

## Positive and Negative Factors in International Electricity Integration

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### ABSTRACT

The article provides a review of international experience in the field of electricity markets integration in Central American countries and European Power Exchange SPOT zone. The revision of earlier results for Nord Pool, North American Free Trade Agreement and MERCOSUR is given. Conclusions about common positive and negative factors affecting the process of integration are derived.

**Keywords:** Electricity, Integration, Regional Markets, Cross-Border Trading

**JEL Classifications:** O240, R110

### 1. INTRODUCTION

The cross-border integration of electricity markets can provide multiple benefits for all participants and, therefore, is attractive for many countries. Scholars distinguish the following typical main objectives of market integration (Conlon, 2009):

- Ensuring a secure supply of electricity and profiting from comparative advantages
- Promoting competition in the electricity market
- Minimizing transaction costs for participants and customers
- Fostering the use of renewable, sustainable or alternative energy sources
- Enabling demand side management
- Allowing for economies of scale, thereby increasing the investment attractiveness of the sector.

The existing regional electricity markets are characterized by individual design, determined by various factors: Initial conditions of integration, organizational and managerial approaches. Newcomers have to find their own integrative way with no standard solutions available. Nevertheless there is evidence that general principles are employed to achieve the aim of integration.

Integration processes in electricity markets are investigated by researchers since at least 2004, when Pineau et al., published their work. On the basis of the El-Agraa's (1989) study, Pineau et al., presented the electricity market integration process as long-term action towards full integration. Several common electricity markets were analyzed using this concept: Countries cooperating in the Nordic Council (Nord Pool), MERCOSUR and North American Free Trade Agreement (NAFTA). The authors admit that the provided framework can be applied to other regions due to its universal character.

This article is based on the research conducted by the Energy Research Institute of the Russian Academy of Sciences in 2014, aiming at the discovering of common international integration practices, positive and negative factors for their application (or avoidance) in the Common Free Market Zone which unites Russia, Belarus and Kazakhstan. The markets from Pineau et al. (2004) were considered as well as Central American Electric Interconnection System (SIEPAC) and the European Power Exchange (EPEX SPOT SE) zone. The regions were selected to consider the experience on various continents, having diverse levels of integration, belonging to different economies.

The framework suggested by Pineau et al. (2004) was applied, implying three integration dimensions: Infrastructural integration, regulatory integration and commercial integration. The explored stages of the integration process also coincide with the Pineau et al. (2004) points (Table 1). Commercial integration scale suggested in Pineau et al. (2004) was amplified by the second scale reflecting price coordination development. The addition was made to reflect EPEX SPOT and Nord Pool practice of price coupling.

The most recent available trade statistics, information about planned investment projects, market organizational structures were analyzed for the identification of the key factors which influence the success of integration as well as its degree. In line with the Pineau et al. approach (2004) and with necessary additions determined by the research goals the following indicators were employed:

1. Infrastructural integration:
  - Existing cross-border transmission capabilities
  - Countries' shares in cross-border electricity exchange
  - Planned new electric lines projects (allocation of costs and responsibility between countries).
2. Regulatory integration:
  - Means and degree of coordination between National Regulatory Bodies
  - Sub-national regulatory bodies and their roles, if there are any
  - National electricity market models convergence.
3. Commercial integration:
  - Electricity cross-border trade volumes, in particular, electricity import and export statistics
  - Shares of imported and exported electricity in internal production and consumption
  - Price coordination level.

The article is divided into three main parts: The first two are devoted to the analysis of SIEPAC and the EPEX SPOT SE zone markets; the third one integrates the obtained results with the renewed assessments for NAFTA, MERCOSUR and Nordic Council markets. At the end the part summarizes the factors which affect the integration process.

## 2. SIEPAC

Central American countries, namely, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama, signed the framework agreement, the Marco Treaty of the Electrical Market of Central America in 1996, setting the common electricity market Mercado Regional de Electricidad (MER) and launching SIEPAC<sup>1</sup>

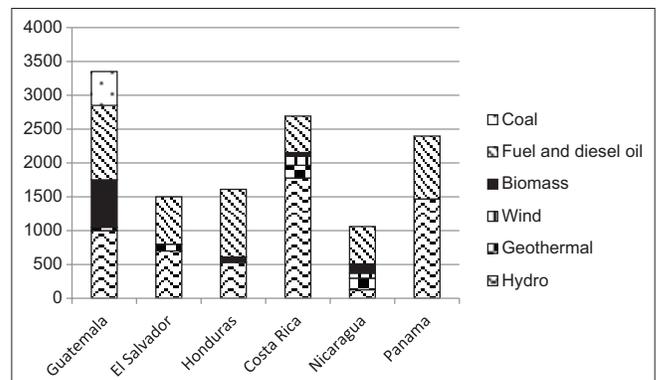
<sup>1</sup> SIEPAC is the acronym for the Spanish title: Sistema de Interconexión Eléctrica para los Países de América

line project. The treaty was validated in 1998 and came into force in 1999. It implies the creation of the regional electricity market based on the standard set of trading rules at the supranational level: Free access to infrastructure for all parties, bilateral contracts, and gradual market development (Economic Consulting Associates, 2010).

The generation mix of the Central American countries relies heavily on hydro resources and fuel oil (Figure 1). Unlike Nordic region, in Central America there are no countries with developed centralized thermal generation that could backup renewables when there is a draught. Fuel and diesel oil capacities have extremely high fuel costs and as a rule are used for a peak load supply. In addition, there is a limited resource endowment of the countries, determining a critical dependency of the countries on imported energy. Consequently, almost all countries in the region are characterized by the striking electricity supply deficit. According to International Energy Agency data (IEA, 2014), 5.8 million people in the region under consideration have no access to electricity. The national electrification rate is the smallest in Nicaragua (74%) and the highest in Costa Rica (99%). Poor electrification hinders industrial development in the region, and SIEPAC project is expected to solve the problem in a way.

Experts admit, there are some controversies concerning the economic and environmental benefits from SIEPAC project. These issues can be combined into three broad categories: (1) Market access, (2) cost structure, and (4) environmental issues. Concerning the market access SIEPAC line does not solve the problem of electric supply for rural and impoverished inhabitants of the region and mainly aims at new large power plants output. In terms of costs the line is expected to put a downward pressure on electricity prices in the region, but due to the range of factors end-use tariffs may

**Figure 1:** Net installed generation capacities by country and source in Central America in 2012, MW



**Table 1: Applied integration continuum for regional electricity markets**

Integration scale	Infrastructural integration	Regulatory integration	Commercial integration	
No regional integration	Isolated national power systems	Independent national regulation	National markets with local ownership	Prices are set at the internal markets
	Cross-border transmission capabilities	Compatible regulation	Cross-border trade and ownership	Prices are set in bilateral agreements
	Coordinated effort in transmission investment	Coordination of regulatory agencies	Regional spot market (unique price reference)	Prices are set at a regional spot market
Full regional integration	Fully integrated regional system operation	Regional regulatory agency	Regional secondary/futures market	Price coupling mechanism

even increase (Martin, 2010). In addition, there has been some resistance from a wide range of US-based and international NGOs and environmental groups.

In spite of the hurdles mentioned above the project was completed in September 2014, after 8 years of construction.

### 2.1. Infrastructural Integration

As it was already mentioned, the pivotal infrastructural facility in Central American market is SIEPAC line. The line which enables the common electricity market functioning has the length of 1793 km and voltage 230 kV with transmission capacity 300 MW. It lies across the region, from Panama to Guatemala, and is segmented as follows: Guatemala: 282 km; El Salvador: 287 km; Honduras: 270 km; Nicaragua: 309 km; Costa Rica: 489 km; and Panama: 151 km.

Cross-border transmission capacities among the countries except for SIEPAC line range from 30 to 100 MW, usually not exceeding 50 MW (Economic Consulting Associates, 2010).

The Central American countries have different level of involvement in electricity trading due to the system installed capacity (Figure 2). For instance, the chart below shows that Guatemala has the biggest share for both parameters, and Nicaragua has the smallest energy system and poor trade involvement.

There are plans for further institutional strengthening, and designs of several additional electricity links in the region connecting Mexico (OECD, 2014) and South America (Isaac, and Castillo, 2013). There is no information about new lines within SIEPAC countries available.

### 2.2. Regulatory Integration

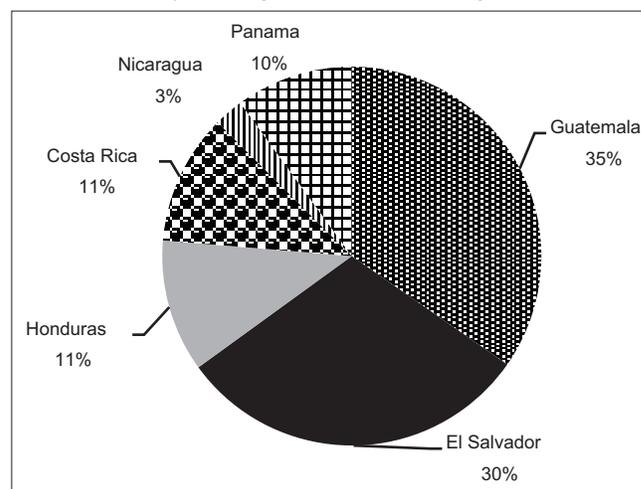
The MER is based on the concept of sub-national market, comprising operations on national and international levels. The sub-national regulatory institutions and common market rules in compliance with the MER code coordinate national regulators. National regulators are coordinated by means of common market rules determined by the MER codes and by participating at the sub-national regulatory institutions.

National regulatory bodies (Table 2) are responsible for the harmonizing domestic markets with regional ones. The MER codes determine the regulatory frameworks for national system operators concerning dispatch, tariffs and transmission services.

The MER is regulated by three sub-national institutions:

1. The regional grid company, the Empresa Propietaria de la Red (EPR). It is a consortium of private and public companies from the Central America region's countries, Mexico, Colombia and Spain. It has become an owner of SIEPAC line and provides an access to it
2. The regional regulator, the Comisión Regional de Interconexión Eléctrica (CRIE). The CRIE serves as a wholesale market operator; it is governed by representatives of every country participating in MER, one member from each country
3. The regional system operator, the Ente Operador Regional

**Figure 2:** The Central American countries' shares in cross-border electricity exchange in the considered region, 2014



Source: CRIE

**Table 2: National electric power industry regulatory bodies of the Central American countries**

Country	Regulatory bodies
Costa Rica	Public Services Regulatory Authority (ARESEP)
Panama	Regulatory Authority for Public Services (ASEP)
El Salvador	General Superintendency of Electricity and Telecommunications (SIGET)
Guatemala	National Electricity Commission (CNEE)
Honduras	National Energy Commission (CNE)
Nicaragua	Nicaraguan Institute of Energy (INE)

Source: World Bank data

(EOR). The EOR regulates regional power transactions by the SIEPAC line and controls the system parameters in coordination with national system operators. The board of the EOR consists of representatives of every country participating in MER, two members from each country (OECD, 2014).

The regional grid company EPR started its operation in 1999, the regional regulator CRIE – in 2000, the system operator EOR was founded in 2001, and the market itself has developed since 2002.

All the countries in the region conducted the liberalization reforms in 1990s, but the process was hindered by low welfare of end users who could not cope with tariff increase. This situation gives way to multiple governmental interventions into the markets in all countries by means of subsidies and price control. The specific characteristics of the markets are described in the Table 3.

### 2.3. Commercial Integration

Clear distinction between the export- and import- oriented Central American countries is shown in Figure 3. Guatemala is the largest electricity importer in 2014, while Honduras mainly exports electric energy. El Salvador, Costa Rica and Panama are export-oriented and import electricity primarily in dry months.

The shares of imported and exported electricity in overall internal power production and consumption remain insignificant (Table 4). Data for 2012 was adopted as the most recent.

**Table 3: Characteristics of the electricity markets in the Central American countries (Camargo, 2008; Johnson, 2012; Flores, 2012)**

Country	First year of reforms	Vertical integration	Monopolistic spheres	Market model
Guatemala	1998	No	Transmission (no open access), distribution	Wholesale competition
El Salvador	1997	Yes	Transmission (open access), distribution	Retail competition
Honduras	1994	Yes	Transmission (no open access), distribution	Monopsony
Nicaragua	2000	No	Transmission (no open access), distribution	Wholesale competition
Costa Rica	1995	Yes	Transmission (open access), distribution	Monopsony
Panama	1998	No	Transmission (open access), distribution	Wholesale competition

**Table 4: The shares of imported and exported electricity in internal production and consumption of the Central American countries, 2012**

Country	Import share of consumption (%)	Import share of production (%)	Export share of consumption (%)	Export share of production (%)
Costa Rica	5	4	4	4
El Salvador	3	3	1	1
Guatemala	5	4	4	4
Honduras	2	1	2	1
Nicaragua	1	0	0	0
Panama	0	0	1	1

Source: Calculated using EIA data

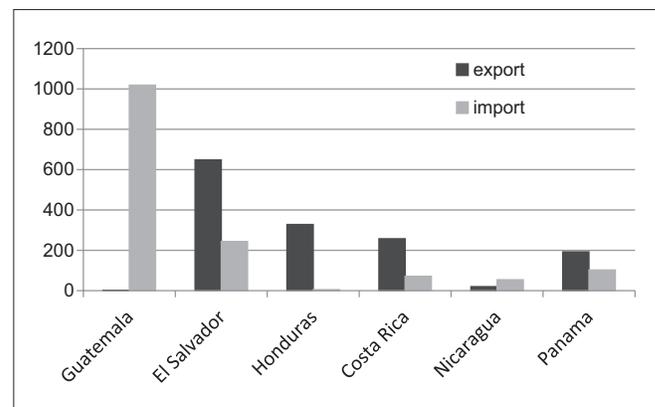
Prices at the MER are set as a result of iterative process at the national and region levels. The regional market operator EOR gathers pre-dispatch information from national market operators, combines it with bids and offers to determine the reasonable regional nodal prices on hourly basis. Honduras and Costa Rica have no competitive national electricity markets and associate the MER prices with those set internally. Basing on the MER nodal prices the other countries agree with them or carry out customization.

### 3. EPEX SPOT SE ZONE

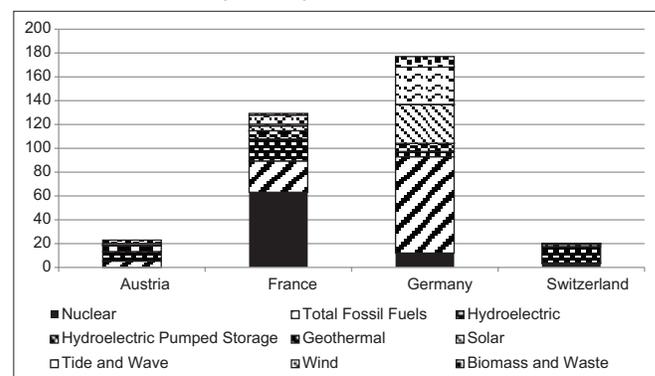
The EPEX was founded in 2008 as a result of Powernext (France) and European Energy Exchange (Germany) merger. The market area was extended to Austria in 2012 with the launch of the intraday electricity market. The latest member of the market is Switzerland, it joined EPEX SPOT in 2013.

The countries participating in EPEX SPOT are characterized by fuel mix diversity: France mainly relies on nuclear generation, while Germany, Austria and Switzerland have more than 50% of renewable sources in the generation mixes (Figure 4). The energy systems of Germany and France have the biggest installed capacity. The integration of the countries is beneficial for the supply reliability increase. Unbundled electricity exchange between countries with developed renewable generation helps to compensate unexpected fluctuations in electricity production from intermittent renewable sources (Figure 4).

The presence of significant capacity of subsidized renewable generation with very low marginal costs on the EPEX market puts a downward pressure on market prices, other things being equal. "Merit order effect," consisting of market replacement of

**Figure 3: Electricity export and import volumes of the Central American countries in 2014, GWh**

Source: CRIE

**Figure 4: Net installed capacities of the Central Western Europe countries by country and source in 2012, GW**

fossil fuel generation by renewable sources as a result of market price decline, is a matter of concern for the EPEX countries. Fossil fuel generation sources are characterized by high mobility and ability to provide backup capacities for the renewables, and their withdrawal can pose a threat for energy system reliability (Bode and Groscurth, 2011).

At the same time lower market prices provide good export opportunities, and in 2014 the region reached the strongest net electricity exporter position for the last 4 years (European Commission, 2014).

#### 3.1. Infrastructural Integration

Countries of the region are relatively well-integrated, but the level varies depending on borders (Table 5). The main transmission capacity is allocated on the borders between Germany and Austria,

**Table 5: Number of circuits on cross-frontier transmission lines between the Central Western Europe countries as of December 31 2013**

Line voltage	France-Germany	France-Switzerland	Germany-Switzerland	Germany-Austria	Austria-Switzerland
110-150 kV	0	0	1	20	1
220-285 kV	2	5	5	11	2
380-400 kV	4	5	7	3	2

Source: ENTSO-E

Germany and Switzerland. France is less integrated in the cross-border trading with the considered countries, it has powerful energy flows with Great Britain and Italy instead.

Germany is characterized by the biggest share of cross-border exchange in the region, France is in the second place, and Austria comes third in the list (Figure 5).

Germany's need of strong cross-border transmission lines for the supply reliability support is conditioned by its biggest capacity of intermittent electricity sources in the energy balance of countries in the region. Additional electricity demand is produced by nuclear phase out in Southern Germany.

There are several forthcoming investment projects aimed at developing regional cross-border interconnections in the mid-term. By ENTSO-E three of them carry pan-European significance: Two projects are on the side of Switzerland and one is between Austria and Germany.

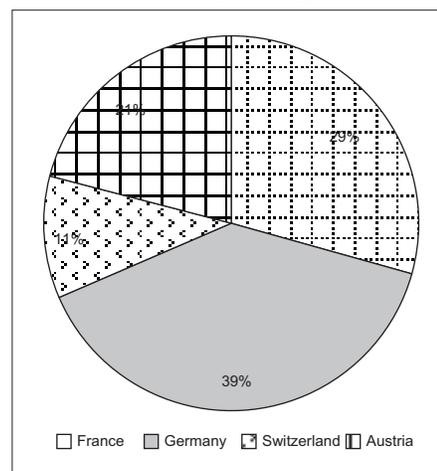
Switzerland is a new player on the EPEX market, so it needs to strengthen interconnections for better market integration. Another reason for the reinforcement is the building of new pump storage power plants in Switzerland, which can play a role of backup capacity for German wind generation. The expected increase in transmission capacity on the borders between Switzerland, Austria and Germany is 4000 MW (ENTSO-E, 2014).

Germany and Austria participate in the set of transmission infrastructure enhancement activities to eliminate bottlenecks in cross-border exchange. As a result, the transmission capability will increase for more than 2000 MW (ENTSO-E, 2014). The responsibility and costs are divided between countries according to the territory of lines and transformers' location. Austrian Power Grid implements the project on the Austrian side, transmission grid operator TenneT is responsible for the German part of the project.

### 3.2. Regulatory Integration

Prior to EPEX SPOT establishment the Pentalateral Energy Forum was founded by energy regulators from Benelux, Germany and France in 2005. The forum was set to promote collaboration between the countries in cross-border electricity trading, taking into consideration limited transmission capacities. The Pentalateral Energy Forum is therefore an intergovernmental initiative, not a supranational regulatory body. It provides a platform for discussions and collaboration for all interested parties and presumes voluntarism (Deloof, 2009).

Memorandum of understanding of the Pentalateral Energy Forum on market coupling and security of supply in Central Western

**Figure 5: The Central Western Europe countries' shares in cross-border electricity exchange in 2013**

Source: ENTSO-E

Europe was signed in 2007. Generally, the stated aim of the memorandum is to enhance market integration and security of supply in CWE region, so that it can be considered as a preparatory step to the EPEX establishment.

The EPEX SPOT zone regulatory bodies of modern national electric power industry are listed in Table 6.

There are no sub-national regulatory bodies in the region. Thus, the process of trading is coordinated by EPEX SPOT exchange, issues of network development coordination are solved by ENTSO-E, and the rest of issues are discussed on Pentalateral Energy Forum.

The Central Western European countries are characterized by different electric power industry models and liberalization degrees (Table 7). In the majority of countries vertically integrated structures remain, and conducted reforms are about the minimum level required by the European Union (EU) regulations. This level is compellingly exceeded only by Austria. The least liberalized market belongs to France with state monopoly Electricité de France. All countries in the region have an open access to grids, referring to regulated natural monopolies.

It can be concluded that the process of market structures convergence in the region is influenced more by common rules of the EU than by internal needs. The statement is corroborated with memorandum of understanding and regional action plan content, oriented at congestion management and price coupling mechanisms.

### 3.3. Commercial Integration

Central West European countries are connected with cross-border trading not only within the region, but support exchange with other countries: Great Britain, Italy, Spain, Denmark and others. Volumes of export and import presented in Figure 6 refer only to trading within the region, so it cannot provide full information about orientation of countries on export or import. As it was mentioned above, the region in total has a strong exporting position due to the declining market prices.

France is evidently export orientated within the region and in general. The basis of its electric power system is nuclear energy, which does not depend on fuel prices fluctuations, and volumes of production do not have seasonal variations. Switzerland participates in EPEX SPOT market mainly for electricity import operations; the country exports big volumes of electricity to Italy. Austria and Germany are characterized by relatively balanced export and import volumes in the region.

According to the data in Table 8 Switzerland and Austria are most involved in EPEX SPOT trading in terms of shares of imported and exported electricity in internal production and consumption. Switzerland does not consume the vast amount of electricity it buys on the market as it provides electricity transit to Italy. Austria is involved in transit as well, the difference between imported and exported electricity volumes in the region is just 100 GWh. France and Germany EPEX SPOT trading volumes comprise insignificant shares in internal production and consumption.

EPEX SPOT applies market coupling mechanism for the optimization of cross-border transmission capacities usage. The mechanism had been successfully implemented in 2006 for tri-lateral market coupling, integrating the French, Belgium and

Dutch day-ahead markets. It was extended to cover Benelux and Germany in 2010. Market coupling implies two-step optimization process. On the first step market players bid for energy on the exchange, and optimal national market state is determined. The exchange then uses the available cross-border transmission capacity to minimize the price difference between market areas. Consequently, market participants do not explicitly allocate cross-border capacities: It is the matter of export and import flows optimization taking into account the existing boundaries (EPEX SPOT)<sup>2</sup>.

## 4. MARKET INTEGRATION EXPERIENCE GENERALIZATION

Table 9 presents the allocation of the regional markets considered in the present article complemented with those from Pineau et al. (2004) on the proposed integration continuum in Table 1. The state of the markets MERCOSUR, NAFTA and Nord Pool has been revised to reflect their modern state.

In general, European regional markets are characterized by the highest degree of regional integration among the considered regions. SIEPAC region takes the second place, having the highest level of regulatory integration and the third levels in the other integration aspects. MERCOSUR and NAFTA regions are the least integrated, the former conducts cross-border trading basing on bilateral agreements without regulatory integration, the latter has electricity exchanges, but infrastructural and regulatory integration is at the incipient stage of development.

2 EPEX SPOT official web-site <http://www.epexspot.com/en/market-coupling>

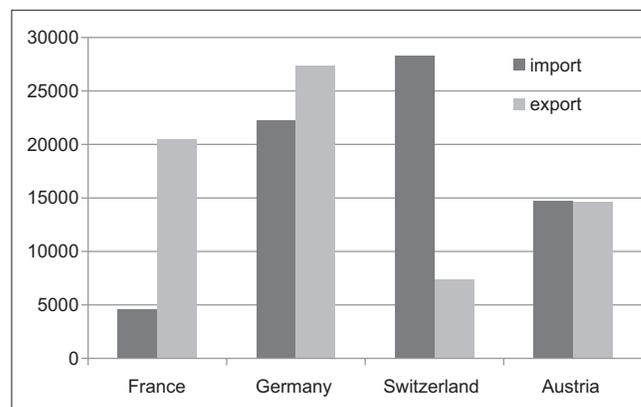
**Table 6: National electric power industry regulatory bodies of the Central Western Europe countries**

Country	Regulatory bodies
Germany	<ul style="list-style-type: none"> <li>Ministry for Economics and Technology</li> <li>Federal Network Agency (Bundesnetzagentur [BNetzA])</li> </ul>
France	<ul style="list-style-type: none"> <li>Ministry for Ecology, Sustainable Development and Energy</li> </ul>
Austria	<ul style="list-style-type: none"> <li>Commission de regulation de l'énergie (CRE)</li> <li>Federal Ministry of Science, Research and Technology</li> </ul>
Switzerland	<ul style="list-style-type: none"> <li>E-Control</li> <li>Federal Department of the Environment, Transport, Energy and Communication</li> <li>Swiss Federal Electricity Commission ElCom</li> </ul>

**Table 7: Characteristics of the Central Western Europe countries electricity markets (Massoni, 2010; Meritet, 2007; Danwitz, 2006; Hofbauer, 2006; Racine, 2014)**

Country	First year of reforms	Vertical integration	Monopolistic spheres	Market liberalization degree
Germany	1998	Yes	Transmission grids (open access), distribution grids	100%
France	1999	Yes	Transmission grids (open access), distribution grids	30%
Austria	1998	No	Transmission grids (open access), distribution grids	100%
Switzerland	2008	Yes	Transmission grids (open access), distribution grids	More than 50% full liberalization is scheduled on January 2018

**Figure 6: Electricity export and import volumes within Central Western Europe, GWh, 2013**



Source: ENTSO-E data

**Table 8: Shares of imported and exported electricity in internal production and consumption of the Central Western Europe countries, 2013**

Country	Import share of consumption (%)	Import share of production (%)	Export share of consumption (%)	Export share of production (%)
France	1	1	4	4
Germany	4	4	5	5
Switzerland	44	41	11	11
Austria	21	22	21	22

Source: Calculated using ENTSO-E data

**Table 9: Integration continuum for regional electricity markets with locations of considered regions**

Integration scale	Infrastructural integration		Regulatory integration		Commercial integration			
No regional integration	Isolated national power systems		Independent national regulation	MERCOSUR	National markets with local ownership	Prices are set at the internal markets		
	Cross-border transmission capabilities	MERCOSUR NAFTA	Compatible regulation	NAFTA	Cross-border trade and ownership	MERCOSUR	Prices are set in bilateral agreements	MERCOSUR
	Coordinated effort in transmission investment	Nord Pool EPEX SPOT SIEPAC	Coordination of regulatory agencies	Nord Pool EPEX SPOT	Regional spot market (unique price reference)	NAFTA SIEPAC	Prices are set at a regional spot market	NAFTA SIEPAC
Full regional integration	Fully integrated regional system operation		Regional regulatory agency	SIEPAC	Regional secondary/futures market	EPEX SPOT Nord Pool	Price coupling mechanism	EPEX SPOT Nord Pool <sup>3</sup>

EPEX: European power exchange, NAFTA: North American Free Trade Agreement

**Table 10: Shares of imported and exported electricity in internal production and consumption by regional markets, 2012<sup>4</sup>**

Regional market	Import share of consumption (%)	Export share of production (%)
EPEX SPOT	6	5
SIEPAC	3	2
Nord Pool	12	13
MERCOSUR	7	6
NAFTA	2	1

To draw some conclusions concerning the results of integrative initiatives in the considered markets it is necessary to analyze the indicators of share of electricity import in consumption and electricity export in production within regions (Table 10). Thus, Nord Pool market is in the most advanced position, MERCOSUR and EPEX SPOT are on about the same second level, and SIEPAC and NAFTA have the smallest cross-border trading volumes.

Differences in the ranging of the markets on the suggested integration continuum and the existing cross-border trading volumes imply the existence of other factors affecting the process of integration besides those applied for scaling. A few surmises concerning those factors made basis for the conducted desk research and they are presented below.

The major role in success of electric markets integration probably belongs to the generation structure and national energy systems' development. Regions with mutually complementing and abundant generation, such as Nord Pool, MERCOSUR and

EPEX SPOT markets, tend to integrate better, than those with similar generation mix and electricity supply deficit (SIEPAC countries).

Willingness to trade, circumstanced by economic and political factors, also matters. The long-term experience of good intergovernmental relations and trading provides a foundation for electricity trade development. In particular, the history of good relations helped Scandinavian countries to establish the efficient and reliable regional electricity market with common rules. It should be mentioned that all the considered regional electricity markets comprise the countries that already started the process of integration and formed politico-economic unions: The EU, NAFTA, MERCOSUR and Central American Integration System. So the integration of national electricity markets is a step in the overall process of convergence.

Geographical conditions are important as well. Countries with small territories integrate more easily, than those with big ones. It is convincingly demonstrated by NAFTA: Mexico and Canada can't trade directly with each other and do it with the US, so the region level of integration remains imperfect. The second example is Central American countries that needed to invest heavily in the SIEPAC grid infrastructure to make a link between all national markets.

Financial conditions and the level of countries' economic development can become a threat for integration. In spite of supranational institutions and the final overall high integration level of Central American countries electricity markets SIEPAC project has had to overcome multiple boundaries related to financial problems. And there are no other cross-border electric lines with the transmission capacity comparable to it.

3 Day-ahead price coupling project launched on 4 February 2014

4 Calculated on ENTSO-E, EIA data

**Table 11: Positive and negative factors of electricity markets integration**

Integration dimension	Positive factors	Negative factors
General regional integration factors	<ul style="list-style-type: none"> <li>• Mutually complementing and abundant electricity generation</li> <li>• Long-term experience of good intergovernmental relations</li> <li>• Macroeconomic stability in the region</li> </ul>	<ul style="list-style-type: none"> <li>• Large territories of the countries, absence of common borders</li> </ul>
Infrastructural integration	<ul style="list-style-type: none"> <li>• Market mechanisms of cross-border capacity allocation</li> <li>• Coordination of efforts in infrastructural development</li> </ul>	<ul style="list-style-type: none"> <li>• Financial problems</li> <li>• Time consuming bureaucratic procedures</li> </ul>
Regulatory integration	<ul style="list-style-type: none"> <li>• National legal systems convergence</li> <li>• Coordinated dispatch policy</li> <li>• Regional regulator introduction</li> </ul>	<ul style="list-style-type: none"> <li>• Poor development of national electric power system</li> <li>• Differences in national system dispatch policies</li> <li>• Unclear national market regulation rules</li> <li>• Differences in privatization levels of national electricity sectors</li> <li>• Differences in liberalization levels of national electricity sectors</li> </ul>
Commercial integration	<ul style="list-style-type: none"> <li>• Electricity exchange foundation</li> <li>• Common rules of transmission tariffs formation</li> <li>• Market coupling mechanism</li> </ul>	<ul style="list-style-type: none"> <li>• Asymmetry in market power of participants</li> </ul>

Regional markets with unequal economic development of the countries have biased distribution of authority in favor of more developed countries. The asymmetry has to be overcome through financial support of underperforming countries (Wilson-Forsberg, 2001).

Related factor is macroeconomic stability in the region and its countries, ensuring a good investment climate. This factor has had a profound effect on MERCOSUR and Mexican markets development.

More detailed summary of the distinguished factors is given in Table 11.

## 5. CONCLUSION

Present article is devoted to the analysis and generalization of international experience in the field of electricity markets integration. The main purpose of the study is to find out the factors which have positive and negative impact on the integration level to take them into consideration when designing the common free market zone. Pineau et al. (2004) approach to integration measurement was adopted as a theoretical basis with necessary changes and additions. Two regional markets, namely Central American Energy System SIEPAC and EPEX SPOT zone, were chosen in addition to those analyzed in Pineau et al. work.

The markets differ by geographical location, level of economic development, electric power industry liberalization and integration conditions. The outcomes of the integration process are different as well, even for the EU markets.

The ranging of markets was conducted using the proposed scales of infrastructural, commercial and regulatory integration. It has revealed the discrepancies in the existing cross-border electricity flows in case of SIEPAC region and EPEX SPOT, witnessing the existence of other factors' impact. The desk research clued in about possible additional factors that should be taken into consideration when planning the electricity markets integration.

Fields for future research can therefore include further corrections of scaling tool used for integration measurement, clarification of the factors' influence and ways of risk hedging.

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