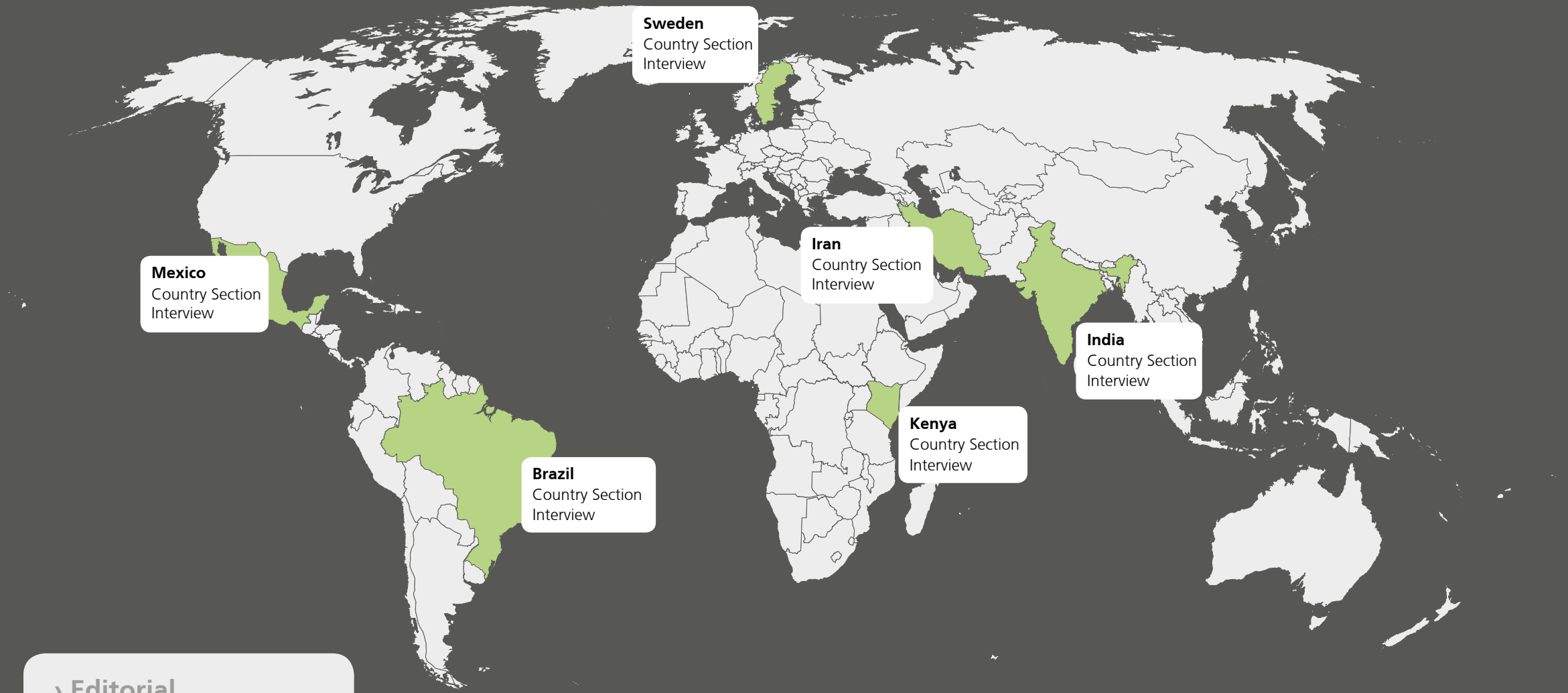
Rödl & Partner

Trendreport

Growth Countries Renewable Energies



November 2017

Dear Sir or Madam,

2017 was again a very exciting year for the renewable energies sector. The development of green technology further boosts the expansion of renewable energies in the world. The levelized costs of electricity for renewable energy plants and the costs for battery storages decreased again strongly this year and this trend will continue in the future. According to a report published by the TU Munich and the University of California the cost for lithium ion batteries will further drop to approximately 100 US-Dollar per kilowatt hour by 2019. As a comparison, in the 1990s the cost per kilowatt hour for a lithium ion battery was 10000 US-Dollar. The decreasing costs will enhance the attractiveness of renewable energies. Especially in countries where recently the energy market has been liberalized the cost in reduction provides new business opportunities for players in the energy sector. The ones who quickly grasp the opportunity and enter successfully the market will be awarded with high incomes and a competitive edge over competitors who enter the market at a later stage. Nevertheless, it is crucial not to underestimate the challenges and the pitfalls in these countries. They may be not obvious at first glance but they can lead the great business opportunity very fast in a losing deal. Therefore, the trend reports of Rödl & Partner provide an important initial overview about the business opportunities and the potential risks of the selected countries. Regarding the country selection, Rödl & Partner chose fast-growing renewable energy markets which are not yet in the focus of public attention and hence, these markets are very interesting for developers, investors and companies from the renewable energies sector.

We prepared trend reports about countries such as Mexico and Iran which are rather known for their fossil fuel reserves than for their ambition with respect to renewable energies. However, these both countries possess excellent conditions for renewable energies and are increasingly taking advantage of it. In this regard Mexico is setting an international example and was also one of the first countries which integrated the expansion of renewable energies into its policy. Furthermore, trend reports about countries such as Brazil and India which have are a tremendously market because of their continental dimensions and huge population are also provided. While India is still relatively at the beginning of a sustainable energy industry which is still highly dependent on coal as energy carrier, approximately 80% of the energy distribution in Brazil comes already from renewable energy sources. Due to the favorable climate conditions and the aim of the Indian government to solve the insufficient energy supply and the environmental pollution with clean energy, India is pushing forward the expansion of renewable energies, though. A look at Kenya shows that there are also interesting business opportunities in Africa. Owing to the commencing liberalization of the power distribution and the introduction of feed-in tariffs for power based on renewable energy sources, Kenya is becoming an attractive market and a big player in the field of renewable energies. Within the European Union Sweden sets an example for both developing countries and developed countries. In Sweden innovative and sustainable solutions and technologies are very fast integrated in the energy sector. This is essential in order to accomplish the Swedish goal of relying 100% of the power distribution on renewable energies by 2040.

We hope that our trend report encourage you for a stronger international engagement. To ensure a successful market entry our renewable energy team is available at all times to accompany your international activities. Moreover, our authors of the trend reports are always available and happy to answer to any specific questions about the trend reports.

Anton Berger
Partner

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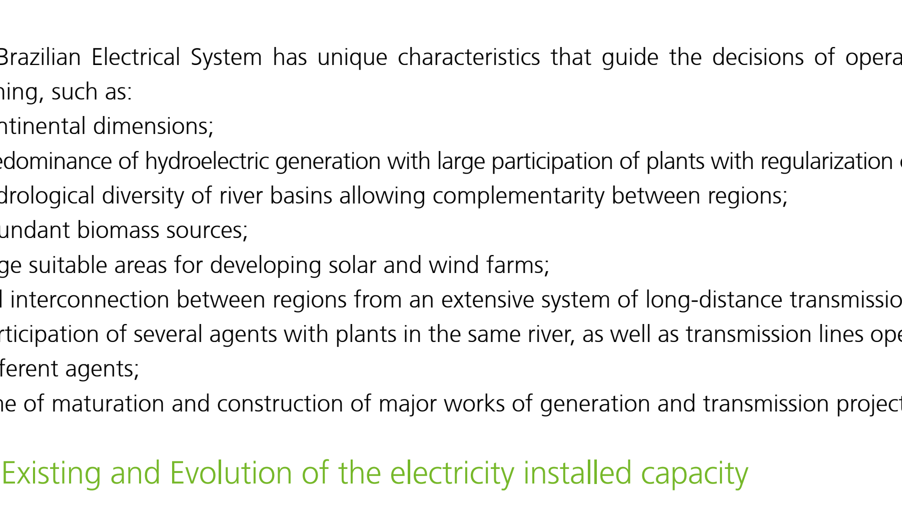
1 Energy Market – Status Quo

1.1 Brazilian Electricity System – General Overview

Together with size and special features to be considered unique in the world, Brazil is regarded as a hydrothermal system, with a predominance of hydroelectric power plant. The diagram below illustrates Brazil's continental dimensions and interconnected electric grid:



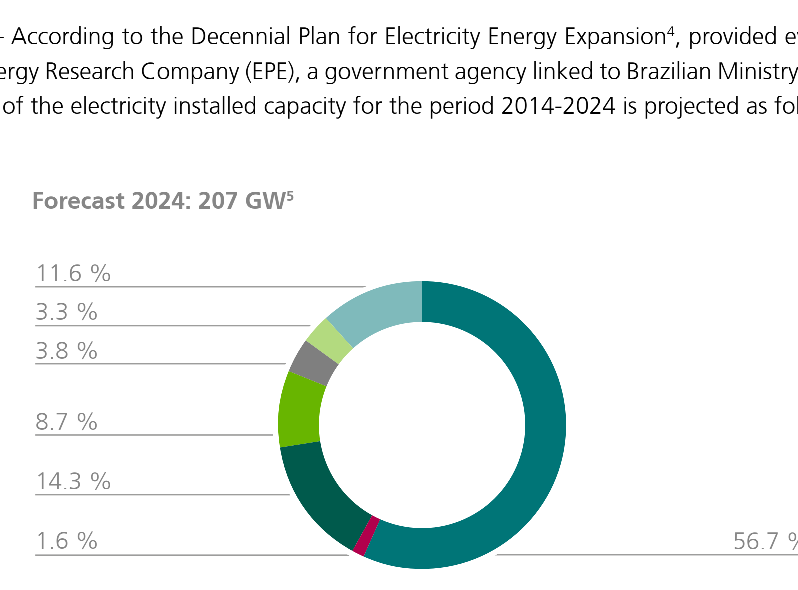
The Brazilian Electrical System has unique characteristics that guide the decisions of operation and planning, such as:

- continental dimensions;
- predominance of hydroelectric generation with large participation of plants with regularization capacity;
- hydrological diversity of river basins allowing complementarity between regions;
- abundant biomass sources;
- large suitable areas for developing solar and wind farms;
- full interconnection between regions from an extensive system of long-distance transmission lines;
- participation of several agents with plants in the same river, as well as transmission lines operated by different agents;
- time of maturation and construction of major works of generation and transmission projects

1.2 Existing and Evolution of the electricity installed capacity

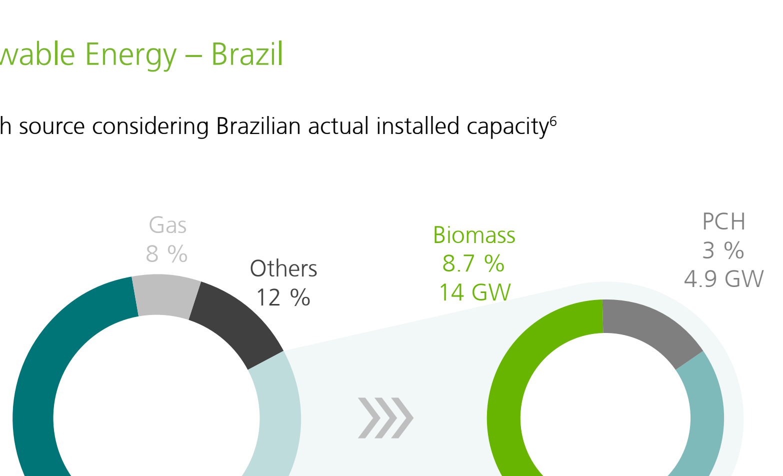
The approximately electricity installed capacity in December/2017 amounts 160GW.[2]

Installed Capacity - 162 GW (approx)[3]



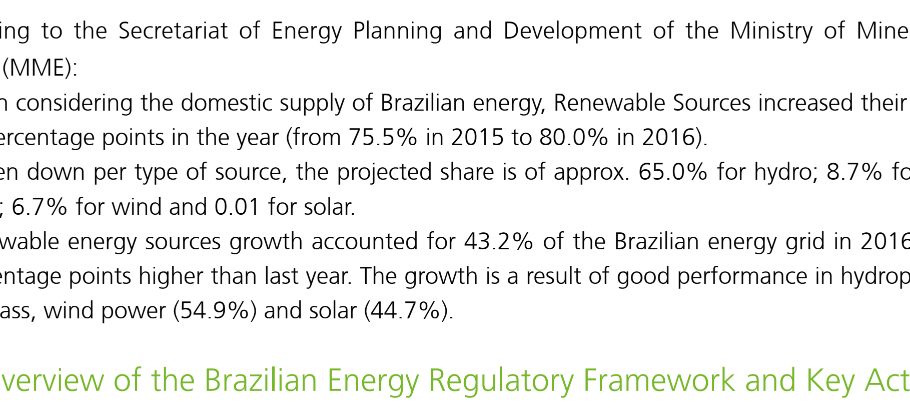
Forecast – According to the Decennial Plan for Electricity Energy Expansion[4], provided every two years by the Energy Research Company (EPE), a government agency linked to Brazilian Ministry of Energy, the evolution of the electricity installed capacity for the period 2014-2024 is projected as follows:

Forecast 2024: 207 GW[5]



1.3 Renewable Energy – Brazil

Share of each source considering Brazilian actual installed capacity[6]



*Others: uranium, coal, oil, process gas

According to the Secretariat of Energy Planning and Development of the Ministry of Mines and Energy (MME):

- When considering the domestic supply of Brazilian energy, Renewable Sources increased their share six-percentage points in the year (from 75.5% in 2015 to 80.0% in 2016).
- Broken down per type of source, the projected share is of approx. 65.0% for hydro; 8.7% for biomass; 6.7% for wind and 0.01 for solar.
- Renewable energy sources growth accounted for 43.2% of the Brazilian energy grid in 2016, two percentage points higher than last year. The growth is a result of good performance in hydropower, biomass, wind power (54.9%) and solar (44.7%).

1.4 Overview of the Brazilian Energy Regulatory Framework and Key Actors

The current model for the energy sector in Brazil, named the New Regulatory Framework (NRF), was conceived in 2003 by means of Federal Laws 10.847/2004 and 10.848/2004.

The main go is to reconcile state planning with market driven competition, aiming to create a friendly environment for private capital in a sector that was, until the end of the 1900's, totally controlled by the state.

The main principles

- maintain competition in generation by means of tender offers meeting the lowest tariff criterion;
- reasonable energy tariffs;
- a reliable energy supply;
- adequate returns on investment by private players; and
- universal access to electric energy

Key Actors/Institutions that regulate the energy sector in Brazil. The most important institutions are the following:

Institution	Function
Ministry of Energy and Mines (Ministério de Minas e Energia)	This Ministry is responsible for the formulation and implementation of policies for the energy sector according to the directives of the National Council on Energy Policy (Conselho Nacional de Politica Energética – CNPE), sectorial planning, monitoring of energy supply and defining preventive measures to avoid a shortage of energy.
Brazilian Energy Regulatory Agency (Agęncia Nacional de Energia Elétrica) – ANEEL	ANEEL is responsible for the mediation, regulation and control of the energy system, the conducting of concession bids and the acquisition of energy for distribution companies.
Brazilian Energy Trading Chamber (Câmara de Comercialização de Energia Elétrica) – CEEE	The CCEE is a private association in charge of administering energy trading and keeping records of all energy contracts in the Brazilian system in both free and regulated energy environments.*
Energy Research Company (Empresa de Pesquisa Energética) – EPE	The aim of this private entity is to develop the necessary studies to enable the Ministry of Energy and Mines to carry on its main responsibilities, including definition of the energy matrix, integrated planning of energy resources and system expansion and promotion of research of energy potential in Brazil.
National Electrical System Operator (Operador Nacional do Sistema Elétrico) – NOS	The operator has the main task of coordinating and controlling the National Interconnect System (Sistema Interligado Nacional – SIN). It is in charge of controlling operational safety, the level of energy losses, energy service tariffs and potential problems in the system's operations.
Distribution Companies	Distribution companies are private entities (which may be partially controlled by the state) chosen by means of public bids to enter into concession agreements with the federal government. Distribution companies are entitled to sell energy directly to end-users (captive consumers) in the regulated market, where the rates are defined by the regulatory agency, ANEEL. Distribution companies are also responsible for the operation and maintenance of the local grid.
Transmission Companies	Transmission companies are private entities (which may be partially controlled by the state) chosen by means of public bids to enter into concession agreements with the federal government. Transmission companies are in charge of operating the transmission network.
Energy generators (also called power plant operators)	Energy generators are responsible for the generation of energy in Brazil.

* The main responsibilities of CCEE are: (a) registering energy trading contracts on the regulated market; (b) registering contracts resulting from contracting adjustments; (c) registering contracts made in the free market; (d) calculating and settling short-term transactions.

1.5 Components of Energy Pricing and Price Levels

Regulated trade environment: The pricing of the currently existing electricity supply varies according to the trade environment of the consumer. In the regulated trade environment, captive consumers pay the energy tariff directly to the distribution company.

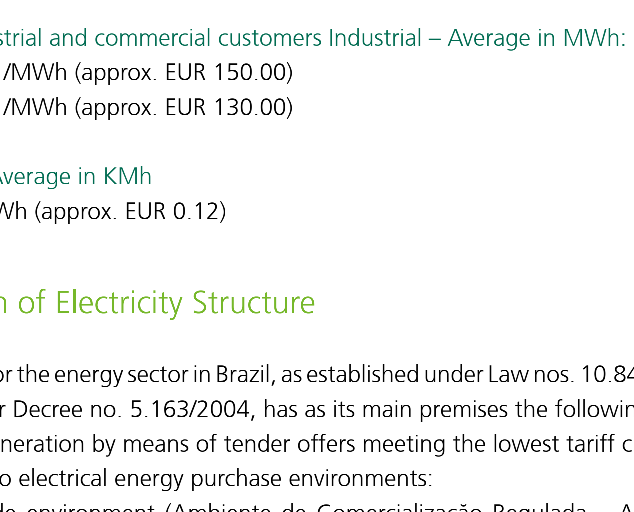
The distribution company will be in charge of paying to the various parties of the energy system their portion of the energy tariff, including paying to generators the price of the energy contracted by means of public bids, paying transmission costs to transmission companies, collecting taxes and energy sector charges as well as charging the consumer for the cost of distribution company services.

The energy tariff paid by captive consumers is heavily regulated by ANEEL (Electricity Agency) and there is no room for negotiation between captive consumers and distribution companies. The most important components of the energy tariff charged by distribution companies are the following:

- energy price: Price paid by distribution companies to energy generators chosen by means of public bids or by means of a quota system;
- transmission costs: Price paid by distribution companies to transmission service companies for the use of and connection to the transmission grid;
- distribution costs: Price paid by consumers for distribution companies' services;
- taxes
- energy sector charges: Charges created by law to support public policy in the energy sector. There are currently eight energy sector charges, amounting 9% of the total energy tariff.

According to ANEEL, the energy tariff is divided as follows:

Energy Tariff



Medium Sized industrial and commercial customers Industrial – Average in MWh:

- 2015 BRL 564.34 /MWh (approx. EUR 150.00)
- 2016 BRL 504.00 /MWh (approx. EUR 130.00)

Private Customers Average in KMh

- 2017 BRL 0.46 KWh (approx. EUR 0.12)

1.6 Distribution of Electricity Structure

The current model for the energy sector in Brazil, as established under Law nos. 10.847 and 10.848/2004, and regulated under Decree no. 5.163/2004, has as its main premises the following:

- competition in generation by means of tender offers meeting the lowest tariff criterion;
- coexistence of two electrical energy purchase environments:
  - a regulated trade environment (Ambiente de Comercialização Regulada – ACR), which protects "captive" consumers;
  - a free trade environment (Ambiente de Comercialização Livre – ACL), which stimulates the initiative of "free" consumers.
- creation of a regulated electrical energy pool to be purchased by distribution concessionaires.

In both energy purchase environments, energy sellers are power plant operators that are based on either a public service regime or authorization by the federal government.

Concerning consumers, the free market is composed of "free" consumers, which may buy energy from any supplier except distribution companies. The regulated market is composed mainly of the so-called "captive" consumers, which are served by the energy distribution companies, with tariffs and supply conditions heavily regulated by ANEEL.

Authorized energy traders are also entitled to buy energy from any supplier and sell it to any consumer (except in the regulated market).

Contracting in the free market is by bilateral agreements between consumers and producers based on market price. The period of supply is also freely negotiated by the parties. In contrast, contracting in the regulated market is driven by standard agreements between energy distribution companies and power plant operators that are selected by means of public energy bids for a period of 20 or 30 years.

Bids are submitted by all interested Brazilian distribution companies in a competitive bidding process aiming for the lowest tariff, equal access to the country's resources and fair allocation of risks and benefits among the regulated environment consumers. The most common bids are the so-called A-3 and A-5 bids. Their main characteristic is that the projects are contracted for terms ranging from three to five years before the onset of the energy supply, allowing investors time to build new power plants or to finish the implementation of existing projects.

Within the current structure model, when two electrical energy trade environments were created (ACL and ACR), all generators, regardless of their exploitation systems, were permitted to act freely in both ACL and ACR.**

** see below

A free trade environment involves energy transactions between generators that hold concessions or authorizations from the federal government on the one hand and free consumers on the other hand. Moreover, authorized energy traders are allowed to buy and sell energy in the free market without restrictions. According to Brazilian energy regulations, once consumers opt for the free trade environment, they must wait for up to five years to return to the regulated environment, unless distribution companies waive such right and agree to reestablish the supply within a shorter period***.

*** Such rule aims to permit distribution companies to plan their demand of energy and contract the necessary amount from generators in advance.

Consumers that may contract in the free market are the following:

- Free consumers: These are companies with a contracted demand of 3000 kW or more, and they may purchase energy from any source, including large hydro plants and the more modern thermal plants and wind farms.
- Potentially free consumers: The potentially free consumer is the one which is entitled to contract in the free environment and decides to stay in the captive market. Such consumers may also opt to contract in the free market and in the regulated market at the same time.
- Special consumers: These are consumers or groups of consumers united by common interests with contracted demand of 500 kW at each site or in total for all operating sites, and they may purchase

** Such trade freedom policy for the generation sector was slightly changed by Provisory Measure 579/2012, thereafter signed into Law n. 12.783/2013. Aiming to reduce the energy tariffs charged by distributors in the Sistema Interligado Nacional [National Interconnected System] – SIN, that Law required that, as of September 2012, water-based energy generation concessions (which comprised basically hydropower plants which concession was almost expiring) could be extended, at the granting authority's discretion, a single time, for a period of 30 years. The system also became known as the quota system. Such extension was based on the concessionaire's express acceptance of the following conditions: 1. remuneration by means of tariff, calculated by ANEEL for each water-based energy plant (instead of price established by Power Purchase Agreements or public bids); 2. allocation of quotas of physical energy guarantee and power to concessionaires and permission holders of energy distribution in the SIN; and 3. submission to service quality standards established by ANEEL.

2 Energy policy – perspectives

Statement – Ombudsman of the Energy Development Department of the Brazilian Ministry of Mines and Energy ****

**** Due to the position in the ministry of our source we must not name him/her.

As part of the studies related to the renewable energy perspectives in Brazil, the Ombudsman of the Energy Development Department of the Brazilian Ministry of Mines and Energy (MME), which is the competent body responsible for the formulation of public policies and strategic directions for expansion of energy supply, has presented a general overview regarding the diversification of the country's energy matrix and how the development of alternatives and renewable energy sources is being planned according to its economic potential and geographical distribution.

In line with the rules and strategic plans related to the energy sector, it was initially highlighted that Brazil has been constantly committed to maintain a substantial share of renewable energy sources in its energy matrix.

As one of the world's cleanest energy mixes, the Brazilian electric power generation is predominantly from renewable sources. The share of renewable energy of the domestic supply of electricity is higher than 80%, while the world average is 24.1%, which ranks Brazil as a global reference in generating power from renewable sources.

In this context, references were made to the three key planning official instruments that draw up energy scenarios for the coming decades and provide inputs to formulate energy policies pursuant to an integrated view of available resources, as follows:

› the 30 years Long-term National Energy Plan (Plano Nacional de Energia 2050 – PNE 2050)[7];
› the Annually Updated Decennial Energy Expansion Plan (Plano Decenal de Expansão de Energia – PDE)[8];
› the Annually Updated Brazilian National Energy Balance – BNE – recently published in July/2017[9].

According to the data collected, of a total installed generating capacity of approximately 160 GW, clean sources account for 130 GW, which is projected to expand by nearly 170 GW in 2024. The expected growth of the electricity sector – with a further 40 GW expansion to the grid – will be significantly represented by renewable energy sources:

› wind generation: planned expansion of 12 GW (10.7 GW existed in 2017);
› small hydro plants: planned expansion of 4 GW (4.9 GW existed in 2017
› biomass: planned expansion of 4 GW (14 GW existed in 2017)
› solar generation: planned expansion of 5 GW (144 KW existed in 2017)
› hydro generation: planned expansion of 15 GW (101 GW existed in 2017)

As also pointed out in the Decennial Plan, based on economic and demographic key assumptions, the share of clean sources in the energy mix is expected to remain constant (40% per cent until 2024). Among the major sectoral trends over this period are:

› substantial increase in natural gas and bagasse (biomass) use,
› growth in electricity use in the energy sector (subsector),
› large increase in coal consumption in industry,
› decrease in the share of fuel wood and charcoal in total consumption, and
› slightly decreased share of gasoline in transport.

Another relevant source of data for observing the production, transformation and consumption of energy is the Brazilian National Energy Balance – BNE, annually edited by the Ministry of Mines and Energy, which was recently published by Brazilian authorities – July/2017.

According to the recent figures released, the share of renewables in the energy mix, due to the drop of thermal and fossil energy generation, have increased from an average rate of 75.5 to 81.7%, from 2015 to 2016. Of this amount, special reference was made to the installed capacity for wind and solar energy, which increased, respectively, at an average rate of 54.9% and 44.7% from 2015 to 2016.

Finally, with the intent of promote investments and seeking to diversify its electricity sector beyond large-scale hydro, government incentives are offered for the development of renewable energy market, which, among others, include:

› Discounts on the Transmission System Usage Rate (TUST) and on the Distribution System Usage Rate (TUSD) for renewable energy generation projects
› Electric Power System Compensation for Micro Generation – regulated by the Normative Resolution ANEEL no. 482/2012 – which sets out the general conditions for access of micro and mini-generation distributed to electricity distribution systems and creates an electricity compensation system
› Special Regime of Tax Exemption for the Infrastructure Development (REIDI), which provides tax exemption regimes in the acquisition of new machinery, equipment, services rendered, as well as building materials for use or incorporation in infrastructure works intended for the fixed assets

Finally, the Expansion Plans present important signals to guide the actions and decisions related to the task of balancing projections of the country´s economic growth and the required expansion of the energy supply, thus ensuring energy security to society at adequate cost, fully reflecting available technological options and environmental sustainability.

As stressed in the Decennial Energy plan "other renewable energy (e.g., wind, biomass, solar and small hydro power plants) share is expected to increase at an average growth rate of 10% a.a., especially because of the strong expansion of wind power capacity (expected to reach 24 GW by 2024). The solar power capacity is expected to reach 7 GW at the end of the horizon, with a share equivalent to 3.3% of the total installed power capacity".

As a result, although the Brazilian power mix is predominantly based on hydraulic energy, it is expected the beginning of its diversification through the significant increasing of other renewable sources throughout the horizon, therefore the Brazilian energy balance is expected to keep its significant share of renewables sources.

3 Renewable Energy – Market – Opportunity

3.1 Legal requirements and limitations

Companies must incorporate a subsidiary in Brazil in order to directly participate in the Brazilian Energy Market as an energy generator. The Brazilian legislation sets forth that in order to receive an authorization from the Federal Government the company must present a number of documents establishing their legal and economic capacity. However, in order to participate in the Brazilian energy market as a supplier of equipment, there are no restrictions applied.

There are no specific restrictions related to acquisition of sites/lands by foreign companies. In broad terms, such restriction would not create obstacles for a foreign investor to develop energy projects in Brazil.

3.2 National Banks funding projects (BNDES)

- Banco Nacional de Desenvolvimento Econômico e Social (BNDES) is Brazil's premier development bank, providing long-term credit in the country and assisting in the implementation of industrial policy. The bank provides more than 70% of long-term bank lending in the country, and it is the largest source of investment in industry and infrastructure. The BNDES provides subsidized financing in a country where credit is expensive by international standards.
- For the energy sector the BNDES will be able to finance up to 70% of the power plant. The annual interest rates offered by BNDES for the energy sector are around 10% to 12%. The aforementioned, which may appear very high at first sight, needs to be considered in the context of the Brazilian scenario of inflation and high interest rates. The inflation rate in Brazil in 2016 was 6.29% and the SELIC interest rate (benchmark rate for Brazilian monetary policy) is currently 10.25% per annum.
- In order to have access to BNDES loans, power plant operators need to buy products that have a certain index of nationalization according the energy source. The nationalization index is an index that aims to determine the number of parts manufactured in Brazil, which are required by BNDES to enable businesses to apply for a certain credit. Among the many difficulties encountered by major companies are the high costs of production using domestic parts, products that do not reach minimum quality standards and the lack of investment in technology and innovation.

3.3 Tax advantage arrangements for power plants

- Special Incentives Program for Infrastructure Development (Regime Especial de Incentivos para o Desenvolvimento da Infra-Estrutura – REIDI), created by Law 11488 of 15 June 2007, encourages companies that have an approved project for implementing infrastructure works in transportation, energy, basic sanitation, irrigation and pipelines.
- Government may also grant a tax exemption as to the valued-added tax (ICMS) on operations involving certain equipment related to the wind and solar energy sectors, such as windmills and photovoltaic generators.
- Power plant operators may negotiate with local authorities for service tax incentives. Service taxes may typically amount to 5% (five percent). However, a number of cities grant benefits in order to engage companies in the construction of power plants.
- Local authorities may also grant the land (by means of use agreements or the free assignment of property) or real estate tax exemptions pursuant to direct negotiations with public authorities.

3.4 Concrete subsidies for the development and the realization of Renewable Energy Projects

- ProGD – National incentive program for distributed generation, with a special focus on solar PV. The ProGD program covers a spectrum of measures including tax incentives and creates lines of credit. With this program the government predicts an investment of 100 million reals (US$26 million) by 2030 in this segment. The nation's Ministry of Energy and Mines forecasts 23.5 GW of distributed generation installations, primarily PV.

- Energy Self-Generating Companies: Legal entities that receives an authorization or enters into a concession agreement with the federal government to produce energy for its own consumption, which may entitle the company to a number of incentives, such as:
  - Tariff discounts;
  - nonpayment of certain energy sector charges
  - Solar-, wind-, biomass- and qualified cogeneration-based Energy Self-Generators are entitled to sell surplus energy in the free trade environment without the need of any authorization from the federal government. Hydroelectric-based Energy Self-Generators, however, may need previous authorization from the federal government to sell surplus energy

- Distributed Generation Program: The program comprises incentives for self-generation of energy connected directly to the Distribution Companies grid.
  The distributed Generation Program comprises installation of small power plants, usually using renewable source, but also fossil fuels, which are located near the energy consumers. The idea of having small generators close to the consumers proportionate many benefits to the energy system including lower investment in transmission grid, lower environmental impacts and diversification of energy matrix.
  The main tax and tariffs of Distributed Generation are the following:
  - nonpayment of Tariff for the Use of the Distribution System (TUSD)
  - tax Benefits
  - Possibility of selling the surplus of energy to the energy grid or compensate the surplus of generation with a future consumption of energy. The credit can be used within 60 months.

- PADIS – Development of Semiconductor and Display Industry Program: offers incentives to companies that invest at least 5% of their local revenues in Research and Developments

3.5 Special requirements for the participation in auctions

Aiming to provide a reliable energy supply, the federal government dictates that distribution companies are required to contract 100% of the demand foreseen for their markets and that all capacity must be contracted and guaranteed in advance. In this regard, all forecasted demand of energy distributors for the next five years must be guaranteed by long-term Power Purchase Agreements.

Bids are competitively placed by all interested Brazilian distribution companies, aiming to obtain the lowest tariff, equal access to the country's resources and fair allocation of risks and benefits among the regulated environment consumers. The most common bids are the so-called A-3 and A-5 bids. The main characteristic is that the projects are contracted for terms of from three to five years before the beginning of the energy supply, allowing investors time to build new power plants or to finish the implementation of existing projects.

The bidder must first register a power plant project either by providing all documents required for authorization or register an existing power plant. The institution in charge of the registration, Energy Research Company, will disclose all projects qualified to take part in the bid. There is no limitation on power plant registrations per bidder, and the bidder sets the energy price per production unit. For instance, the same bidder may register two power plants -- one in the northeast and another in the south region of Brazil. For economic reasons (logistics, access to the grid, tax arrangements, etc.) the investor may place different bids for each power plant.

These energy auctions are open for national and international legal entities and investment funds either individually or jointly by consortium agreements. In order to grant power plant authorization and execute the Power Purchase Agreement, foreign entities (as well as investment funds, if awarded) must incorporate a special purpose entity (SPE).

There are special economic conditions for bidders, who must demonstrate the economic capacity to carry on the projects. Legal entities must reach certain thresholds, including liquidity ratios and minimum net equity requirements. The minimum net equity of the bidder must equal at least 10% of the power plant's total construction cost. Bidders must post a bid bond worth 1% percent of the project's total amount in order to participate in the bidding procedure, which may be called off if the bidder fails to present the proper documents, ratify its proposal or honor any obligations during the bidding procedure. Moreover, after the authorization is granted, the authorization holder must present a guarantee that the obligations will be fulfilled, which amounts to 5% of the project's total cost.

In terms of technical requirements, besides the presentation of all main characteristics of the plant during the registration phase, the bidder must indicate the professional in charge of power plant implementation and the operation and construction schedule, in line with bid requirements.

Finally, if there are delays in the commissioning and commercial operation of the plant, the project owner will be subject to administrative penalties; the fulfillment guarantee may be called; and, more importantly, the project owner must buy energy from a third party in order to fulfill its obligation to the energy distribution companies.

4 Overview on the main renewable sources and markets in Brazil

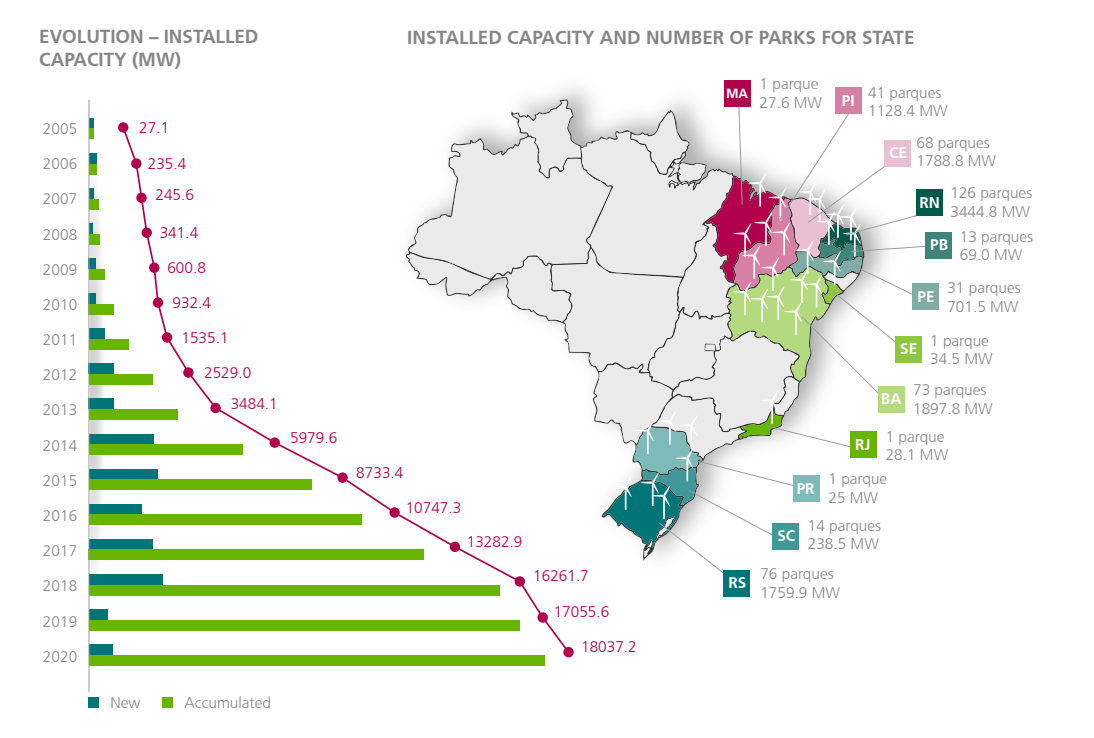
4.1 Wind Energy

Installed Capacity and Forecast

Brazil is on the list of the largest producers of wind energy in the world. The „Wind Energy in Brazil and the World" survey of the Ministry of Mines and Energy shows that the country ranked fourth in the world ranking of wind power expansion in 2014.

With a current installed capacity in operation of 10754 MW, Brazil has already contracted 16600 MW of wind energy in auctions.

The government's estimate is that Brazil's installed wind capacity will reach around 24000 MW. Of this total, 21000 MW will be generated in the Northeast region, which will represent 45% of the total produced in the region.



Supply Chain

More than 1000 companies with presence in Brazil

Aerogenerators Manufacturers
Acciona
Alstom
Gamesa
GE Energy
Sany Wind
Siemens
Vestas
WEG
Wobben

Engineering, Consulting and Construction
Arteche
Barlovento
Braselco
Briskcom
Camargo Schubert
DNV – GL
Encalso
Engecorps
MGO
Multiempreendimentos
Papyrus
Powerhouse
Renobrax Energias Renováveis
Tecnogera
Way 2

Parts and components Manufacturers
ABB
Algolix
Alphatec
Alubar Energia
Belgo Bekaert Arames
Cassol
Engebasa
Metaltork
Olin
Ormazabal
Peveduto
Protende
Protendidos Dywidag
Saertex
Semikron
Torrebras
Villares Metals

Logistic, assembling and transport
Companhia de Navegação Norsul
Makro Engenharia
Saraiva
Tomé Equipamentos e Transportes
Wilson Sons

Turbine Blades Manufacturers
Aeris
LM Wind Power do Brasil
Tecsis

Construction
Basf
Dois A Engenharia
Iberobras
MC-Bauchemie
SS&B Construtroa
Villa Construções

Main opportunities:
- Maintenance and Operation and trained management and staff are the key opportunities identified in the wind industry market and will be further required in the next years.
- Knowledge and experience – Engineering and advanced technology services will be also required, considering new Auctions conditions requiring that Developers shall be also responsible to guarantee infrastructure transmission and connection to the grid.
- Stable and growing demand for wind turbine and equipment supply developed for Brazilian climate.

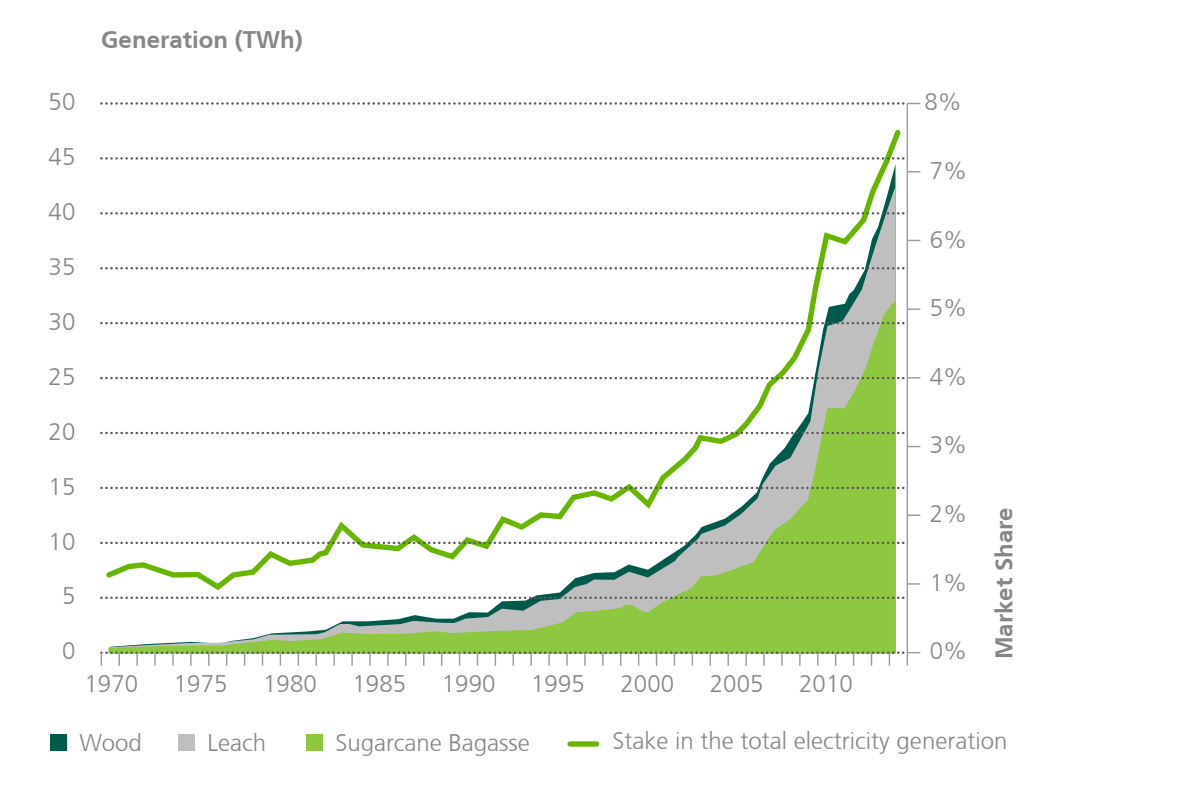
4.2 Biomass

Installed Capacity and Forecast

Currently 517 biomass plants are in operation in Brazil, totaling an installed capacity of 14 GW.

Opportunities: The process of eliminating sugarcane burning and mechanizing harvesting, as well as the transition of the current oil refineries to the total "green" refineries will be challenging, but may offer good business opportunities. The potential market for the supply of mechanical harvesters', boilers and turbines machineries and parts, as well as technology, engineering, M&O and construction services to integrate biomass and petrochemical platforms will enable the development of more flexible, efficient and less costly plants.

In Brazil, the sugarcane biomass (bagasse) is the main fuel used in 394 power plants.



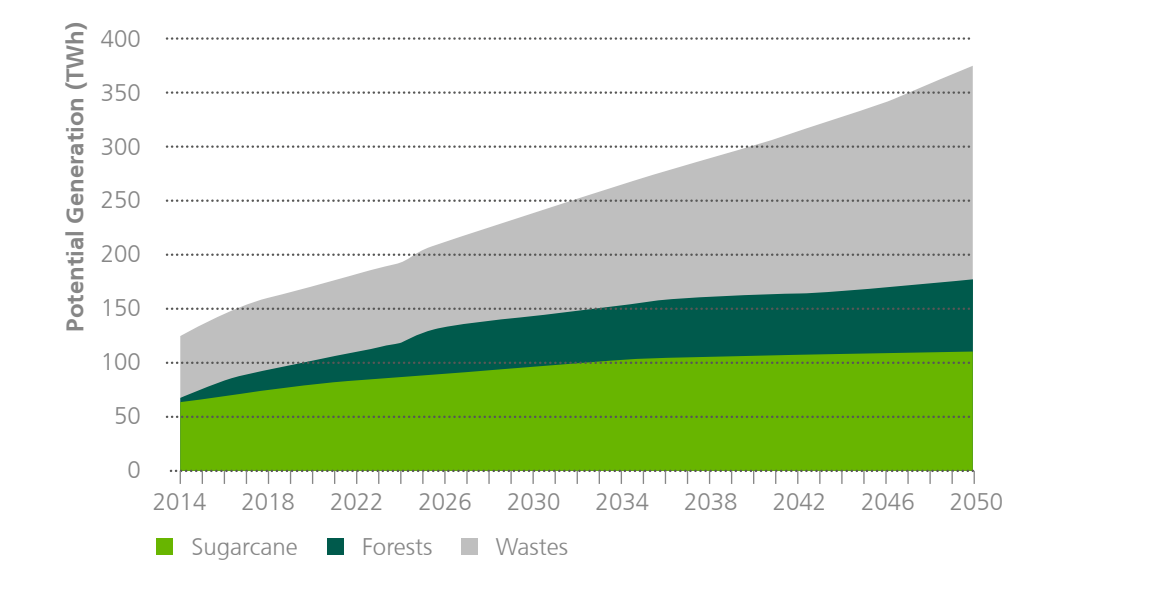
According to Brazilian Ministry of Energy and Mines (December/2016), biomass is currently the second most important source for generation of electric power, corresponding to 8.7% of Brazilian Electricity Matrix.

Only in 2016/2017, Biomass Energy is expected to grow from 8.7% to 9.0%.

At international levels, Brazil also occupied leading positions as bioenergy producers:[11]

Country	TWh	%
USA	56.3	30.7
Germany	13.4	7.3
Brazil	13.4	7.3
Japan	9.4	5.1
Finland	8.9	4.9
UK	8.5	4.7
Canada	8.5	4.6
Spain	7.8	4.3
Others	57.1	31.1
Total	183.3	100.0

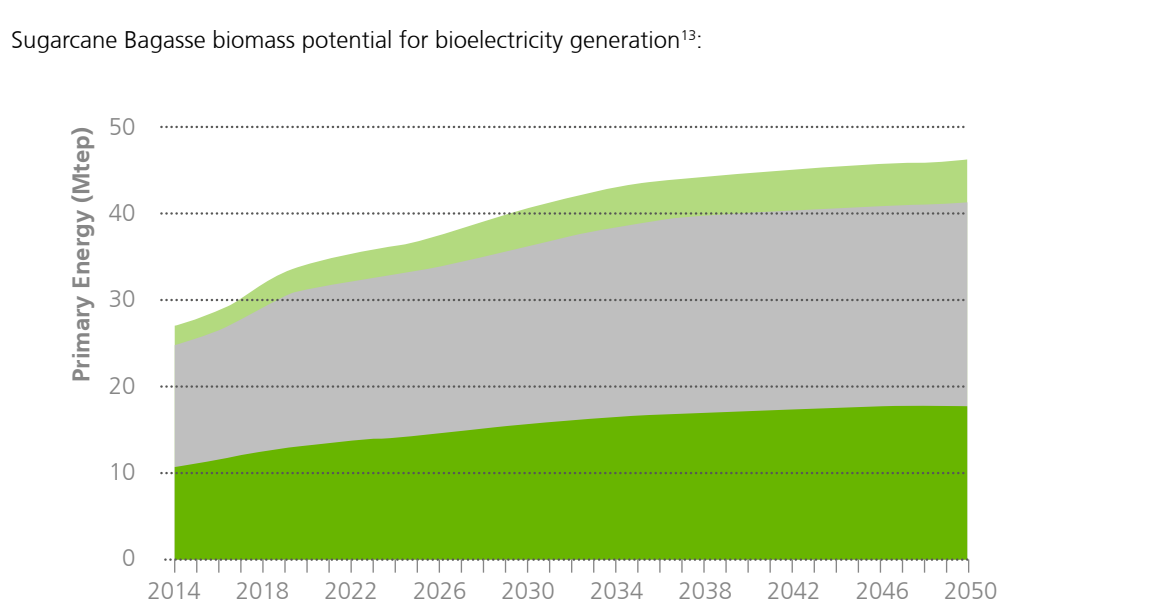
Potential for expanding bioelectricity in Brazil – 2050[12]:



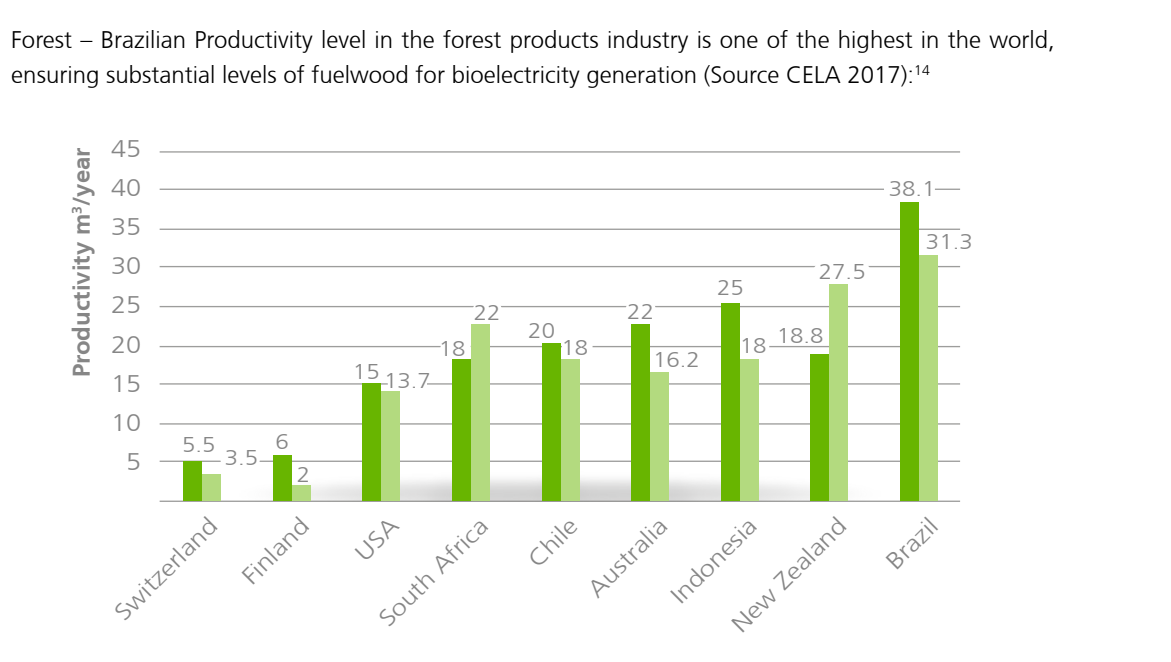
Biomass Sources

In Brazil, the utilization in large scale of sugarcane in the production of Ethanol, provides a significant volume of biomass as a fuel for bioelectricity generation.

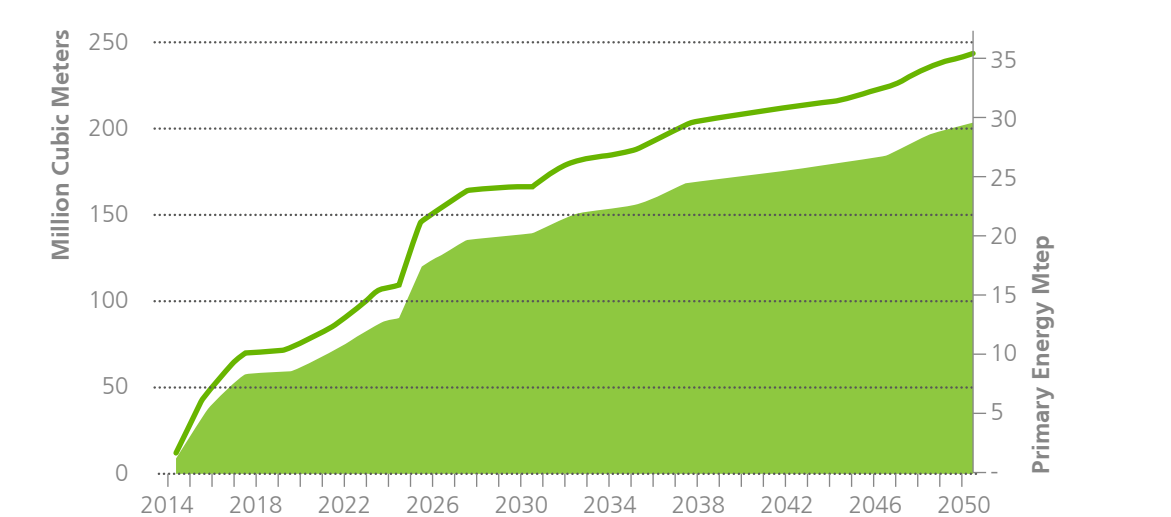
Sugarcane Bagasse biomass potential for bioelectricity generation[13]:



Forest – Brazilian Productivity level in the forest products industry is one of the highest in the world, ensuring substantial levels of fuelwood for bioelectricity generation (Source CELA 2017):[14]



Forest – Fuelwood potential for bioelectricity generation:[15]



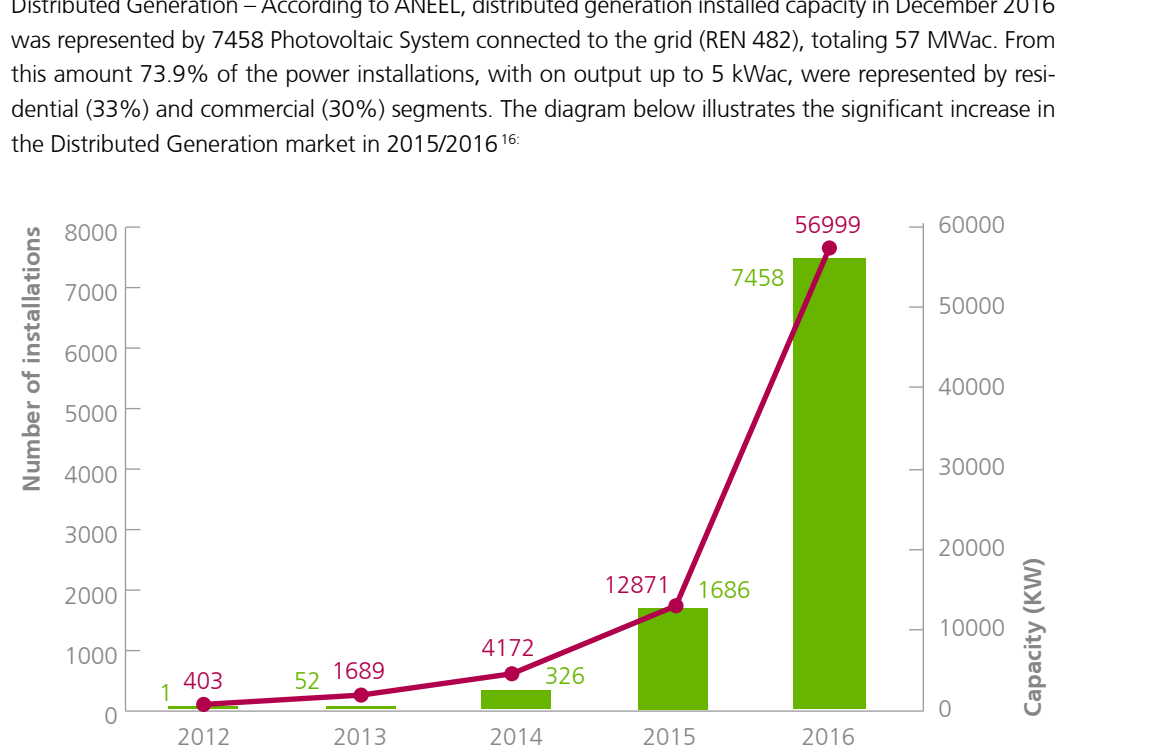
4.3 Solar Energy

Installed Capacity

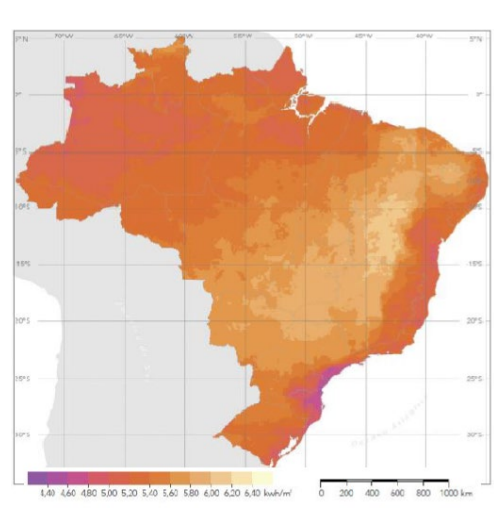
Centralized generation – actual installed capacity is 144 MW and 3.2 GW in 99 projects already contracted, foreseen to be in operation during 2017 and 2018:

December 2013	Oktober 2014	August 2015	November 2015
5 Projects	31 Projects	30 Projects	33 Projects
92 MW_{ac}	890 MW_{ac}	834 MW_{ac}	929 MW_{ac}
	1048 MW_p	1044 MW_p	1116 MW_p

Distributed Generation – According to ANEEL, distributed generation installed capacity in December 2016 was represented by 7458 Photovoltaic System connected to the grid (REN 482), totaling 57 MWac. From this amount 73.9% of the power installations, with on output up to 5 kWac, were represented by residential (33%) and commercial (30%) segments. The diagram below illustrates the significant increase in the Distributed Generation market in 2015/2016[16]:



Potential Capacity



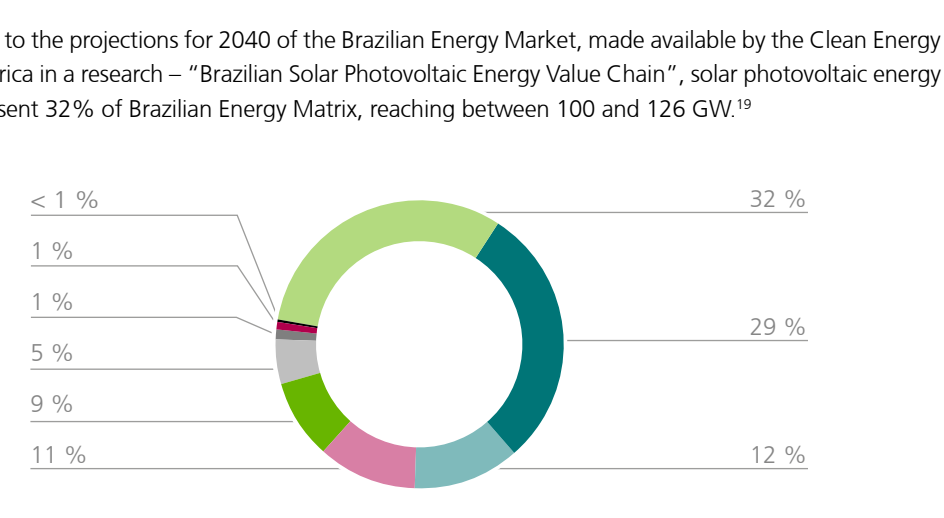
Solar Energy – Actual Installed Capacity in 2017 is approx. 145 MW and 3.2 GW in 99 sold projects, foreseen to be in operation during 2017 and 2018.

Centralized Generation (Projection-2040) – According to the projections of ANEEL and EPE, Brazilian Potential Capacity in Centralized Solar Photovoltaic Generation applications for 2040 is 35 GW, representing an expected amount of EUR 25 billion in accumulated investment.[17]

Distributed Generation (Projection-2040) – According to the projections of ANEEL and EPE, Brazilian Potential Capacity in Distributed Solar Photovoltaic Generation applications for 2040 is 68.8 GW, representing an expected amount of EUR 45 billion in accumulated investment.[18]

Forecasts

According to the projections for 2040 of the Brazilian Energy Market, made available by the Clean Energy Latin America in a research – "Brazilian Solar Photovoltaic Energy Value Chain", solar photovoltaic energy may represent 32% of Brazilian Energy Matrix, reaching between 100 and 126 GW.[19]

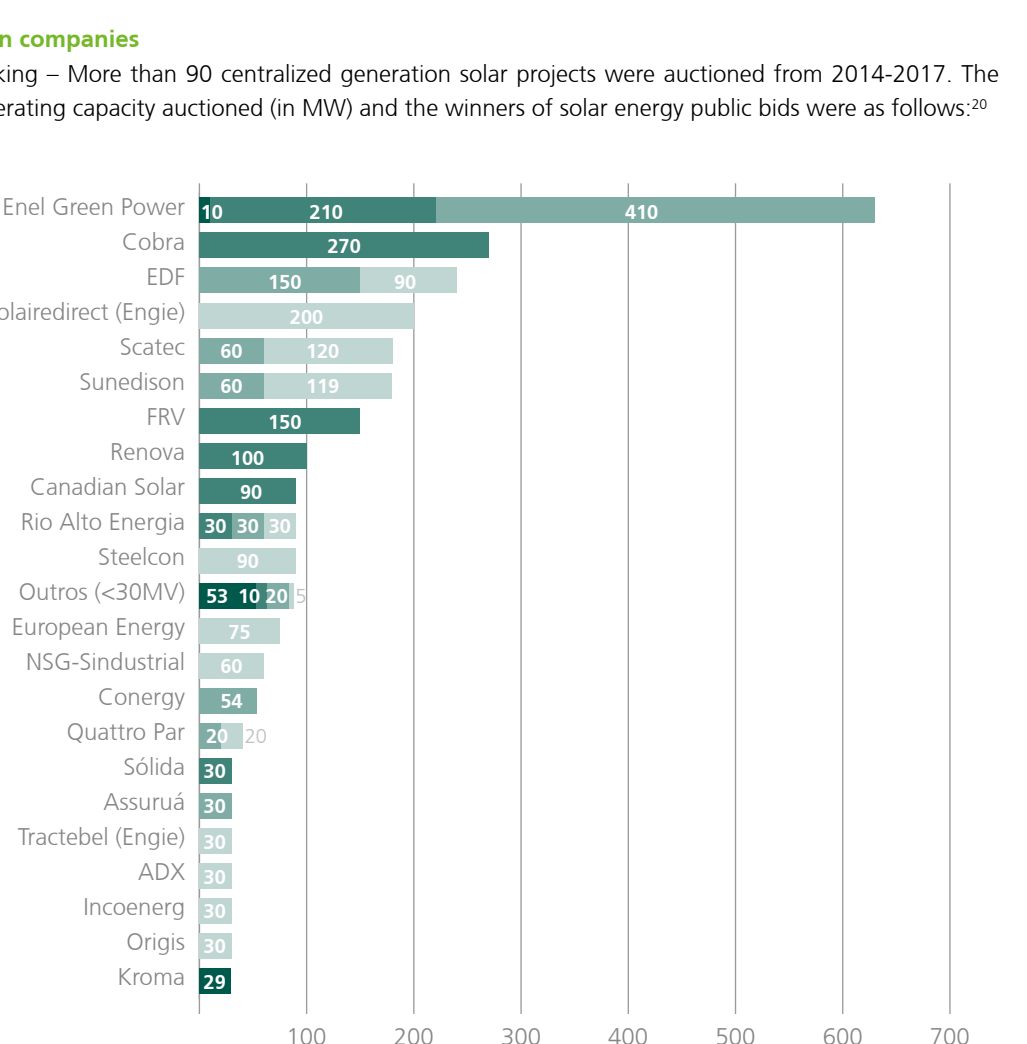


Still regarding this research (CELA, 2017), approximately 75% will correspond to Distributed Generation.

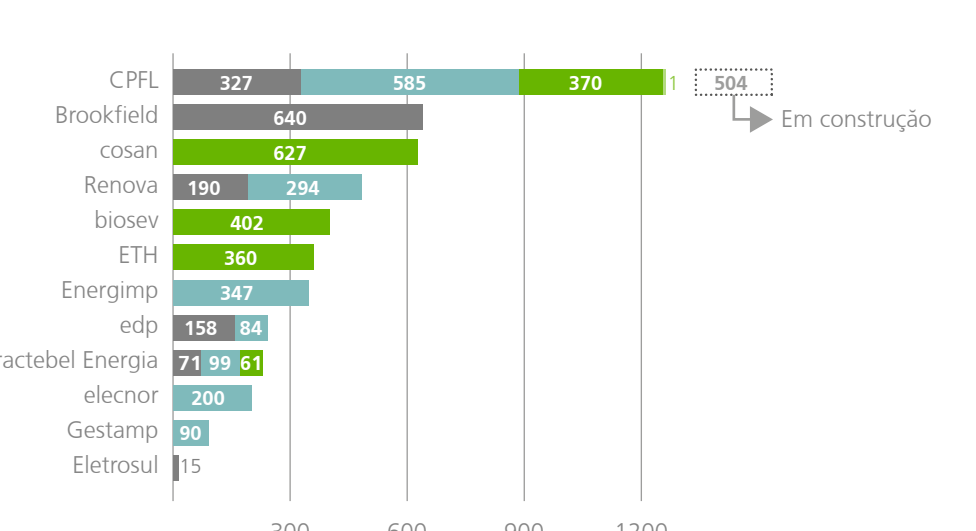
Market Opportunities: Growing demand for higher quality of tech-related solutions and services, such as:
- certifications and quality and safety test standards;
- Recycling Chain of photovoltaic modules;
- high demand for Maintenance and Operations Services (M&O) due to insufficient technical qualification and lack of experience of human resources;

Main companies

Ranking – More than 90 centralized generation solar projects were auctioned from 2014-2017. The generating capacity auctioned (in MW) and the winners of solar energy public bids were as follows:[20]

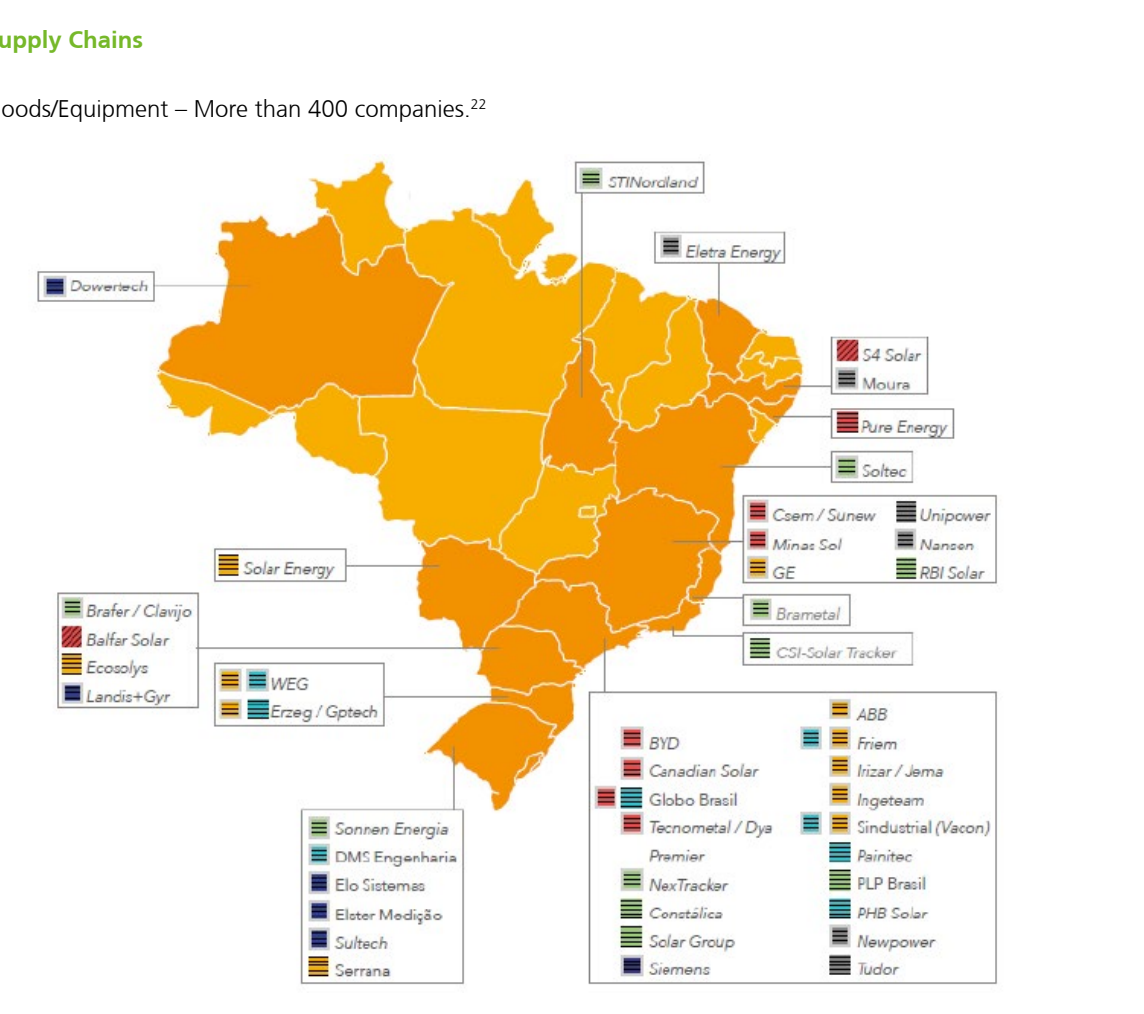


Brazilian biggest player in Renewable Energy Sector – in operation[21]:

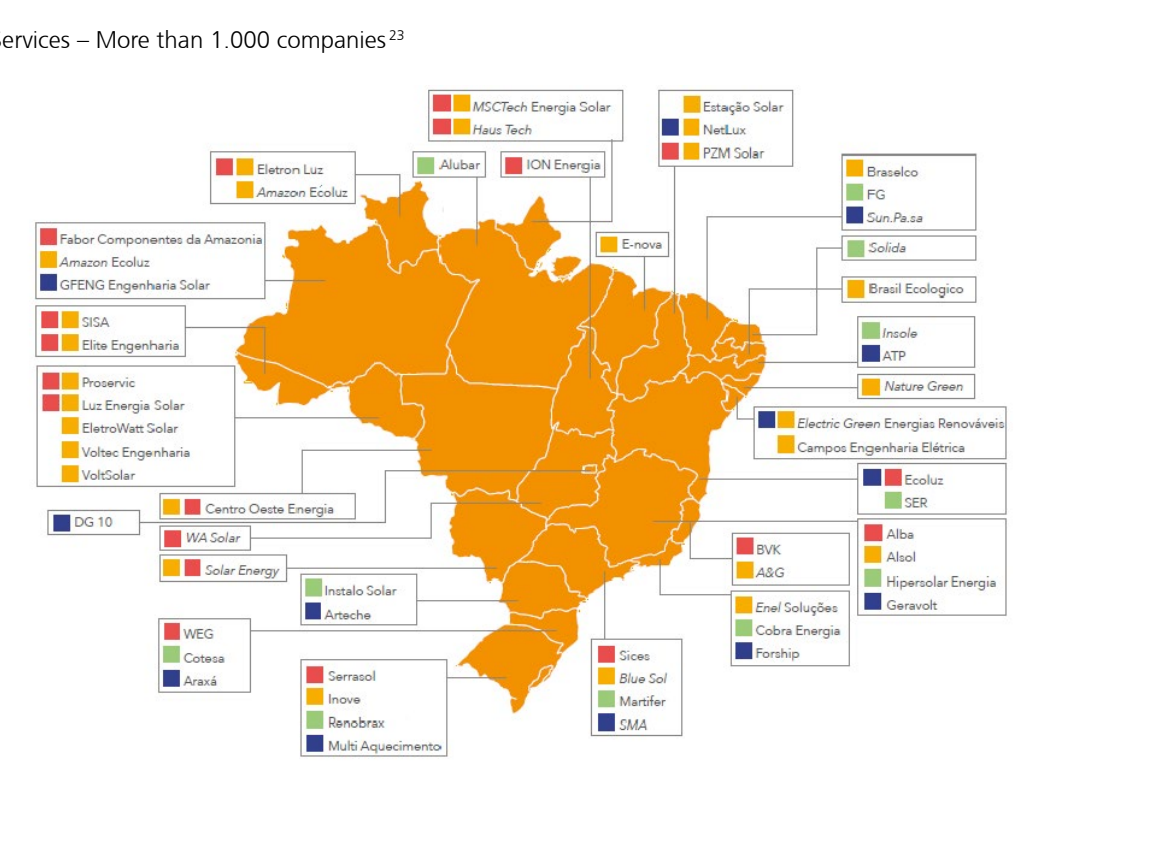


Supply Chains

Goods/Equipment – More than 400 companies.[22]



Services – More than 1.000 companies[23]



5 Pitfalls in the Regulatory Framework

Difficulties in accessing funds. In order to have access to subsidized loans, power plant operators need to buy products that have a certain index of nationalization according the energy source. The nationalization index aims to determine the number of parts manufactured in Brazil, which are required to enable businesses to apply for a certain credit. Among the many difficulties encountered by major companies are the high costs of production using domestic parts, products that do not reach minimum quality standards and the lack of investment in technology and innovation.

High cost of capital (highest real interest rate in the world). The annual interest rates offered in subsidized loans (e.g. National Development Bank – BNDES) for the energy sector are around 10% to 12%. The aforementioned, which may appear very high at first sight, needs to be considered in the context of the Brazilian scenario of inflation and high interest rates. The inflation rate in Brazil in 2016 was 6.29% and the SELIC interest rate (benchmark rate for Brazilian monetary policy) is currently 10.25% per annum.

Complex and bureaucratic Tax System – Heavy Tax Burden on inputs and payroll. Due to the high number of declarations required, inefficient tax processes and constant changes in the Tax legislation, Companies in Brazil devote substantial hours annually to comply with their tax obligations.

Logistics Infrastructure bottlenecks (transports, input costs, etc) – Due to a lack of balance in the Brazilian transport matrix, heavily based towards highways and with port structures with critical weaknesses, the deteriorated transport system in many regions is responsible for large economic losses, hurting competitiveness.

Grid Connection – Lack of Transmission Lines, which are not enough to fully meet growing demand, forces Energy Developers to compete in power auctions more strongly for grid-connection lines than for power purchase agreements (PPAs).

Difficulties in obtaining environmental permits usually delay the construction schedule;

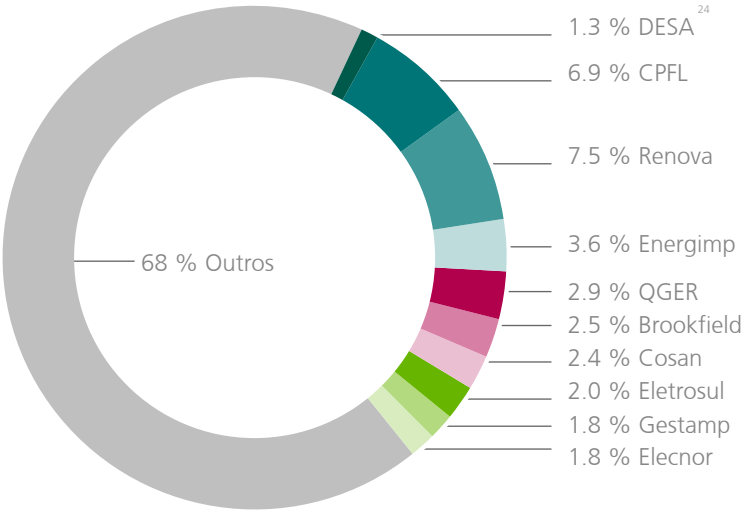
General Construction Risks: fines from regulatory authorities and costs related to project delay;

Although the high costs for local production, low maturity of supply chain and lack of specialized, qualified, and trained workforce in the sector represent some of the main bottlenecks in the Brazilian Renewable Energy Industry, at the same time they bring substantial business opportunities in varied areas.

6 M&A-Activities

6.1 Fragmented Market/Chances

In Brazil, it is observed many M&A opportunities due to a highly fragmented market
Renewable Energy Market Share in contracted energy (26.0 GW)



6.2 M&A Activities in the Energy Sector – Last 12 months

M&A reported in Brazil in the last 12 months – 2016/2017 (Source Transactional Track Record – TTR www.ttrecord.com:

- announced transactions: 105
- closed transactions: 60
- transactions in progress: 41
- volume of business: approx. EUR 30 billions.

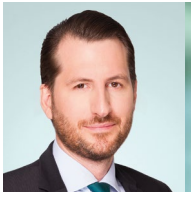
6.3 Renewable Energy Investment in Brazil in 2016

According to the Global Trends in Renewable Energy Investment (2017), provided by Bloomberg New Energy Finance, the investment in Brazil in Renewable Energy amounted USS 6.8 BN.

	Brazil
Solar	1.0
Wind	5.4
Biofuel	0.4
Geothermal	0.0
Biomass and w.t.e	0.0
Small hydropower	0.1
Marine	0.0
Total	**6.8**

Economic recession and political crisis had a negative influence on renewable energy developments. However, considering Brazilian economy gradual recovery in 2017, the auctions cancelled in 2016 by Energy Ministry, due to weak power demand, will be probably taken over in 2018/2019, which may represent good business opportunities.

7 Contact Persons



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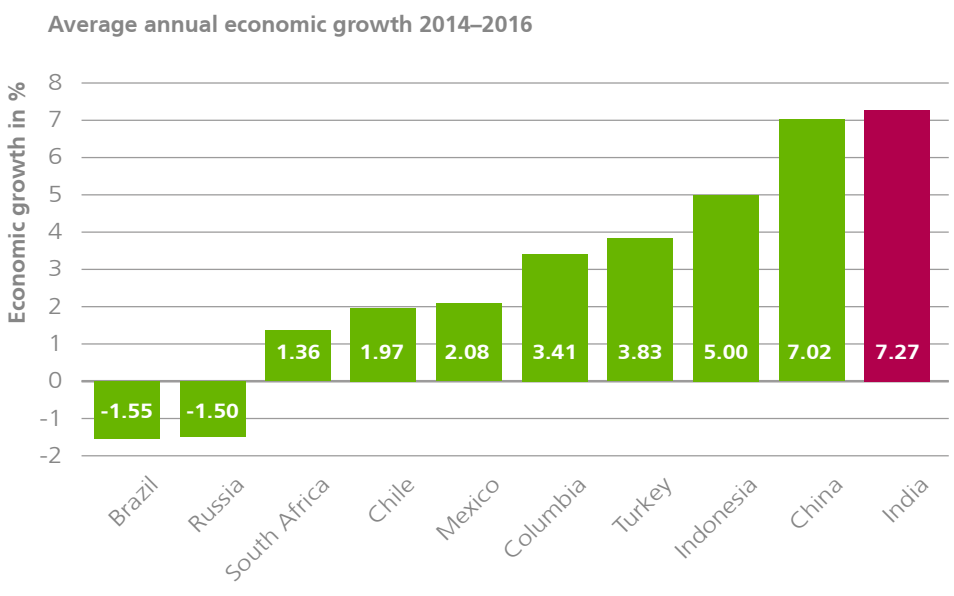
1 Energy market – the status quo

India is one of the world's fastest growing emerging nations and an important trade partner for Germany. On account of the steady growth that the country has been experiencing for some years now, India has developed into one of the biggest drivers of growth in the world economy. In the budgetary year 2016/2017 alone, India recorded economic growth of 7.1%.



However, economic growth, the associated new technologies, and a population which is already over 1.3 billion also increase the energy needs of the largest democracy in the world. As coal power still represents the main component of the services which are in place, renewable sources of energy (RE) offer an interesting alternative for industrial customers. Producing energy from fossil fuels is often more expensive because major consumers in India have to pay higher prices for power due to cross-subsidisation of private households. Furthermore, a comprehensive power supply is not in place in all areas of the country; the power grid is in a poor state, meaning that daily power cuts are not unusual.

In order to be able not only to produce more energy across the whole country but also to reduce the increasing environmental impact of fossil fuel sources of energy, India is now increasingly focusing on renewable sources of energy.

1.1 Main players in the energy sector

Set up in 1992, the Ministry for "New and Renewable Energy" (MNRE) is responsible for the planning of Renewable Energy on a national level. The "Indian Renewable Energy Development Agency" (IREDA) has been set up as an entity of the MNRE, to issue low-interest loans for projects in the area of Renewable Energy. Responsibility for energy provision, however, lies with the 28 federal states of India. The energy market was only opened up to private companies a few years ago. Although it is still strongly shaped by central and federal government companies, the proportion of private industry is increasing at a steady rate. The energy market is to some extent still working with archaic structures, however, and is struggling with high levels of debt from the past.

	Central government	Federal states	Private sector
Policies	MOP	Federal governments	
Planning	CEA/MNRE (IREDA)		
Regulation	CERC	SERCs	
Generation	Central state electricity generating companies	Federal state electricity generating companies	Private electricity producers (e.g. Tata Power)
Transmission	Central Transmission Utility	Power Grid Corp of India Ltd./SEBs	Private transmission initiatives (e.g. HVDC)
System Operation	Regional load dispatch centres	State Load Dispatch Centers	
Distribution		Transmission license holders	Private electricity producers (in Mumbai, Delhi, Kalkutta)
Trade	Power Trading Corporation		Private power trading companies (e.g. IEX)

The proportion of electricity which is directly controlled and generated by the central government currently stands at 25%. The proportion of electricity generated by the individual federal states stands at 32% and by the private sector at 43%. Private players in the market are mainly coming into the market in the area of electricity generation, and are investing in transmission projects and trading in electricity, whereby their interests are currently focussed on particular metropolitan areas such as Delhi, Mumbai or Calcutta.

1.2 Legal framework conditions

The key elements of Indian energy policy for the promotion of renewable energy plants, and in particular photovoltaic (PV) plants, are the "Electricity Act" (EA) as well as the "National Action Plan on Climate Change" (NAPCC). The goals of the EAs are:

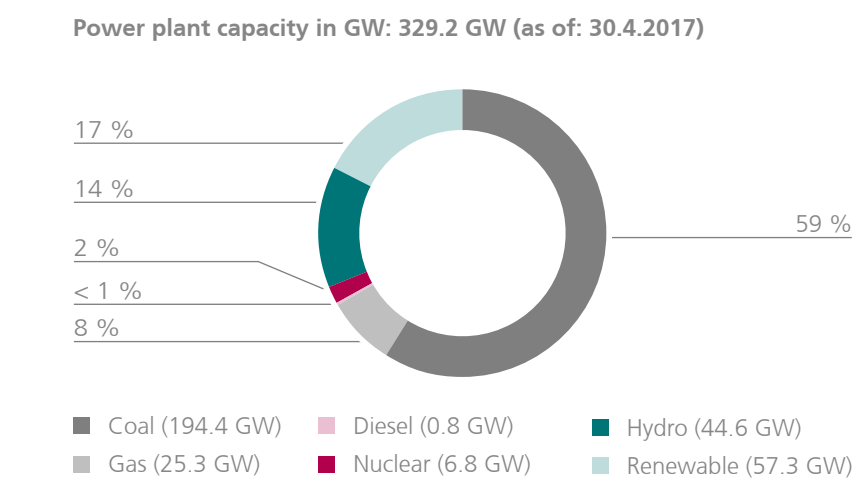
- the further decentralisation of the Indian power supply network
- an expansion of private investment in the energy market
- its accelerated liberalisation
- the promotion of renewable sources of energy

Since the EAs came into force, electricity producers and consumers are no longer bound to sell their electricity to the "State Electricity Boards" (SEBs) or to buy it from them. From now on, they can conclude direct contracts with one another. In doing this, they may use the existing power grid for a fee, and with no discriminatory conditions (open access).

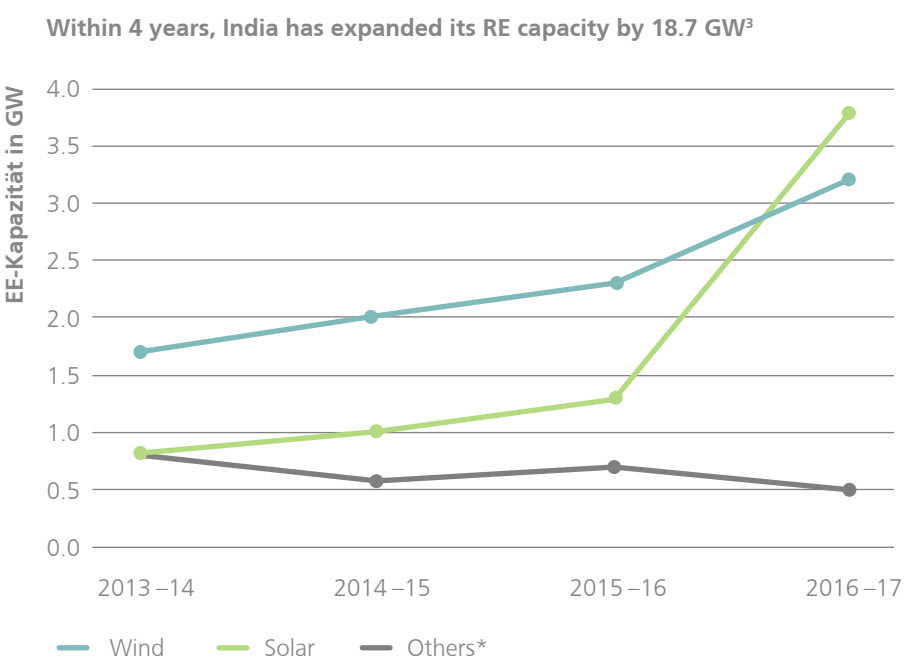
Der NAPCC, on the other hand, defines goals for development in the energy sector, in particular regarding electricity and the rural areas, and focusses on the promotion of solar energy.

1.3 Current mix of power sources

There is a chronic shortage of energy in India, with still more than half of the more than 329 GW installed services being generated through coal power, and in total around 220 GW of the installed services originating from thermal and unsustainable sources of energy. Going into detail, the current mix of power sources consists of coal power, solar energy/wind power/ biomass, hydro-electric power and nuclear energy.



The proportion of RE, excluding hydro-electric power which stands at 17% (5.72 GW) of the electricity market, is thus relatively high in international comparison (Germany – 29% in the year 2016). Wind power, at almost 56% (32 GW) of the capacity of renewable sources of energy, lies just behind hydro-electric power, making India one of the four largest wind energy producers in the world. The picture looks similar in the area of solar power. Here, already 12 GW are installed and, in the long term, the country is backing solar energy as the future main source of energy of the renewables.



* including small hydro-electric power plants, biomass and energy generation from waste

In the expansion in the areas of biomass and hydro-electric power, progress is also being made, even though a little less dramatic. Yet despite this progress in the area of renewables, coal will continue to be an important source of energy for electricity generation.

1.4 Minimum quota of Renewable Energy

The government does not have any particular prioritisation among the various sources of energy. Considering also the fact that the global energy landscape is characterised by strong competition, India's energy policy tends rather to be aimed at developing and driving ahead with all domestic sources of energy, as fast and as comprehensively as possible.

Nevertheless, a statutory minimum quota has been set in the Indian federal states for the proportion of Renewable Energy of the overall total volume of energy. The level of the mandatory proportion is prescribed by the state "Central Electricity Regulatory Commission" (CERC) in coordination with the "State Electricity Regulatory Commissions" (SERCs) in so-called "Renewable Purchase Obligations" (RPO). If the mandatory proportion stipulated in the RPOs is not reached by the SERCs, then the deficit must be balanced out through trading in "Renewable Energy Certificates" (REC). The RECs are bought up by the local energy producing companies registered for RECs. One of these certificates corresponds to one megawatt hour (1 REC = 1 MWh). In the area of solar power, there is a standardised solar RPO quota for each federal state of 0.25% of their total energy production. By 2022 this is set to rise to 3%.

1.5 Electricity prices

Prices for the end customers vary greatly. The price structures are dependent on the particular federal state and electricity provider in question; however, the price of electricity increases in line with demand. Electricity customers from industry and business pay more than simply the costs of producing the electricity. Cross-subsidisation means that the price of electricity for major consumers rises. The increases in price vary from one federal state to another and amount to around 15% of the price to the end customer in Gujarat, 32% in Karnataka, 41% in Delhi and 52% in West Bengal. Through this increase, they subsidise lower prices for private households and above all for agriculture, where the price of electricity often tends towards zero.

Electricity prices have continuously risen over the past few years. Since the financial year 2009/10, the electricity price for industrial customers has risen by 32% to an average of 5 INR (6.6 ct)/kWh, and for private households by 29% to around 4 INR (5.3 ct)/kWh.

The spectrum of different tariffs is set by the state-run CERC and implemented by the federal state SERCs in each state. This can sometimes result in considerable differences between the individual federal states. The highest level, for example, is Maharashtra with a price of almost 14 INR (18.5 ct)/kWh for industrial customers. The tariffs in most of the industrial metropolis areas are, on the other hand, between 6 and 11 INR (8 ct – 14.5 ct)/kWh. By comparison – the tariffs for diesel generators are considerably more expensive at 18 to 20 INR (23.8 ct – 26.4 ct)/kWh. Furthermore, prices are dependent on the local costs for production, transmission and distribution. The average electricity price for fossil fuel energy sources, settled through trade licenses, is currently around 3.30 INR (4.4°ct)/kWh (as of February 2017).

Only a very small percentage of electricity – around 3% of total electricity production – is traded on the two power exchanges in India. In February 2017, the sale price for solar power on the two power exchanges IEX and PXIL was 3.50 INR (4.7 ct)/kWh, and 1.50 INR (2.0°ct)/kWh for all other sources of renewable energy. The prices also vary widely here and are dependent on the season, as well as on the price speculations of the various different electricity providers and customers.

2 Energy policy – outlook

By signing the Paris Agreement on Climate Change, India has committed to producing 40% of its energy capacity from non-fossil fuel sources of energy by the year 2030. The Indian government has affirmed this commitment with their own political plan. According to this, an installed output of 175 GW is to be fed into the power grid by non-fossil fuel plants by the year 2022:

Solar energy plants	100 GW
Wind energy	60 GW
Biogas & Biomass	10 GW
Small hydro-electric power plants	5 GW

Moreover, the Indian government has also initiated the "Secretariat of International Solar Alliance" (ISA) on an international level, for the further expansion of renewable forms of energy. USD 30 million as well as land have been made available for this purpose, and the support of the Indian government for the next 5 years has been assured. The 24 states who are so far participating, including Latin America, Africa, the USA, France and China, are working together to increase the installed output of solar energy plants through the merging of markets. With the agreement of the Indian cabinet on 28.12.2016, India was also the first country to ratify this agreement.

As far as political implementation on a national level goes, the Indian government is pursuing an ambitious programme to fight climate change, their focus being on the work carried out in institutions and on monitoring mechanisms.

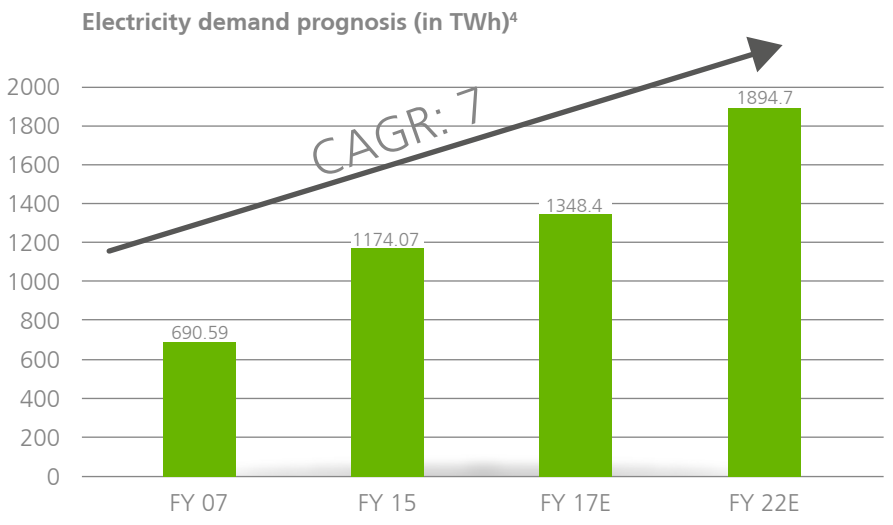
Furthermore, under Prime Minister Modi, the country is currently driving ahead with an ambitious expansion programme for Renewable Energy through a diverse range of tenders – after the great success of the first onshore wind energy auction in Asia, held in February 2017 in India (at a tariff of 3.46 INR/kWh or 4.6 ct/kWh), the SECI, India's body for the implementation of the INDC goals (Intended Nationally Determined Contributions) announced tenders in the coming business year of an additional 4 GW of wind energy, and between 4 and 6 GW per year up to the year 2022, in an attempt to reduce greenhouse emissions. To this end, the Indian government has increased wind energy capacity in the past business year 2016/17 by 5.4 GW. That represents in turn a 35% increase on the government's plans at the beginning of the business year.

Thanks to this clear political line and the funding programme which is in place, it would seem that India's plans to realise the INDC goals set in the Paris Agreement within the agreed time frame are very likely to be realised. Independent statistics anticipate that, with the current policies, 39% of their energy production could be achieved through Renewable Energy by 2030. The "National Electricity Plan", published in December 2016, announces that the INDC goal which was set will in fact be exceeded, and the non-fossil fuel capacity in 2026-27 will reach as much as around 56.5%. Through the implementation of their plan, India is set to become one of the biggest "Green Energy" producers in the world and, when it comes to renewables, they will in fact be doing better that a number of industrialised countries.

3 Renewable Energy market – Opportunities

3.1 Energy deficit

According to the Global Competitiveness Report for 2016-2017, India was in 68th position out of a total of 138 countries in the category Infrastructure (Energy and Telecommunications), thus well below their average position of 39 in the overall ranking of global competitiveness. The reason for this lies in the fact that the majority of all sectors continue to use diesel generators and oil-fired furnaces. Furthermore, almost a third of the Indian population currently still has no access to electricity or to any other form of commercial energy. Electrification has still yet to be carried out in these areas. In small and medium-sized towns, households have to do without their energy supply for two to four hours a day due to power cuts. In the electrified rural areas, there are sometimes power cuts lasting up to 20 hours a day, a problem which prevents the sustainable development of manufacturing industry in these areas. Even though India's energy deficit has reduced somewhat, the energy supply is already now insufficient for the country's needs. And yet, a five-fold increase in electricity demand is anticipated in the next 20 years.



Electricity tariffs are still very high and, together with power transmission losses of just under 20%, they represent a not inconsiderable cost factor for companies. There is also an opportunity for German companies here, however, as energy efficiency is an exceptionally important affair for the German industrial companies.

The country still lacks the required number of qualified personnel as well as the innovative technologies needed in order to carry out fast modernisation of the energy sector, meaning that here too, a diverse range of potentially lucrative options are opening up. The demand for Indian energy technology in their own domestic market is still developing rather slowly; instead foreign companies are increasingly in demand. Investment in Research and Development for sustainable energy systems and the qualification of the labour force are both urgently needed in order to raise the competitiveness of the whole industry to an international level. Companies which enter this field or invest in it will profit from the rapid upturn in the area of Renewable Energies which the country will be experiencing in the coming years.

The resources required to meet these complex challenges can only be provided by the state to a limited extent. Private investors are therefore very much in demand. The investment requirement in the Indian transmission and distribution market in the period 2008 – 2017 has been estimated at approximately 19.2 trillion rupees (EUR 240 billion). It offers in return potential profits of 3.2 to 3.8 trillion rupees (EUR 40–48 billion). Around half of this is required in the area of technical development and the procurement and the construction of power grids. This opens up some interesting possibilities for German companies who can provide the relevant products for the power grid, in particular in the area of hydro-electric and wind power, biomass and PV, as well as in the modernisation and expansion of the power grid (e.g through island grids or interactive grids). The same applies to the area of energy efficiency. First government initiatives (e.g. the expansion of LED lighting in the country) have put the theme firmly on the agenda and German expertise in this area is also well known in India. It is worth mentioning here that, in contrast to many other fields (for example, retail) there are no FDI (Foreign Direct Investment) restrictions in place for renewable sources of energy.

3.2 Funding instruments

India has an almost unmanageably large number of funding instruments for the expansion of renewables, provided by both the Union government in Delhi and the individual states (for example, Odisha, Punjab and Tamil Nadu). The public authorities put their efforts primarily into strengthening the demand side of the market.

An example of a funding programme which is highly regarded in terms of potential is the so-called "Jawaharlal Nehru National Solar Mission" (JNNSM). This programme is based on tenders for the awarding of subsidies for solar power plants, and German companies may also participate in this. The highest price for the bidding process will be set in advance as the so-called reserve price through the MNRE (as of November 2016, 4.35 INR (5.8 ct)/kWh). The payment at the set feed-in tariff and the purchase of electricity are carried out within the framework of a Power Purchase Agreement (PPA) with the "Solar Energy Corporation of India" (SECI), who are also responsible for marketing the electricity.

There are also feed-in tariffs and direct subsidies in addition to this, however. You will find a small selection of these in the overview below:

Measure	Description	Funding organisation	Funded area
„Renewable Purchase Obligations" (RPO)	Duty of the network provider to purchase energy from renewable sources (this should strengthen demand and thus increase the market price)	Union, Kamataka Kerala, West Bengal, Tamil Nadu	All – in Tamil Nadu only solar
„Renewable Energy Certificates" (REC)	Producers of renewable energy receive RECs, which are freely traded and can be used for the fulfilment of the RPOs	Union, Rajasthan, among others	All – in some areas also specific requirements for solar energy
Feed-in tariffs	State guarantee of the purchase price, sometimes with annual increase via publicly accessible PPAs	Tamil Nadu, Gujarat	Solar
Accelerated depreciation	Up to 40% depreciation of the capital goods in the first year, then 20% in the second year.	Union	Solar, wind
Direkte subsidies	30% subsidy with regard to set-up costs for small power plants (above all in the "off-grid" area)	Union	Solar, water
Subsidised loans	Discounted loans (interest rate of 5 to 7%) for the setting-up of solar parks	Union	Solar

Solar power plants benefit in particular from the climatic conditions in India, with solar radiation of four to seven kWh per day, on around 300 days of sunshine per year. Solar energy from solar thermal power plants is above all produced in the western federal states of Rajasthan and Gujarat. PV plants are installed across the whole country.

The national action plan, on the other hand, creates the political framework conditions as well as a framework for support, opening up a profitable market to companies which has potential for the future and which is by far not yet saturated – the federal state of Tamil Nadu recently issued a tender for the construction of PV plants with a capacity of 500 MW. The highest price for the bidding process has been set at 4.5 INR/kWh (6.0 ct/kWh). The SECI is also currently preparing several PV tenders for energy purchase contracts, amounting to a total capacity of 2300 MW.

3.3 International subsidies

The World Bank also recently announced the provision of a subsidy of approx. USD 23 million for the financing of grid-connected PV roof projects, which represent a significant component of India's solar goals. These funds will be paid in addition to an existing loan from the World Bank of over USD 625 million, which was awarded for the solar roof segment in May 2016. The goal of the financing programme is the setting up of 400 MW grid-connected PV roof systems. The funding will be awarded through the State Bank of India (SBI) to plant developers and end users, with priority given to those from the commercial and industrial areas, in this case with a particular focus on small and medium-sized companies and financial institutes, as long as they are not banks. The current subsidy from the World Bank is intended to remove obstacles to investment in PV roof projects, which still exist in political, financial and technical terms (for example, a lack of suitable means of financing and technical experience, and a low level of consumer awareness). Aside from financing, the subsidy also includes the provision of know-how and consultancy services for capacity-building among investors, project developers and companies, as well as the regulatory framework conditions for political decision-makers.

In addition to this, there are also further international institutions which fund the development of PV roof projects in India. At the beginning of October 2016, the Asian Development Bank (ADB) announced the awarding of a loan of over USD 500 million. In January 2017, a total of over USD 1.5 billion was secured from the World Bank, the ADB and the development bank of the BRICS states for use in the Indian PV roof market. On top of this, the Indian state railway company recently announced a goal of generating 5 GW of solar power capacity by 2025 through the installation of solar panels on trains. This will be realised in three phases through both roof-mounted and floor solar installations (Phase 1: Gujarat & Rajasthan, Phase 2 & 3: the remaining federal states), and to some extent tenders are already in the planning stages. This should result in the capacity of solar power generation being increased five-fold, in comparison with the original goal of 1 GW.

Despite the long-standing political debate concerning the construction of large dams, hydro-electric power does also have significant potential, in particular in the area of small hydro-electric power plants. India would like to develop their currently-installed output of 35 GW to 150 GW by 2030 and is receiving both technical and financial support in this area from German development cooperation. In particular in the Himalayas and the north east of the country, India has waterways which have up to now not been made use of and which would be well-suited to the production of hydro-electric power. Wind power is focused principally on the southern federal states of Tamil Nadu and Andhra Pradesh. With Suzlon Energy Ltd, the country has the world's third largest wind turbine manufacturer, currently in the process of setting up one of the largest wind parks in the world in the state of Gujarat, with a capacity of 1000 MW.

4 Pitfalls

India is currently facing important decisions in terms of setting the course for its energy policy. One of their biggest problems continues to be the price of electricity. Despite India's huge potential and the political framework setting which has been created, their contradictory policy on subsidies is causing financing problems in the expansion of RE, both in agriculture and in private households.

Many banks are, furthermore, not yet in the position to be able to assess the situation of Renewable Energy financing or to make an estimate of their own risks if they offer financing. IGEN (Indo-German Energy Programme) and the GIZ (German Society for International Cooperation [Deutsche Gesellschaft für Internationale Zusammenarbeit]) work very closely with the banking sector, however, and provide regular training, to help renewables to gain better acceptance.

On account of the dilapidated and inefficient power grid, there is a further problem – in the transmission of electricity, over 20% of the generated quantity of electricity is lost. At peak times, the energy deficit amounts to over 10%. The level of transmission losses is one of the highest in the world. On account of this, there are daily power cuts across the whole country, in particular in the summer months, and this also causes enormous problems for large manufacturers and the processing industry on their production sites. Many companies therefore have diesel generators to bridge these shortages, but these are inefficient and expensive to run. The reason for the transmission losses lies with networks that are often antiquated and inefficient, but losses also arise from electricity theft (illegal tapping of the cables). Coordination between the individual State Electricity Boards also needs to be enhanced in order to improve electricity generation and distribution. On account of the strained situation, the scope for manoeuvre of the State Electricity Boards is, however, limited, meaning that many necessary and sensible initiatives, reforms and investments are prevented from going ahead.

The negative impact of the use of coal on the health of the population, as well as the associated costs, represent an important factor which is now becoming more relevant in India too. It will remain to be seen what influence this factor will have on India's coal policy over the next few years. The country's ambitions for the development of Renewable Energy show, however, that India has recognised the enormous potential of this source of energy for a sustainable means of energy provision. India's strong will to take on a leading role internationally in the area of the production and use of renewables is shown both in their commitment to the implementation of the Paris Agreement on Climate Change and repeatedly in statements made by the Indian government, for example, in the context of the German-Indian government consultations at the end of May in Berlin, during which the German federal government committed to investments of EUR 1 billion per year in India, among other things for RE, and more recently also in the founding of the International Solar Alliance (ISA). Bi- and multilateral initiatives make an important contribution towards a further reduction in the cost of Renewable Energy through both developments in technology and the transfer of technology, thus accelerating a turnaround in the trend as regards energy provision.

The expansion of wind power has in some areas reached its limits, as the allocation of land in this densely populated country, with its complicated leasehold and land laws, has caused difficulties in the past few years. As an alternative, the Indian government is, however, examining options for offshore wind parks. In line with this, the first of these is expected to be completed by 2019, and further wind parks will follow on. Indian wind energy companies have no experience up to now with offshore plants, meaning that there are lucrative business opportunities for European companies in this area too.

Besides this, there is a wide range of other projects in the field of renewables. By 2030, electric cars – charged with electricity from renewable sources – will replace diesel and petrol fuelled vehicles in India.

In the solar power industry, dependence on imports of solar modules poses a problem. But, at the same time, it represents an opportunity. In the business year 2016/17, approx. 89% of solar modules were imported. The WTO (World Trade Organization) assessed the obligation of project developers to source a certain percentage of their solar panels from Indian production as being a breach of their contract, meaning that Indian companies will in future no longer benefit from an advantage in this respect in their own domestic market. This once again opens up an enormous potential for foreign companies to encourage and support domestic production, as long as they do not put off international competition.

In the context of the prevailing energy deficit in India, the role of renewable sources of energy needs to be redefined, for it no longer represents an alternative source of energy provision but rather will play a key role in the solution for fulfilling the national demand for energy in the country, as gas and oil are only available to a limited extent. The expansion of the enormous potential for hydro-electric power needs in particular to be strengthened in the coming years. The plan in the mid-term is to gain the largest proportion of electricity from wind power, but in the long-term, the main focus will be on solar power.

There are, however, a number of things to be aware of – German companies, above all in the solar power industry, have so far only had limited success in the acquisition of contracts or in the submission of offers for public tenders in the energy sector. This is mainly due to the fact that many German companies are not prepared for the Indian market, supplying as they do expensive, high-tech products and only few technologies which have been adapted to the Indian market and are more reasonably priced. This means that, in the tender process, they have as yet catered too little for the local requirements and wishes of the customers. In the local energy market, India currently still needs technically straightforward solutions, robust power plants at a low cost and with low maintenance costs.

Companies should therefore take into consideration the fact that the Indian market, with its particular characteristics, is not comparable with European countries. The barriers to entry into the market are generally focused around the following categories:

- product,
- market,
- financing,
- state as well as legal framework conditions,
- (specialist) personnel
- also customers and consumers.

Other barriers, such as electricity theft, corruption, stakeholders, risks in the setting-up of a company and in doing business, and intercultural aspects must not be disregarded either.

A stable, Western-style legal system has been established in India, and having English as the the official language also makes business relationships easier. Intensive preparation for this market is nevertheless an unavoidable factor. This comprises both finding out about the relevant funding instruments and various practical questions, such as local financing with already existing projects, the possible selection of an Indian partner, and the appointment of an advisor who is familiar with the legal framework conditions and with Indian business practice.

5 Conclusion

India is seen internationally as one of the countries in Asia with the fastest growth rate, only superseded by China in terms of size and importance. On account of the enormous momentum for development, the infrastructural deficits and the huge demand for electricity, the Indian energy market offers lucrative business opportunities for German and European companies in the area of renewables.

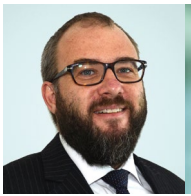
India's economic dynamism has the potential to shape the country into a global future market which will continue to be increasingly attractive for German investors. The market will open up further worldwide and, on account of the country's current energy policy, which is focusing on RE, the demand for advanced and innovative technologies will increase dramatically in the future.

The country is currently in a state of upheaval and will, in the coming years, become the world leader in the field of renewables. Within the setting of global climate protection, renewable sources of energy present the only realistic alternative to resolve the existing energy deficit and the ongoing shortage of energy in India. Even now, a positive trend can be observed which will be beneficial to their ambitious plan – in an auction in May, a company received a subsidy for solar power at a price of 2.44 INR/kWh (3.24 ct/kWh). The electricity price this year is thus for the first time lower than that for coal power and, according to reports, it could drop further to a record low of 1.5 INR/kWh (2.0 ct/kWh).

Furthermore, within the past 3 years, India has increased its solar capacity by 370%, from approx. 2.6 GW to over 12.2 GW. The price for wind power is currently at a record level of 3.46 INR (4.56 ct)/kWh and, in the business year 2016-17, they achieved the highest expansion to date of wind capacity of 5.5 GW. With the plan of generating 175 GW of electricity from Renewable Energies up to 2022, the programme is, moreover, the world's largest Renewable Energydevelopment programme.

For technically innovative companies who can adapt to the needs of the Indian market, the Indian market will offer interesting possibilities for expansion in the form of high potential for profit. For German companies, India can also serve as a springboard to further emerging countries. Through the development of local capacity, enormous cost advantages can be realised, which facilitate not only entry into the Indian market but also into other emerging markets too. Investors, technologies which have been adapted to suit the market, German expertise and the expansion of domestic production are all in demand. In this process of change towards sustainablity, German companies can still get involved in the setting up of Indian market structures and can be active in setting both technical and process standards. By doing this, a strategic basis for future competitive advantage can be created. The potential of this country is enormous, with its high solar radiation levels (solar power), its long coastline (wind power) and the natural slopes of the Himalaya mountain range (hydro-electric power).

6 Contact Person



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India
Interview with Dr. Winfried Damm

Dr. Winfried Damm, Programme Head IGEN, GIZ

Dr. Winfried Damm, graduated at FU Hagen, Germany, received a MBA from Michigan State University (USA) and a Ph.D. from FU Berlin.

He worked for two years as a consultant, four years for a member of national parliament in the energy sector and joined the municipal utility (Stadtwerke) of Leipzig in 1992. There he headed sales, marketing, PR, strategy, controlling, M&A, international department and was responsible for external relations among others. He had been involved in many national legislative outcomes starting with the first feed-in-law for renewables up to capacity market discussions.

Dr. Damm started working with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in December 2014 and joined the GIZ India office in January 2015 as Director of the Indo-German Energy Programme.

The GIZ India has 3 areas of focus (environment, sustainable urban development and energy). With IGEN, Dr Winfried Damm coordinates activities in the field of energy and has been in charge of this area for 2 years. The GIZ also serves as a point of contact for companies working in the Renewable Energy area who have operations in emerging or developing countries.

IGEN – What does it stand for?

IGEN stands for "Indo-German Energy Programme". We are active in the areas of energy efficiency, renewable energy, rural development, solar water pumps and also integration between the administration systems of Germany and India.

India has set itself ambitious goals in the area of renewables, among other things 40 GW is to be generated through solar roof projects. IGEN supports the Indian government in their plans. In the past, we have managed to convince both the Delhi Metro and the cricket stadium in Bangalore to install solar panels, and we offered them support and guidance through the process. IGEN also takes care of more minor issues too, e.g. solar air domestic heating in Ladakh.

What opportunities do you see for German companies in the Renewable Energy market?

Over the next few years, India will be like a boom market which has in terms of renewable energy! This means that anyone looking for a new venture in this field should definitely take a look at this country. On the other hand, it is not an easy market in economic terms – it is highly competitive. Indians want to purchase things as cheaply as possible, which is then also reflected in the level of quality. Their cultural affinity for the drawing up of contracts is also somewhat different from how it is put into practice in Germany . We would therefore recommend having a competent advisor at your side and working with personnel from the local area. But otherwise, India is phenomenal in terms of sales figures, their admiration for German technology and their desire to work with German people.

The energy company STEAG can be cited as an example of a success story in this area – the company was launched with a staff of 10-15, and in the meantime now has over 1000 direct employees, as well as a further 1000 with limited contracts. It also forms a significant support for the STEAG group in Germany and in the meantime also acts as a project developer for solar plants.

IGEN has been assigned by the Federal Ministry for Economic Affairs the task of initiating economic forums for sharing experience and information. And the GIZ would be very pleased if more Germans would take a look at the Indian market. IGEN, for their part, would then offer their support, within the framework of their possibilities.

Which technologies have a good future in India?

All technologies used in Germany for the generation of energy can of course also be put to use in India. They need, however, to be adapted to the Indian climate and regulatory requirements.

Even though wind power has performed very well in the past year, solar power will in fact dominate the market in the next few years. In the predictions from their further planning up to the year 2027, the government wants to raise their goal from 175 GW to 275 GW. Within 5 years, that will then amount to 100 GW more, whereby in order to realise this they will utilise 50/50 solar and wind power.

They will be focusing on large power plants (ground-mounted), although there will also be an increase in roof-mounted projects in the next few years. As regards CSP (Concentrated Solar Power), I am more skeptical, however. IGEN has supported a large programme with over 120 solar measurement stations in pretty much all the federal states of India. The measurement stations have signalled very clearly that air pollution is very high, meaning that direct irradiation can present quite a problem. However, the worst irradiation values in India are still better than the best values in Germany. Although this is not completely true, it does highlight the fact that solar irradiation is plentiful across the whole of the country.

On account of the air pollution in the North of India, the solar panels also have to be cleaned fortnightly. This cleaning procedure is rather unusual in comparison with the situation in Germany. It is important to use as little water as possible, or ideally perform the cleaning operation without the use of water. But this is just one example of the necessary adaptation for the Indian market.

IGEN currently has a further project in progress with PV/ T (Photovoltaic/ Thermal). This is a new technology which has been thankfully taken up and tested by the Indian administration. It involves laying a thermal loop behind the PV module to cool it down. This increases the efficiency of the module and also generates hot water, which can in turn be used in processes requiring heat, for example, in hospitals or laundries.

Storage systems for network integration of the Renewable Energy and the prevention of power cuts: What is the current situation in India?

India has a huge amount of experience with storage facilities in a wide range of different forms. The traditional storage unit is the diesel generator. These generators are very expensive. Nevertheless, almost every household/office has one in the wealthier areas of the cities.

Power cuts will in future be reduced on account of the very ambitious policies which are in place. Nevertheless, network fluctuations and short interruptions in supply are still a part of everyday life, which is why many homes are equipped with battery storage units. The Indian market is therefore very familiar with these lead-based storage units. If you were to equip solar power plants with an appropriate battery storage unit, then this could even have two positive effects in terms of (i) the bridging of power failures and (ii) a progressive electricity tariff in the household sector. If they are successful in cutting out on the expensively drawn electricity in the progression, it could be possible to achieve a so-called indirect subsidy for the plant. It could then definitely be worthwhile. It is of course cheaper to use the electricity directly and there are, as a rule, sufficient occasions and possibilities to do this.

A further example of how India is hoping to move ahead rapidly is LED lights. In the meantime, over 250 million LEDs have been sold through the state company EESL alone, at a price of below one euro per unit. There will soon only be LEDs in India. When Indian people come to Germany, they see that Germany is in fact the 'developing country' in this respect.

In which areas will energy efficiency be promoted by technical solutions?

Energy efficiency technology is being examined. It must, however, be practical to use and reasonably priced. The next segments here are engines. In the area of industry, every kind of sensible energy efficiency technology will be encouraged, whether it be compressed air, the relevant use of insulation or control technology. This is a very broad field!

In Germany, panels set up to produce electricity for a company's own use are currently very popular in industry. What is the situation in India?

This idea is only just getting going. In the next 5 years, it is anticipated that every large industrial plant will have a PV installation on its roof. It only has to be of evalution for companies to do it. Industrial electricity prices are considerably higher than household prices. As a rule, the industrial electricity price is in the meantime INR 7-10 (approx. 11 to 14 euro cents), while it is possible to produce roof-mounted solar power für INR 5-7. This provides industrial companies with a chance to cut the price they pay for electricity by around a third.

Between which Indian federal states are suitable for what kinds of projects/technologies?

If you work in industry, you can certainly work anywhere in India. Otherwise, it is a question of the culture in the individual federal states. When you go to India, you cannot compare it to Germany, however, but rather to Europe. Just as Greece and Finland have quite different cultures and ways of handling projects, there are likewise also differences in India. You have to consider which government is in place in the particular state, which ambitions they have in the area of Renewable Energy and how closely they are following the national plans. Then you will quickly get a feeling for it.

Your best experience in India in the area of RE?

There are many, but solar water pump projects are a good example! It is really nice to see how you can replace diesel generators with solar water pumps, and how the farmer can then decide for himself whether he wants to make use of the yield from the solar panels or whether he is going to feed it into the grid. With solar water pumps, an attempt is being made not only to solve the biggest problem of energy generation, but also to achieve a more efficient use of water pumps in the sense of reducing water consumption. Up until now, the pumps have been in constant use. As the energy provider has to pretty much give away the electricity, it is necessary for him to operate "Load Shedding". The water pumps are in principle regulated by the electricity provider switching off the electricity for many hours per day. This results in the farmers leaving the pumps switched on the whole day long. When electricity comes, then they pump water and then, as a rule, much too much. This means that the ground water level in the land sinks drastically. With solar water pumps, however, the farmer decides how much water he needs and the electricity (when it is sunny) is always available. For unused electricity, he can earn money from the electricity grid operator. This means a win–win situation for all those involved, and a positive impact on the gound water level.

Iran

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List of Acronyms

GDP	Gross Domestic Product
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
ECA	Energy Conversion Agreements
RE	Renewable Energy
FIPPA	Foreign Investment Promotion and Protection Act
FiT	Feed-in Tariff
IGMC	Iran Grid Management Company
IPDC	Iran Power Development Co.
IRENA	International Renewable Energy Agency
MAPNA	Iran Power Plant Project Management
MENA	Middle East and North Africa
NDFI	National Development Fund of Iran
PPA	Guaranteed Power Purchase Agreement
SABA	Iran Energy Efficiency Organization
SATBA	Renewable Energy and Energy Efficiency Organization
SUNA	Renewable Energy Organization of Iran

1 Energy market – the status quo

1.1 Overview Iran

Iran is the second largest economy in the Middle East and North Africa (MENA) region after Saudi Arabia, with an estimated Gross Domestic Product (GDP) in 2016 of US$412.2 billion. It also has the largest population of the region Egypt, with an estimated 80.3 million people in 2016. Iran's economy is characterized by the hydrocarbon sector, agriculture and services sectors, and a noticeable state presence in manufacturing and financial services.

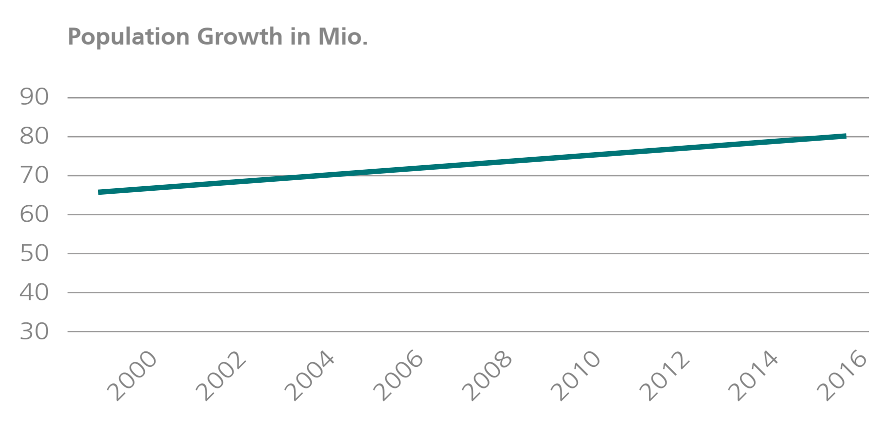


Figure 1: Population Growth

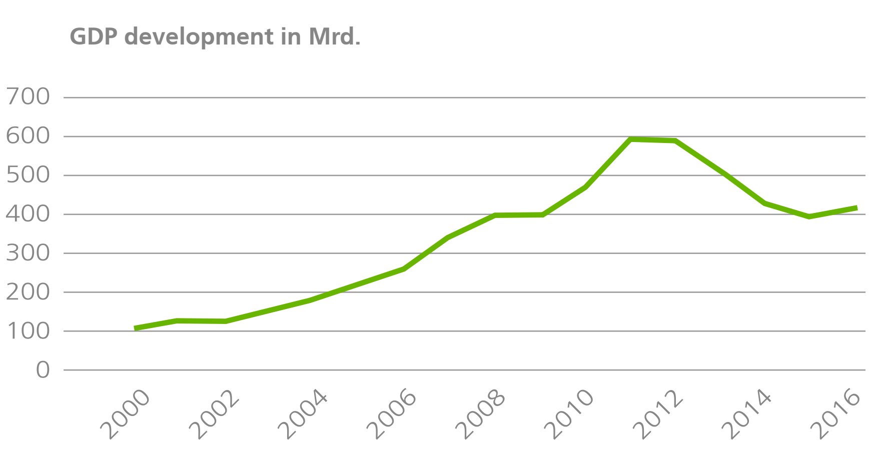


Figure 2: GDP development

Iran ranks second in the world in natural gas reserves and fourth in proven crude oil reserves. Economic activity and government revenues still depend to a large extent on oil revenues and therefore remain volatile.

Iran uses a mass transmission network which covers 100% of all urban areas. However, the electrification of rural areas has been a long term objectives in different FYDPs. Due to the vast distribution of villages over the country, rehabilitation and renovation of the network constitutes a major priority of TAVANIR's annual development programs. Besides this, in March 2013 about 600 villages with less than 20 households did not have access to the Grid which results in 98.9% electrification rate for villages.

Die Abbildung 3 zeigt, dass Haushalte (31.7%) und Industrien (34.6%) 2013 den höchsten Stromkonsum haben. Zwischen 2005 und 2013 ist der Strombedarf des Wohnungssektor und des Industriesektors um jeweils 4.3% und 5.6% gestiegen. Figure 3 shows that the residential (31.7%) and the industrial sector (34.6%) have the highest electricity consumption in 2013. Between 2005 and 2013 the electricty demand for the residencial and industrial sector increased by 4.3% and 5.6%, respectively.

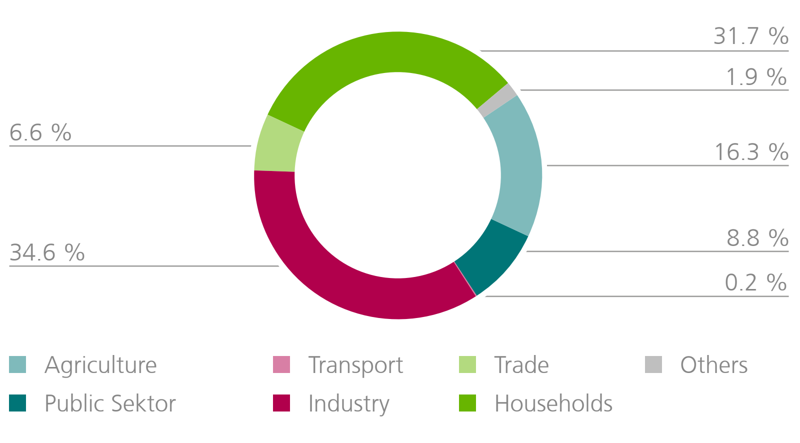


Figure 3: Proportion of the electricity demand divided in sectors in 2013

1.2 Electricity Market

Before restructuring the electricity market of Iran in 2004, the Iranian government worked as a monopoly with sole responsibility of generation, transmission and distribution. Due to the high consumption growth of electricity and the necessity to enhance private investment, the The Electric Holding Company of Generation, Transmission & Distribution Company (TAVANIR) took some steps to a reforming mechanism of power market starting in 2001. The initial objectives were set to prosper competition in the market, increase the share of private investment in power plants and to improve the efficiency in electricity generation. One decade after implementing the competitive basis of electricity market, most of the market players are still governmental or semi-governmental.

Electricity Generation

In Iran, electricity is provided by the following:
› State owned power plants which are administered by TAVANIR and affiliated Regional Electricity companies
› Hydroelectric power plants under the control of the Department of Water and Sewage of the Ministry of Energy
› Private owned power plants
› Large industries
› Nuclear power plants which manages the nuclear power plant

Privatization in electricity generation started by contracting Energy Conversion Agreements (electricity generation

In Iran, electricity is provided by the following:

› State owned power plants managed directly by TAVANIR or indirectly through affiliated regional electricity companies

Privatization in power generation started by contracting Energy Conversion ECAs) and continued by developing some Build Operate Transfer (BOT) and Build Own Operate (BOO) projects with private investors. In 2013, TAVANIR sold some of its power plants and increased the share of private electricity generation to 41% of the total installed capacity.

Transmission

In each Regional Electric company there is a department under the title of "Deputy of Power Transmission" or "Deputy for Operation" which is responsible for maintenance, operation and development of transmission lines and sub-stations. Because all 16 Regional Electric companies are owned and administered by TAVANIR, the transmission sector is still considered as a regulated monopoly.

Distribution Companies

Currently 39 Distribution Companies (DSOs) are working in the country. These companies could be in charge of a province, a city, and in some cases several companies could be responsible for the distribution of electricity in one province. For example, there are two distribution companies in the Mazandaran province. The distribution companies belong to TAVANIR and are under supervision of regional electricity companies. Some activities of the distribution companies such as upgrading and renovation services of the distribution network, development of rural electrification of agricultural irrigation systems, sales, meter recording, administration and transportation services have been released to the private sector.

Market Management and Regulatory Framework

The Iran Grid Management Company (IGMC) was funded as a state-owned company to handle the power market and operate the electricity network in 2004. The main objectives and the scope of activities of IGMC are:
› Conducting and monitoring the production and transmission of the national network to ensure safety in the grid and in the power supply.
› Provide access to the network for all applicants including all state-owned and private sectors.
› Developing competitive electricity market in generation and distribution
› Adopting policy-induced participation of private sector into the market

The market regulation is administrated by the Electricity Market Regulatory Board, which is a group of experts assigned by the Minister of Energy to monitor market performance and to revise the market operation rules and procedures.

1.3 Player in the current sector

Department of energy

The Iranian Ministry of Energy was created in 1975 to carry out and coordinate water and energy activities (excluding oil and gas). Until the mid-1990s, the Iranian power sector was controlled centrally by the Ministry of Energy. With the start of the privatization program, the government is also trying to involve the private sector more strongly in this sector.

Ministry of Energy

The Ministry of Energy (MoE) of Iran was established in 1975 to be in charge of managing and coordinating water and energy activities except oil and gas. Until the middle of 1990s, the electricity sector in Iran was completely centralized and managed by the Ministry of Energy. In accordance with privatization program, the government seeks to increase private sector participation in currently centralized sector, including the electricity sector.

The MoE is the main organ of the Government, responsible for the regulation and implementation of policies applicable to four main industries including electricity, renewable energies, water and wastewater services. To carry out these tasks and responsibilities, a very complex structure was designed.

The first level is responsible for governance and policy making. There are five departments in this level:

› Deputy of Legislation Support and Parliament Affairs
› Deputy of Energy and Electricity
› Deputy of Water and Sewage
› Deputy of Research and Human Resources
› Deputy of Planning and Economic Affairs

The second or middle level is the executive level which is in charge of planning, monitoring and evaluating the implementation of the macroeconomic policies and regulations by their subsidiary companies. These four Expert holding companies administrating electricity industry water and sewage supply industries. Among them is The Electric Holding Company of Generation, Transmission & Distribution Company (TAVANIR Holding Company) which is the responsible for renewable energies. The other three holding companies are: Iran Water Resource Management Holding Company, Country Water and Sewage Company and TAVANIR Holding Company.

The third is the operational level. Each holding company at the second level holds several subsidiaries at the operational level. For example there are 83 companies under the management of the TAVANIR subsidiaries.

he third level is on the operational level. Each of these holding companies from the second segment have subsidiaries that are operating in their stead. As an example, TAVANIR Holding Company controls 83 subsidiaries.

TAVANIR Holding Company

TAVANIR was established to organize the supervisory activities of the government in the fields of operation and development of the Electric Power Industry. It conducts the affiliated companies and utilizes facilities of the Electric Power Industry of the country . Currently the company is responsible for the management of 16 Regional Electric Companies, 28 Generation Management Companies, 39 Distribution Companies, Iran Power Development Co. (IPDC), Renewable Energy Organization of Iran (SUNA), Iran Energy Efficiency Organization (SABA), Iran Power Plant Project Management (MAPNA) and Iran Power Plant Repairs Co. SUNA's subsidiaries are the most interesting in terms of renewable energies. Figure 4 shows the structure of TAVANIR again.

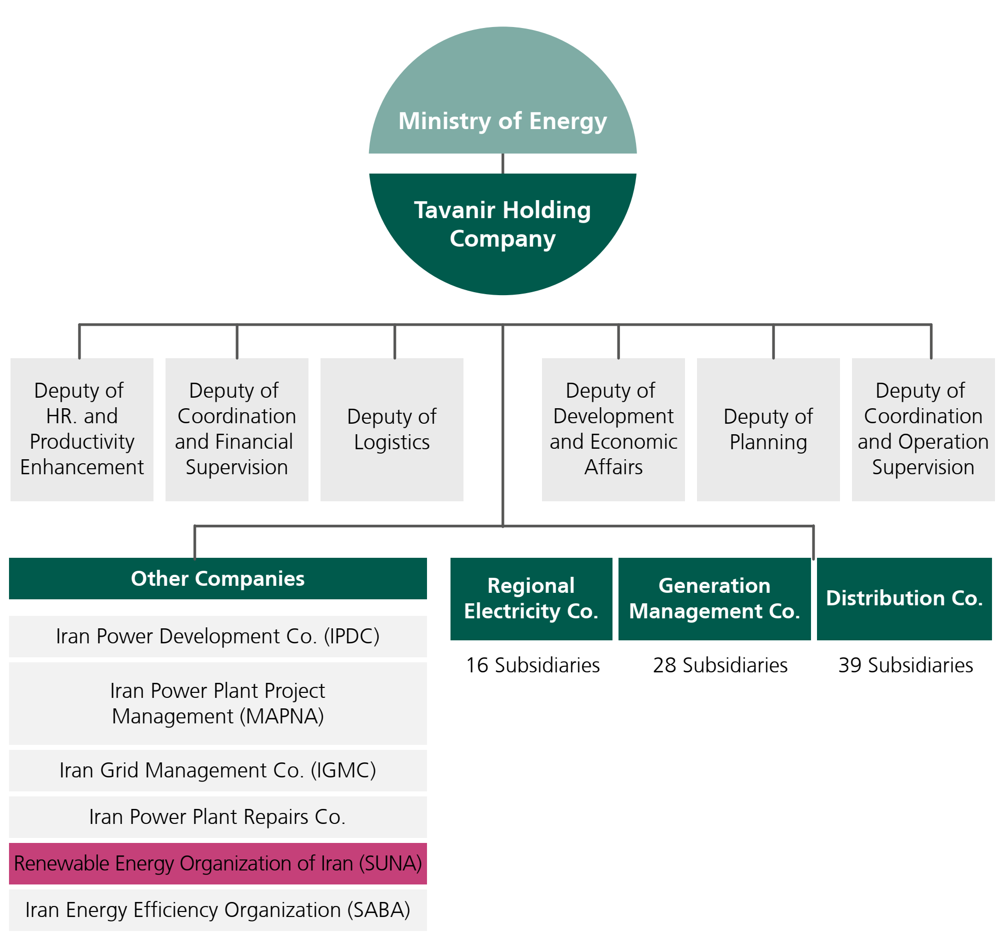


Figure 4: Structure of TAVANIR

Renewable Energy Organization of Iran (SUNA)

In 1996 the Renewable Energy Organization of Iran (SUNA) was established to:

› Evaluate the renewable energy potential in Iran
› Implement projects (solar, wind, geothermal, hydrogen and biomass)
› Guarantee the purchase of the electricity generated to attract private sector's participation in this field.
› Preparation plans for the development of renewable energies and preparation for relevant data.
› Provide knowledge and training in this field.

In 2000 SUNA became a state organization, filling the gap of an executive body in the government for development of renewable energies: five years later, all missions and legal operations on renewable energies were centralized in the Ministry of Energy and the Ministry, who assigned this responsibility to SUNA.

Renewable Energy and Energy Efficiency Organization (SATBA)

The two organizations SUNA and SABA came together to promote renewable energies and energy efficiency. This took responsiblilty of implementing the Renewable Energy and Energy Efficiency Organization (SATBA), which, unlike the earlier production, is no longer owned by the TAVANIR which is under the direct control of the Ministry of Energy. This action was of great importance for the renewable energy sector in Iran. The SATBA having not only a significant influence and greater financial resources than SUNA before, e.g. the SUNA had finacial difficulties repaying their debts on time under a 20-year Electricity Purchasing Contracts.These problems for SATBA as a new main partner, should be a thing of the past and restore the confidence of investors in this market.

1.4 Power mix

As previously mentioned, Iran has large oil and gas reserves. The results indicate a significant asset in the Iranian electricity market through conventional energy sources. Only since 2013 nuclear power is a part of the Iranian electricity mix, after the first nuclear power plant with a capacity of 700 MW became fully operational in Bushehr. According to plans,, two more reactors will be built on site of the Bushehr nuclear plant, each with a capacity of 1000 MW.

The total installed capacity of 73242 MW in 2014-2015 is composed as follows:

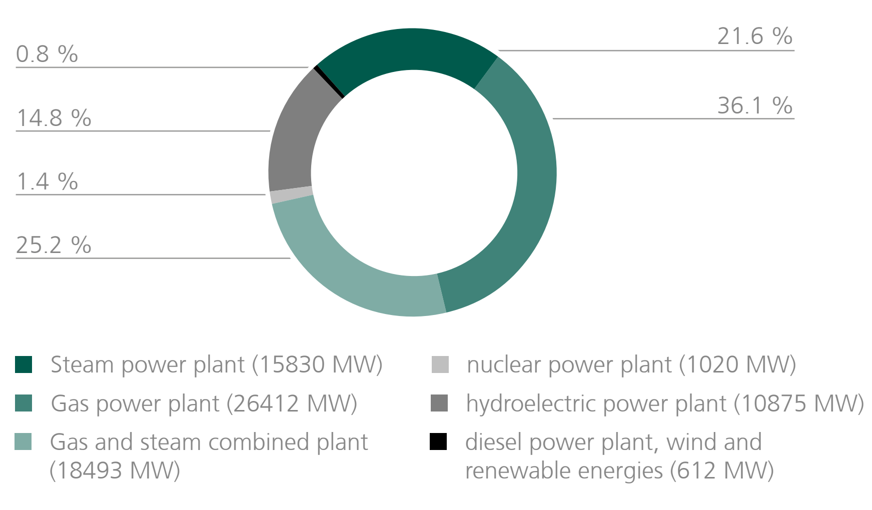


Figure 5: Installed capacity in Iran in 2014–2015

1.5 Market design

The electricity trade in Iran is performed in the following three mechanisms: Energy Market, Energy Exchange and Energy market

Electricity Trade

Figure 7, shows the basic operational diagram of Iran's power market. Sellers are state owned regional electricity companies and other private companies which have received a license from the Ministry of Energy to offer electricity in the power market. Sellers bid in the market for different quantity level and compete for the bidding price. Sellers which are state owned electricity companies offer the demanded blocks and finally the market clears for the matching points and notifies both seller and buyer. The main characteristic of the power market is that the bidding price is regulated and must be respected in a predefined certain cap.

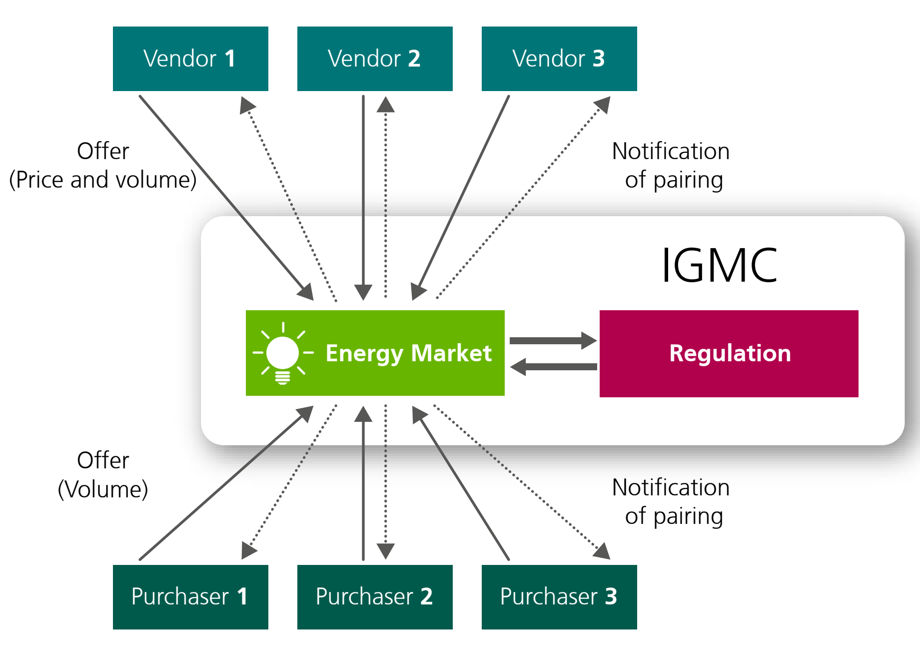


Figure 6: Transactions at the iranian Energy Market

Power Exchange

In the Iran Energy Exchange (IRENEX), the electricity trade is done through contracts with the purpose of real power delivery in the future. The main specification of the electricity pool is the unregulated bidding and offering mechanism in a competitive basis. It must be noticed that only the private independent power generators can participate in the IRENEX.

Bilateral Contracts

Another possibility in the power market is that both, the producer and the consumer, negotiate for specific capacity of electricity in a bilateral contract. Therefore, the price is defined during the negotiation without any regulation. However, the transaction has to be approved by the system operator (IGMC). Bilateral contracts are in their infant stages in which by subsidized tariff for final consumers there is a limited motivation to secure their needs by negotiation.

Figure 8 illustrates the process and flow of energy and monetary payments including all governmental and private entities. All generation companies, including public regional electricity companies, deliver their electricity to the market and compete for the price and quantity of the sale. It should be noticed that TAVANIR works as off-taker in power purchase agreements (PPA) in the power industry and usually participates in the competitive market on behalf of other private power plants that have PPA contract. Currently, independent thermal power plants benefit of a 5-year PPA. After the PPA period, they directly sell the electricity to the wholesale electricity market, energy exchange or to the potential customers. Likewise, for renewable resources the Iran Renewable Energy Organization (SUNA) has the role of 'planning, policy making, providing solutions and publicizing of information in this field. SUNA is assigned to facilitate private investment in this sector and works as electricity off-taker from the renewable generators. SUNA proposes and develops the legal and financial settings in annual Budget Acts and Five Year Development Plans (FYDPs).

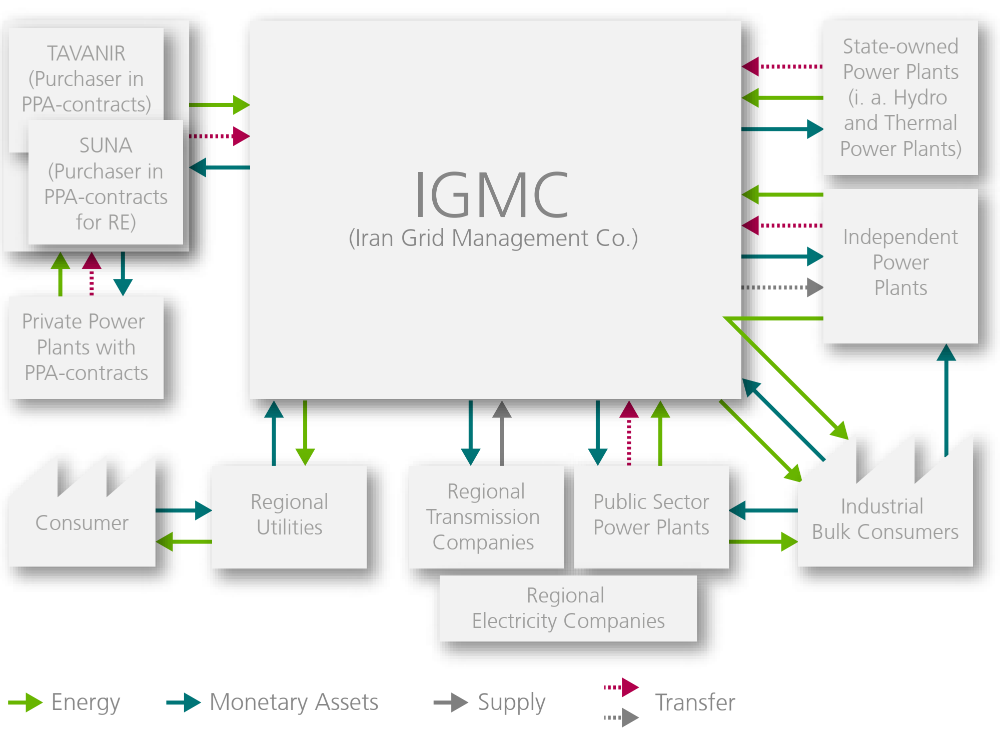


Abbildung 7: Overview of the Energy- and money flows in Energy Sector

2 Energy policy – perspective

2.1 Benefits and incentives

Iran is a member of the International Renewable Energy Agency (IRENA), and politically, the establishment of renewable energies (RE) has been promoted for some time. Under the 5th Five-Year Development Plan (2010-2015), the Iranian government had foreseen the first steps to develop alternative energy production, through the introduction of guaranteed feed-in tariffs (FiT). The price level of the Iranian FiT is considered to be above-average, an up-to-date overview of the prices varying according to technology and capacities of the plant can be viewed online at the Renewable Energy and Energy Efficiency Organization (SATBA) at www.satba.gov.ir. An additional increase in the competitiveness of RE has resulted in a 30% increase in FiT for such power plants built using Iranian materials, technologies and designs since 2016. In addition, funds from the National Development Fund of Iran (NDFI) were made available for the promotion of foreign investment in Iranian EE. However, these means have so far only been of modest practical relevance, since the application procedures are not only bureaucratically complex and lengthy, but also rarely lead to success.

The most sustained incentive for foreign companies to engage in Iranian power plant projects is, besides a high market potential and the bundling of institutional competences, by a sole responsibility of the SATBA for all RE projects in Iran, in the liberal and largely stable legal framework of the country. Already, according to the national legal provisions of Iran, foreign investment is considered with domestic investment; in particular, foreign companies may have up to 100% of all shares in Iranian corporations. In addition, foreign investment under the Foreign Investment Promotion and Protection Act (FIPPA) provides comprehensive protection against (non-compensatory) expropriation and nationalization as well as numerous other political risks as long as they have applied for FIPPA licensing for their local investment projects. These application procedures are, as a rule, prompt and unbureaucratic, which means that such protection is particularly advantageous for the most capital-intensive and long-term RE power plants. Also, the existence of a FIPPA license is essential for the opening of the protection area of the bilateral Iranian-German Investment Protection Agreement of 2005.

Economic security benefits Iranian power plants by concluding a „Guaranteed Power Purchase Agreement" (PPA) with a mandatory minimum term of 20 years, which is set out in its essential content by SATBA. Under this PPA, the generated energy is exclusively sold to the SATBA; any trade in the generated energy is prohibited for the duration of the contract. In this context, it is worth mentioning that this also includes the prohibition of selling shares of the relevant power plant operator company in Iran. Although the Iranian Ministry of Energy u.U. in principle, interested investors are strongly advised to finalize their investment structure before the start of the formal procedure for granting a power plant operator license.

Implementation Stages

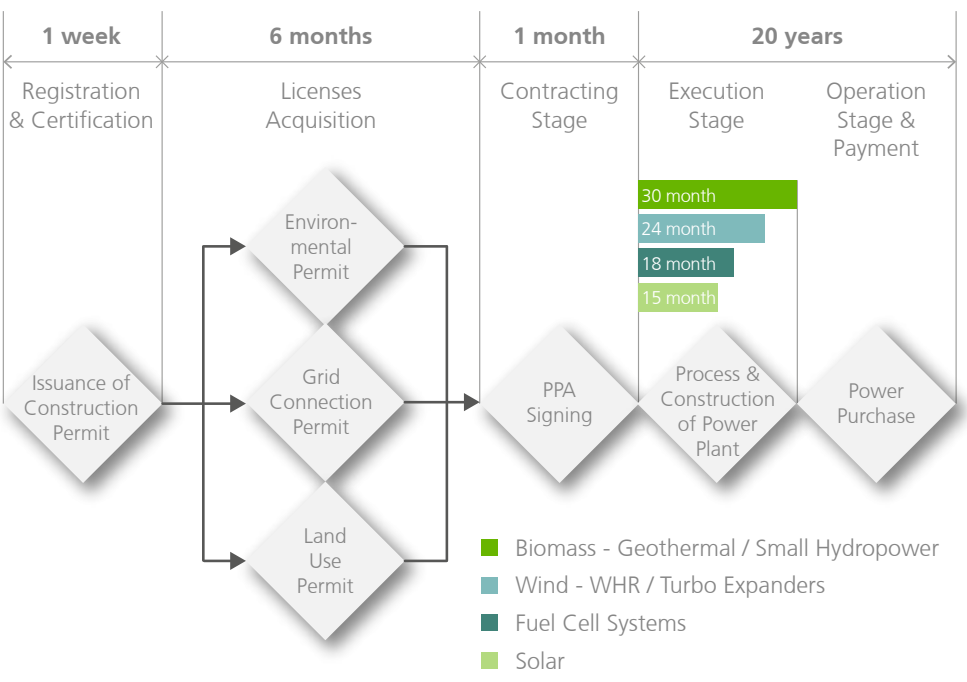


Abbildung 8: Overview of the approval procedures of a renewable energy power plant in Iran

2.2 6th Five-year development plan

The Sixth Five-Year Development Plan (2016-2020) is comprised of three pillars: Building a resilient economy; Progress in science and technology; Promoting cultural heritage.

Under the Sixth Five-Year Development Plan, the Iranian government has set the goal of increasing the installed capacity of renewable energies (without hydropower) to 5000 MW by 2020. One of the measures to achieve this goal is guaranteed electricity abstraction contracts also with non-state power plants with special feed-in contracts.

Iranian authorities have adopted a comprehensive strategy encompassing market-based reforms as reflected in the government's 20-year vision document and the sixth five-year development plan for the 2016-2021 period. The plan is comprised of three pillars, namely, the development of a resilient economy, progress in science and technology, and the promotion of cultural excellence. On the economic front, the development plan envisages an annual economic growth rate of 8 percent and reforms of state-owned enterprises, the financial and banking sector, and the allocation and management of oil revenues among the main priorities of the government during the five-year period.

2.3 Subsidy Program

The Iranian government carried out a major reform of the subsidy program on major products and products, including petroleum products, water, electricity and bread. The reform has led to a moderate improvement in the efficiency of expenditure and economic activities. First, all indirect subsidies, which amounted to approximately USD 77.2 billion, were replaced by a direct transfer of money to Iranian households. The second phase of the subsidy reform began in spring 2014 and involved a more gradual adjustment of the oil price than was predicted and a targeted money transfer to low-income households. In contrast, about 3 million high-income households have been deleted from the list of beneficiaries. As a result, the expenditure on subsidies decreased from 4.2% of GDP in 2014 to 3.4% of GDP in 2016.

Since the subsidy reform began, electricity and water prices have continued to rise and will continue to move upwards until they cover the full costs. It can safely be said that this reform has begun a new era for both conventional energy and renewable energies and the long history of a highly subsidized energy supply will come to an end.

2.4 Paris Agreement

Although Iran was also present in Paris as a participant in Paris on 12 December 2016, it has not yet ratified the Paris Convention, nor has it come into force.

3 Renewable Energies – Market – Opportunities

3.1 Renewable energies

The demand for electricity in Iran has steadily increased in recent years and is expected to grow even more strongly in the future. The average growth in power generation was 5% in the last 10 years. Iran would have to generate about 5 GW of additional electricity per year to meet demand in the coming years.

Iran's development potential for renewable energies is considered exceptional. RE already had a share of almost 15% in the Iranian energy mix in 2013, but this almost completely came from the well-established hydropower in Iran. Wind and solar energy, on the other hand, played only a subordinate role in 2016 with just 0.3%, and geothermal energy is also of no great importance in Iran. According to the will of the Iranian government, this will change for the future.

Even if, following the relaxation of the international sanctions, a massive expansion of the country's fossil energy sources is predicted, the Iranian five-year development plan (2016-2021) aims to achieve and operate a sustainable diversification of Iranian energy production through the expansion of wind power and photovoltaics. To increase energy production by 5 GW to 2021 annually, the Iranian government plans to provide US $ 3 billion of government investment. The expansion of RE is not only intended to contribute for a long-term reduction of Iran's dependence on the oil business but also to the country's high and steadily increasing energy demand. In particular, the urban agglomeration areas of Iran also suffer from massive environmental pollution and public pressure on the government to solve this situation is growing. The supply of power to rural areas of Iran, which is currently only very small, is also to be improved by decentralized energy production from wind and solar power plants. Wind and solar energy have excellent conditions in Iran, not just under climatic conditions.

3.2 Wind energy

Estimates of the wind potential in Iran vary greatly depending on the study being consulted. Although the World Bank estimates a potential of 6500 MW, SUNA states, there is a potential that between 12000 MW and 16000 MW.

The construction of wind parks in Iran has several advantages. On the one hand, the potential locations for wind parks have flat planes, which reduces the costs for the installation and implementation of the wind power project. Furthermore, the infrastructure necessary to carry out such a project, e.g. Access to roads and electricity is already available. Due to the fact that Iran is one of the driest countries in the world, demineralization plants are of great importance to the country. The wind power plants could supply these plants with electricity and do not require any water for the operation itself.

According to the government, a stronger focus than in the past is to be placed on wind energy. So far realized wind parks are in Manjil, Binaloud, Safeh, Sarein and Takestan.

Location	Capacity (kW)	Lead Partner
Manjil Wind Farm Site	90220	Renewable Energy Organization of Iran (SATBA)
Binaloud Wind Farm Site	28380	Renewable Energy Organization of Iran (SATBA)
Zābol (Sistan)	660	Renewable Energy Organization of Iran (SATBA)
Baba Koohi (Schiraz)	660	Renewable Energy Organization of Iran (SATBA)
Aun Ibn Ali (Tabriz)	1980	Renewable Energy Organization of Iran (SATBA)
Sarein (Ardabil)	660	Renewable Energy Organization of Iran (SATBA)
Sofeh (Isfahan)	660	Renewable Energy Organization of Iran (SATBA)
Mahshahr	660	Renewable Energy Organization of Iran (SATBA)
Nir	660	Renewable Energy Organization of Iran (SATBA)
Sarab	660	Renewable Energy Organization of Iran (SATBA)
Khaf (Chorāsān-e Razawī)	1500	Behin Ertebat Mehr Co.
Takestan	20000	MAPNA
Nishabour – Binaloud	4300	Atrin Iranian – NIBA
Total	**151000**	

Table 1: Overview of the installed wind farms in Iran

3.3 Solar power

Iran has excellent conditions in the field of photovoltaics. A solar irradiation of approx. 2.5 to 3. Solar energy

5.5 kWh/m² depending on the location and about 300 sunny days lead to the fact that the solar potential in Iran is twice as high as in Germany (about 1.1 kWh/m²). The fact that Iran has a high rate of electrification (98.4%) makes it possible to connect the PV system to the grid in most areas. In 2014, the Iranian government invested a total of USD 60 million in solar projects. The best places for PV projects in Iran are located in the provinces of Hamadan, Isfahan, Yazd, Kerman and the city of Shira. Therefore, the bulk of applications for PV projects submitted to SUNA come from this region. As far as Schiras is concerned, there have been more than 10, together with Kerman about 90 and Yazd about 100 applications. As mentioned above, 90% of the villages that do not comprise more than 20 households without access to conventional electricity. Because these villages are very far apart, decentralized power generation solution would be most effective. In conjunction with the optimum solar conditions, the installation of solar power plants would be the most effective and efficient way to supply electricity to these localities in the long term. According to a report by the Iranian Ministry of Energy, 27 villages could be supplied with electricity by the end of 2013 by means of the PV solution. However, it should taken into acount that such localities do not have the capital to manage these projects alone. Therefore, the Iranian government would have to pay the costs of installation and distribution in order to offer the private sector a lucrative business.

Until now, relatively little has been achieved in the solar sector. The main reason is due to the large oil and gas reserves, which led to low prices for fossil fuels. Accordingly, electricity generation using such energy carriers is very reasonable.

Although Iranian banks are also financing solar projects, it should be taken into account that interest rates are around 18%. In addition, only 70% of the project is often financed. Therefore, financing from abroad should also be considered.

3.4 Biomass

The economic potential of bioenergy is 23 TWh per year. This estimate includes agricultural residues, municipal waste and solid biomass. 150 tonnes of agricultural waste and residual quantities are generated each year.

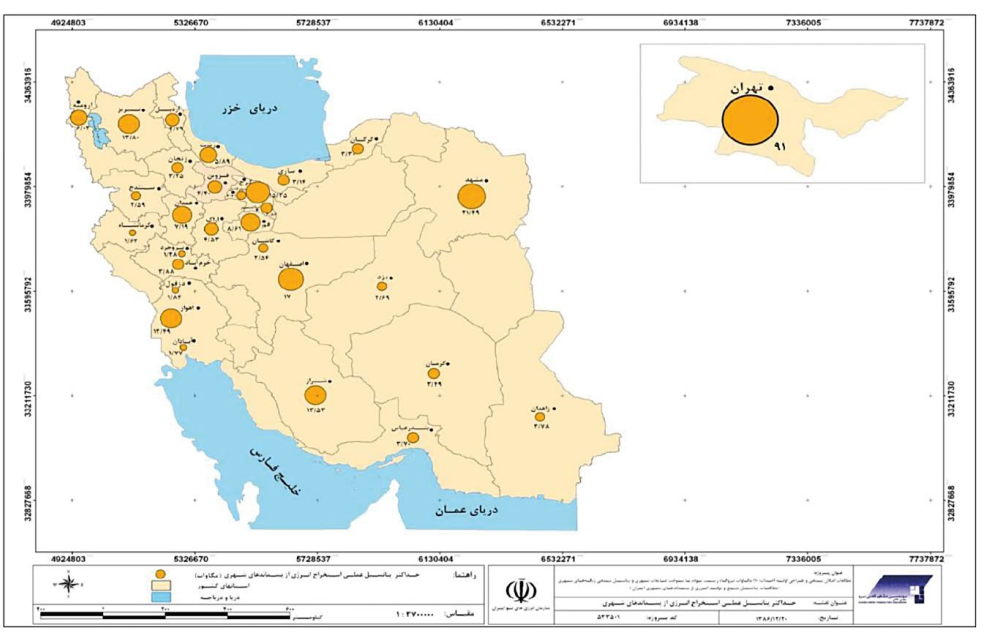


Abbildung 9: Map of municipal waste in Iran

Selected biofuels built by the private sector:

Location	Capacity in MW	Type
Teheran	5	waste water biogas plant
Mashhad	0.6	biogas plant
Schiraz	1.2	biogas plant

3.5 Hydropower

Concerning hydropower, Iran had an installed capacity of 11196 MW in 2015 and produced electricity of 13785 GWh in the same year. This means that hydropower accounts for the largest share of renewable energy sources. In addition, Iranian companies have a great deal of experience in the development of hydropower projects. These companies are also increasingly active abroad, e.g. in Tajikistan and Sri Lanka.

Most major hydropower projects are carried out by the Iran Water and Power Resources Development Company (IWPCO).

3.6 Promotion

The promotion of renewable energies takes place in Iran via three instruments:

- Fixed feed-in tariff
- National Development Fund
- Special power output

In June 2015 Parliament adopted amendments to the rules on feed-in tariffs. The two main new features are (i) the extension of the term of the PPA with a guaranteed feed-in tariff from 5 to 20 years; and (ii) a fundamental change in the delivery mechanism. The uniform tariff applied to all technologies and based on the avoided costs of fuel and CO_2 emissions was abolished. Instead, it is based on the technology, as well as on the respective costs of electricity generation (Levelized Cost of Energy).

Both innovations create a much more attractive framework for investors and project developers with a focus on renewable energies. However, because of the long-term planning security due to the 20-year term to contrarily the differentiated observation of the individual technologies.

type of technology		Guaranteed power purcase salary	
		IRRs/kWh	Euro/kWh (Status 13. Sept. 2017)
Biomass	Dump	2700	0.068
	Anaerobic Fermentation	3500	0.088
	Combustion	3700	0.093
Windanlage	>50 MW	3400	0.086
	≤50 MW	4200	0.106
	≤1 MW (assigned to the participants and limited to the distribution capacity)	5700	0.144
Solaranlage	>30 MW	3200	0.081
	≤30 MW	4000	0.101
	≤10 MW	4900	0.124
	≤100 kW (assigned to the participants and limited to the distribution capacity)	7000	0.177
	≤20 kW (assigned to the participants and limited to the distribution capacity)	8000	0.202
Geothermal (including excavation and equipment)		4900	0.124
Waste recycling in industrial prozess		2900	0.073
Small Hydropower ≤10 MW	Installation by riversides and besides dam systems	2100	0.053
	Installation at pipelines	1500	0.038
fuel cell system		4948	0.125
Turbo Expander		1600	0.040

Table 2: Feed-in remuneration Iran

The fixed feed-in tariffs are supplemented by the National Development Fund, which takes over a certain extent of the investment costs for infrastructure projects. However, the selection criteria are currently being edited and it should be mentioned that these means are also final. There is also a further promotion of renewable energies. TAVANIR charges a special electricity tax for each electricity account. This policy is similar to the pay-as-you-go mechanism of the EEG and is 30 Iranian Rial (approximately EUR 0.089 cents). The revenue will be used for the expansion of electricity supply in rural areas and for the generation of electricity from renewable energies.

4 Pitfalls

A major difficulty with the settlement of RE power plants in Iran is probably the fact that the entire project financing alone is the responsibility of the investor, who has to use these mainly from his own resources. Although the Iranian government is investing a number of investment incentives through a guarantee of economically interesting FiTs and, if necessary, tax incentives, the costs of planning, development and commissioning should be exclusively and in advance by the investor until a successful commissioning of the power plant. Neither the SATBA nor the Iranian Ministry of Energy grants funding to this extent, e.g. in the form of credit grants, discounted financing conditions or prepayments on PPA payments. When financing their RE projects, investors are rarely able to hope for support from Iranian banks, as they are still unable to finance them at competitive rates.Ebenso wenig gelingt oftmals eine Finanzierung von iranischen Projekten durch internationale Banken. Obwohl die europäischen Finanzsanktionen (z.B. Ausschluss aller iranischen Banken vom internationalen Transaktionssystem SWIFT) bereits im Januar 2016 ausgesetzt wurden, sind die großen internationalen Banken bis heute kaum bereit, Mittel zur Finanzierung eines iranischen Investitionsvorhabens zur Verfügung zu stellen. Dabei stellen die Banken in Deutschland keine Ausnahme dar und zeigen starke Zurückhaltung wenn es darum geht Geschäfte im Iran zu begleiten. Aus diesem Grund werden bisher Geschäfte zwischen Iran und Deutschland fast nur von der Europäisch-Iranische Handelsbank (EIHBank) begleitet, die mit allen großen iranischen Großbanken zusammenarbeitet.

However, it is not often possible to finance Iranian projects through international banks. Although the European financial institutions (for example, the exclusion of all Iranian banks from the SWIFT international transaction system) were suspended as early as January 2016, the large international banks are still not prepared to provide funds for financing an Iranian investment project. The banks in Germany are no exception and show strong restraint when it comes to accompanying business in Iran. For this reason hitherto transactions between Iran and Germany are almost always accompanied by the European-Iranian Trade Bank (EIHBank), which cooperates with all major large Iranian banks

Although Chinese companies have already shown a sustained interest in the expansion of RE in Iran, it remains to be seen to what extent this is also suitable for European investors.

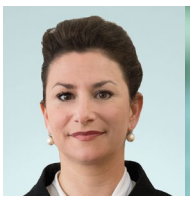
5 Conclusion

The political support measures of the Iranian government must not mislead of the fact that RE are still in their infancy in Iran. Apart from a very complex financing of power plant projects, the merger of foreign investors with Iranian project partners, which is often necessary for purely practical reasons, is also problematic. As with other sectors of the Iranian economy, the RE industry has only a very few sufficiently experienced private-sector companies, which is why a joint venture formation is a very long-term process from a purely practical point of view. In order to attract foreign experts who are urgently needed to develop the RE in Iran, Iran must continue to undergo a comprehensive reform process. In this context, both the current excessive subsidies of local electricity prices (from conventional energy sources) by the Iranian government will be an issue which has led to high Iranian government debts on private power generators, as well as the lack of transparency of the current energy sector of Iranian banking. As an alternative to the Iranian financial services sector for the financing and investment of RE projects, the approved asset positions can also apply. After the lifting of the embargo, 100 billion euros are again available, which were previously frozen in the west.

The diversification of the Iranian energy mix brings various advantages for the country. If some of the electricity needs are covered by renewable energies, Iran has the possibility to export even more oil and gas and thus generate more government revenues. In addition, a decentralized energy solution greatly simplifies the power supply in rural areas. In addition, the fact that a country like Iran, which, despite its huge fossil resources, is based on renewable energies and achieves climate protection targets would gain a strong reputation. In the case of Iran, the latter advantage would be of great importance to be recognized as a good partner on the world stage.

The Iranian membership of the International Renewable Energy Agency (IRENA) and the Iranian cooperation with various regional and international expert commissions on the topic of renewable energies could be the beginning of a pioneering role with regard to renewable energies, especially in the Middle East. As a result, Iran could be very attractive as a hub for German companies and investors in the area of renewable energy sources in the Middle East. In order to underline its commitment to renewable energies, ratification of the Paris agreement is of primel importance.

6 Contact Person



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Iran
Interview with Amir Najafi

Amir Najafi, Energy Services Consortium Secretary bei der "Iranian Association for Energy Economics (IRAEE)"

Iran is considered the hot spot of the renewable energy sector. Despite considerable market potential and government support, the market development is not yet picking up speed though. To your mind – what are the reasons for this rather slow development?

There are many governmental support schemes and plans – on the other hand the process of implementations has just begun. as in in the Southern European countries having a strong local partner is KEY. We see the most promising projects in the range up to 7 MW, because this will typically be the fastest way to realize PV solar.

We mainly provide consulting services for the financing, manufacturing and project development sector. In your opinion – which of these groups is most likely to encounter the most considerable market potential?

Bringing Financing from outside Iran is the number one priority. Again, the focus should be on smaller scale projects – and keep in mind: you can also realize 50+ MW projects in total by just combining several smaller ones.

Entering the Iranian market is not an easy task. Do you consider joint ventures to be a good option, or is it rather recommendable to walk the path alone?

A form of Joint Venture – via an offshore structure in combination with an Iran operating company – is the best way to enter the market. There is billions of Euros of renewable energy related business defined between Iran and Germany. The local party will typically cover the land issues, including registration and negotiations, as well as certain parts of the construction and maintenance.

Looking into the future – there are still many obstacles hindering a successful project financing in Iran. Do you expect the government to come up with state programs producing relief?

Government has no other option but to come up with state programs producing even more incentives than already in place. On the other hand, as you and your team of Rödl & Partner are aware through the projects your Iran team has successfully advised on: the legal structures and contracts are pretty well defined. Not much work here- the key part is finding the local partner and the credible foreign investor and EPC company.

Current subsidies in Iran mainly cover utility scale projects. Do you expect a positive development for the roof-mounted photovoltaics market – which could then, due to its considerable size, be of major interest for distributors and manufacturers alike?

I don't see much perspective in the roof mounted market for the next 5-10 years. Focus will be on PV farms.

Exotic fact: In the northern regions, Iran disposes of considerable deep geothermic potential. A government supported project has been started, still remaining at an early development stage though. Do you see further development potential here?

Iran Government is very advanced in Geothermic but it is still an untouched diamond for those who wants to enter in this market. Given energy pricing at the moment, geothermal will continue to be a niche sector for longer time.

It is generally assumed that German products are highly appreciated in Iran. At this point in time, would you tend to confirm this assumption with regard to the renewable energy sector?

German products were always highly appreciated in Iran. However, Japanese has also purely found a good position in the market (Market positioning) – and pricing is key.

There are also lots of good quality Asian manufacturers in the PV sector, for example, so there has to be a balance between pricing and quality – simply the best offer from all aspects wins.

Over a medium term – which technology do you consider likely to meet the highest market potential?

CHP – Wind – Solar – Bio Gas (gas turbines).

Kenya

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Interview »

World map »

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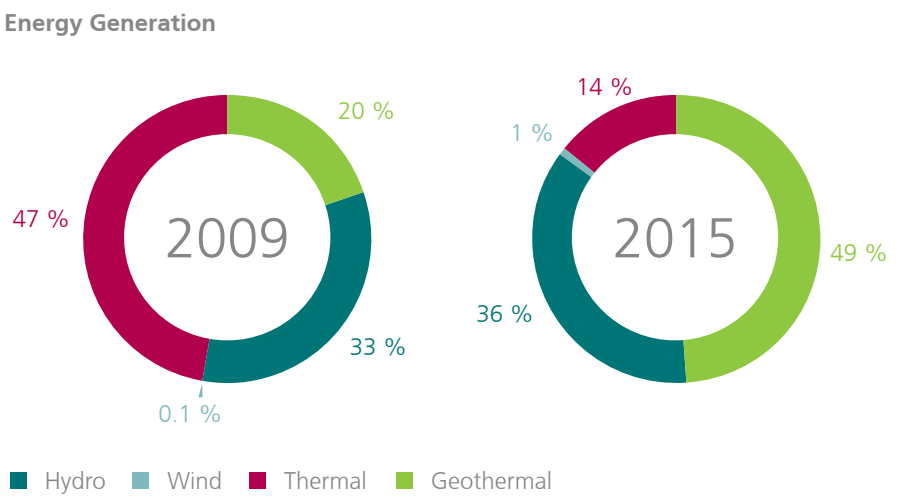
List of Acronyms

EIAs	Environmental Impact Assessments (EIAs)
ERC	Energy Regulatory Commission
FDI	Foreign Direct Investment
FiT	Feed in Tariff
GDP	Gross Domestic Product
IPP	Independent Power Producers
KenGen	Kenya Electricity Generating Company
KETRACO	Kenya Electricity Transmission Company
KNBS	Kenyan National Bureau pf Statistics
KNEB	Kenya Nuclear Electricity Board
KPLC	Kenya Power and Lighting Company, now Kenya Power
REA	Rural Electrification Authority
VAT	Value Added Tax

1 Energy Market Status Quo

1.1 Energy Mix 2009 and today

The Government has heavily invested in the generation of power from renewable energy as a result of regular shortfalls in supply. This lead to a generation of 86% of clean energy in 2015, which is a huge contrast to only 53% in 2009, visible in the charts hereunder.[1]



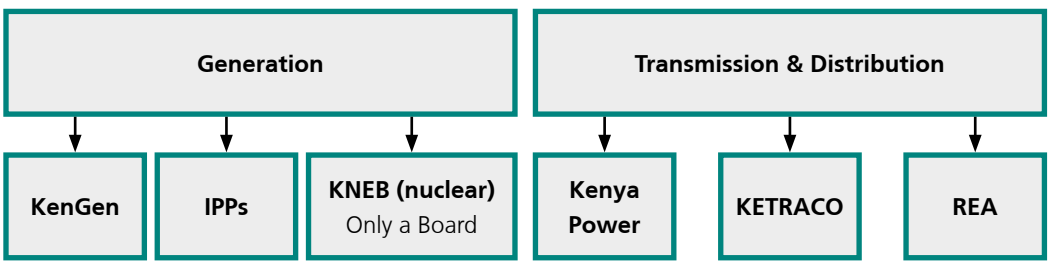
The Cost Power Development Plan states that the optimum solution would be that geothermal capacity should be 26% of the system, 19% from nuclear power plants, 13% from coal plants, 9% from imports and 9% from wind, 5% from hydro plants and diesel and gas at 20% by 2031[2]. The Government has also shown a greater commitment to invest in Renewable Energy with the introduction of Feed in Tariffs.

1.2 Institutions in the Electricity Sector[3] + Liberalisation

Kenya Electricity Generating Company (KenGen), a 70% state owned company, is the leading power generator in Kenya. As of 30th June 2016, the Company generated 80% of the national energy in Kenya. It operates hydro, geothermal, wind, and gas- and diesel-fired power plants.[4] The other 20% are held by the Government under the Rural Electrification Programme, supervised by the Rural Electrification Authority (REA), imports and finally by Independent Power Producers (IPPs). The power generation was only liberalized in 1997 and therefore the market has only been recently opened for IPPs.

Kenya Power and Lighting Company (KPLC) or Kenya Power as it is now known has a monopoly in electricity transmission and distribution in Kenya and is the sole distributor to customers; it is holding the only licence as Public Electricity Supplier required under the Energy Act 2012 for the distribution of electrical energy of a capacity of more that 3000 kW. KPLC signs Purchase Power Agreements (PPAs) with licencees and listed power undertaking companies, such as above mentioned KenGen and IPPs[5] and feeds their generated electricity into the national grid. Kenya Electricity Transmission Company (KETRACO) is a government-owned company, which plans, designs, constructs, owns, operates and maintains transmission lines.[6] Transmission assets prior to the formation of KETRACO still belong to Kenya Power; all other transmission lines now belong to KETRACO.

The *Energy Act 2006* further established the Energy Regulatory Commission (ERC), as well as the Energy Tribunal. These supervisory regulatory bodies are independent of state influence. The ERC's mandate, among others, is to protect the interests of the consumers and is working towards a diversification of energy suppliers and therefore plans to create an independent power system operator (ISO)[7] next to KPLC. The basis of the *Energy Act 2006* is the *Sessional Paper no. 4 of 2004*, which sets up for liberalization. The policy and strategy maker in the energy sector is the Ministry of Energy and Petroleum. The *Energy (Solar Photovoltaic Systems) Regulations* require that all persons designing and installing solar PV (technicians), all manufacturers, vendors, distributors and contractors of solar PV systems shall be licensed by the ERC.



1.3 Price Levels

The electricity prices differ in the different consumer categories in accordance with the gazette tariffs by the Energy Regulatory Commission (ERC). The consumer categories are Domestic consumers, Small Commercial consumers and Commercial/Industrial consumers. The tariffs shown hereunder are effective from 1st July, 2015.[8]

Tariff		Voltage	Consumption per month	Fixed charge (in EUR)	Consumption per month	Cost per kWh (in Cent)	Demand charge (in Euro)
Domestic (DC)		240 V oder 415 V	≤ 15000 kWh	1.21	0–50 kWh 51–1500 kWh >1500 kWh	0.0202 0.1028 0.1658	
Small Commercial (SC)		240 V oder 415 V	≤ 15000 kWh	1.21		0.1088	
Commercial/ Industrial (CI)	CI	415 V	> 15000 kWh	20.15		0.0742	6.45
	CI 2	11 kV	> 15000 kWh	36.27		0.0645	4.19
	CI 3	33 kV	> 15000 kWh	44.33		0.0605	2.18
	CI 4	66 kV	> 15000 kWh	52.39		0.0588	1.77
	CI 5	132 kV	> 15000 kWh	137.03		0.0572	1.77

Reports state that the relatively high crude oil production and inventory levels led to reduction in international oil prices. Otherwise, this is an inconsistency to the decrease of electricity from thermal sources to 14%. The effect can thus be described as overrated. Cooking gas average prices fell to an eight year low after the Government scrapped the applicable Value Added Tax (VAT) to boost uptake among poor households.

1.4 Grid Access

It is possible for RE-electricity to be feed in the national grid. This however depends on signing a Power Purchase Agreement (PPA) with Kenya Power as it has a monopoly and one of the requirements to receive a generating licence is the PPA. The signatories to this agreement are favored to sell to the grid, but besides this, there is no priority feed-in for Renewable Energy.

The purchase of electricity through tender has not yet been implemented and wheeling is only done by KETRACO. Kenya is further considering a net metering policy for solar photovoltaic (PV) systems, but due to 2017 being an election year, we have not yet seen this any recent changes in legislation. Although net metering should ideally apply for all sources of Renewables, it will most likely mostly apply for PV systems. It should further be noted that the net metering discounted credit has only been applied for electricity exported to the grid. Net metering is an opportunity being financially attractive and environmentally responsible.

However, it must be noted that the law allows you to sell electricity to an independent off-taker and additionally it is permitted to directly provide electricity to the consumer. Unfortunately, this remains a theory for now; it has not yet been seen in the market.

In Kenya there are certain sectors such as aviation, banking, insurance, telecoms and mining where statutory requirements on local ownership exist. However based on our comments above, in theory, an off-taker that is set up in Kenya could be wholly owned by non-Kenyans. For energy companies dealing in electricity at present there are no local ownership requirements.

Further, at present there are no local content requirements in the electricity production and Renewable Energy sector. A generating licence does not require local content.

2 Energy Policy – Perspectives

2.1 Which expansion targets for Renewable Energy does the government aim?

The Kenya Vision 2030 from 2007 is the country's development blueprint for the period of 2008 till 2030. It is aiming to transform Kenya into a "newly industrializing middle-income country" by the end of 2030 and aim to double Kenya's rate of growth.[9] In regard to the energy sector it realizes the same as a critical development area, which has to follow Kenya's growth and need of stable electricity. The need of separation of generation and distribution, and the exploration of Renewable Energy sources, as well as geothermal power is mandatory, as well as protecting the environment.

There are no subsidies for electricity prices in the fiscal budget, but incentives are in existence. However the Kenya Annual Budget 2017/2018 indeed mentioned Renewable Energies. A remarkable amount has been e.g. allocated for the exploitation of geothermal, wind and solar resources, which will increase the clean energy mix "cementing Kenya's position as a world leader in Renewable Energy".[10]

Although the Government's 5000+ MW program is now considered to be aspirational, it is focused on delivering new electricity generation infrastructure to eliminate the current supply deficit while also providing new generation capacity to support the Vision 2030 program; majority of which will be derived from Renewable Energy sources. This is clearly outlined in the 2013–2017 Strategic Plan for the Ministry of Energy and Petroleum which also sets the following targets:

- Installation of solar electricity generators (PV systems) in five hundred (500) off-grid public facilities/ institutions annually;
- Develop a national small hydro power atlas and 20 MW of small, mini, micro and pico hydropower from various sites;
- Install twenty (20) wind/solar hybrid generators in isolated mini grids; and
- Undertake forty (40) Investment Grade Audits and eighty (80) General Audits to reduce Energy consumption by 10-30%.

2.2 Nuclear Power Generation

We have seen the Government focusing on nuclear power generation. Our opinion however is that in respect of the Kenyan economic sector being based on agriculture, Renewable Energy sources are not only protecting the environment, but also fit better to the small and middle scale of electricity usage. Electricity can thus be used and simultaneously being generated, not to produce an amount not needed.

2.3 Feed in Tariffs

Feed in Tariffs (FiT) provide security for investors and are meant to encourage Independent Power (IPPs). The initial FiT policy that was enacted in 2008 was designed to cater only for wind energy, hydropower and bioenergy. Due to the fact, the FiT policy provides for a review latest after every three years, the first revision was undertaken in 2010 and power generated using geothermal and biogas energy has now been included. The most current revision has been undertaken in 2012 finally including solar energy. Find hereunder the current tariffs:

The FiT values for small renewable projects (up to 10 MW of installed capacity) connected to the grid

	Installed capacity (MW)	Standard FiT (US $/ kWh)	Percentage Escalable portion of the Tariff	Min. Capacity (MW)	Max. capacity (MW)
Wind	0.5-10	0.11	12%	0.5	10
Hydro*	0.5	0.105	8%	0.5	10
	10	0.0825			
Biomass	0.5-10	0.10	15%	0.5	10
Biogas	0.2-10	0.10	15%	0.2	10
Solar (Grid)	0.5-10	0.12	8%	0.5	10
Solar (Off-Grid)	0.5-10	0.20	8%	0.5	10

* For values between 0.5-10 MW, interpolation shall be applied to determine tariff for hydro.

The FiT values for renewable projects above 10 MW of installed capacity

	Installed capacity (MW)	Standard FiT (US $/ kWh)	Percentage Escalable portion of the Tariff	Min. Capacity (MW)	Max. capacity (MW)	Max. Cumulative capacity
Wind	10.1-50	0.11	12%	10.1	50	500
Geothermal	35-70	0.088	20% for first 12 years an 15% after	35	70	500
Hydro	10.1-20	0.0825	8%	10.1	20	200
Biomass	10.1-40	0.10	15%	10.1	40	200
Solar (Grid)	10.1-40	0.12	12%	10.1	40	100

FiT guarantee a Power Purchase Agreement (PPA) with Kenya Power, which are approved and granted by the Energy Regulatory Commission (ERC), regulating a fixed tariff structure for both parties for a period of twenty (20) years. The grid system operator, for now KPLC, has to guarantee connection, purchase, transmission and distribution for the listed sources. Prior to the agreement, every IPP has to undertake a feasibility assessment conducted by the Ministry of Energy and Petroleum[11]

2.4 Subsidies for electricity prices

In order to meet the growing energy needs of its citizens, government funds research and innovation of new technologies to improve electricity access. It actively pursues new local and international technologies to expand and upgrade the transmission and distribution networks as well as promote the transition to a renewable based energy system to the citizens mainly through zero rating of energy efficient technology to make it more available to citizens and through increased availability of renewable energy sources at subsidized prices.[12]

2.5 Tax benefits

A recent incentive was published under *Legal Notice 165 of 2015* provided that payments made to non-residents for services rendered under a PPA shall be exempt from tax. This relates to withholding tax on any payments to such non-residents. Other tax incentives include:

- Exclusion from payment of customs duties on equipment used in electricity generation stations;
- Exemptions from the payment of VAT on equipment used in electricity generation stations;
- Low rates of taxes on dividends;
- Interest paid on loan from foreign sources for investing in Renewable Energy is exempted from tax; and
- Capital allowances are granted on investment asset.

Kenya is a very interesting market for German companies due to
- the early established double taxation agreement
- and the Treaty on the Encouragement and Reciprocal Protection of Investments.

2.6 Paris Agreement

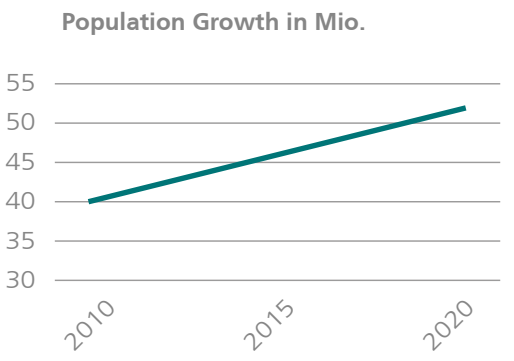
The Paris Agreement entered into force on 4th November 2016 and has entered into force in Kenya on 27th January 2017 after ratification on 28th December 1016. The Kenyan Government participated in the Conference on Climate Change in Morocco, which targeted the implementation of the Agreement by 2018.[13] Kenya as well has a National Climate Change Action Plan (2013-2017).

The overall goal of the Paris Agreement is to commit to a global peak of emissions. Kenya thereby commits to consent to the agreement. The Paris Agreement includes provisions for mitigation, adaptation, loss and damage, carbon trading, finance, technology and enhanced capacity building frameworks, and transparency.[14]

3 Renewable Energy – Market – Opportunity

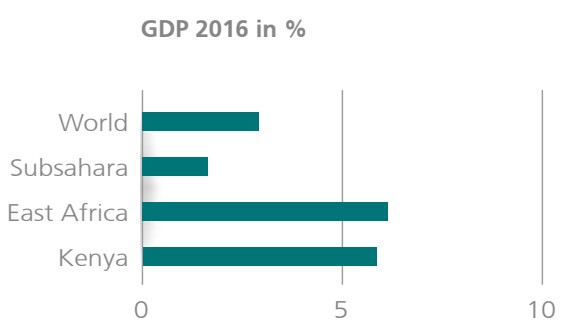
3.1 Economic development in Kenya

According to the World Bank, the population of Kenya is increasing drastically at around 30% from 2015 till 2030.[15]



As to the Kenyan Urbanization Review, Kenya is urbanizing rapidly but is described as under-urbanized. The estimation is that in 2030 40% will be living in urban areas. In 2010, 23% have access to electricity, 57% in urban areas and 9% in rural areas.[16]

Kenya's real Gross Domestic Product (GDP) maintained its growth rate for the third consecutive year, rising up to estimated 6.1 in 2019[17]



The Contribution to the GDP of Electricity Supply has been rising continuously.

2012[18]	2013	2014	2015	2016 (estimate)
1.1	1.1	1.0	1.4	1.7

Kenya is developing towards becoming a promising investment location. These changes have not gone unnoticed as Kenya ranked 92 of 190 in the latest World Bank ease of doing business index. Kenya's level in the 'Corruption Perception Index' published by Transparency International stays at 26 out of 100. The inflation rate is at 6.99 in January 2017 as to the Kenyan National Bureau pf Statistics (KNBS). The number of Environmental Impact Assessments (EIAs) in the energy sector has been estimated to have increased 164% from 2012 till 2016, being a requirement for Power Purchase Agreements (PPAs).[19]

3.2 Trend of electricity demand in Kenya

As to the Economic Survey 2017, the total generation, including imports, has been 9514.6 GWh in 2015, 85% being from hydro, geothermal and wind. The total domestic demand has been recorded at 7826.4 GWh with large and medium commercial and industrial customers accounting for 51% and domestic and small commercial consumers at 42% and others at 6.4%. Total imports from Uganda and Tanzania came up to 0.6%, decreasing by 37% in comparison to 2014. Interestingly, under the Rural Electrification Programme (RP) 972018 customers were connected.[20]

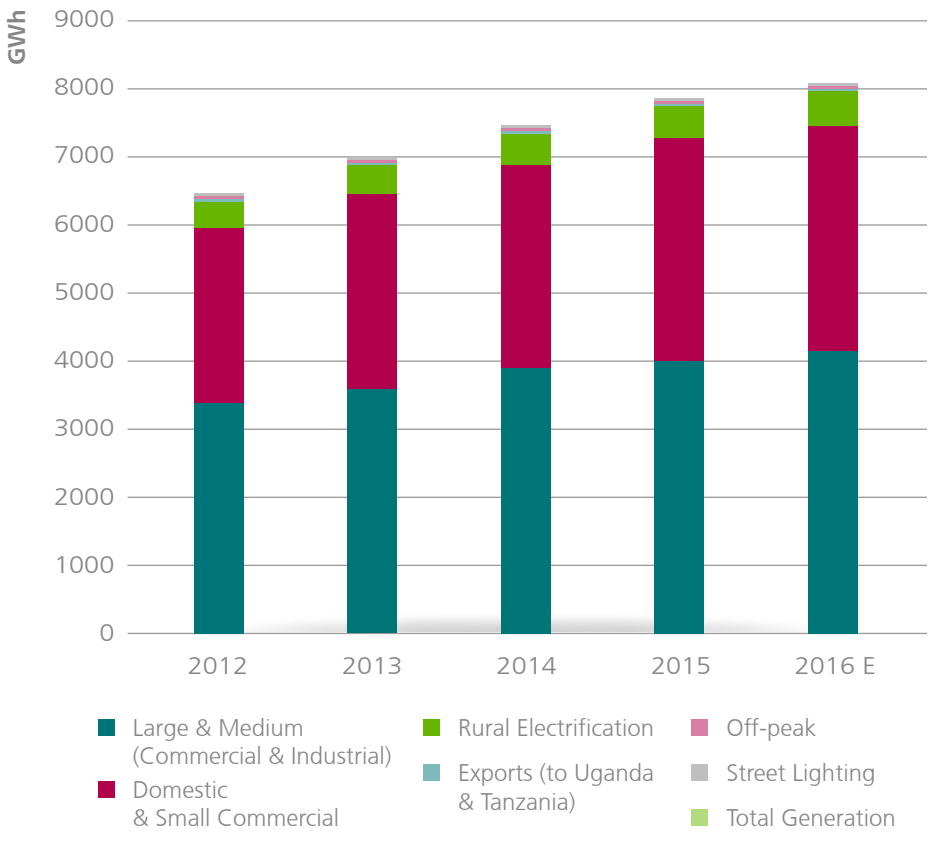


Figure 1: Electicity Demand

3.3 Land

One of the major sectors, that the Constitution of Kenya 2010 of Kenya sets out to revolutionize, is the land sector. The Constitution guarantees the security of land rights by land owners as follows:

- Every person (citizen and non-citizen alike) has the right to acquire property in Kenya; and
- Parliament is prohibited from enacting any law that would arbitrarily deprive a person of their interest in or over property.

Article 65 of the Constitution restricts ownership of land by non-citizens in that they can only hold land on leasehold tenure and the lease period cannot exceed 99 years. Leases for periods over 99 years that had been issued before the Constitution came into force are deemed to be for periods of 99 years. For the purposes of this provision every company that is not wholly owned by Kenyan citizens is regarded as a foreign company.

On the expiry of a lease granted to a non-citizen, the interests or rights over the land shall vest in the national or county government and, unlike citizens, non-citzens will not have a first right of pre-emption but may nonetheless apply for an extension. Any subleases or charges granted by the non-citizens would be extinguished at the expiry of the term.

3.4 Opportunities

As a conclusion the electricity demand in Kenya is increasing and regular shortfalls do not want to be accepted. Therefore the full value chain allows a progressive market entry, except for transmission and distribution. A Joint Venture is not necessary or advisable. This leads to the conclusion of the best chances of success can be predicted for component suppliers and project development companies.

All types of technologies are highly likely to be successful, except maybe for hydro energy due to unpredictable challenges given droughts from time to time. We expect to see the highest growth rates in the solar energy, especially for PVs.

3.5 Investors

National and international banks operate as sponsors and lenders in Kenya. As explained above, the public sector, being Kenya Power and KENGEN invest in Renewable Energy through channels of grant, debt, equity etc. It can be noted that there are no special requirements for the participation in auctions.

There are however, several independent funding organization, such as Access Infra Africa Fund, DI Frontier Market Energy & Carbon Fund, Africa Clean Energy and Finance Center and several more just to name a few.

4 Pitfalls

The main challenges the policy faces is that growth in installed capacity is not matching demand, mainly due to delays in implementation. Secondly, the strict requirement by lenders for payment guarantees further slows down the investments. Other challenges such as frequent weather variability from hydrological sources; inadequate human capacity; community compensation and benefit sharing as well as national and county government revenue sharing; amongst others continue to hinder the fast growth of investments. This includes political and corruption issues, as well as inefficiencies and bureaucracy.

To address some of the challenges, the government has put in place a number of incentives in the policy, which are:[21]

- Waiver of duty on power generation equipment imported into the country;
- Government offering letters of Comfort to IPPs in order to facilitate securing of funding for Operators;
- Periodic resource assessment by the government and conducting of feasibility studies for availing to the private sector; and
- Provision of tax holidays to attract investments in Renewable Energy.

5 Conclusion

Kenya's electricity market provides a sound enabling environment for investment. The energy market offers independent regulation, cost-reflective tariffs, and a functional market design that is favorable for investors.

Kenya Power is partially owned by private investors and is one of the continent's most financially viable distribution & supply companies. Kenya Power operates profitably, provides transparent financial reporting, and has not been late on any energy payments for six years;

Kenya Power's financial stability and access to capital markets allows investors to invest without reliance on sovereign guarantees, although independent power producers ("IPPs") require a letter of support from the government that covers political risk in order to obtain financing for projects. The Government usually issues the letters to the IPPs and their lenders to facilitate the financing of projects using World Bank support.

Kenya recognizes the importance of creating a sustainable environment conducive to inward Foreign Direct Investment (FDI) and has developed an enabling framework:

- The Kenyan shilling has a floating exchange rate and is able to be freely traded;
- There are no restrictions on borrowing by foreign companies;
- Foreign and domestic companies may open foreign currency accounts in local banks;
- Kenya has lowered or eliminated tax duties to attract investment;
- Guaranteed capital repatriation & dividend and interest remittance by foreign investors;
- Kenyan law provides protection against the illegal expropriation of private property;
- Kenya is a signatory to the UNCITRAL and ICSID dispute resolution conventions; and
- Both Standard & Poor's and Fitch Group have provided Kenya with a long term sovereign credit rating of "B+"

Further, we noted that there is indeed an interest by foreign companies in regard to Mergers & Acquisitions with local companies. These amongst others is Yingli Green Energy Europe GmbH.

6 Contact Person

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Kenya
Interview with Michael Derus und Ali Maani

Michael Derus, Deputy Head of Mission and Head of the Economic Section, EMBASSY OF THE FEDERAL REPUBLIC OF GERMANY

Being a lawyer by training, Michael Derus has been working as a diplomat in the German Foreign Service for almost thirty years. Since August 2015 he is the Deputy Head of Mission and Head of Economic Affairs of the German Embassy in Nairobi. He previously held the position of Consul General of the Federal Republic of Germany in Lagos, Nigeria. Former bilateral assignments brought him to Brazil, Mozambique and Serbia. He also served in various other fields of international relations, inter alia as Political Counsellor at the Permanent Representation of Germany to the European Union, as Deputy Director for Nuclear Disarmament, Arms Control and Non-Proliferation and as Director for International Treaty Law in the German Foreign Office in Berlin.

Ali Maani, Electrical Engineer, Power systems

Eduction & Honors:

- Ranked 4 among 500000 participants in nation wide university entrance exam, 2003.
- Bsc of Electrical Engineering, Power Systems, Sharif University of Tech, Score: 3.85/4, 2007.
- Best Bsc thesis in Sharif University of Tech, 2007.
- Ranked 1 participants in Buiseness idea festival, Sharif University of Tech., 2007.
- Selected as an „Exceptional Talent" by the Iran National Exceptional Talents, 2003.
- Registered Electrical Engineer in Tehran Building Engineers Organization, Deg 2.
- Best expert at Ministry of Energy, 2012.
- Risk Assessment registered expert, Iran Central Insurance, 2013.

Expriences:

- Pars Niroo Group, Directing Manager, 2015 - Present.
- Zabol Wind farm, 50 MW.
- Lootak Wind farm, 12 MW.
- 2 CHP Power plants, each 25 MW Capacity in Mazandaran/Golestan.
- Ministry of Energy, Niroo Research Inst., DG/CHP working group, Head, 2012-2014.
- Distributed Generation Master plan in Tehran distribution network.
- 4 DG Power plants each 23 MW Capacity in Kerman.
- Renewable Energies masterplan in Iran, Tavanir, SUNA.
- Kahak Wind farm developments, 100 MW, Mapna.
- Solar Power plant 1 MW Capacity in Arak.
- Ministry of Energy, Privatization department, Expert, 2008-2012.
- Iran power generation & distribution, privatization planning.
- Development of Iran Natioanal Center for DG/CHP administration.
- Agent of Ministry of Energy, Iran Foreign Investment Organization (FIPPA), 2012-2014.

Publications:

- 40 papers on Domestic Conferences, Ministry of Energy.
- 6 Papers on "Economic World" Newspaper, Iran best economic newspaper.
- 1 ISI Journal Paper, European Transaction on Electric Power (ETEP).

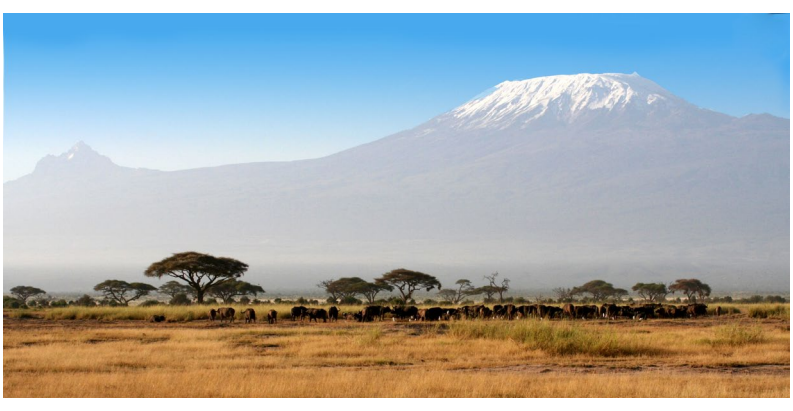
Does the Kenyan legislation support foreign investors in the energy branch?

Foreign investment is key for Kenya's goal to advance in the field of energy supply. We have seen very ambitious plans however a number of challenges are lying ahead. Foreign investment is promoted through policies and programs, i.e. the Scaling Up Renewable Energy Program in cooperation with the World Bank is pushing investment in Kenya's renewable energy transformation. The Feed-in-Tariffs (FiT) policy has also shown investment effects such as the first grid-connected biogas plant in Africa by German investment (Naivasha). A reliable legislative framework remains essential to attract further foreign investment.

In your opinion, will the Paris Agreement benefit Kenya's economy?

Definitely. Kenya is extremely exposed to the adverse impacts of climate change, which has manifested itself in the drought. Hence, the faster the global community moves towards a decarbonized future, the better for Kenya. Furthermore, I believe that greening Kenya's own industrialization path could also boost its economic growth.

First of all, Kenya already is a champion in the field of clean energy, but will have to add considerable additional energy capacity to satisfy its growing demand and to electrify rural areas. Furthermore, the drought has brought hydro power production levels down and changing weather patterns will continue to challenge Kenya's ability to supply most of its electricity from hydro power. Hence, considerable investment is required in the energy sector over the coming years. In this endeavor, Kenya has the opportunity to benefit from renewable energy solutions at economically viable prices. In many cases, renewable energy technologies are now cheaper than oil, gas and even coal. Therefore renewable energy solutions could be favorable. Especially off-grid solutions such as solar power and biogas offer green alternatives to help achieve rural electrification. If combined with targeted educational measures particularly in the field of Technical and Vocational Training, Kenya could increase the share of local value creation through investing in renewable energy technologies.



Also in other sectors, the Kenyan economy can greatly benefit from the Paris Agreement. Sustainable transport solutions such as safe and clean mass rapid transport could not only boost productivity by reducing the amount of hours spent in traffic, but significantly reduce air pollution. Last but not least, ambitious climate action will safeguard Kenya's biodiversity and ecosystems, and create more jobs and income from eco-tourism.

What has the Kenyan Government achieved on improving the economic surrounding in regard to energy?

The Government of Kenya has already done a lot in that field. The future decisions on energy policy will have to include other important aspects: the price for electricity and the energy supply security. Both are not only important for households but also for economic actors.

Is the Ministry of Energy & Petroleum active in achieving projects?

We welcome increased investment in renewables and hope that the policy framework for the Third Medium Term Plan (2018-2022) will reflect the positive outlook for future renewable energy development in Kenya. Germany as the country of the "Energiewende" is convinced that technologies such as coal and nuclear power plants will be obsolete in the coming decades.

Will the G20 Summit come with changes for Kenya?

The potential of Kenya with its stable economic outlook and young aspiring population is very high. Thus, Kenya is one of the pillar countries in Africa and an important economic partner. Apart from initiatives targeted at further economic growth in Sub-Sahara Africa, Kenya will definitely profit from the G20 Summit's commitment towards free trade.

We understand that KPLC has to contract with anyone who fulfills the requirements for a PPA. Is this correct and how do you rate the danger of being solely depended on a governmental institution.

In Germany we experienced that a competitive market is conducive to offer the best energy solutions and distribution. Private customers and the economy as a whole have profited from privatization through lower electricity bills.

How would you value the stability of the Kenyan economy in the near future?

Kenya's economic outlook has been stable over the past years. The fact that the elections in August 2017 were held peacefully is an important step if you want to keep up the interest of foreign investors in the country.

What would you like to be a change in near future?

Good governance is a precondition not only for attracting investment but also for economic growth. I am convinced that Kenya can still make headway in this field and I think that also the new government will continue to make this a priority.

Last, but not least, Kenya amongst other countries, such as South Africa, discuss building several nuclear power plants in the next five years. Is this a chance or a risk for Kenya?

Germany due to the high financial and social burden, in particular with regard to management and storage of nuclear waste, has decided to completely step out of the civil use of nuclear energy. I doubt that, against the backdrop of other challenges like youth employment and drought resilience, it would be economically prudent to invest a big chunk of the national budget of Kenya into the development of a technology which might be obsolete when it stands ready to be fed into the grid. As Kenya has optimal conditions for the use of sustainable and green sources of energy, the country also in this field could prove once more its outstanding capacity of leapfrogging and skip the nuclear age.

Mexico

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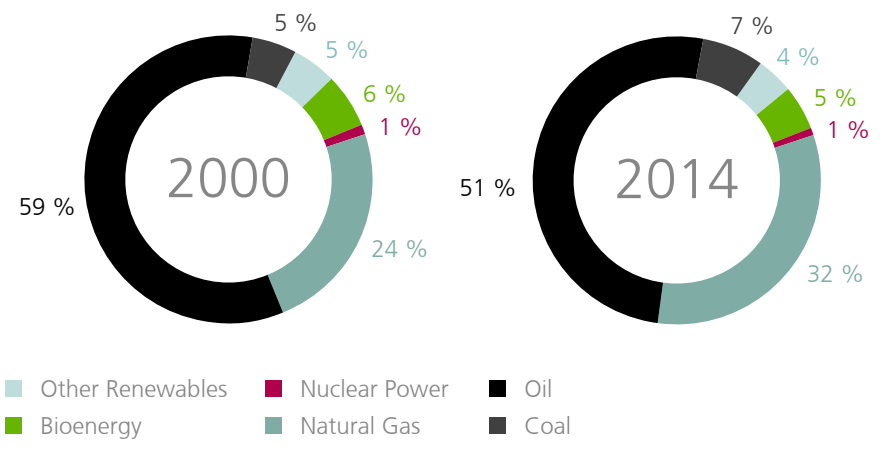
List of Acronyms

CEL	Certificados de Energías Limpias
CENACE	Centro National de Control de Energía
CFE	Comisión Federal de Electricidad
CHP	Combined Heat and Power
CRE	Comisión Reguladora de Energía
DAC	Doméstica de Alto Consumo
MEM	Mercado Eléctrico Mayorista
PEMEX	Petróleos Mexicanos
SENER	Secretariat of Energy

1 Energy Market – Status Quo

1.1 Energy Mix[1]

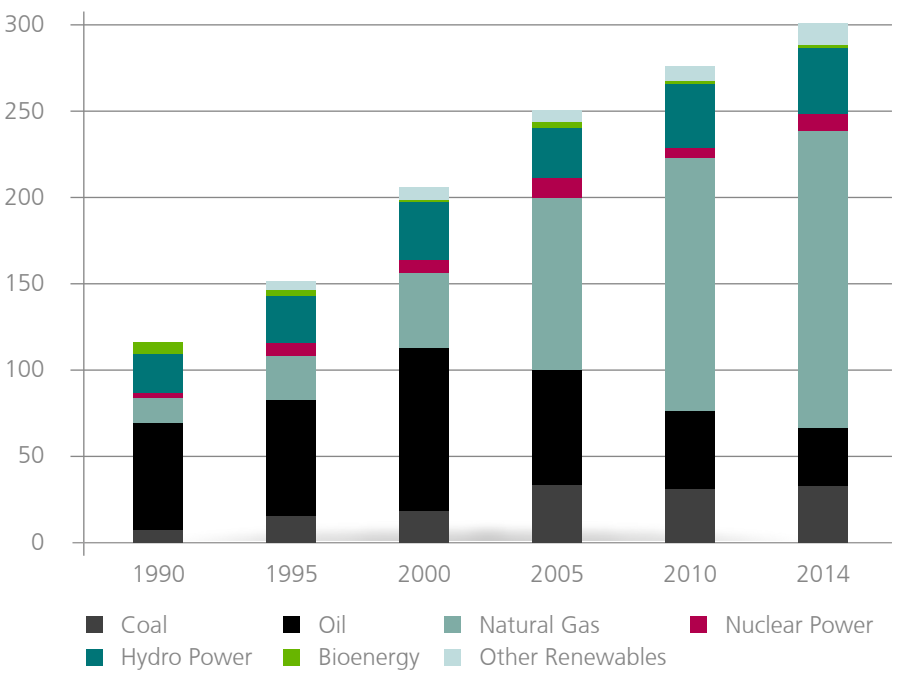
Energy Consumption by Technology



Since 2000, primary energy demand has increased by approx. 25% which corresponds to the economic growth for the same period. Fossil fuels continue to dominate the energy mix. Over the last 2 decades, oil, natural gas and coal together made up approx. 90% on average. Of this, oil accounts for more than half. Although its share fell to 51% between 2000 and 2014, this is still one of the highest figures in the world. By comparison, in the Middle East, the share of oil is 48%. Natural gas consumption has increased by more than 70% since 2000. The reasons for this are increased demand for natural gas for electricity generation, industry demand and cheap natural gas imports from the US due to the shale gas boom.

Although the proportional share of energy consumption of renewables fell to approx. 8.5% by 2014, approx. 14% of the electricity used in Mexico today comes from sources of renewable energy. This demand for electricity more than doubled over the last 20 years and made up 18% of total energy consumption in 2014, slightly below the OECD average of 22%. In addition, more than 99% of the population have access to electricity. Natural gas dominates electricity generation and provides more than 50% of the total electricity supply. In 2015, 19 GW of the entire electricity generation capacity of 70 GW were attributed to non-fossil sources. The largest share of non-fossil sources came from hydropower. The split in installed capacity is reflected in the yearly power production. As seen in the figure below, the fossil sources produces more than 70% of the electricity.

Electricity Generation by Technology



1.2 Energy Sector Players

The Comisión Federal de Electricidad (CFE) is a state-owned company which, prior to the 2013 energy reforms, enjoyed a monopoly on the transfer, supply and distribution of electricity. This led to inefficiency and drove up costs.[2]

1.3 Electricity Prices

In Mexico, electricity prices[3] are partly subsidized so that these prices do not reflect the actual costs of electricity production. The difference is covered by the state-owned company CFE. The costs incurred through these subsidies amounted to USD 6 billion in 2014.

Apart from subsidized electricity prices for private households and farms, electricity prices in Mexico are comparatively high. On average, electricity prices for commercial users and non-subsidized private households are about 25% higher than in the US or Canada.[4] Non-subsidized households are households with high rates of electricity consumption. They have to pay the doméstica de alto consumo (DAC) rate. This rate is not subsidized and significantly more expensive than regular household rates. Through this progressive price structure, Mexico is trying to create incentives for low electricity consumption. Industrial consumers also have to acquire a one-time subscription right for new connections which is determined by the required supply. For example, a connection for 1000 KVA will require a one-time payment of approx. USD 85000.00.

In addition to electricity consumption, the cost of electricity is also determined by the region in which the consumer is located. Regions are grouped by average temperatures in summer and divided into categories 1, 1A, 1B, 1C, 1D, 1E and 1F. Category 1 is the general household rate and 1F is the rate for regions with the highest average temperatures. Specifically, this means that regions in category 1F have average temperatures of at least 33 °C.

House-hold Rate	Household Rates for Communities in Very Warm Regions					
1	1A	1B	1C	1D	1E	1F
< 25 °C	25 °C ≤ T < 28 °C	28 °C ≤ T < 30 °C	30 °C ≤ T < 31 °C	31 °C ≤ T < 32 °C	32 °C ≤ T < 33 °C	≥ 33 °C

The higher the temperature, the greater the subsidies and the cheaper the electricity. Lower costs are due to lower variable electricity costs and the thresholds that define lower, medium and high consumption being much further apart. In this case, this means that, while under Rate 1, medium consumption only requires consumption of 76 kWh per month for users to pay higher prices, under Rate 1F, medium consumption will only be achieved after consuming 301 kWh per month.

Rate 1			
Electricity Consumption (kWh per Month)	Rate (Mex$/kWh)	Rate (EUR/kWh)	Upper Large Consumer Limit (kWh per Month)
niedrig (1–75) mittel (76–140) hoch (>140)	0.793 0.956 2.802	0.038 0.045 0.133	250

Rate 1F (Summer Season)			
Electricity Consumption (kWh per Month)	Tarif (Mex$/kWh)	Tarif (EUR/kWh)	Upper Large Consumer Limit (kWh per Month)
niedrig (1–300) mittel (301–1200) mittel-hoch (1200–2500) hoch (> 2500)	0.583 0.762 1.768 2.802	0.028 0.036 0.084 0.133	2500

Rate 1F (outside of the Summer Season)			
Electricity Consumption (kWh per Month)	Tarif (Mex$/kWh)	Tarif (EUR/kWh)	Upper Large Consumer Limit (kWh per Month)
niedrig (1–75) mittel (76–140) hoch (>140)	0.793 0.956 2.802	0.038 0.045 0.133	2500

There are substantial differences between the normal rates for private households and the rates for private households with high consumption (DAC). Under normal rates, consumers pay approx. EUR 0.03 to EUR 13 per kWh.[5] Under the DAC rate, a fixed amount of approx. EUR 4.7 is due per month to which the variable costs which lie between EUR 0.17 and EUR 0.22 per kWh will then be added.

Rates of Large Consumers (DAC)						
Region	Fixed Rate (Mex$ per Month)	Fixed Rate (Mex$ per Month)	Rate (Mex$/kWh)		Rate (EUR/kWh)	
Center	98.86	4.692	4.348		0.206	
North West	98.86	4.692	4.071		0.193	
North and Northeast	98.86	4.692	3.971		0.188	
South and Peninsula	98.86	4.692	4.032		0.191	
			Summer	Non-Summer	Summer	Non-Summer
Baja California	98.86	4.692	4.225	3629	0.201	0.172
Baja California Sur	98.86	4.692	4.605	3629	0.219	0.172

Unlike electricity prices for agricultural and private users (except for DAC), rates for industry and trade are not subsidized. Their prices cover the costs for energy generation.

1.4 Transmission and Supply Network

Mexico's power grid is divided into 7 connected and 3 isolated regions (Baja California, Baja California Sur and Mulegé-Santa Rosalía). The different climatic conditions within Mexico lead to different requirements and peak times.[6]

Mexico is planning to expand its transmission grid, which was 104000 km long in 2014, to 132000 km by 2030.[7] This transmission grid expansion will allow the share of renewable energy to continue to increase in the energy mix. For example, although the region around Baja California has a large potential for wind, solar and geothermal energy production, it is not connected to the main power grid. Moreover, the supply grid would also have to be extended and modernized to both meet increasing demand for electricity and reduce grid failures.

1.5 Market Design

Under the merit order, prices for the forms of energy with the lowest marginal costs are first set for the national electricity grid on the Mercado Eléctrico Mayorista (MEM), the Mexican electricity market. The final bid price is the marginal cost price of the last provider who set costs. Power plants that create clean energy usually have lower marginal costs than plants that use fossil fuels to produce energy. This may lead to a preference for the environmentally friendly option of the Centro National de Control de Energía (CENACE), the energy regulation commission.[8]

2 Energy Policy – Perspectives

2.1 Mexico's 2013 Energy Reforms

In 2013, extensive energy reforms (reforma energética) were introduced that ended the structures that characterized the oil, gas and electricity sector for more than 80 years. By liberalizing the energy market, the monopoly of the 2 government-owned companies PEMEX and CFE was abolished.[9, 10]

These energy reforms allowed private investors to invest along the energy value chain and introduce new technologies to the sector in addition to capital. Previously, the options of private market participants for producing electricity were limited. Independent power producers had to sell the electricity they produced to the CFE via long-term purchase contracts. However, the reforms allowed large industrial electricity clients to ensure their supplies through long-term supply contracts with private power producers. From the outset, the reforms included the promotion of clean energy. Clean energy is defined by the government as renewable energy, nuclear energy, energy from highly efficient CHP plants and energy generated from waste and thermal power plants with carbon capture and storage processes.

As part of the reforms, the CFE was legally broken up by separating the grid business from electricity generation. The CFE now has a number of subsidiaries with different managements who compete both against each other and with private market participants. This was done to increase the productivity and efficiency of the CFE group. It is also possible for CFE's ownership share to drop by 51% because of these subsidiaries.

Although the supply and transmission grid continues to be operated by the government as a subsidiary of the CFE, private companies may invest in, expand, manage and maintain the grid with the permission of the Secretariat of Energy (SENER), the ministry of energy. In addition, the Comisión Reguladora de Energía (CRE) ensures non-discriminatory access to the grid for all market participants. This state-owned energy regulatory commission also sets energy prices.

In 2016, the first Mexican energy sector auctions were held. At these 2 auctions in March and September, long-term contracts for energy and capacities were auctioned. These power purchasing agreements guaranteed specific rates for each unit that is produced for the entire duration of the project. The duration of both agreements is 15 years. No generating technologies are given preferential treatment at these auctions. Instead, the buyer, the CFE, determines the technology-neutral criteria for energy, capacities and clean energy certificates.

There were 18 successful bids by 11 companies at the first auction and 57 successful bids by 23 companies at the second auction. The results can be seen as the direction in which the Mexican electricity market is moving. At both auctions, projects that included wind and solar power won nearly every contract. The auction also proved to be very effective in setting low costs for renewable energies for the power grid.

As part of the energy reforms, a number of market instruments were introduced to increase the attractiveness of investments in the electricity sector. These are measures that will help investors plan for the long term:

- Establishment of a capacity market that will ensure the needed electricity capacities
- Introduction of environmental certificates: Certificados de Energías Limpias (CEL)

2.2 Certificados de Energías Limpias

For every megawatt hour of clean energy, power plants receive a CEL which they can sell. This provides another source of income for clean energy producers. Furthermore, large electricity consumers must obtain a certain percentage of the energy they consume from environmentally friendly sources. To prove their compliance with this percentage, these consumers have to purchase the number of CELs determined by the department of energy. This creates a CEL market. These certificates are used to ensure further expansion of electricity production via clean energy.[11]

2.3 Paris Agreement

Although Mexico possesses immense oil and natural gas reserves and is the world's 10th largest oil and natural gas producer, it is one of the leading proponents of sustainable economic growth that has already integrated climate aims into its policies.

Mexico was also one of the first countries to agree to climate protection measures prior to COP21 by, among other things, setting emissions reduction targets of 25% by 2030. Mexico ratified the Paris Agreement on 21 September 2016, which entered into effect on 4 November 2016. In addition, Mexico was the second country in the world to subject itself to binding climate targets.

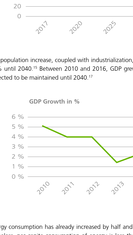
Mexico's other climate objectives are:

- Increase the share of clean energy in electricity production
  - to 25% by 2018,
  - to 30% by 2021,
  - to 35% by 2024,
  - to 40% by 2035
- Reduce greenhouse gas and soot emissions by 22% and 51% by 2030

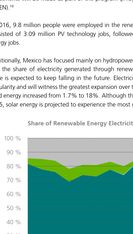
3 Renewable Energies – Market – Chances

3.1 Electricity Demand

The Mexican population is expected to grow to approx. 157.8 million people by 2040, an increase of 21%. Furthermore, rising incomes, a growing middle class and urbanization will continue to increase demand for electricity.[14]



The population increase, coupled with industrialization, will lead to demand for electricity to grow by 85% until 2040.[15] Between 2010 and 2016, GDP grew by 3.1% per year on average.[16] This rate is expected to be maintained until 2040.[17]



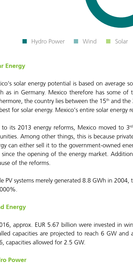
Energy consumption has already increased by half and energy demand by a quarter since 2000. Nonetheless, per capita consumption of energy is less than 40% of the OECD average. This highlights the large potential for growth in this sector. To meet demand and keep electricity prices stable, Mexico will require approx. USD 10 billion per year for investments. Therefore, the 2013 energy reforms are of great significance for Mexico because they not only make the points addressed possible, but also strive for private investments.[18]

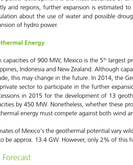
3.2 Renewable Energies

Mexico plans to invest approx. EUR 79.2 billion into the energy sector by 2031. Of this, EUR 59.4 billion, i.e. 75%, will be used for the development and generation of clean energy. While EUR 2.35 billion will be invested in clean energy in 2017, only EUR 1.6 billion will be used for conventional energy. These investments will be made as part of the program „Programa de Desarollo del Sector Eléctrico" (PRODESEN).[19]

In 2016, 9.8 million people were employed in the renewable energy sector. Of this, the largest share consisted of 3.09 million PV technology jobs, followed by 1.7 million biofuel and 1.2 million wind energy jobs.

Traditionally, Mexico has focused mainly on hydropower for renewable energy. During the last 2 decades, the share of electricity generated through renewable energy was at least 60%. However, this share is expected to keep falling in the future. Electricity from wind and solar energy is increasing in popularity and will witness the greatest expansion over the next years. From 2008 to 2015, the share of wind energy increased from 1.7% to 18%. Although the share of solar energy was only approx. 1% in 2015, solar energy is projected to experience the most growth due to the excellent conditions for it.[20]





Solar Energy

Mexico's solar energy potential is based on average solar radiation of 5.5 kWh/m², which is twice as much as in Germany. Mexico therefore has some of the highest solar radiation levels in the world. Furthermore, the country lies between the 15° and the 35° parallel which is generally considered to be the best for solar energy. Mexico's entire solar energy resources are estimated to be 5000 GW.

Due to its 2013 energy reforms, Mexico moved to 3rd in the world for solar energy investment opportunities. Among other things, this is because private individuals and companies that produce solar energy can either sell it to the government-owned energy supplier CFE or feed it directly into the grid ever since the opening of the energy market. Additional investments of EUR 67 million are expected because of the reforms.

While PV systems merely generated 8.8 GWh in 2004, they produced 190.3 GWh in 2015, an increase of 2000%.

Wind Energy

In 2016, approx. EUR 5.67 billion were invested in wind energy. This is expected to double by 2018. Installed capacities are projected to reach 6 GW and are predicted to grow by 350% until 2030. In 2016, capacities allowed for 2.5 GW.

Hydro Power

With capacities of 12.5 GW and a share of 75% of the electricity generated through renewable energy, hydro power development is the most advanced of all renewable energies. However, due to Mexico's mostly arid regions, further expansion is estimated to be limited.[21] In addition, concerns among the population about the use of water and possible droughts as well as local opposition may hinder the expansion of hydro power.

Geothermal Energy

With capacities of 900 MW, Mexico is the 5th largest producer of geothermal energy after the US, the Philippines, Indonesia and New Zealand. Although capacities remained largely unchanged over the last decade, this may change in the future. In 2014, the Geothermal Energy Law was passed which allows the private sector to participate in the further expansion. In addition, the ministry of energy granted concessions in 2015 for the development of 13 geothermal locations which could increase installed capacities by 450 MW. Nonetheless, whether these projects can be realized remains to be seen, since geothermal energy must compete against both wind and solar energy.

Estimates of Mexico's the geothermal potential vary wildly. The Mexican government assesses its potential to be approx. 13.4 GW. However, only 2% of this has been proved.

3.3 Forecast

Energy

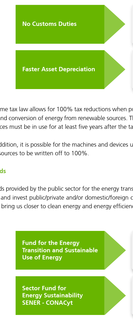
The share of renewable energy for total energy consumption is expected to increase from 9% in 2014 to 14% in 2040. Despite this increase, fossil fuels will continue to be the main source of energy with an expected share of 83% in 2040.[22, 23]

Electricity

Unlike in the energy mix, the share of carbon-based generating forms is declining more strongly in the electricity mix. By 2040, capacities for renewable energies are expected to increase from 25% to 46%.

3.4 Incentives for Renewable Energies

Beneficial terms are offered for generating and consuming energy from clean sources. The tax and financial incentives are summarized by the following chart: [24]



Tax Relief

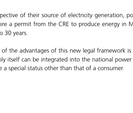
Please note that officials in different regions may offer additional benefits for project realization.

Income tax law allows for 100% tax reductions when purchasing machines or devices for the production and conversion of energy from renewable sources. The only requirement is that these machines and devices must be in use for at least five years after the tax deduction.

In addition, it is possible for the machines and devices used for the generation of energy from renewable sources to be written off to 100%.

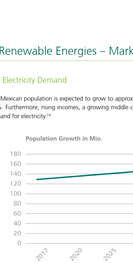
Funds

Funds provided by the public sector for the energy transition and sustainable use of energy seek to obtain and invest public/private and/or domestic/foreign capital. This will support projects and programs that bring us closer to clean energy and energy efficiency.



Financing

The financing provided by the Mexican government, including tax offices, for the development of energy projects are the following:



Regulations

Irrespective of their source of electricity generation, power plants with capacities of at least 0.5 MW require a permit from the CRE to produce energy in Mexico. Energy production permits are valid for up to 30 years.

One of the advantages of this new legal framework is that the excess energy produced by a plant to supply itself can be integrated into the national power grid and sold. To do this, the company will require a special status other than that of a consumer.

4 Pitfalls

Land disputes, especially with indigenous peoples, present an obstacle for the further expansion of renewable energies. For example, wind power projects in the South of Mexico had to be cancelled because the interests of the local indigenous peoples were not sufficiently considered. Information, leases and compensation were withheld from the indigenous peoples.[25]

Corruption represents an enormous risk for companies in Mexico. Bribery is wide-spread among the justice system, the police and in bureaucratic processes for companies. This may lead to long waiting periods and high costs for corporate registrations. In 2016, Mexico ranked 123rd in the corruption perception index, a position it shared, among other nations, with Sierra Leone, Azerbaijan and Honduras. By comparison, Germany ranked at Number 10 and Italy at Number 60.[26]

5 Selection of Funding for Projects in Mexico

› Clean Technology Fund (Climate Investment Fund)

The Clean Technology Fund with assets of USD 5.8 billion supports developing and industrializing nations by granting resources for upgrading to low-carbon technologies (renewable energies, energy efficiency and clean transportation). These technologies are supposed to reduce greenhouse gas emissions in the long term.

› Climate Partnerships for Businesses [27]

Through its „Climate Partnerships for Businesses," the German Investment and Development Corporation (DEG) promotes transfers of technology and knowhow to support the development of a climate-friendly economy. For this, the program promotes private sector projects that support the introduction of climate-friendly technologies, adjust proven greenhouse gas reduction technologies to specific conditions in target countries or demonstrate the applications of innovative technologies and create structures for the use of climate-friendly energies.

› develoPPP.de [28]

The German Federal Ministry for Economic Cooperation and Development (BMZ) uses develoPPP.de to promote companies that are active in developing and industrializing nations and want their entrepreneurial contributions to be sustainable. German and European companies as well as companies in developing or industrializing nations for which companies registered in the EU or European citizens hold at least 25% of shares may participate. Through develoPPP.de, the German Investment and Development Corporation will cover up to 50% of a project's costs, though no more than EUR 200000.

› IRENA/ADFD Project Facility [29]

IRENA and the Abu Dhabi Fund for Development (ADFD) have created a program for financing renewable energy projects in developing countries. While IRENA is responsible for searching for and selecting projects, the ADFD offers beneficial loans of EUR 350 million in total for 7 years.

› Latin America Investment Facility (LAIF) [30]

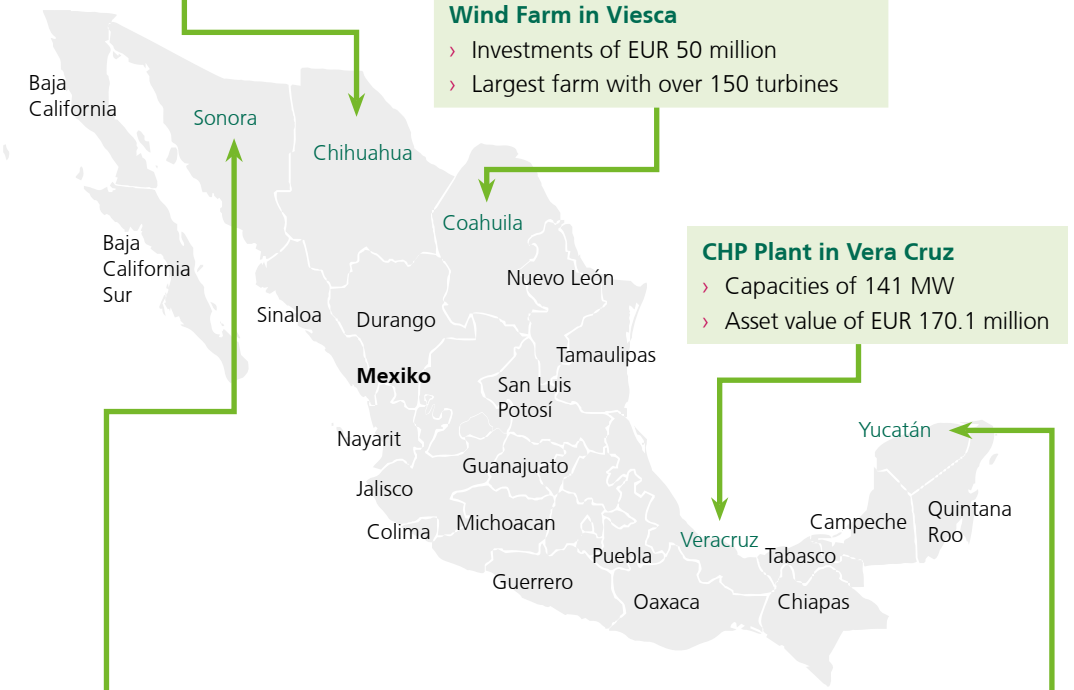
Funding is mobilized through a combination of EU development subsidies and loans from other financing sources, e.g., European and regional banks. LAIF aims to help Latin American countries finance infrastructure projects in the sectors of transportation, energy, environment and social affairs and the private sector.

6 Selection of Renewable Energy Projects

Open-Field PV Plant
- Estimated Output 80 MW
- Annuak production of 183.8 GWh

Wind Farm in Viesca
- Investments of EUR 50 million
- Largest farm with over 150 turbines

CHP Plant in Vera Cruz
- Capacities of 141 MW
- Asset value of EUR 170.1 million



Open-Field PV Plant
- Expansion to 270 MW
- Investment costs of approx. EUR 300 million
- Commissioning in 2019
- Supply of approx. 500 households

Wind Farm in Dzilam de Bravo
- Capacities of 60 MW
- Investment costs of approx. EUR 59.6 million

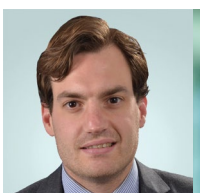
7 Conclusion

The speed and determination with which Mexico has reformed its energy market are extraordinary. In addition to opening its market to private providers, the expansion of clean energy was made a fixture of the new law. Although there is always the risk of new aims and impulses hindering or reversing reforms after new elections, such fundamental changes, especially to energy, will require political alliances. Due to the political division of the country, such alliances currently seem unlikely.

Therefore, it is safe to assume that Mexico is on a good path towards meeting its climate objectives and will increase the clean energy share of its electricity supply by 40% by 2035. It is therefore not surprising that the energy auctions of 2016 created such great interest, both from the renewable energy sector and from foreign investors.

Nonetheless, Mexico will continue to be one of the big players regarding fossil resources. And Mexico intends to maintain this position. This is why the second pillar of the 2013 energy reforms was introduced to make the government-owned oil company PEMEX more productive and efficient. Therefore, it cannot yet be said when the dominance of fossil fuels over the energy mix will be broken.

8 Contact Person



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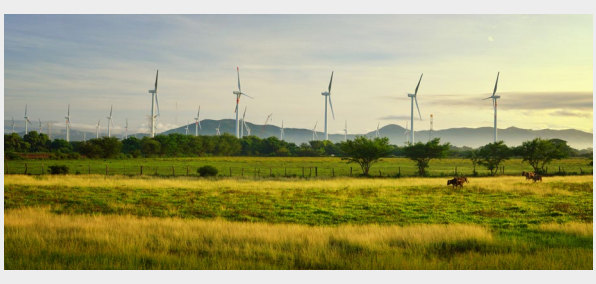
Mexico

Interview with José Ignacio Agüeros Goméz

José Ignacio Agüeros Goméz, Attorney at Law, Expat für die Impulsora Latinoamericana De Energia Renovable S.A. De C.V. in Puebla, Mexico



José Ignacio Agüeros Goméz, a Spanish attorney at law, has been working as an expat for Impulsora Latinoamericana De Energia Renovable S.A. De C.V. in Puebla, Mexico since 2016. The company is planning and building a large wind farm at the bottom of „Pico de Orizaba", which, at 5363 metres, is the highest volcano in Mexico, located in the most eastern part of the federal state. Benefitting from very stable and strong downdraughts, the wind farm will generate more than 400 MW if fully put into operation. Mr Agüeros is responsible for the installation of an about 100 km long power line connecting the wind farm to the nearest transformer station in Tecali and handles obtaining rights of way and pipeline wayleaves as well as easements and licenses.

What renewable energy source is the most promising and has the best future prospects in Mexico?

Wind power certainly has very high and largely unexploited potential due to the numerous mountains and the long coastlines in Mexico. However, more is being invested in photovoltaics which has evolved into a hit thanks to the now worldwide prevailing very low prices for PV components. Mexico offers excellent conditions for solar energy in nearly all parts of the country and a great, flexible range of sites to choose from. Siting a solar park as close as possible to the nearest transformer station helps counter-balance the drawbacks of the yet underdeveloped infrastructure of the power grid, which is one of Mexico's weak points. The disadvantage in wind power is that one has "to look for wind" and, once it is found, the other on-site conditions are not convenient. In respect of both forms of energy production it can be stated that Mexico is a country of boundless areas the vastness of which investors in Europe can only dream of. For European standards, a production capacity of 20 MW is already very high, whereas in Mexico, even the smaller solar parks and wind farms already have a capacity of 50 MW and more.

Which market players have the best opportunities in Mexico: financiers, project developers, technical designers or manufacturers of components?

Mexico offers market players great opportunities and conditions. Your question has made me realise that manufacturers of components are entirely underrepresented in Mexico and, therefore, could benefit from special market opportunities. Renewable energies are developing rapidly and a manufacturer producing components with low unit labour costs and no import duties in Mexico would have a real competitive advantage. Mexico is a huge consumer market and from there, one can make duty free supplies to NAFTA countries and the countries of the newly created Pacific Alliance consisting of Chile, Columbia, Peru and Mexico.

What are the chances of receiving state incentives or implementing Public Private Partnership Programmes?

As far as I can tell, there are nearly no direct state incentive programmes available in Mexico for renewable energies but subsidies are only granted indirectly in the form of tax reliefs. There are no feed-in tariffs. Project developers are largely on their own but, nevertheless, they have a very good chance of earning profits from the sale of power due to a high power price and inefficient energy production by state-owned companies.

What special challenges in regulatory and practical terms do investors face in Mexico?

In Mexico, the regulatory framework for renewable energies is hugely satisfying and provides clear guidelines for project developers to orient themselves by. As regards the application and enforcement of law, which, principally, is a very problematic issue in Mexico, I can state that, in general, when it comes to renewable energies, laws and commitments made by public bodies are fairly reliable. My observation is that, e.g., environmental impact assessments and provisions of environmental law are often adhered to more strictly and carefully than in Europe. This fact really surprised me at the beginning. Unfortunately, the authorities are very inflexible.

A big problem is corruption in Mexico. Energy parks are usually situated in rural, very poor regions and the mayor with jurisdiction over such a region usually demands an extralegal "levy". This is a huge problem for us because for compliance reasons alone bribery is categorically out of the question at our company. If, as in the case of our wind farm, the distance to the next transformer station is only 60 km but some villages have to be skirted and, therefore, the entire pipeline is 100 km long, this causes us higher costs and also significant energy losses during transport. It is illusory to assume that investors can smoothly carry out their projects in Mexico without bribing any officials. On the other hand, there are legal possibilities to get inhabitants of such villages who often live below the poverty line involved in the project (e.g. by buying rights of way etc.) and local authorities are very helpful once they see an advantage in a project for themselves, e.g. new jobs or infrastructure development.

Another big problem is organised crime. Our project is located next to the oil pipeline connecting the port of Veracruz to the city of Puebla. Higher taxes have led to a strong increase in fuel prices and, therefore, drilling and draining the pipeline and the illegal sale of oil have become a lucrative business for the mafia. You'd better make sure not to get in their way. We have concluded an informal arrangement according to which we are allowed to work at the construction site only on specific work days and, in return, we are left alone on these days. Last week, there was a military action with helicopters and gunfire nearby. I can only recommend that investors stay away from major overland power lines that could be of strategical interest to the mafia.

Another problem are the so-called "ejidos" – properties held by cooperatives, the concept of which evolved during the Mexican Revolution more than one hundred years ago. The purchase of such a property theoretically requires the consent of more than 200 inhabitants of a municipality, a circumstance often not mentioned by the seller, of course. Since the inhabitants often lack education in legal matters, this issue looks like a legal problem only ostensibly in practice; in fact, it is rather a social challenge which needs to be solved very tact- and skilfully and in collaboration with local contact persons. For this reason, communicating the planned project early on in a sensitive way to those affected on site is an absolute "must-do".

What is the local infrastructure like?

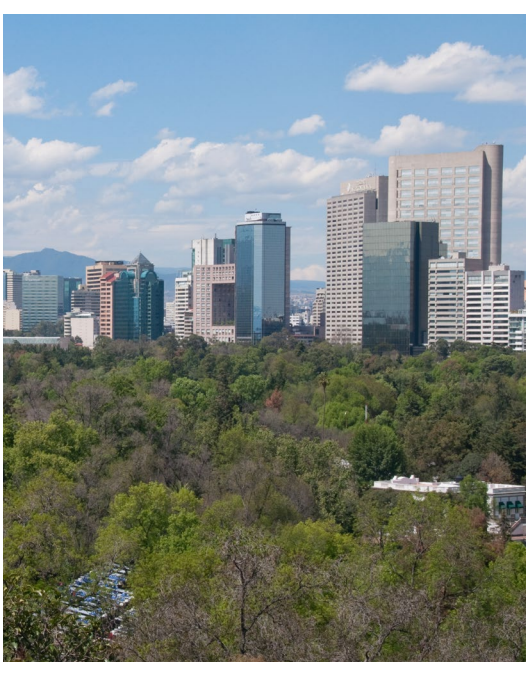
I have already implemented several projects in other Central American countries and must say that the infrastructure in Mexico is comparably good. With our projects in the Federal States of Oaxa, Puebla and Chiapas we always had access to a sea port and, from there, a good road connection to the given project site. Developing the last public road to the actual project site is difficult since it must be done at one's own cost. In this context, it is important to early on arrange for the reclassification of land according to the Regulation on Land Use („uso del suelo") so that it matches the purpose and intended use. Compared with Europe, the transport of wind turbines to the destination is easier since, normally, no registration of heavy transport and, therefore, no notification of a fixed time slot is required and, as my experience tells me, the Mexican road authorities are ready to compromise.

What is the procedure for obtaining a permit?

The regulatory framework is satisfying and enables acting on a reliable ground. But investors should not expect the European kind of administration law and administrative procedures since in Mexico everything, virtually everything, is done differently. At the beginning, I was indeed very surprised by the bureaucratic and formal way in which things are done in Mexico. Therefore, investors should be particularly careful about avoiding formal errors. Wrong spelling of names or wrongly written amounts could trigger the most severe consequences since formal errors cannot be cured under Mexican public law. A formal error renders an application invalid even if there is no impact in terms of substantive law at all.

Another problem is that administrative guidelines are amended in a non-transparent way and such amendments are neither reasonable nor understandable to the citizens. Here, investors should have [a sufficient degree of] flexibility and frustration tolerance. A particular problem is the fact that, unlike in Europe, the discontinuity principle, i.e. the annulment of legislative projects already underway in the case of a change of government, has effects also on the administrative level, e.g. on procedures for obtaining permits. If the government changes after elections on federal, state or municipal level, a large number of civil servants are dismissed and the vacant positions are newly staffed in Mexico, a fact, of course, that is in contrary to the European idea of civil service law and continuity in administration. In the case of a change of government, in particular if the governing party changes, pending administrative proceedings are radically cancelled in a way that is very concerning from the constitutional point of view. For this reason, we highly recommend that investors plan their project launches at the beginning of legislative periods in the given federal state. It is very peculiar but also very helpful that, in Mexico, it is completely legal to contract individual officials working for local authorities to work for you in respect of a given project. So, we have hired officials from various authorities to handle our wind farm project on an exclusive basis and, as service providers, they are at all times available for answering questions. This procedure has been ensured by us by formal arrangements with the authorities. In Europe, of course, such a procedure would be totally unthinkable but in Mexico, there is no other way to get things done.

What do you consider to be the three most serious risks?



Basically, the political framework of Mexico provides investment certainty, a fact that has been recognised also at the international level. Criminality and corruption are certainly a big problem. Since projects are often located in rural regions, great value should be placed on social inclusion, in particular of indigenous municipalities where a part of the inhabitants have only poor Spanish language skills. Therefore, we strongly recommend hiring Mexican citizens who are very familiar with the local conditions and are able to communicate the project. In our case, relocating a village with about 50 dwellings was no problem at all, since we provided the inhabitants at our own cost with modern houses equipped with access to electricity and water at a different location. Those locals were very flexible and happy about the relocation. Try to do something like that in Europe!

Mr. Agüeros, thank you very much for the interview!

Sweden

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List of Acronyms

EF	Ekonomifakta
Ei	Energy Market Authority
ENTSO-E	European Network of Transmission System Operators for Electricity
PH	Pär Hermerén, Energy Analyst at Teknikföretagen, Sweden
MED	Ministry of the Environment and Energy
NREAP	Swedish National Action Plan
SCB	Statistiska Central Byrĺn
SEA	Swedish Energy Agency (Energimyndigheten)
SvK	Svenska Kraftnät

1 Overview

Since 1995 Sweden has been part of the European Union, which hence provides German companies a good access to a stable and investment friendly market characterized by a well-built infrastructure. Sweden provides a riskless and friendly environment for investments and businesses. The country ranked 9th in the "Ease of Doing Business" index conducted by the World Bank. Furthermore, Sweden received good results in the categories about reliable power supply and registration of ownership.[1]

2017 Sweden had about 10 million inhabitants and a population density of 21.9 inhabitants per square kilometer. As a result Sweden has the 84th largest population but only the 152th highest population density in the world.

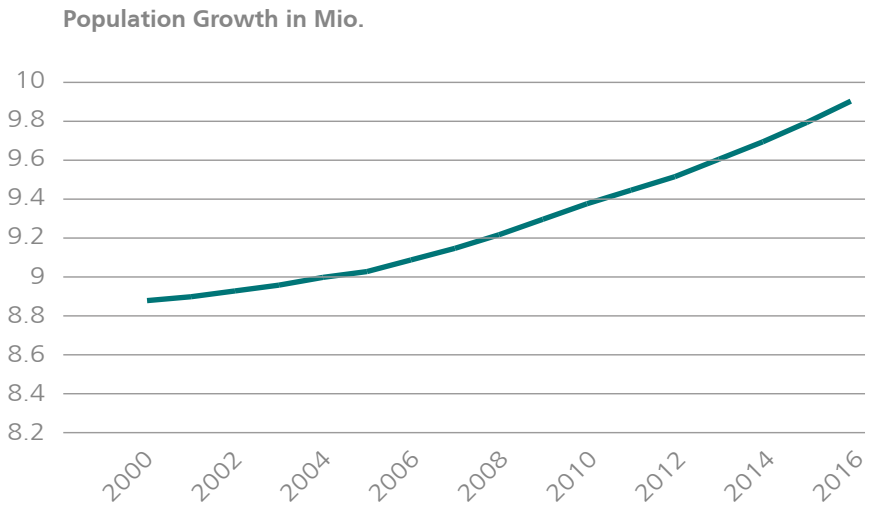

Figure 1: Development of total Swedish population[2]

In 2016, Sweden's GDP amounted to approximately USD 551 billion. In a direct comparison in Euro, Sweden is the seventh largest economy in the EU in 2016. The United States, which is the world's largest economy, is about 36 times larger than the Swedish economy.

Figure 2: Development of the GDP in Sweden (current USD)[3]

2 Energy Market – Status Quo

2.1 Energy Mix

In 2015 the share of renewable energy was almost 54% of the total Swedish energy demand. Among the renewable energy sources in Sweden bioenergy and hydropower are by far the most important ones. While hydropower is mainly used to generate electricity, bioenergy is also used for heating most of the time. The high hydropower and bioenergy potential in the country together with a proactive renewable energy policy lead to a high share of renewable energy in comparison with other countries.

Since 2015 the Swedish Energy Agency (Energimyndigheten) have been implementing a program targeting a reduction of the energy demand, an increase of the renewable energy share and mitigation of the climate impact coming from small- and medium-sized enterprises. The energy demand of small- and medium-sized enterprises should, therefore, decrease to 10% of the total value creation until 2023.

The expansion of renewable energies is growing in Sweden. One of the pillars of this trend is wind energy which continues to take a bigger share of the power distribution. Even solar power is increasing, however, on a low level. The wind energy sector is dominated by on-shore wind energy plants, however, the Swedish Energy Agency was assigned to assess the market potential and the technology development of off-shore wind energy.

Energy distribution by technology since 1970, TWh

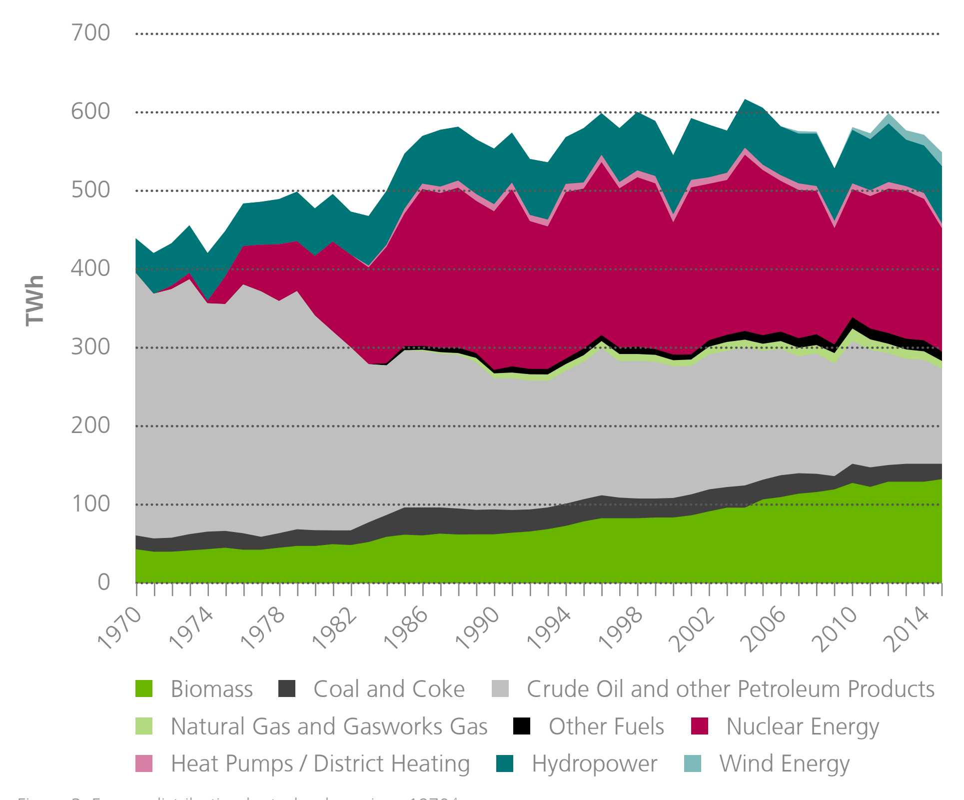

Figure 3: Energy distribution by technology since 1970[4]

Energy demand by technology since 2000, TWh

	Biomass	Coal and Coke	Petroleum Products	Natural Gas and Gasworks Gas	Other Fuels	Nuclear Energy	Heat Pumps/ District Heating	Hydropower	Wind Energy	Energy Import	Total
2000	84	24	168	8	7	168	7	79	0	5	**551**
2001	86	26	163	9	8	214	8	79	0	-7	**586**
2002	91	26	174	9	9	201	8	66	1	5	**590**
2003	96	26	174	10	10	200	7	53	1	13	**589**
2004	96	27	177	10	12	227	7	61	1	-2	**615**
2005	105	25	164	10	13	210	6	72	1	-7	**599**
2006	109	27	162	10	12	194	6	62	1	6	**589**
2007	114	26	148	11	13	191	6	66	1	1	**578**
2008	116	23	154	10	14	184	6	69	2	-2	**575**
2009	119	17	144	13	12	149	5	66	2	5	**532**
2010	127	24	157	17	14	166	5	67	3	2	**584**
2011	123	23	150	14	14	171	5	67	6	-7	**566**
2012	129	21	143	12	16	188	6	79	7	-20	**578**
2013	130	22	134	11	15	189	4	61	10	-10	**566**
2014	130	21	134	9	14	182	5	64	11	-16	**555**
2015	134	19	119	10	14	155	5	75	16	-23	**525**

Table 1: Energy demand by technology since 2000[5]

2.2 Energy Demand

The industry sector uses virtually as much energy today as they did in 1970. However, much has changed in general. For example, industrial production is significantly higher today than 1970 which means that the productivity in the industry sector increased as well. This sector further has become less dependent on oil since the mid-1970s. The fossil fuel was replaced by other energy carriers, e.g. electricity and biofuels.

Energy use in the housing sector is not constant and the variation over time can be explained to some extent by warm and cold winters. Nevertheless, since 1970 the housing sector has reduced its energy consumption by 14%. The dominant energy carrier for this sector is electricity and district heating. The residential sector has been able to reduce energy use because parts of these losses are found in the heating plant or at the electricity producer. Before the introduction of the large energy efficient programs implemented by the government, losses occurred in, for example, in the consumer oil boilers.

The transport sector includes road traffic, rail traffic, aviation and shipping. Thus, it comprises both passenger and freight transport. Energy use in the transport sector is largely dominated by petroleum products, mainly petrol and diesel. Since 1970, the sector's total energy consumption has increased by 56%.

Energy use in the transport sector since 1970, TWH

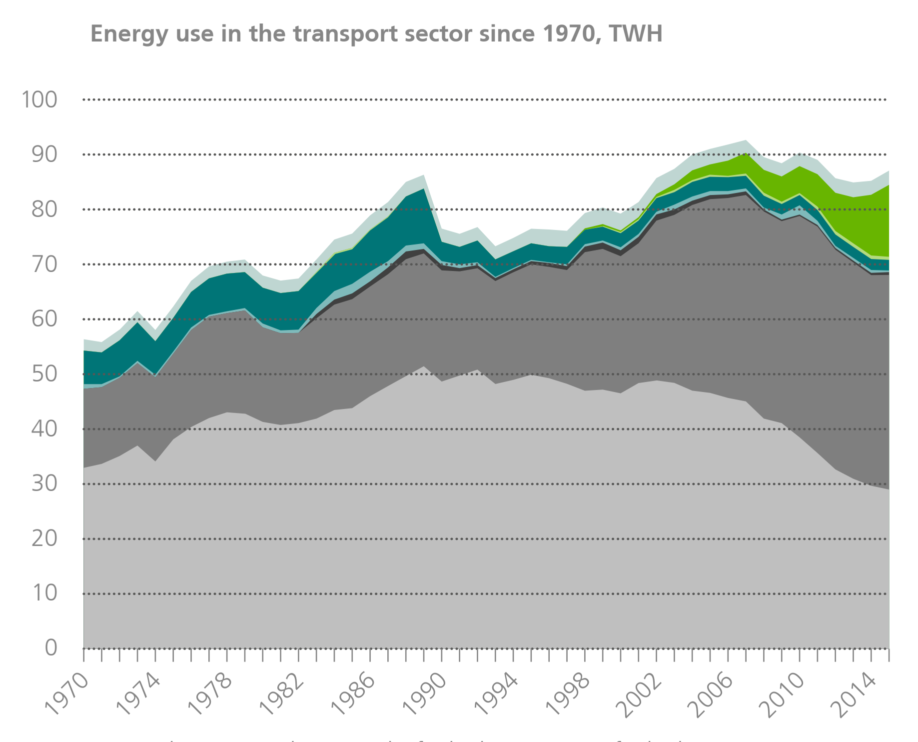

Figure 4: Energy use in the transport sector since 1970[6]

2.3 Energy Market Design[7]

Ministry of the Environment and Energy (MED)

The Ministry of the Environment and Energy (MED) is responsible for formulating the energy policy. In March 2015 the MED convened an energy commission to develop the renewable energy strategy for 2025 to 2050. The energy commission consists of the minister of energy, eleven other parliamentarians, the head of the Swedish Energy Agency (SEA), the Energy Market Authority (Ei) and the transmission network operator Svenska Kraftnät (SvK).

Swedish Energy Agency (SEA)

The Swedish Energy Agency supports the MED by doing administrative work for power supply and consumption in general. The agency further provides data about the development and competitiveness of the energy sector. In order to accomplish the energy and climate goals the Swedish Energy Agency develops and implements specific instruments as well as formulating proposals and statements in agreement with the Ei.

Energy Market Authority (Ei)

The Ei monitors the Swedish electricity, gas and heating market to ensure its functioning and that the interests of the energy consumers are safeguarded. In this regard the Ei prepares reports and proposals for necessary statutory changes for the government. Furthermore, Ei regulates the income of the power grid and gas grid operators and since 2014 the authority has been issuing grid concessions as well.

At the same time when the Swedish power market was liberalized in 1996 the electricity exchange Nord Pool Spot was founded by Sweden and Norway. SvK and Nord Pool Spot transmit their data to the platform of European Network of Transmission System Operators for Electricity (ENTSO-E).

Players

The Swedish energy market was liberalized in 1996, however, the energy market is still dominated by three large companies: the Swedish Vattenfall, the Finish Fortum, the German E.ON. These three companies are the major player in the field of power generation, power trading and distribution.[8]

The Swedish power market was deregulated in 1996 by transferring the state-owned energy production to Vattenfall AB and by assigning the transmission grid to SvK, a state-owned public transmission and distribution company. The transmission network (Stamnät) is state property and is maintained by SvK, whereas the distribution network is predominantly operated by Vattenfall, Fortum and E.ON. In addition to them there were 162 local network operators in 2015.

Nowadays, end consumer can choose from around 125 power generators, however, electricity is mainly produced by the companies Vattenfall, Fortum and E.ON. In 2014 their share of power generation and distribution were 75% and 43%, respectively. The power grid is monopolized and divided in different geographic regions which are managed by about 170 grid operators possessing grid concessions. The network and the grid operators are monitored by the Swedish Energy Markets Inspectorate (Ei).

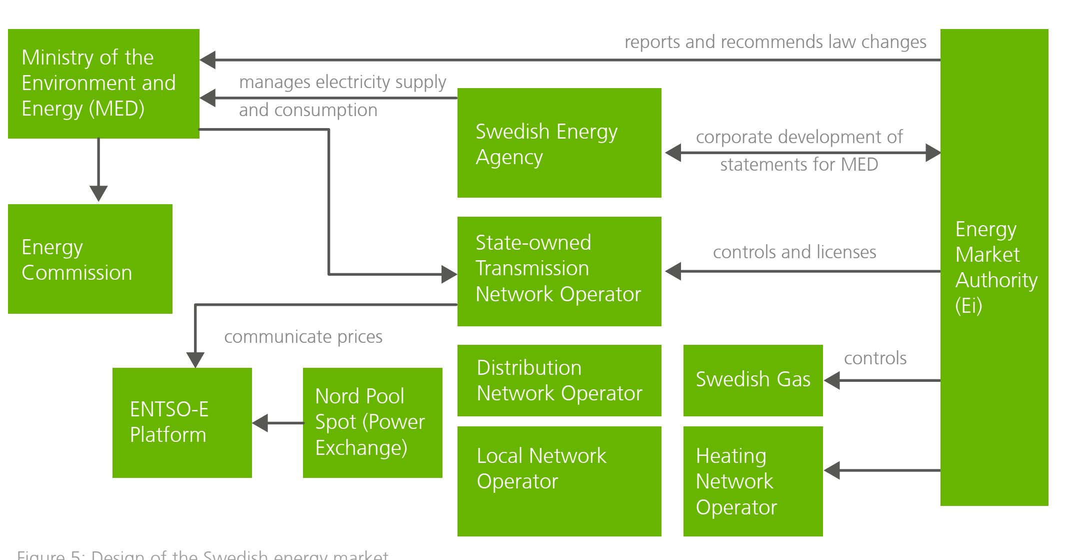

Figure 5: Design of the Swedish energy market

2.4 Power Market

The total electricity production in Sweden in 2016 amounted to 152 TWh. Hydropower accounted for 61 TWh, which is approximately 40% of Sweden's total power generation. Hydroelectric production is dependent on the amount of precipitation in the form of rain and snow. During a normal year, approximately 65 TWh of electricity is produced, but depending on precipitation this may deviate by about 15 TWh. Nuclear power also accounted for 61 TWh in 2015, which corresponds to 40% of total electricity generation in Sweden. Hydropower and nuclear power are complemented by wind power and cogeneration. Wind power accounted for 10% of total production and cogeneration accounted for 9%.

The largest consumers of electric power are the residential and the industry sector. While the consumption of the industry sector decreased in recent years, the consumption of the residential sector remained stable. Due to the increased use of bioenergy for heating the use of electricity is on decline.

Power generation by technology since 1970, TWH

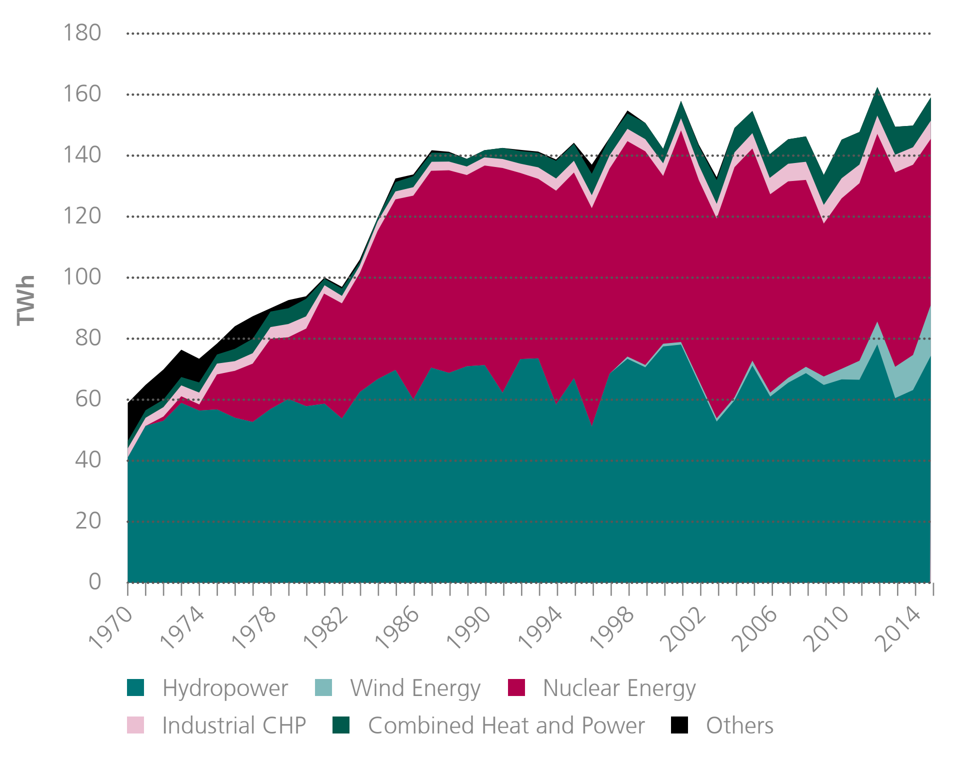

Figure 6: Power generation by technology since 1970[9]

Electricity use by sector since 1970

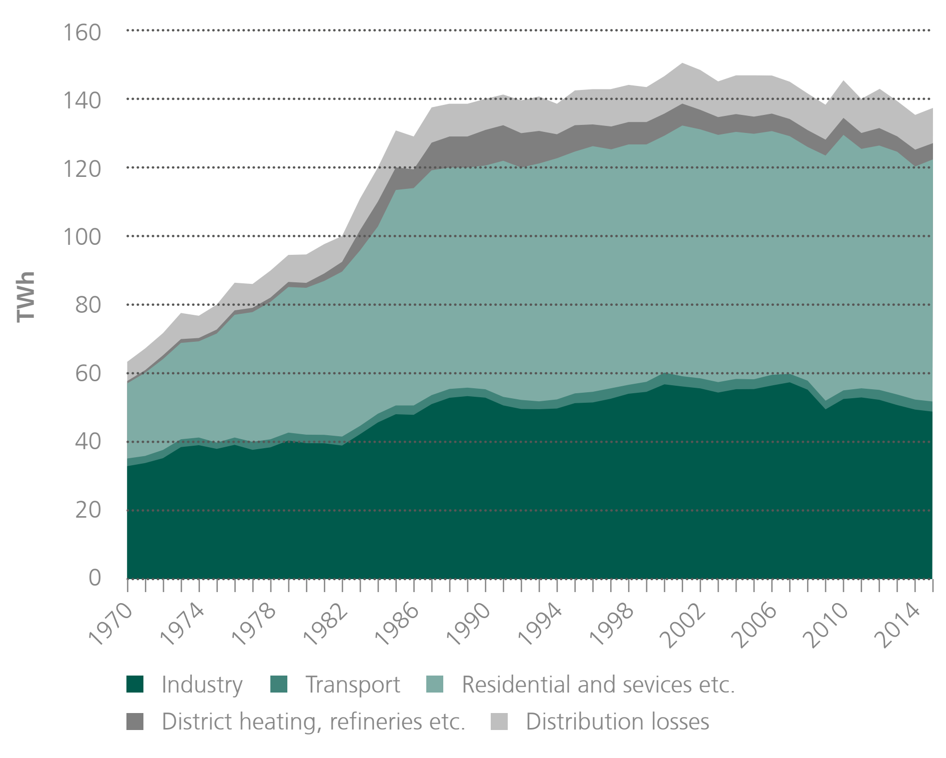

Figure 7: Electricity use by sector since 1970[10]

2.5 Electricity prices

Since November 2011 Sweden is divided into four electricity price areas, namely Luleĺ, Sundsvall, Stockholm and Malmö. The regional prices are not regulated, however, most of the time the price level is the same.

Electricity price on average for households in 2015, per kWh*			Electricity price on average for industry in 2015, per kWh***		
consumption group	1.1.–31.6.2015	1.7.–31.12.2015	**consumption group**	1.1.–31.6.2015	1.7.–31.12.2015
annual consumption < 1000 kWh	318 öre 0.33 Euro**	322 öre 0.21 Euro	annual consumption < 20 MWh	122 öre 0.13 Euro	132 öre 0.14 Euro
1000 ≤ consumption < 2500 kWh	193 öre 0.20 Euro	195 öre 0.34 Euro	20 ≤ consumption < 500 MWh	67 öre 0.07 Euro	66 öre 0.07 Euro
2500 ≤ consumption < 5000 kWh	173 öre 0.18 Euro	175 öre 0.18 Euro	500 ≤ consumption < 2000 MWh	58 öre 0.06 Euro	55 öre 0.06 Euro
5000 ≤ consumption < 15000 kWh	143 öre 0.15 Euro	145 öre 0.15 Euro	2000 ≤ consumption < 20000 MWh	51 öre 0.05 Euro	48 öre 0.05 Euro
consumption ≥ 15000 kWh	125 öre 0.13 Euro	125 öre 0.13 Euro	20000 ≤ consumption < 70000 MWh	45 öre 0.05 Euro	42 öre 0.04 Euro
			70000 ≤ consumption < 150000 MWh****	38 öre 0.04 Euro	33 öre 0.03 Euro

* including VAT
** price conversions in Euro obtain from the exchange rate from 9. August 2016 (1 Euro = 9.51 SEK) According to: www.oanda.com
*** exclusive VAT
**** No prices are available for industrial customers with annual consumption from 150000 MWh

Electricity prices for households and industry on average in 2015[11]

As the taxes constitutes a major part of the electricity price, it does not surprise that on average the electricity price for the industry is lower than for households against the background that the tax burden for the industry sector is also lower. In January 2016 the industry sector pays a tax amount of 0.5 öre/kWh (0.0005 EUR/kWh) compared to the households paying 19.3 – 29.2 öre/kWh (0.02-0.03 EUR/kWh).

By comparing figure 8 and 9, you can observe that while the electricity prices for households remained relatively stable from 2010 (18.39 Cents) to 2016 (18.94 Cents) the electricity price for the industry dropped by 2.07 Cents, i.e. a decrease of approximately 25%.

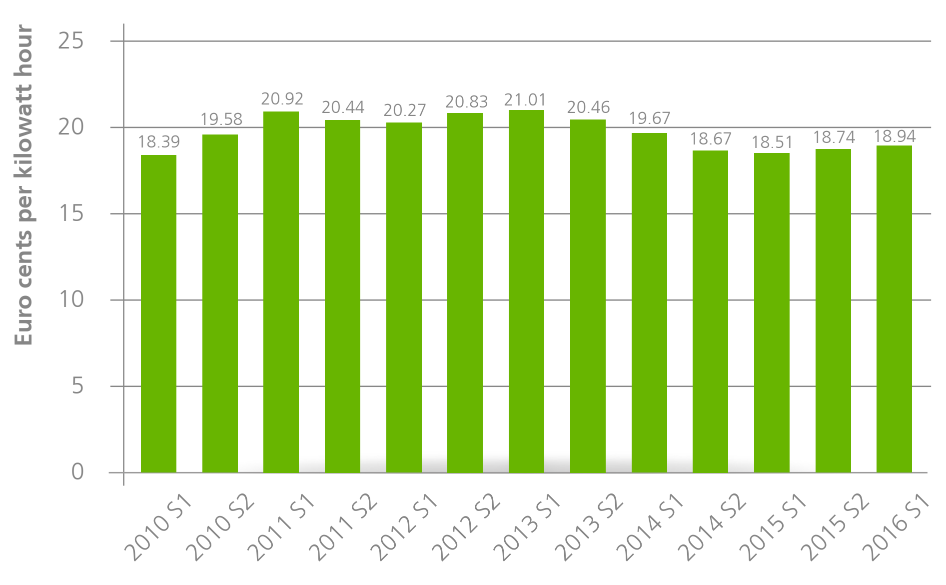

Figure 8: Electricity prices for households in Sweden from 2010 to 2016[12]

Figure 9: Electricity prices for industry in Sweden from 1996 to 2016[13]

3 Energy Policy – Perspective

3.1 Government Policy

Climate, environment and energy were three important areas Prime Minister Stefan Löfven highlighted when he presented the Statement of Government Policy in September 2015:

- Promotion of an Environmentally Friendly Transportation System
  - Introduction of new supports for electric buses
  - Investments in charging infrastructure and biogas
  - Strengthening of the green car rebate
  - Increase of the environmental tax effects
  - Enabling of new public transport through urban environmental agreements
  - Initiatives to encourage more people to cycle
- Energy Transition and Climate-Smart Housing
- Renewable Energy
  - Investments for 100% renewable energy
  - Raise of the electricity certificate system goals
  - Continuation of the support for marine-based wind power
  - Upgrading and making the million home program energy-efficient

In the Swedish National Action Plan (NREAP) of 2009 the Swedish Government committed to specific goals regarding renewable energies. At least 50% of the energy demand should be covered by renewable energies until 2020. Furthermore, the use of energy should be more efficient by 20% and the emission of CO_2 should be decreased by 40% taking the 1990 as reference year. In addition to that, 10% of the transport sector should be operated by using renewable energies. In 2012 Sweden already achieved several of these goals, e.g. covering the energy demand with renewable energies. Another example is that in 2013 the share of renewable energies in the heating sector was already 67.2%, which was higher than the goal of 62.1% by 2020.

The good results regarding the climate goals led to an ambitious target. In June 2016 the Swedish Government consisting of a coalition between the Social Democratic- and Environmental Party together with the Moderate Party, the Center Party and the Christian Democrats announced that until 2040 the power generation should be completely from renewable energy sources. Nevertheless, it is to be mentioned that it is a target but not a deadline for banning nuclear power and, it does further not mean closing nuclear power plants through political decisions. The further installation of renewable energies is mainly promoted by

- Certificate trading system
- Tax regulations
- Subsidies

The Swedish Government further seeks to become a power exporter which was already realized to a certain point in 2014. In that year the amount of power generated was higher than the demand. To be more precise, the power generation was 150 TWh higher than the power consumption and the energy net export was 15.6 TWh. In 2007 the energy net export was still negative with -1.3 TWh. Nevertheless, it has to be considered that it was achieved due to a decline in power demand from the industry sector which resulted from the recession after 2008 and 2009.[14]

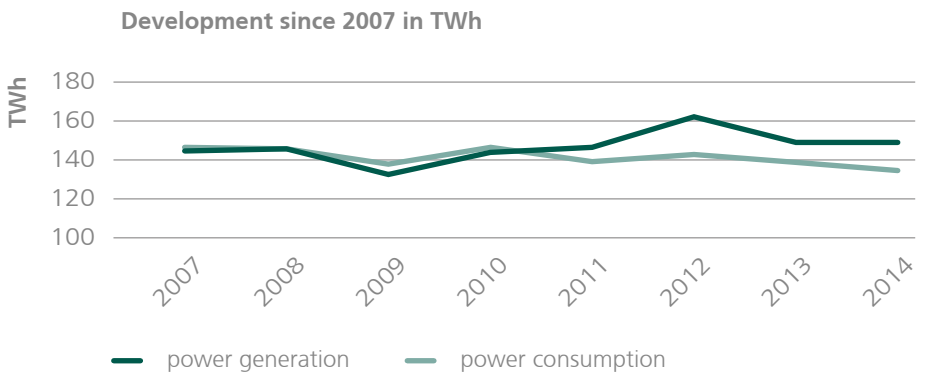

Figure 10: Development of power generation and power consumption (in TWh)[15]

Since 2012 Sweden and Norway have a shared market for green certificate market. Due to the electricity certificate trading producers of renewable energies receive a certificate for each MWh generated. On the other hand, power distributors, specific consumption groups and energy intensive industries are subject to a renewable energy quota. A certain percentage of the consumed electricity has to be from renewable energy sources. The quota is legally binding and is set every year. In 2016 the quota was 14.4% and until 2020 it should be increased to 19.5%. However, by 2035 it should be decreased back to 0%. The certificate system of Sweden and Norway was prolonged until 2030. At least until 2046 Swedish and Norwegian certificates should still be able to be traded.[16]

Since 1 January, 2015 micro power producer such as private households or companies receive a tax credit for feeding in their excess power. The feed-in amount is limited to 30000 kWh per person. Another indirect support for renewable energies are tax reliefs for renovation and modernization measures (ROT-program) involving the installation renewable energies.

Moreover, there are several funding programs for households, companies and the agricultural sector when it comes to the installation of renewable energies, e.g. in 2015 the Swedish authority for agriculture passed an initiative which refunds 40% of the installation costs.

3.2 Paris Agreement

Sweden signed the Paris Agreement in 22 April, 2016 and ratified the agreement in 13 October, 2016. Finally, on 12 November, 2016 it entered into force. Additionally, Isabella Lövin, the Minister for International Development Cooperation announced a new strategic support to increase access to renewable electricity in the least developed countries (LDC). In this regard SEK 15 million is given to the UN Secretary-General's Sustainable Energy for All initiative and SEK 20 million to the Scaling Up Renewable Energy Program in Low Income Countries.[17]

4 Renewable Energy – Market – Opportunity

The Swedish Government has commissioned the Swedish Energy Agency to support small and medium-sized enterprises in optimizing their processes, i.e. their energy usage, through support from the European Regional Development Fund. The initiative is being conducted within the framework of the National Regional Fund Program and with the Swedish Agency for Economic and Regional Growth as the administrative authority. The initiative will continue until 2020.

The mission of the National Regional Fund Program is to support the transition to a low carbon economy and to increase the share of renewable energy, as well as to promote energy efficiency in companies. In order for the Swedish Energy Agency to have the necessary resources the authority is equipped with a total of SEK 80 m per year. The resources should be used to improve the energy efficiency in small and medium-sized enterprises during the period 2015–2020. While SEK 40 m a year is coming from the Swedish Government, the other SEK 40 m is from the European Regional Development Fund.

In Sweden renewable technologies are being used comprehensively in all sectors. The continued push towards the development and implementation of green technologies has enabled Sweden to become the first country in Europe to meet the renewable energy targets set by EU for 2020. To be precise eight years ahead of schedule. This accomplishment is partly due to the industry demand and the rapid adoption of new technologies.[4] Other relevant Green Projects are:

- Northvolt has decided to establish a large car battery factory in Sweden
- Swedish PowerCell announced that it had signed a letter of intent with partners in the German automotive industry on the joint development of a fuel cell platform
- Envision Energy (Shanghai), a leading wind comprehensive technology and service provider for smart energy solutions acquired a 25 MW wind farm located outside Eskilstuna in mid Sweden. This represents the largest Chinese wind power investment so far in Sweden and also involves the establishment of a new technology supplier in the market

	Share of energy from renewable sources	Heating, cooling, industrial e.t.	Electricity	Transports
2005	41	52	51	4
2006	43	56	52	5
2007	44	59	53	6
2008	45	61	54	6
2009	48	64	58	7
2010	47	61	56	7
2011	51	62	60	10
2012	53	66	60	13
2013	52	67	62	17
2014	53	68	63	19

Table 3. Share of renewables in energy use in Sweden.[5]

4.1 Bioenergy

Sweden is a world leader in bioenergy with an installed capacity of 5056 MW for CHP which is predominantly based on biomass.[6] In 2014 about 200 power generation plants through biomass were installed which produced 13 TWh. The production of district heating from biomass plants was 36 TWh in 2014.

Figure 11. Installed capacity of biomass.[7]

In 2014 23% of the yearly produced biomass from forests (approximately 1.36 EJ) was used to produce energy. It is to be expected that Sweden will produce and process more biogas in the future, because the government intends to further develop the transport sector by relying more on biogas. From 2014 to 2023 the authority for agriculture is funding the production of biogas using organic manure and crop residues. The amount of funding is calculated by multiplying the production over the course of the program with 40 öre/kWh (0.04 EUR/kWh). To be eligible for funding the installed capacity of the plant has to be smaller than 50 kW. Due to the funding programs the production of biogas provides an attractive additional income source for agricultural businesses.

As mentioned before more than half of Sweden's energy production is from renewable sources and much of this is due to the more extensive use of biofuels, particularly for the production of electricity and heating. Therefore, biofuel is a very important domestic renewable energy source, although organic wastes from households and industry also constitute an important fraction. These two sources are also the major fuels used in the district heating sector, which supplies heating to 93% of all apartment buildings, and 83% of all commercial premises.

Another field regarding bioenergy is also interesting in case of Sweden: cogeneration units using wood and pellets. Approximately 69% of the area is covered with forest in Sweden. The Swedish association for bioenergy predicts that the timber volume will further increase in the future, whereas the price for wood will continue to decrease by 2020. These conditions are very favorable for the use of biomass. The decrease in oil and gas prices in 2015 did not affect negatively the attractiveness of using wood in the industry, though. One of the reasons lies in the changes the industry has to pay for energy and CO_2 of fossil fuels.

Since cogeneration units are widespread in Sweden there are many manufacturers in the bioenergy sector manufacturing components and plants. In the field of biogas many Swedish companies are active, e.g. Swedish Biogas International which is specialized in the development and construction of biogas plants.[8]

4.2 Solar Power

The installed capacity of solar power was about 140 MW in 2016 and has therefore still a limited position in the Swedish energy mix. Regarding the installed capacity on-grid plants still dominates.

Figure 12. Installed capacity of PV and solar heat.[9]

The average insolation in Sweden is 1000 kWh/m², which is about half of the average insolation in southern Spain. As a result it does not surprise that the technology is regarded as costly in Sweden. It is furthermore least accessible and productive when the energy consumption is at its highest during the winter months.

Figure 13. Map of Sweden showing solar radiation.[10]

Since January 2015 the installation costs for PV plants can be funded up to 30% for companies and up to 20% for private owners and public organizations. However, the system costs for PV has to be under SEK 37000 (EUR 3904) per kWp and the total system cost cannot be higher than SEK 1.2 m (EUR 126600) to be eligible for funding. Solar power plants which have an installed capacity of less than 255 kW are exempted from energy taxes. In case of owning several plants, the sum of their capacity is to be taken into account.

As in Norway and Finland, most applications of PV can more and more be found in the domestic offgrid sector, where installations are sited in remote cabins, campers, caravans and boats. As the Swedish underlying conditions for solar power are unlikely to be changed in the near future the major use of them will remain in the private homes, minor industries, shopping centers and in agriculture sector.

Isabella Löven, the Deputy Prime Minister of Sweden announced that the expenditures for the national funding program for solar power will be increased significantly. According to the Swedish Government this action was necessary because otherwise there would be delays in the disbursement of funds due to the high demand. The available funding will be increased from SEK 225 m (EUR 23.2 m) to SEK 425 m (EUR 43.8m). For 2016 the government even plans to budget EUR 53.8 m.[11]

4.3 Wind Energy

In 2016 the installed capacity increased by 620 MW and the total installed capacity was 6430 MW in the end of 2016. At that time 9% (15.5 TWh) of the total power distribution was from wind energy sources. However, even if the installed capacity was higher we see a small drop in the power generation from wind energy sources from 2015 to 2016.

	Number of turbines	Capacity (MW)	Production (GWh)
2000	527	241	447
2001	570	295	482
2002	620	345	609
2003	667	402	631
2004	764	475	865
2005	813	522	939
2006	967	565	908
2007	1098	822	1432
2008	1166	1090	2001
2009	1971	1676	2490
2010	1658	2018	3487
2011	2018	2018	3487
2012	2383	3603	7164
2013	2639	4194	9842
2014	2961	5097	11234
2015	3174	5940	16268

Table 4. Wind power, number of turbines, capacity (MW) and production (GWh).[12]

As the expansion of renewable energies continues, wind power is becoming an increasingly important part of the country's energy system. Sweden possesses excellent requirements for the use and installation of wind energy plants. 5871 km² of the land and 3856 km² of the sea are suited for the installation of wind energy plants as there are wind speeds of more than 6.5 m/s at a height of 71 m.

Swedish companies producing turbines do not exist, which provides a good opportunity for German manufacturers of turbines. Leading turbine producers who are already active in Sweden are for example Siemens and Vestas.

Wind energy plants which have an installed capacity of less than 125 kW are exempted from energy taxes. In case of owning several plants, the sum of their capacity is taking into account. Nevertheless, new installations of wind energy are most of the time large-scale projects, e.i.: wind parks located in the northern part of Sweden. Moreover, companies such as Google are starting to enter PPAs with large wind parks to supply their EU data centers with clean energy. The Swedish Government plans to increase the power generation from wind energy sources to 15.2 TWh by 2020.[13]

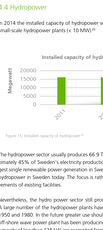

Figure 14. Map of Sweden showing wind speed.[14]

4.4 Hydropower

In 2014 the installed capacity of hydropower was 16155 MW whereby 1050 MW of them belongs to small-scale hydropower plants i.e. 10 MW.[15]

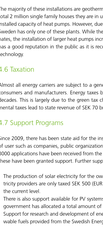

Figure 15. Installed capacity of hydropower.[16]

The hydropower sector usually produces 66.9 TWh of electricity in a year, which corresponds to approximately 45% of Sweden's electricity production. Consequently, it makes hydroelectric power the largest single renewable power generation in Sweden. However, there is no expansion of new large-scale hydropower in Sweden today. The focus is rather on environmental adaptations and efficiency improvements of existing facilities.

Nevertheless, the hydro power sector still provides interesting opportunities for German companies. A large number of the hydropower plants have to be modernized as they were built mainly between 1950 and 1980. In the future greater use should be made of wave power. Since January 2016 the first off-shore wave power plant has been producing electricity. Wave power plants which have an installed capacity of less than 125 kW are exempted from energy taxes. In case of owning several plants, the sum of their capacity is taking into account.

4.5 Geothermal Energy

At the end of 2014 the installed capacity of geothermal energy was 5600 MW.

Figure 16. Installed capacity of geothermal energy.[17]

The majority of these installations are geothermal heat pumps for private consumers. In 20-25% of the total 2 million single family houses they are in use. In 2014 Sweden was ranked third worldwide for the installed capacity of heat pumps. However, due to the limited resources in the field of deep geothermic Sweden has only one of these plants. While the new installation of small geothermal heat pumps stagnates, the installation of larger heat pumps increases, e.g. for apartment buildings. Geothermal energy has a good reputation in the public as it is recognized as an environmentally friendly and economical technology.

4.6 Taxation

Almost all energy carriers are subject to a general energy tax. The amount of tax paid is different for consumers and manufacturers. Energy taxes belong to the taxes that have increased most in recent decades. This is largely due to the green tax change which began in May 2001. Energy and environmental taxes lead to state revenue of SEK 70 bn in 2015.

4.7 Support Programs

Since 2009, there has been state aid for the installation of solar cells. The support is aimed at all types of user such as companies, public organizations and individuals. Until December 2014, approximately 8000 applications have been received from the County Administrative Board, of which around 3000 of these have been granted support. Further supports are:

- The production of solar electricity for the own use is entirely exempted from taxes. Meanwhile electricity providers are only taxed SEK 500 (EUR 5) per megawatt hour, which is a 98% reduction from the current level.
- There is also support available for PV systems connected to the grid. For the period 2013-2016, the government has allocated a total amount of SEK 210 m for this measure.
- Support for research and development of energy-efficient vehicles and vehicles that can run on renewable fuels provided from the Swedish Energy Agency is approximately SEK 350 m annually

4.8 Financing

In recent years the government in Sweden has been reluctant to provide, e.g. "soft loans" with very favorable conditions to investments in renewable energies. However, this may change in the future with the ambitious climate goals.

From press releases announcing funding for wind farms and other larger developments it is evident, that it is very common for two or more financiers to provide a syndicated loan, as banks and other financiers are unwilling to expose themselves to the entire risk of such a project. Syndicated bank loans are rarely less than SEK 200 m.

The larger commercial banks in Sweden, primarily Nordea, SEB, Swedbank and Handelsbanken, are all offering project financing and have all been involved in power generation developments.

4.9 Regulatory

The Swedish Energy Agency is the supervising authority for certain areas of the Swedish legislation such as fuels, biofuels, and biofluids. The legislation is based on two European directives, the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD).

The directives have been transposed to the Swedish legislation through Act (2010:598) concerning sustainability criteria for biofuels and biofluids and the Fuel Quality Act (2011: 319).

- Renewables Act (HBL – hållbarhetslagen)
  This act establishes a set of sustainability criteria that have to be met in order for biofuels and biofluids to be considered sustainable in Sweden.
- Fuel Quality Act (DML – drivmedelslagen)
  This act contains fuel specifications and reporting requirements imposed on fuel suppliers concerning supplied volumes, greenhouse gas emissions, and the origin of fuels.

5 Pitfalls

As Sweden has a lower population and industry the power market is relatively small. Furthermore, the population of Sweden is unlikely to grow very fast in the future. That's why the electricity demand in Sweden is expected to remain on the same level which limits the opportunities of the power market with respect to power generation.

Sweden is well-known for its innovative capacity and for embracing very fast new technologies. Therefore, the energy market is very dynamic and, hence very competitive. Only the companies which can adapt quickly to the very fast changing conditions as well as provide the newest technologies will benefit from engaging in the Swedish energy market.

Another issue which has to be considered when it comes to renewable energies in Sweden is the climate change, i.e. its resulting impact on the natural resources and conditions in Sweden. Due to the climate change the temperature and the sea level are expected to continue to rise, especially if you include the melting of the ice caps in Greenland and Antarctica in the calculation. In addition to that, the number of days of heavy precipitation will increase and together with the rise in the sea level it will lead to stronger floods, landslides and erosion in the future. These natural disasters will pose a threat to power plants and the corresponding infrastructure in certain regions.

6 Conclusion

Sweden provides excellent conditions for an engagement in the clean energy market. The Swedish politics as well as the majority of the population is sharing the same mindset regarding a sustainable and green economy. Moreover, the risks and challenges for engaging in Sweden are relatively small. Issues such as corruption or discrimination towards foreign companies can be hardly found. As mentioned before Sweden ranked to the top 10 countries according to the "Ease of Doing Business". Against the background that Sweden achieved successfully and faster than expected several climate goals, it will not be a surprise if Sweden will also achieve the goal of 100% renewable energy by 2040. That's the reason why, a change in climate policy is not to be expected in the future and, hence gives companies of the renewable energy sector planning security.

The Swedish energy policy is a one of the most comprehensive one in Europe. The power sector is only one part of the energy policy. Another important one is the transport sector. By 2030 Sweden targets a totally fossil-free vehicle fleet. For that goal Sweden is spending a high amount in ethanol research and is also promoting electric cars. The combination of electricity and biofuels will lead the transition of the transport sector. To conserve the energy Sweden is also introducing programs to promote energy efficiency in households and in the industry. To put it in a nutshell, the energy market in Sweden provides many different business opportunities.

Due to its successful experience and knowledge in implementing green technologies the country can be seen as a role model for many countries. On the one hand, developing countries which need a sustainable infrastructure in line with their growing population can take Sweden as an example to find ways for sustainable economic growth. On the other hand, developed countries as well should have a glance at the Swedish energy market. It is merely a matter of time before the technologies and the innovative market design in this sector are also implemented in other countries

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Sweden
Interview mit Pär Hermerén

Pär Hermerén

Academic Education

1998	Stockholm School of Economics M.Sc. Business and Administration
1995	University of Uppsala Human Geography

Working Experience

seit 2008	Swedish Association of Engineering Industries Director Energy and Transport Policies
2002–2008	Governmental Offices Sweden Desk Officer – Energy Efficiency, Security of Supply, International Energy Markets
1998–2002	Stockholm Energy, Birka Energy, Fortum Markets Business Intelligence, Business Development

Other Commitments

- Member of Board, Forum for Swedish Smartgrid
- Member of Board, RISE Certification Board

The following chances/possibilities and pitfalls were discussed during Interview with Mr. Pär Hermerén, a Future Energy Analyst at Teknikföretagen, Sweden

Sweden is worldwide recognized for its innovative capacity and for its environmental mind-set. What are the technologies in the energy sector which are currently drawing attention?

Electrical grid companies are currently investing in new capacity and technologies. A hot topic is, therefore, smart grids and smart meters. They are already quite developed in Sweden but nevertheless the technology still provides interesting automatization and steering possibilities. However, it has to be said that the current tariffs and political regulation represent a challenge for further investment in this field.

So let's take further the topic. What are the important questions and issues?

How to attract more investments in these new technologies from the grid companies, and make the grid "smarter"?

How to reduce energy intensity with 50% until 2030, as the political goal is set?

How to reach the goals in decarbonization of transport, and to develop electrification?

Is there another technology which is currently hot in Sweden?

Storage and batteries is a hot topic in Sweden in combination with for example chargers, which will be installed in large quantities. With further investments in renewables, the development of energy storage is key for the future. This should be seen in relation to the Swedish goal of reaching 100% renewable electricity in 2040.

According to recent studies the wind energy market in Sweden has a high potential and provides good business opportunities. Nevertheless, could you tell us what are the pitfalls or the risks in doing business in this sector?

The Swedish wind power market is open for foreign investors, that means that for example German investors are permitted to acquire and operate wind power farms in Sweden. The investments have been declining lately, mainly as response to political uncertainty. However, that has possibly changed now as the system with green certificates will be enhanced. Additionally, there is always also the risk of public protests because of environmental concerns against wind farms.

Sweden does not have the best requirements for solar energy, however, there is a growing trend of installing PV systems for private use. Could you tell us more about this?

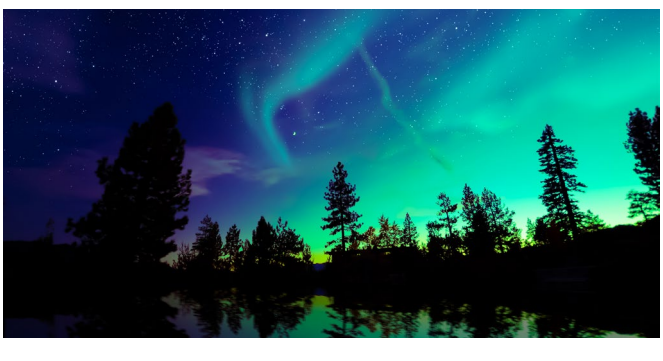
That's true. There is a growing trend of self-supply with power from solar energy sources. Firstly, the government promote the installation of PV systems for small users through funding programs, mainly for own consumption. This lead to great requirements for further expansion of solar power. Furthermore, having solar panels on the roof is nowadays very popular as it gives the company or the private person a good image as being "climate responsible".

Sweden is using green certificates to promote renewable energies. Today to which renewable energy source these certificates are predominantly allocated?

These green certificates are almost completely allocated to biomass plants and wind mills.
Over the course of time, since 2003, approximately with a share of 50% each. Last year however, wind mills have taken about 70% of these certificates.

Finally, the last question. What kind of market opportunities can be currently found in Sweden?

As mentioned before, the electrification of transports will be a growing business. Since the electrification of the roads for heavy transportation is still at the experimental level, this field also provides high potentials. Moreover, the political goal of cutting CO_2 emissions in transports by 70% until 2030 will be an impetus for biofuel.



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World map »

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