmasquim, the president of the national organization for energetic research (EPE), who conducted the study on which ANEEL's new regulation is based, says that, even though energy cost are too high already, thus making photovoltaic energy competitive, the government still aims to provide benefits to consumers in order to increase the adoption rate of solar energy.

"THE REGULATION FOR SUBSIDIZED ELECTRIC GRID CONNECTION WILL BE APPROVED BY THE END OF APRIL 2012"

IVAN CAMARGO
(ANEEL PRESIDENT)

6. Market Trends And Potential

Following the data presented on the previous chapters it is clear that several constraints contributed to the small adoption of photovoltaic energy in Brazil so far. However, the presented data shows that this scenario will change in coming years.

Current photovoltaic projects have been mostly focused in large public buildings, such as schools, hospitals, shopping centers and parking lots. Similarly, small public equipment's, such as water pumps, are also powered by photovoltaic energy. This market is likely to continue to grow, since a significant number of public facilities, shopping centers and large sport facilities will be built during the next ten years. Most significant projects include the Solar Stadiums, for the 2014 FIFA World Cup and 2016 Olympic Games, and the Solar Airports planned for the cities hosting these major sport events.

Nevertheless, the largest share of market grow will be sustained by smaller but numerous projects. These will be focused on individual small producers generating energy to supply their own houses/buildings energy needs and selling the surplus to electric companies.

The federal government forecasts that new legislation will foster the adoption of photovoltaic energy, expecting this industry to achieve similar growth rates to those of solar heating systems in recent years. This means that, following the introduction of new incentives and federal programs, photovoltaic industry sales are likely to achieve 10-20% annual growth rates during the next decade.

Furthermore, significant public incentives are given to companies investing in this sector. For example, the National Economic and Development Bank (BNDES) charge a 3% interest rate for supporting these projects, considerably lower than the Brazil National Bank reference rate (9.5%).

"Brazil has the necessary raw material and great climate conditions to develop photovoltaic industry. With new incentives and federal programs, sales are likely to achieve 10-20% annual growth rates during the next decade."

In this context, the greatest potential for photovoltaic panel's manufacturers and installers rely on the populous areas of the South and Southeast of Brazil. The Northeast is also a very interesting location to invest, since it is also considerably populous and has the highest sunlight incidence in the country.

Within these regions, opportunities can be found on the establishment of local partnerships across the entire photovoltaic supply chain, since Brazil has all necessary raw materials to produce photovoltaic panels. Furthermore, due to the high tariffs on imports, the best option relies on local manufacturing rather than importing manufactured components from abroad.

In the research field, several small start-ups are also developing innovative solutions and looking forward to establish partnerships with European companies and research centers. These companies are mostly based in technology parks located in the South, namely in São Paulo and Florianópolis. However, other parks, such as Tecnovia (Salvador da Bahia – Northeast), are also being established in order to develop research and companies incubation in this field.

Henceforth, for foreign companies, the greatest opportunities rely on the possibilities arising from the transfer of technology that Brazil is still lacking and which is essential to the development of a solar industry and to supply rising photovoltaic demand.
In order to promote this technology transfer partnerships must be established between European and Brazilian companies. Adding to the research presented on this report, Fraunhofer MOEZ can offer its expertise and market knowledge in order to provide specific support in this field. This includes the conduction of targeted research in order to find the right partners for each specific client and the support of the internationalization process to Brazil, by promoting business contacts and the establishment of partnerships.

FAIRS & EVENTS

FEEAI – 17-20 April 2012
Electronics, Energy and Industrial Automation Fair taking place in Joinville (Santa Catarina).

ENERSOLAR+ BRASIL – 11-13 JULY 2012
In July 2012, Sao Paulo will host the first international solar industry fair in Brazil. ENERSOLAR+ BRASIL will take place between the 11th and the 13th of July and will bring together organizations from the photovoltaic, solar heating and concentrated solar energy (CSP) sectors.
http://www.enersolarbrasil.com.br

POWERGRID BRASIL – 27-29 NOVEMBER 2012
Energy, Technology, Infrastructure and Energy Efficiency Fair and Congress taking place in Joinville (Santa Catarina).
http://www.powergridbrasil.com.br

IMPORTANT LINKS

ANEEL
(NATIONAL ELECTRIC POWER AGENCY)
http://www.aneel.gov.br

APEX BRAZIL
(BRAZILIAN TRADE AND INVESTMENT PROMOTION AGENCY)
http://www.apexbrasil.com.br

BNDES
(NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT BANK)
http://inter.bndes.gov.br

EPE (ENERGY RESEARCH COMPANY)
http://www.epe.gov.br

MMA (MINISTRY OF THE ENVIRONMENT)
http://www.mma.gov.br

MME (MINISTRY OF MINES AND ENERGY)
http://www.mme.gov.br

ONS (NATIONAL ELECTRIC SYSTEM OPERATOR)
http://www.ons.org.br