



Czech-Austrian Winter and Summer School

Wholesale electricity markets

Differences in price, developments, structure

Guidelines for the Student Papers

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Abstract

The target of the seminar paper is to analyze wholesale electricity markets, including its functioning. Introducing and clarifying the emergence of an open/liberalized market and finding coherence with the European Union. Finding the development of electricity prices on the wholesale market and getting to know the market participants. Then, by comparing the work, it will provide information on the differences between the Czech Republic and Austria.

Key words

Electricity, wholesale electricity market, development, trade, price, Liberalization

Abstrakt

Cílem seminární práce je analýza velkoobchodu s elektřinou včetně zjištění jeho fungování. Uvedení a objasnění vzniku otevřeného/liberalizovaného trhu a nalezení souvislostí se spolupracováním s Evropskou unií. Zjištění průběhu cen elektřiny na velkoobchodním trhu a seznámení se s účastníky na trhu. Poté provedením komparace práce uvede informace týkající se rozdílů mezi Českou republikou a Rakouskem.

Klíčová slova

Elektřina, velkoobchod s elektřinou, vývoj, obchod, cena, Liberalizace

1. Introduction

Today, electricity is very important to all of us. No household can work without electricity. The process of liberalization of energy markets in the EU states started at the beginning of the 1990s. There are retail markets and wholesale electricity markets where different participants meet and offer or buy electricity. On the wholesale market, participants buy and sell each other's electricity. Wholesale electricity markets have been created to address ever-increasing electricity prices and boost innovation through competition with free businesses. This market starts with producers. The electricity produced by them is purchased by the entity, which then sells it to final customers. Electricity cannot be stored on the market, so production and consumption must be always the same and energy must be delivered to the distribution network at the time of consumption.

This work is divided into 4 chapters, with each chapter examining the situation in Austria and the Czech Republic, in addition to bringing it closer to the whole European Union, comparing the differences and examining why this is the case.

The first chapter examines the development of the market in both countries. Information about the history of the market is found together with its development. The chapter interprets the interconnection of selected countries and indicates whether the cause of introducing a liberalized market is related to the regulations issued throughout the European Union or not.

The next chapter compares the development of electricity prices. It finds out what the differences between countries are, how high or low they are, and why. Then the chapter also presents a comparison of oil prices because these prices are clearly linked together.

The last chapter introduces individual electricity market participants. It points out the differences between countries and explains the function of individual participants. Market participants are an essential part of the functioning of the market. Without them, the market couldn't work. The chapter will also find out if they exist in any of the selected countries, any different participants, and whether or not trading between participants is the same.

2. Market Development

2.1. Europe

Throughout the last decades, the development of the European and as well as of the Austrian wholesale electricity market was mainly influenced by the EU's efforts to liberalize the energy markets. (E-Control, 2011)

Originally, the liberalization of the energy markets was mainly focused at increasing the competitiveness of the European industry with third country suppliers like for example Japan or the United States, preparing even competitive conditions within the EU as well as ensuring the security of supply. (E-Control, 2011) Furthermore, free market access as well as the consumer's right to choose their own energy supplier play important roles. (E-Control, 2011)

To achieve those targets, crucial key elements for the regulation of the European internal energy market had to be implemented. The first element is called unbundling. It means a separation from the production of energy and the energy transmission, or in other words the separation of the natural monopoly of a power grid and the competitive field of energy sales. (E-Control, 2011), (Oesterreichs Energie, s.a.) Without unbundling the owner of a power grid could try to obstruct other competing suppliers' access to the transmission system to keep a monopoly. Secondly, access to the energy grid systems to parties apart from the owners and cross-border energy trade need to be ensured. (E-Control, 2011) Furthermore, there needs to be a clear definition of the roles, rights and duties of the different market participants. (Oesterreichs Energie, s.a.)

Finally, a common, liberal energy market must have legal oversight. So, a network of independent regulator and control agencies on national (for example E-Control in Austria) and international (ACER) level was implemented. (E-Control, 2011) (Oesterreichs Energie, s.a.)

Up until today four packages have been passed by the European Union which define and further develop the liberalized energy markets.

The First Energy Package covered two directives, concerning the common rules for the internal market in electricity as well as in gas. The electricity directives of these two first liberalization directives was adopted in 1996. (GOUARDÈRES, F., 2019) (Emissions-EUETS, 2019) The First Energy Package started the process of unbundling on the accounting level of the energy providing companies as well as the opening up of the market access for certain (larger) energy consumers. (Oesterreichs Energie, s.a.)

The Second Energy Package which was adopted in 2003 had the goal to further establish a European internal market in electricity and therefore repeals the directive of 1996. It further opened up access to the energy markets and gave costumers – industrial and domestic ones alike – the right to freely choose their gas and electricity suppliers. (GOUARDÈRES, F., 2019) (Emissions-EUETS, 2019) Beside of these targets, the member states of the EU had to found and implement independent regulators. In Austria the responsible agency is the E-Control, which was already founded in 2001. (E-Control, 2011) (Oesterreichs Energie, s.a.) In the Czech Republic the responsible agency is the Energy Regulatory Office (ERO) and it was set up also in 2001.

Finally, a Third Energy Package was adopted by the EU in 2009. (GOUARDÈRES, F., 2019) It changed the requirements for as well as strengthened (national) regulators. Furthermore, it established and defined the role of the Agency of the Cooperation of Energy Regulators

(ACER). (Oesterreichs Energie, s.a.)(EU COMMISSION, 2015) Additionally, networks of the European Transmission System Operators were implemented (ENTSO-E for the electricity market, ENTSO-G for the gas market) and the rules for cross-border energy flow were harmonized. (E-Control, 2011) (Oesterreichs Energie, s.a.) (EU COMMISSION, 2015) Finally, it strengthened the role of the consumers. (Oesterreichs Energie, s.a.) (Stromliste, s.a.)

Another important part of the Third Energy Package is that it defined three options, in which the legal unbundling energy supply and transmission had to take place ((Oesterreichs Energie, s.a.) (EU COMMISSION, 2015):

The Ownership-Unbundling-System stands for a complete separation by forcing the energy companies to sell off at least the majority share of their electricity networks and by forbidding any interference in the operation of the transmission system by the original owner. (E-Control, 2011) (EU COMMISSION, 2015)

The Independent System Operator-Systems describes a situation in which a supplier still officially owns its transmission networks, but an independent company operates and manages them. (E-Control, 2011) (EU COMMISSION, 2015)

The Independent Transmission System Operator-System (ITO) works like the ISO, but instead of an independent company, a legally independent subsidiary is responsible for the management and maintenance of the parent company's electricity networks. The ITO is still part of the holding. (E-Control, 2011) (EU COMMISSION, 2015) All three legal forms of unbundling are recognised as possibilities in Austria's Electricity Industry and Organisation Act. (Parlament, 2009)

The latest Energy package – the Clean energy for all Europeans package – aims at speeding up the transition of the European energy system to include increasing shares of renewable energy as well as a reduction of the emissions of greenhouse gases. (EU COMMISSION, 2019) It is built up out of four directives and four regulations. The first half of the package defines binding targets for the energy performance in building, the renewable energy share (32% of the EU's energy mix) as well as an increase of energy efficiency (32.5%) which must be reached up until 2030. Furthermore, the member states must draft national energy and climate plans (NECP) describing how they will achieve their individual targets. (EU COMMISSION, 2019), (EU Commission, 2019b) The second part of the package consists out of four dossiers and aims at redesigning the EU internal electricity market to meet the requirements of a sustainable and efficient energy system by integrating renewables and improving cross-border cooperation. Furthermore, consumer rights will be increased. These changes are mostly factored into the updated electricity directive and the new electricity regulation. (EU COMMISSION, 2019)(EU Commission, 2019b)(EU Commission, 2019a) The other two dossiers regulate a future, stronger role of the Agency for the Cooperation of Energy Regulators (ACER Regulation) and make sure that in case of crisis the member states have prepared plans to follow Regulation on Risk Preparedness of the electricity sector. (EU COMMISSION, 2019)(EU Commission, 2019a)

As this newest Energy package has only been agreed upon in late 2018/early 2019, its contents have not yet been included into Austrian national law. (EU COMMISSION, 2019)

2.2. Austria

The development of the Austrian electricity market followed the changes of the European legislative. But the liberalization of the Austrian market happened faster as specified by EU law. Already the first Austrian Energy Liberalization Act exceeded the targets specified in the first EU Energy package. The complete opening and the liberalization of the Austrian electricity market was reached on October 1st 2001, when all consumers obtained the right to choose their supplier freely. (E-Control, 2011) Before the liberalization of the energy markets, a consumer was connected to the grid system of one vertically integrated energy company and was forced to buy energy only from them. To enable this freedom to choose commercially, Austria introduced the balance group system which allows to reflect the commercial flows to the individual market players separated from the physical flows. (E-CONTROL, 2013)

National regulator became the in 2001 founded e-control. One of its first task was the development of the implementation of the rules for the Austrian electricity market. (E-Control, 2011)

In Austria, two laws cover most of the contents of the Third energy package. In the gas area it is the Natural Gas Act. The targets of the electricity are like the necessity to unbundle are found mainly in the Electricity Industry and Organisation Act (Elektrizitätswirtschafts- und organisationsgesetz – EIWOG) 2010. As the EIWOG is a Basic Act of the federation, Austria's nine states had to pass implementing laws as well. Since its passing, it has already been amended for several times. (E-Control, 2011) (E-CONTROL, 2009)

The market liberalization also led to changes in the electricity wholesale market. While the distribution of electricity exchanges was comparably heterogenous at the beginning, throughout the liberalization process a certain consolidation took place. (E-Control, 2011) Nowadays, French EPEX, German EEX and Austrian EXAA belong to the most important official electricity exchanges in Austria. (E-Control, 2011) (E-CONTROL, 2019)

While most of the Clean Energy Package's content has not yet been implemented, it can be assumed that it will lead to an evaluation and revision of Austria's Electricity Industry and Organization Act. An evaluation process of the Austrian Energy Efficiency Act (about whether it meets the targets of the new energy efficiency directive) was already started. (BMNT, 2019). Further parts of the package will be incorporated in the national Heat strategy as well as in the Act to expand renewable energy (Erneuerbaren-Ausbau-Gesetz) which are currently in preparation. (BMNT, 2019a) (BMNT, 2018)

A first draft of Austrian national climate and energy plan was filed to the EU at the end of 2018. In the draft, the Austrian government commits itself to "increase the share of renewable energy in gross final consumption of energy to 45-50%, and source 100% of electricity consumption from renewables (national balance)" (EU Commission, 2018)

A small setback for open markets was the recent electricity price zone separation. Since 2002 Austria and Germany were in the same electricity price zone. It was often criticized, because a lot of solar- and wind energy that was transported from the North to the South of Germany going to Austria was stressing the undersized transportation lines. Grids often had to be stabilized by Re-Dispatches which resulted in high costs.

Also electricity flows that went not directly from Germany to Austria but via Poland and the Czech Republic where causing problems in these countries.

In May 2017 a law was passed, that separates the electricity price zone Germany/Austria, starting in October 2018. It was negotiated that the maximum power to be transmitted through the boundary-coupling points on the border is 4900 MW. According to analyses this limit was previously overstepped only 10 to 15% of the time. (NEXT, 2019) As a result, trades can't be carried out unlimited, which results in a price difference between the two countries. While the price gets lower in Germany, it will rise in Austria. More detailed information is written in the chapter 3.1.

2.3. Czech Republic

In the Czech Republic the energy sector was adapted to the needs of industrialized economy. The industrialization began in the second half of the 19th century. The electrification was on larger scale conducted during the First Czechoslovak Republic. The process was designed to meet industrial requirements. After the Second World War, the economy was further industrialized to be in line with plans of the Soviet Union focusing on heavy industry.

The first impetus for attempts to liberalize and integrate European energy was laid down in the European Council Directive on electricity transmission through electricity grids and the European Council Directive on the procedure to increase the transparency of gas and electricity prices charged to industrial end-users. Their goal was primarily to reduce electricity prices. A final decision on the liberalization of the European electricity market was laid down in a Directive of the European Parliament and of the Council on common rules for the internal market in electricity. (Kalabiška, 2016)

Since 2005, a liberalized/open electricity market has been opened in the Czech Republic, with the possibility that customers, like in Austria, have the option to choose their electricity supplier in the electricity grid. One of the objectives of liberalization was precisely the freedom for customers to choose a supplier.

The accession of the Czech Republic to the European Union had a great impact on this process. The Czech Republic had to implement European legislation to the Czech Republic and the European Union directives and regulations have a significant share in the opening of the electricity market. This process had also effects on the price. The electricity price is now directed by individual traders and customers have the opportunity to save on changing supplier. In the European countries, energy companies were owned or regulated by the state in the pre-liberalization period and electricity prices for consumers were set centrally. In the Czech Republic, this function was held by the enterprise České energetické závody. After 1989, however, a number of organizational units were gradually separated from this enterprise, which in 1992 gave rise to joint-stock company ČEZ and E.ON. (Kalabiška, 2016)

At present, the Energy Regulatory Office regulates the one part of electricity price – the price without taxes. The ERO functions like an independent chapter in the state budget. This office

hasn't economic activity and it isn't authorized to provide subsidies. (Energy Regulatory Office, 2019)

The Energy Regulatory Office

In 2001, the Energy Regulatory Office was established as an administrative authority for energy regulation. The main tasks of the ERO are price controls, support for competition in the energy industries, supervision over markets in the energy industries, support for the biomethane, protection of license holders vested interests and protection of legitimate customers and customer's interests in the energy industries. (Energy Regulatory Office, 2019)

3. Historic Price Development

3.1. Austria

The wholesale electricity price is the basis for the energy price a customer has to pay. It is without taxes, net costs and other additional costs. A large proportion of wholesale market deals are bilateral contracts between producers and consumers in the Over-the-Counter (OTC) market. On the other hand there are official electricity exchanges like the Austrian EXAA, the German EEX and the French EPEX. As the OTC prices are very similar to the exchange prices, the wholesale prices can be estimated based on the exchange prices. (E-CONTROL, 2019)

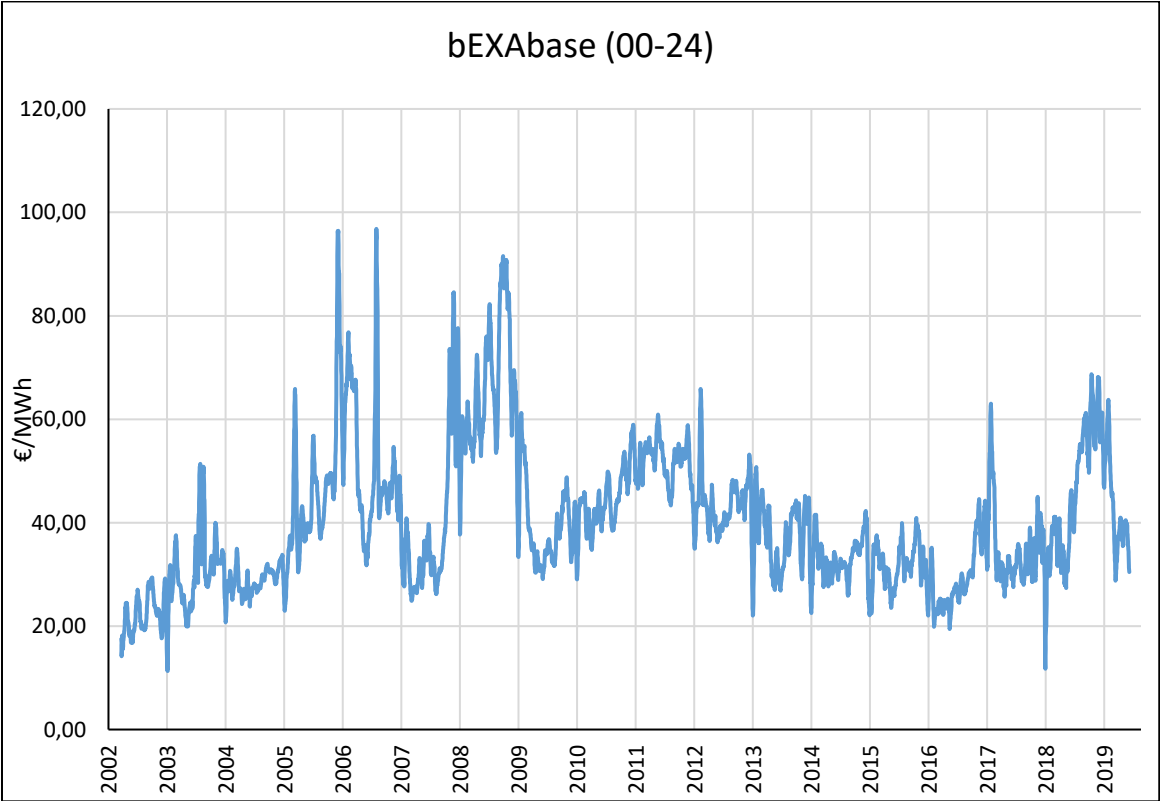


Figure 1: bEXAbase electricity price development 2002-2019 (EXXA, 2019)

Figure 1 shows the price development of the bEXAbase product on the EXXA exchange market. For the diagram a 14 day running mean value was calculated out of historic data. (EXXA, 2019)

The price development over the years can mostly be described with developments on the oil market (Figure 2), as there is a strong correlation between these prices. For example in the beginning of 2009 the oil prices dropped significantly, so did the electricity price.

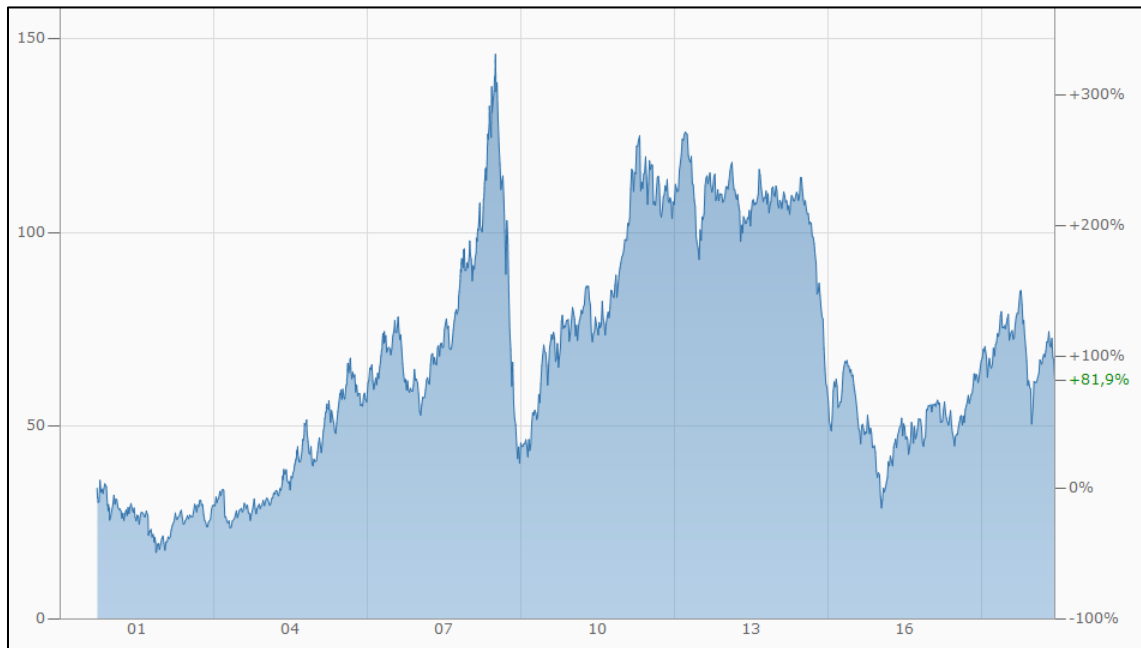


Figure 2: Oil price development of BRENT in Dollar in Austria until June 2019 (Finanzen, 2019)

In October 2018 the price increased. This is partly due to the separation of the electricity price zones of Germany and Austria. The energy delivered across the border is now limited and therefore the price in the relatively smaller Austrian region increased compared to Germany. It was estimated that the increase would be about 2 to 6 € / MWh. (Austrian Energy Agency, 2018). From October to May the actual average difference on the EXXA exchange market between the Austrian and the German electricity price was 4.42 € / MWh. For the calculation, the daily average price of Austria was subtracted from the price in Germany and then the mean value was calculated (see Table 1).

Table 1: Price deviation after the electricity price zone separation

	Average Price Austria (€/MWh)	Average Price Germany (€/MWh)	Average Price Difference (€/MWh)
Oct. 18	62.33	53.10	9.23
Nov 18	62.24	57.04	5.21
Dec 18	55.24	48.09	7.16
Jan. 19	57.32	50.45	6.88
Feb 19	46.73	43.21	3.52
Mar. 19	33.19	30.76	2.44
Apr 19	38.74	38.08	0.66
May 19	38.60	38.35	0.25
Average	49.30	44.88	4.42

Austrian Electricity Price Index (ÖSPI)

The ÖSPI is calculated and released every month by the Austrian Energy Agency. Since 2006 it measures the wholesale electricity price changes. As a basis value, the electricity price of the year 2006 is taken. For getting the index the ÖSPI takes the Electricity Price – Futures of the following four quarters into account. (Austrian Energy Agency, 2018a)

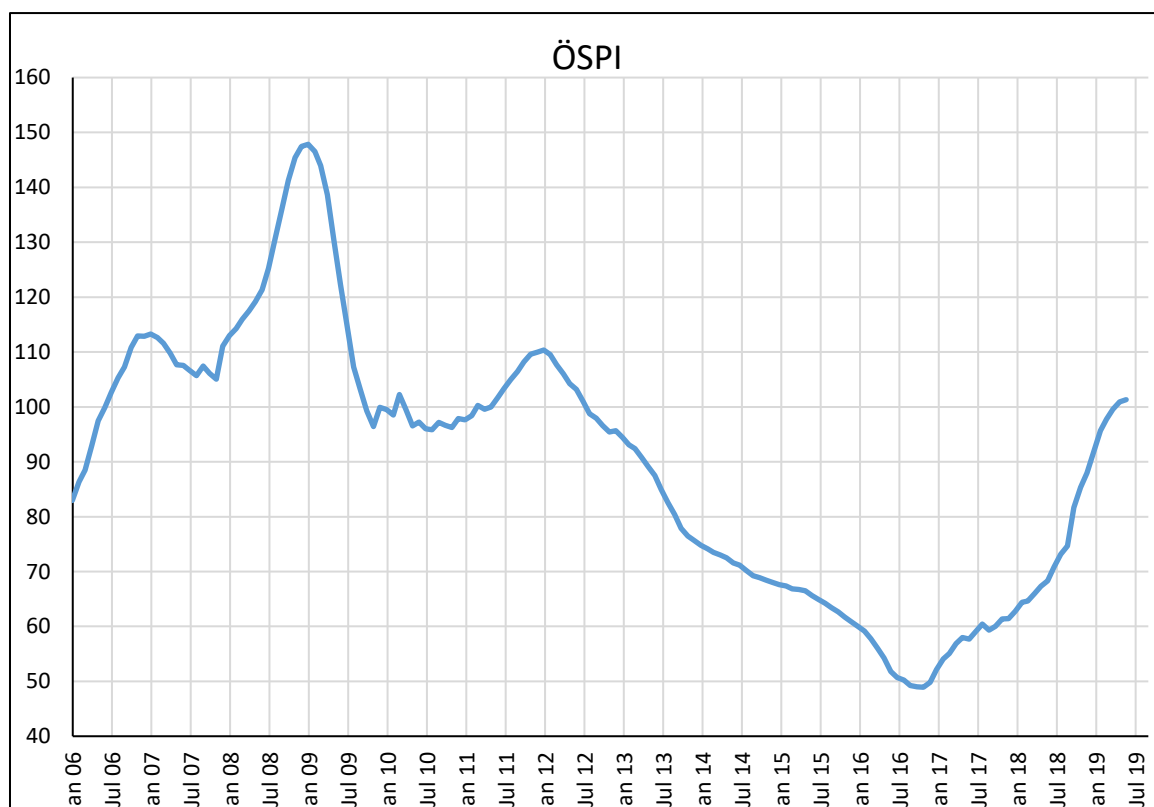


Figure 3: Development of the ÖSPI, 2006 to 2019 (Austrian Energy Agency, 2019)

As illustrated in Figure 3, the electricity wholesale prices plummeted after a short-term absolute high in January 2009 and subsequently remained at a relatively low level. Since the interim high in January 2012, wholesale electricity prices have been on a constant downward trend, which reached its absolute low in November 2016. Since then, prices are almost constantly rising again. In September 2018 the price increase rate changed significantly. This is partly due to the separation of the electricity price zones of Germany and Austria.

3.2. Czech Republic

Price development has been mixed from the point of view of different customer categories in the Czech Republic. In 2009 the Czech Republic became the fourth most expensive EU Member State when measured by gas prices for household consumers in purchasing power parity.

The biggest difference between retail and wholesale market is price. The retail price is composed of unregulated and regulated items. The wholesale price is determined by the market. It isn't regulated. Manufacturers set the price to make a profit. The wholesale market costs faced by retailers include spot energy cost and hedging costs. (Parisot, L., Nidras, P, 2016)

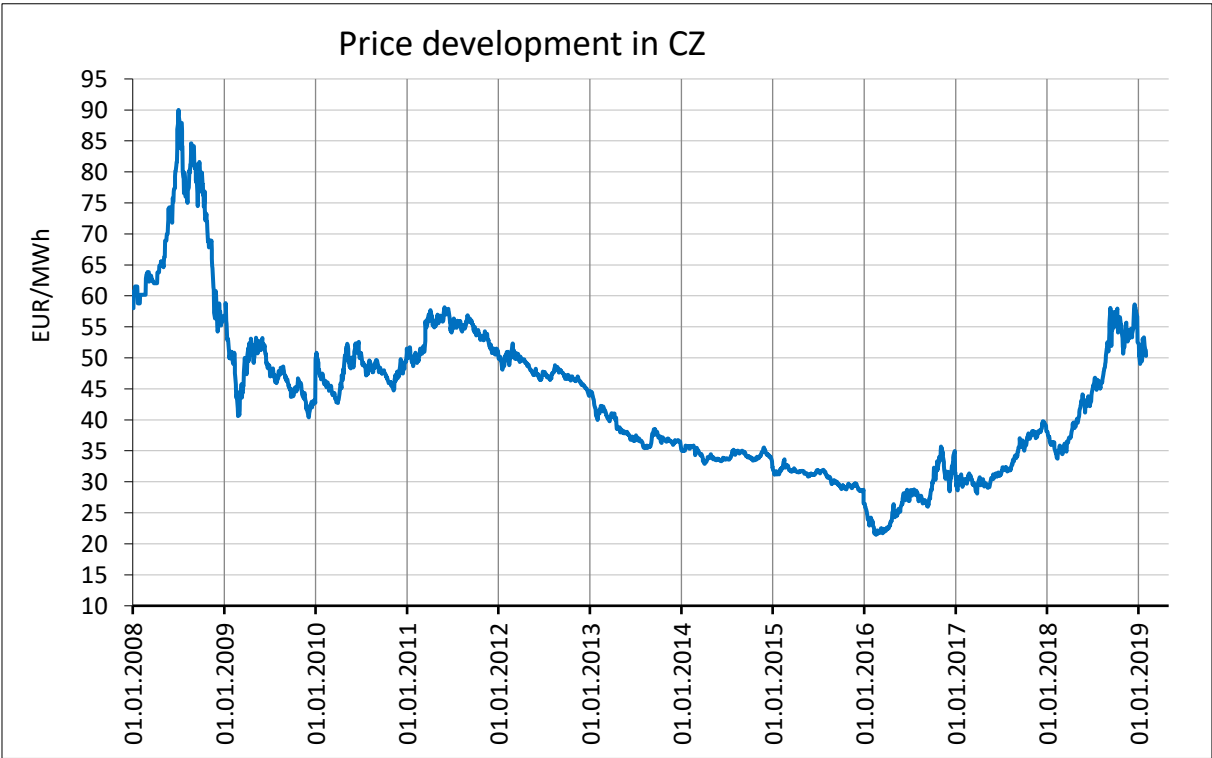


Figure 4: Development of the electricity price from 2008 to 2019 (PXE, 2019)

Figure 4 shows that the development of electricity from 2012 to 2016 was accompanied by a downward trend in the markets. This downward trend was due to the economic crisis. The biggest drop occurred in February 2016, when the electricity price was 21.45 EUR per MWh. Compared to that, the highest price of electricity is in July 2008 - 90 EUR per MWh.

Oil prices have a major impact on the price of electricity. But the electricity prices are following oil prices with a 75-day delay.

After the drop in prices in 2014 to 2016, crude **oil prices** have broadly been rising again. The rise that began in spring of 2016 has been driven by global factors. Exchange rate developments also add to price uncertainty. Global energy markets are denominated in US dollars rather than Euros. (European Commission, 2019)

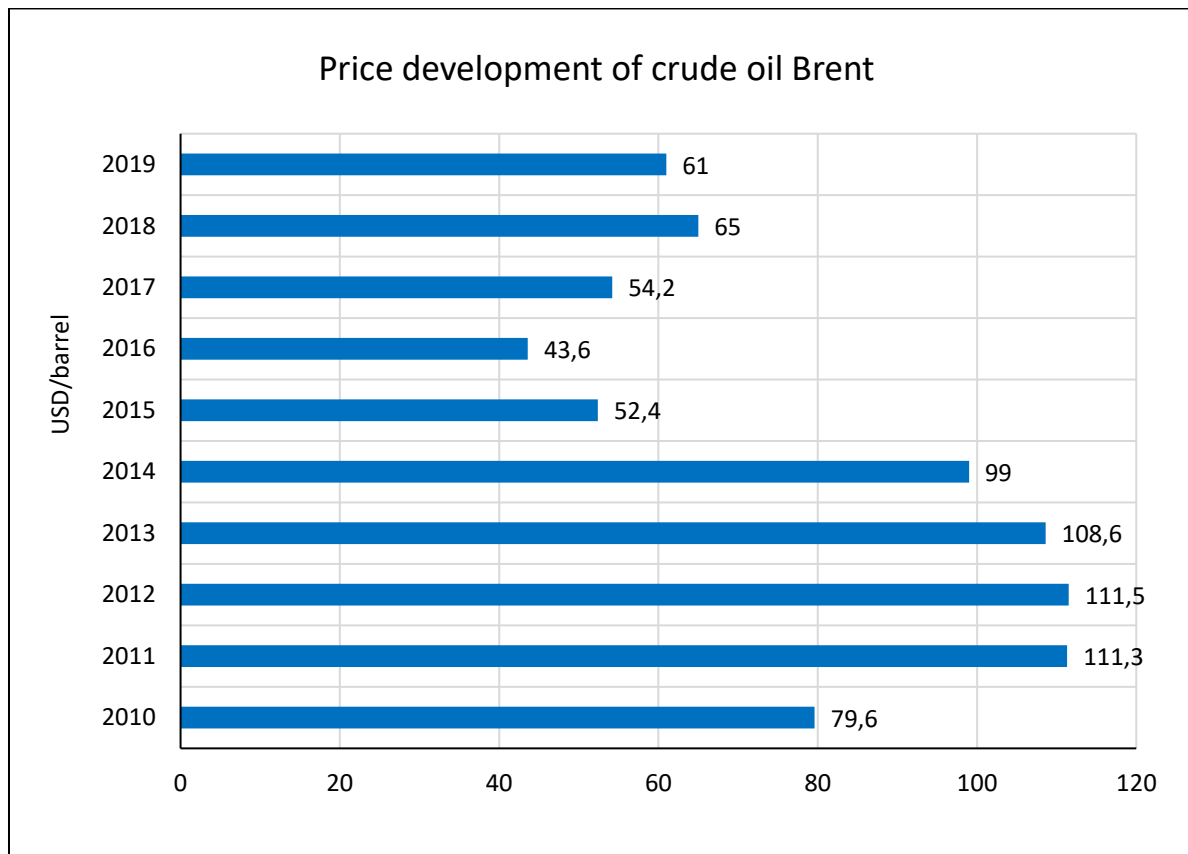


Figure 5: Oil price development of Brent in USD in the Czech Republic (Ministry for Finance, 2018)

Brent Oil is traded through futures contracts. After WTI, Brent oil is the second most highest in demand. In the Figure 4 can be seen price development of electricity and differences with oil prices in the Figure 5. These prices are linked and they have almost the same development. Every year, oil prices were higher than electricity prices. In the present, the price difference is only about 10 Euros. In the Figure 2 can be compared the oil development in Austria with Czech prices. The development in both countries was also almost the same and the prices were very similar.

In the Figure 6 can be seen the differences between Czech electricity prices and Austrian electricity prices starting from 2010. In 2008 the prices in both countries are almost the same.

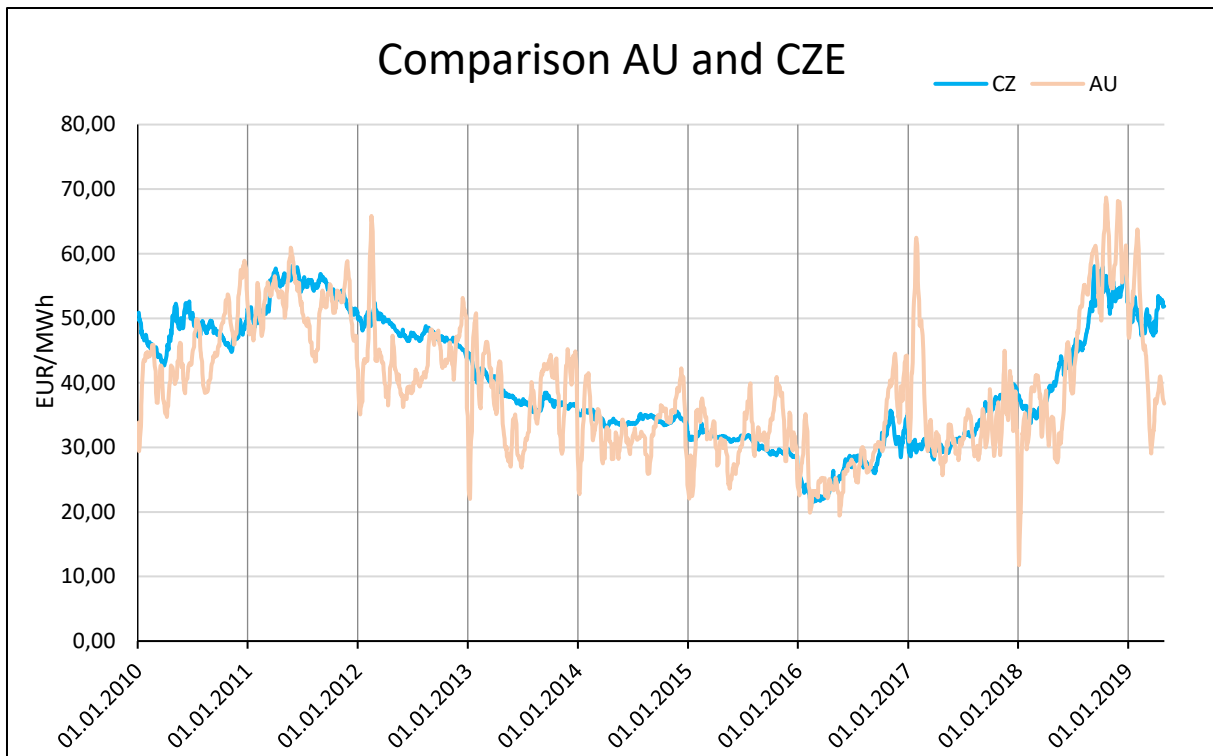


Figure 6: Comparison of prices between the Czech Republic and Austria per years (EXXA, 2019; PXE 2019)

The price developments are almost the same in both countries. The prices in the Czech Republic were apparently lower than the prices in Austria. The market in Germany is associated with the market in Austria and their common market is several times stronger than market in the Czech Republic and therefore the Czech Republic try to balance prices with neighbors.

In Austria the prices moved very fast. For example in January 2017 the price was very high, but in March the same year the price was half as high. There are large differences between months.

In the present, the Austrian electricity price is lower than Czech price. The Czech suppliers give higher prices to electricity because in stock exchange market the price increased too.

In the future, the price of electricity in wholesale markets will increase. It can be expected because Germany is planning a full shutdown of all nuclear power plants in 2022.

Index PXE General CZ

In Austria there is the ÖSPI, and in the Czech Republic the Power Exchange Central Europe has created the PXE index. The index serves only for information. The objective is to express the situation in the Czech electricity market in figures, and subsequently compare the historical price development. (PXE, 2019)

The index calculation is based on the MSCI international standards (Morgan Stanley Capital International). The PXE index was updating every time when the trading day is closed, and the value is published on the PXE website. (PXE, 2019)

Table 2: PXE Index (KURZYCZ, 2019)

Date	Index PXE
12.12.2007	1 815.10
30.12.2008	858.20
30.12.2009	1 117.30
30.12.2010	1 224.80
30.12.2011	911.10
28.12.2012	1 038.70
30.12.2013	989.04
30.12.2014	946.71
30.12.2015	956.33
30.12.2016	921.61
29.12.2017	1 078.16
28.12.2018	986.56

This index is expressed in points and it changes every business day. PXE Index either strengthens (growing) or weakens (falling).

The Table 2 shows the development of the PXE Index in the Czech Republic to the end of years. The biggest difference occurred from 2007 to 2008, when the Index dropped by 60 percent. In present the Index moves around 1 000 points.

4. Trading

The development of a wholesale market for electricity was a mature step in the liberalization process. At the beginning of the liberalization the exchange markets were very heterogeneous. Over time the structures have adapted and markets got more similar to each other. Today the most important energy trading exchanges in Central Europe are the EPEX Spot/EEX, the APX-ENDEX and Nordpool. (E-Control, 2011)

The trading exchanges offer trades on different markets. Table 3 gives an overview of the markets and a time structure to each one. Electricity can be bought a few years in advance via Futures or even on the same day on the intraday market. The markets are explained in more detail in chapter 4.1. Although it is explained from the perspective of the Czech Republic, the basics apply to Austria as well.

Table 3: Structure of the various trading forms in terms of time (E-Control, 2011)

STRUCTURE OF THE VARIOUS TRADING FORMS IN TERMS OF TIME								
OTC	Spot market		Forwards/Options and structured products					
Exchange Market	Intraday	Day-Ahead	Weekly and monthly contracts	Futures and Options				
	today	tomorrow	1 month	1 year	2 years	3 years	4 years	5 years

4.1. Czech Republic

The main piece of legislation of Electricity trading is the Energy Act. This Act sets out the conditions for public administration, business activities and also regulation in the energy sector. (Mondaq, 2012)

Electricity is traded at Prague-based Power Exchange Central Europe (PXE), and in spot markets (block, day-ahead and intraday) operated by CS OTE, a. s. The PXE trades the long-term trading, like a futures. Since 1st September 2009 the Czech day-ahead market has been united with the Slovak day-ahead market. Now Czech electricity traders can place bids for purchase and sale of electricity for the whole territory of the Czech Republic and **Slovakia**. Intra-day trading takes place through a notice published on the internet that sets out all offers for the purchase and sale of electricity. Some electricity market players are able to sign purchase contracts for the supply of electricity in future weeks, months, quarters or years, at a price negotiated on the contract date. This market players can trade on the futures. (Mondaq, 2012)

PXE Trading

In the Czech Republic the electricity may be traded on the PXE, in the form of commodity futures. This company was established on 8 January 2007 as Energetická burza Praha. Since then PXE offered services on the electricity markets, namely providing anonymous trading and settlement of standardized energy products.

The Prague-based Power Exchange Central Europe offers power trading for Czech, Slovak and Hungarian power. This regulated market is organized and managed primarily under the Commodity Stock Exchange Act. Trading on the PXE is allowed only to participants who meet the conditions for participation in trading at the PXE in accordance with the law. The individual contract trades are monthly, quarterly or annually (Mondaq, 2012).

OTE a. s.

This company is the Czech electricity and gas market operator. The sole shareholder of the Company is the Czech Republic. The OTE's operations represent an irreplaceable position on the electricity and gas. The main activities include the organization of the short-term electricity market, organization of the balancing market with regulation energy and administration of support for renewable energy sources. (OTE, 2019)

The Daily market operates with everyday traffic, seven days a week, when electricity can be traded for 24 hours the following day. The market operates on the same principles as the stock exchange and the price here is the result of supply and demand. The amount of traded products is governed only by the OTE framework rules and the exchange participants are anonymous. (Říha, 2011)

The Intraday market is organized for hours inside a business day, continuously seven days a week and 24 hours a day. That means this market is still trading on the day the physical supply and demand takes place. The market is open from 3 pm on the day preceding the business day. An intraday market participant may enter an unlimited number of different bids for each trading day of a given trading day. (Říha, 2011)

The Block Market is the latest trading platform for electricity set up by OTE. By block products are meant longer time zones.

BT distinguishes three basic types of blocks: Base, Peak and Off Peak. The Base block refers to the electricity supply at all hours of the day, each day of the week. The Peak block includes electricity delivery in the strongest time period. That means from 8h to 20h. On the other hand, the Off Peak block includes delivery in a low-power time zone. That means from midnight to 8h. (Říha, 2011)


Futures represent the average of the expected spot prices over a longer period, making them less volatile. Electricity Futures Market leads to a more efficient and competitive wholesale and retail market with long-term benefits for consumers. This market introduces the purchase or sale of a standardized amount of electricity at a pre-agreed price at a set future date. (Commission de Régulation De L'Énergie, 2019)

4.2. Austria

Table 4 shows the most important exchange markets in Austria, namely EEX, EPEX Spot and the Austrian EXXA. It also gives an overview of the traded products and the trading periods. The EEX only trades futures, while the EPEX Spot has a day-ahead and an intraday market. The EXAA only has a day-ahead market.

Table 4: Trading periods on electricity markets (Next, 2018)

Electricity Exchange	Futures Trading	Day-Ahead-Auction	Day-Ahead-Auction	Intraday-Auction	Intraday-Market	
	EEX	EXAA	EPEX Spot	EPEX Spot	EPEX Spot	
	until 12pm of the last day of the previous month	until 10:12 am of the previous day	until 12:00 am of the previous day	until 12:00 am of the previous day	from 3:00 pm of the previous day to 5 minutes before t0	
Product	Monthly Base	Hourly, Quarter-hourly	Hourly, Block products	Quarter-hourly	Hourly, Quarter-hourly	
Over-the-Counter (OTC)	Until 0 minutes before t0 for trades inside a balancing area. 15 minutes otherwise					Day-After-Market
balancing energy	primary balancing	secondary balancing		Minute balancing energy		



Time **t0**

5. Market participants

Basically, the participants of the energy market can be separated in two groups. The first group is necessary (physically and financially) for the basic functioning of any energy market. To this group belong among others transmission system operators, energy suppliers, consumers, traders. If one of this players is missing the operating of the market would be hardly possible or not possible at all and are very similar in different national market systems. To ensure equal competition, a liberated market and a security of the electricity system, various regulations have been passed on national and EU-level. As a result a second group of market participants has evolved e.g. regulators or members of balancing groups in Austria. As national governments have options in how to translate EU law in national legal Acts, the roles and definition of the members of the second group can vary.

5.1. First group

5.1.1. Electricity producers

Electricity producers trade and sell the output of their power plants. A power plant is an energy facility for converting different forms of energy into electricity.

The manufacturer is a company or an individual person entering the electricity trade. If he is authorized and has a license, the manufacturers may operate electricity generation facilities. The producers has the right to connect this equipment to the electricity grid if they hold an electricity license and fulfill the conditions for connecting to the transmission or distribution systems (Chemišinec, I. a spol. 2010).

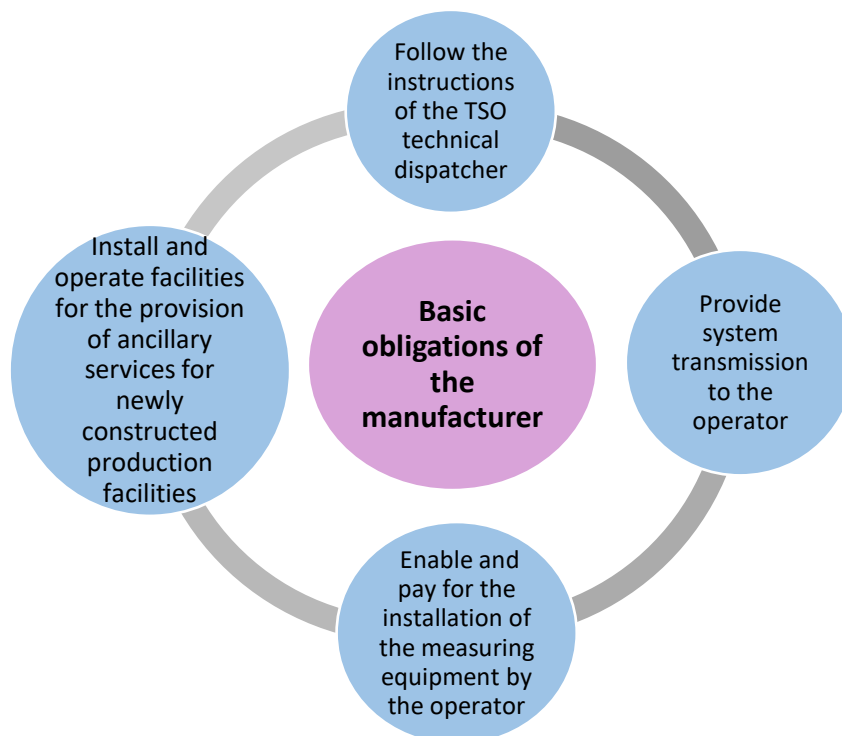


Figure 7: Basic obligations of the manufacturer (Chemišinec, I. a spol., 2010)

5.1.2. Electricity suppliers, retailers and traders

An electricity trader is an individual person or legal entity. His activity is usually conditioned by the authorization to trade (license) with electricity. The license is issued for a certain period of time, Mostly it's a shorter time. Traders are also allowed to act as end customers or producers. They have the right to transport the agreed amount of electricity if they have an electricity transmission or distribution contract.

The suppliers negotiate with the customer on an electricity supply contract. The price of electricity is one of the basic parameters. The subject of the distribution system operator's activity is the technological provision of electricity supply including the connection to the electricity grid and measurement of the supplied electricity volume (Chemišinec, I. a spol. 2010).

5.1.3. Electricity costumers

A final costumer is a legal entity or individual person who only processes the electricity taken. They have the right to access the transmission system and distribution systems and, since 2001, to freely select the electricity supplier. Then they have the right to buy electricity from the electricity generation license holders and from the electricity trade license holders (Chemišinec, I. a spol. 2010).

5.1.4. System Operators (SO)

A system operator is responsible for a grid with a nominal frequency of 50 Hz. His tasks include metering, data handling of grid users and submission of necessary information to all market participants. There are Transmission System Operators (TSO) and Distribution System Operators (DSO) with very similar tasks but working on different grid levels (E-CONTROL, 2013).

Transmission system operators (TSO)

The transmission system is an interconnected set of 400 kV, 220 kV and selected 110 kV lines and equipment. They serve to ensure the transmission of electricity throughout the country and to interconnect with the electricity systems of neighboring countries, including measuring, protective, control, signaling, information and telecommunications system. The transmission system is operated in the public interest (Chemišinec, I. a spol. 2010). In Austria there is only one TSO, the Austrian Power Grid (APG). In the course of the unbundling process of the EU, the APG was recognized as an independent TSO by the European Commission and the E-Control Austria in 2012. (APG, 2015) In the Czech republic there is the ČEPS, the Czech Transmission System Operator. The ČEPS is the holder of an electricity transmission license and provides electricity transmission. (Chemišinec, I. a spol., 2010)

Distribution system operators (DSO)

Electricity distribution is the transport of electricity to the final customers. Distribution system is also operated in the public interest. They serve to ensure the distribution of electricity throughout the country and also to interconnect with the electricity systems of neighboring countries, including measuring, protective, control, signaling, information and telecommunications system (Chemišinec, I. a spol. 2010).

Three regional distribution companies are currently represented in the Czech Republic. There are ČEZ Distribution, E.ON Distribution and PRE Distribution. In Austria, among many others, the Wiener Netze GmbH and the Netz Niederösterreich GmbH are distribution system operators. (E-Control, 2017)

5.2. Second group

5.2.1. Regulators

To oversee the liberalization process of the internal energy markets, independent national regulators have to be founded by each member. Their role was defined and further developed in the second and third energy package of the EU (E-Control, 2011) (Oesterreichs Energie (s.a.) (EU COMMISSION, 2015). The main regulatory participants in Austria and the Czech Republic were both founded in 2001. Its main responsibility is to regulate electricity, gas and heat supply industries in order to support free market.

Competences are, setting support schemes and mechanisms in line with legislation and market conditions; preparation of laws and subordinate legislation; competition protection, support and supervision; and cooperation with other public institutions (Chemišinec, I. a spol. 2010). In Austria, the e-Control is the responsible regulator since 2001. In the Czech Republic is the regulator the Energy Regulatory Office.

5.2.2. Control Area Manager CAM

In order to be able to technically control the energy flow in the European interconnected grid and to keep the frequency within the permissible range, the European transmission grid was divided into control zones. Control area managers are responsible for the power-frequency control in their control area, the tasks are shared internationally. In Austria, the control area manager is the APG (Austrian Power Grid AG) because Austria has just one control area. It is also monitoring the energy exchange between control zones, dimensions the necessary control reserve energy and reports the amount of balancing energy and its costs to the balancing group coordinator. (E-CONTROL, s.a.)

5.2.3. Balance Group and Market Participants

The Balance group model forms the basis of the liberalised Austrian energy market (APCS, s.a.). It allows consumers to choose their supplier and allows a distinction on the balance sheet between energy trade and operation of the distribution/grid system. (E-CONTROL, 2013) The implementation of the balance group model leads to the forming of further market participant roles:

All consumer and suppliers are legally obliged to be part of a balancing group (E-CONTROL, s.a. a). They represent the **members of their balance group** (E-CONTROL, 2013). Technically, each balance group can be seen as a virtual group, in which supply and balance always have to meet each other (E-CONTROL, s.a. a). Whenever a balance group interacts with other market participants, it is represented by the so-called **Balance responsible party (BRP), or balance group representative**. (E-CONTROL, 2013)(E-CONTROL, s.a.) The duty of this person or party include obtaining and sending the consumption forecasts of the group to the clearing and settlement agent as well as paying and billing for required balancing energy demands. (E-CONTROL, s.a.) The price of the balancing energy needed by the balance group is calculated at the clearing and settlement agency based on data provided by the market participants. (APCS, s.a.) In Austria, there is one clearing and settling agency for the control area AGP, Tirol and Vorarlberg. It is run by the APCS Power Clearing and Settlement AG. (APCS, s.a.)(APCS, 2019) Having the official licence to operate a settlement agency makes the APCS the **Clearing and settlement agent (CSA)**, (APCS, s.a.) (E-CONTROL, s.a.) (E-CONTROL, s.a. a)

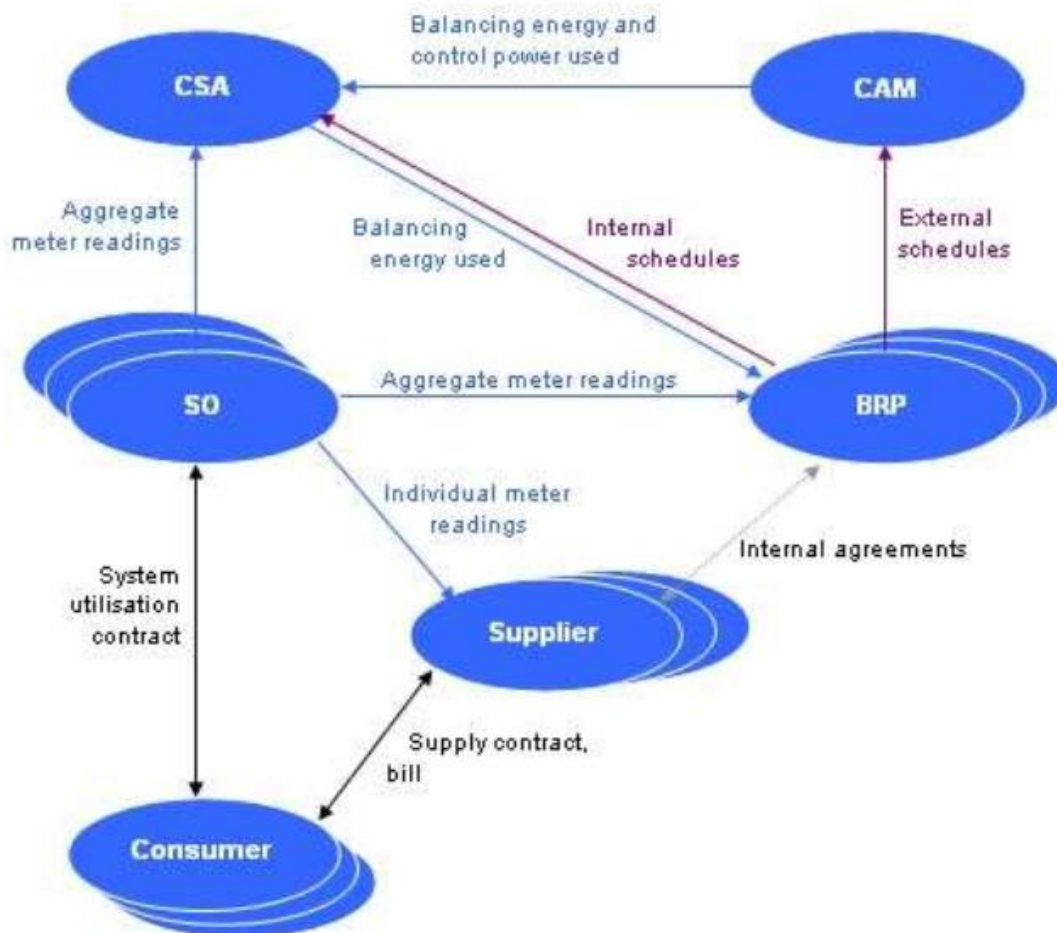


Figure 8: Overview of the Austrian market participants and the relations between each other (E-CONTROL, 2013)

Figure 8 gives an overview over the Austrian market participants and the relations between each other. It shows, which information is shared and which agreements are set.

6. Conclusion

Analyzed information shows that the development of the Czech and Austrian wholesale markets is fully linked to liberalization. The liberalization of the electricity market helps to integrate wholesale markets in Europe in order to create a single European market. The EU has approved 4 change packages, which contain rules and targets for the wholesale electricity market. The beginning of the functioning of wholesale electricity markets in selected countries varied. In the Czech Republic, the market started to work in 2005 whereas in Austria it was already in 2001. The reason for the later adoption of the liberalized market and the launch of its functionality is mainly that the Czech Republic joined the EU 9 years later. The Austrian market followed up on the changes in European legislation, while the Czech Republic implemented European legislation in the Czech legislation only after accession to the EU.

Electricity prices are determined on the wholesale market based on the way of trading on the market. Manufacturers set the price themselves to make a profit. The evolution of prices in chapter 0 clearly indicates the differences between the countries under review. In the past, the price of electricity in Austria was higher than the price of electricity in the Czech Republic. At present, however, the Austrian electricity price is lower than the Czech electricity price. Electricity suppliers on the Czech market are increasing the price due to rising prices on stock exchanges.

Wholesale trading is in principle the same in both countries. There are markets that have different time options for buying electricity. There is an intraday market on a daily purchase basis. Within 24 hours, or in other words, the next day, you can buy electricity at the Day-Ahead market. Then there are markets where electricity is bought for years to come. They are called Futures. Currently, there are the most important exchanges such as EPEX, EEX and EXAA (In AT) and PEX (In CZE).

The participants in the wholesale electricity market are almost identical for both countries. There are two groups of participants. The first group contains the necessary members of the market without which the market could not function (or hardly). These include Electricity producers, electricity suppliers, electricity customers and system operators. The second group of participants is represented by regulatory and other specific participants.

The differences in the functioning of the market in selected countries are therefore not high. The biggest difference between countries is the price of electricity, which is unstable and changes every year. The principle of functioning of the market is the same here, everything is determined by the standards of the European Union.

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