Business and Management PhD Programme

Thesis résumé

Pálma Tünde Szolnoki

Does the hatchery work?

Evaluation of the effectiveness of the natural gas balancing system on gas markets which are at the beginning of market opening

Ph.D. Dissertation

Supervisor:

László Szabó PhD

Budapest, 2018

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I. Research history and reasoning of the topic

The past twenty years of the European natural gas market liberalization was the intellectual playground for the practical application of economic theories. 'Market building' in this area is literally true. European regulators have set as a goal competitive markets in the place of the vertically integrated monopolies, and have been gradually transforming the sector from the starting point towards the goal through a series of regulatory cycles. In this transformation, the economic theories – especially regulation economics, market theory and new institutional economics – as well as the European (and world) discourse about these theories of academic, advisory and public administration institutions, have constantly shaped the regulatory direction and the tools used.

One of the peculiarities of the natural gas market is balancing: keeping the physical quantity of natural gas injected into and withdrawn from the system in balance within a short time interval. With the opening of the market balancing has emerged from a simple intra-corporate physical problem into a commercial and physical regulatory task requiring complex coordination.

The experiance of the market development paths of the now mature Western European natural gas markets shows that the well formation of the balancing rules is the cornerstone of gas market regulation. A malformed system could mean a serious barrier to market opening, while, if the details are well set, it may be a hatchery for the wholesale gas market: market-based balancing rules can give the boost to the spot markets that they really need in their way towards becoming a liquid market.

Another important experience of the last twenty years of market opening is that fully market-based operation cannot be introduced overnight. Balancing regulation, like the rest of gas market regulation, means the cautious, continuous adjustment of the rules tailored to the structure, possibilities and regulatory goals of the market. Fully market-based operation can be achieved gradually through the cycles of continuous monitoring of the effects of the rules introduced and the regulatory adjustments delivered based on the results of these evaluations. During this transitional period, regulation is a very sensitive balancing with market capabilities, so it is particularly important for the regulator to deeply understand the functioning of the market and to continuously analyze the impact of the new rules introduced.

This thesis, on the one hand, prepares a comprehensive inventory of the balancing regulatory instruments applicable during the transitional period, and as such summarizes, synthesizes and deepens the results of academic literature and practice-based professional papers. When presenting the inventory, I present the regulatory tools per each area, the variants of the tools and their effect according to the development level of the market. The inventory is summarised by a regulation development path that illustrates the constellations of regulatory tool variants that constitute the balancing regulatory system's various phasis between the initial integrated monopoly structure and the final fully market-based balancing regime.

The dissertation, on the other hand, expands the literature on the evaluation of the effectiveness of balancing regulation, it introduces new analytical tools and builds up a comprehensive analitical methodology. The methodology examines areas - for example, whether there is fundamental potential to introduce market-based balancing or the issue of Internal Adjustment opportunities - which have not been studied in the literature so far – and it also provides a different and more comprehensive approach for the areas already examined by the previous literature. For this I define new indicators that most importantly are based on publicly available data so that they can be used by everyone and, in contrast to the analyses of previous literatures, are also methods that can be applied to the key period when the balancing regime can greatly support market development, when there is no liquid marketplace yet. The methodology is illustrated on three country-cases - Croatian, Polish, Czech.

Because of the key role of balancing, European regulation has now harmonized the balancing regulation of European Member States by a separate regulation. This Pan-European Balancing Network Code (BAL NC[1]) is mandatory for all member states, even with all the various types of exepmtions practically all Member States have to implement it by April 2019 at the latest. It places the balancing regime on a fully market based basis and its stated goal is to generate liquidity and launch the spot wholesale markets.

1 The Regulation referred to as BAL NC: Commission Regulation (EU) No 312/2014 of 26 March 2014 establishing a Network Code on Gas Balancing of Transmission Networks.

For some Member States[2] the transposition of BAL NC poses a serious challenge which in return means that the balancing regulation can therefore really actively shape the wholesale spot markets in these cases. Thus, knowing what kind of balancing regulatory tools are available for transition steps, which tool can be used at which maturity stage, and the evaluation whether the implemented tool is effective is of particular importance for this group of countries. In addition to the European Member States, natural gas market opening is also current in neighboring countries. For example, countries that have signed the Energy Community Treaty[3] have undertaken to introduce EU energy market regulation in their own gas markets. Thus, in our region, for many countries it is a current issue how to setup and regulate the balancing regulatory regime.

My dissertation provides academic support for this regulatory challenge by providing a coherent overview and a list of the regulatory tools that can be used in different stages of development and provides a comprehensive methodology for evaluating and monitoring the effectiveness of implemented regulation.

2 This country group requested an extension of the deadline of 1 October 2015 until April 2019: Slovakia, Sweden, Romania, Poland, Northern Ireland, Ireland, Greece and Lithuania.

3 The Signatories of the Energy Community Treaty are: Albania, Montenegro, Macedonia, Serbia, Ukraine, Moldova, Kosovo, Bosnia and Herzegovina. Of these, Ukraine and Serbia have a natural gas sector of such size where these regulations can be interpreted.

II. Research methods

I first reviewed the international literature on evaluating the impact of gas market regulations. I have paid particular attention to the analyzes of the flexibility market and the indicator-based analyzes of international organizations (ENTSOG - European Network of Transmission System Operators for GAS and the ACER - Agency for the Coorporation of Energy Regulators) on the balancing system's performance[4].

During my research, it became apparent that these indicators in the literature are not suitable for my intended task: evaluating the efficiency of balancing systems and setting up a methodological framework for this.

On the one hand, some of the indicators exist only in theory, because they are defined by data requirements that are not yet accessible even to ACER the European regulatory authority. Some of the other metrics are also based on data that are not publicly available, thus are not available for the academic sector as well. And finally, the main problem of the rest of the indicators and analyzes is that they do not form a coherent methodology for measuring the effectiveness of the balancing system, rather they measure only the fulfillment of one individual rule or another.

Therefore, I have developed new indices and a complete methodological framework. Compared to earlier analyzes, the methodology I developed for the assessment of the efficiency of the balancing system is based on a theoretical model (described in Dickx et al., 2014). By using this model I defined what an effective balancing system is. Previous literature already had pointed out that in order to evaluate market efficiency, we must first define what is meant by efficiency. Likewise, without defining the efficiency of the balancing system, we do not know exactly what the purpose of regulation and measurement is to be. With the help of the definition, I identified the directions of investigation and the indicators to be used in the investigations.

4 Among others: CEPA (2015), ENTSOG (2017), ACER (2017)

Based on the collected data, I developed an alternative indicator system that enables carrying out evaluation on publicly available data for the following balancing system areas of gas markets at any stage of development:

- Fundamentals of the flexibility market
- The evolution of the balancing requirement
- The degree of imbalance resolved by traders
- The evolution of imbalances not resolved by traders

I collected data on the gas market of three countries, I built on databases that are available publicly for researchers:

> The data sources were the publications of natural gas Transmission System Operators (TSOs) on the technical capacity, nomination, re-nomination and gasflow data of the Entry and Exit points and the daily imbalance settlement quantities aggregated per direction.

From these data sources, I have created an analyzable data structure for different segments of the gas market (eg. large consumer and DSO segments) and calculated my suggested indicators for these data sets.

I have modified and extended in several areas the set of indicators created by the previous literature.

One of the main indicators that has not been actually calculated even by European organizations so far due to the complicated data need is the balancing requirement. To create a calculable alternative index for it I have suggested using the daily operational data instead of the earlier definition which is based on the daily trade transactional data. This could be done as the daily nomination, re-nomination and gas flow data are actually the technical footsteps of trading.

By this method, I did not only create an approximate indicator for measuring the balancing requirement, but I also created an indicator for estimating the ratio of trader and system operator engagement in resolving imbalances.

In addition, based on the theoretical model of Dcikx et al (2014) I have also created new measurable indicators for areas not yet studied in practice. One is the Internal Adjustment indicator for which I have proposed two types of calculation methods. The advantage of this

indicator is that it not only provides information about the balancing system, but it also reveals the efficiency of the wholesale market. This can be particularly valuable in analyzing the markets of Member States that do not yet have a transparent marketplace and, therefore, indicators of the degree of market development used in the literature cannot be used.

The pair of the Internal Adjustment indicator is Aggregated Imbalance, which expresses the physical imbalance of the system. The measurement of physical imbalance and the trend of the values provide a direct picture of the evolution of the balancing activity's effectiveness.

As the developed indicators are based on publicly available data, I could expand the length of the analyzed data series - compared to the ACER and ENTSOG analyzes which only analysed a one-year-long time series taking place right after the implementation of BAL NC - and I could analyse the trends of several (4-5) years. Thus, not only the fluctuation within one year (which may contain significantly distortions) shows the degree of improvement or deterioration, but I could detect tendencies over several years.

When using the methodology I also identified its shortcomings and limitations. The most important of these are also indications of possible ways forward:

- A step forward is to define the way that the values of the indicators can be captured in a more exact manner, that is to say, not only the direction of improvement / deterioration but also the degree of improvement. Prerequisite for this is the availability of better data sources with similar structure.
- It would also be a significant step forward in the methodology, if the analyses could be prepared for more than one country with the same data type and the same time series (at least 5 years), this way the methodology could be extended by indicators and evaluation forms for cross-sectional comparisons. As data sets with the same structure are available for several countries, the comparability of calculated indicators improves, the indicator values can also function as a benchmark for the level of development of the flexibility and balancing markets. In this case, it would be possible to combine the indicators with the development levels outlined in the efficiency definition, which could lead to a better classification of market development.

III. Results

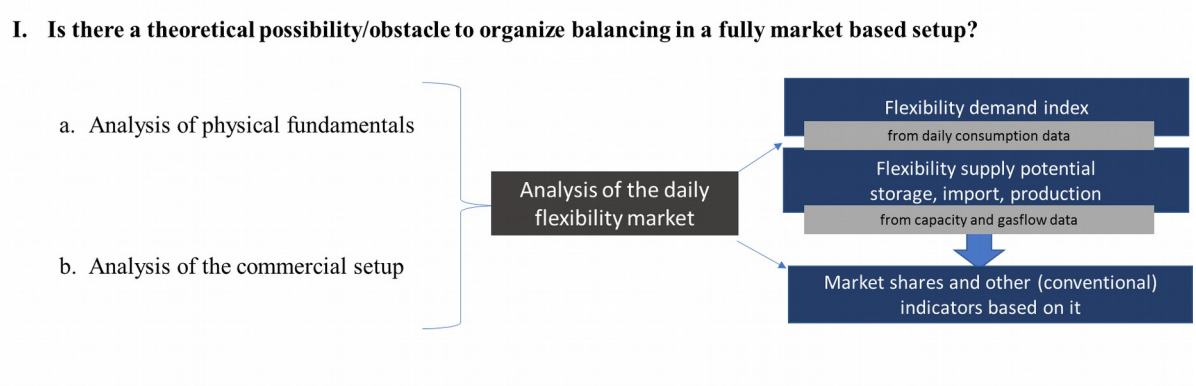
The dissertation synthesizes and extends the literature on gas balancing regulation and its effectiveness evaluation in two main directions:

On the one hand, it provides an in-depth and comprehensive overview of the regulatory toolkit based on academic literature, materials from European organizations and individual country experiances. It includes systematization of the entire regulatory toolkit, it covers the operating framework for balancing regulation, and within that, the three pillars of balancing regulation. Within the pillars, it summarizes the regulatory tools and their possible variants, and describes which tools to use in different development phases. As the summary of this inventory, a balancing regulatory development path is set up, showing which constellations of regulatory instrument variables fit for the different development phases between the vertically integrated sector and total market-based balancing.

This section is a more detailed and comprehensive elaboration of the topic analysed by Meeus et al. (Meeus et al., 2008), also covering the transition phases that precede the implementation of market based systems.

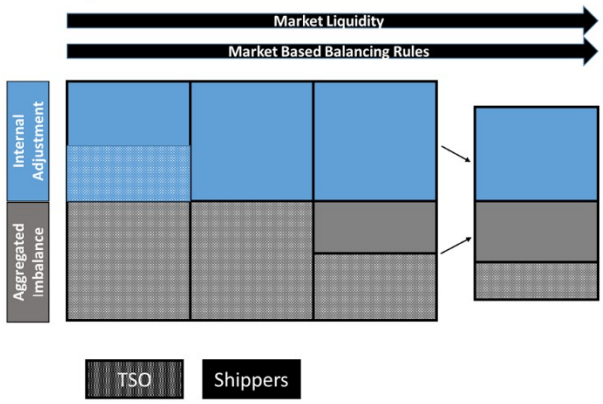
Another result of the dissertation is the new, comprehensive methodology for balancing systems' efficiency analysis, which has already been summarized in the previous 'Research methods' section.

In brief, the methodology consists of the following areas of analysis and indicators:



II. Analysis of the efficiency of the balancing system:

a. Defining efficiency based on a theoretical model



b. Definition of indicators based on publicly available data to analyze the areas indicated by the theoretical model

- The evolution of balancing requirement
- The degree of imbalance resolved by traders

→ Measurable alternative indicators
From consumer Exit point data on nomination, renomination and gasflow

- The evolution of Internal Adjustment – Aggergated Imbalance →

New area for analysis, measurable indices
from consumer Exit point data on nomination, renomination and gasflow and/or from imbalance settlement data

I have illustrated the functioning of my indicators and the functioning of the methodology as a whole on three country-cases. In Croatia, an extensive set of data is publicly available thus I could apply the complete methodology and could evaluate the development of the Croatian balancing market. On the basis of my results, significant developments have been made in balancing the consumption portfolio of the large consumers (directly connected to the transmission system). Suppliers of this group plan their portfolios more and more accurately leaving less and less balancing requirements. In addition, a significant part of the balancing need is solved during renominations within day, so the system operator has a really residual role. Finally, the wholesale market - both day ahead and intraday - is coordinating the opposite sign of imbalances between traders more and more efficiently.

These positive processes are much more moderate in the case of the smaller consumers (connected to the distribution network), so I suggest that regulation should focus more on this segment in the future, and support it's balancing with additional regulatory tools such as information provision improving rules.

I have also analyzed the trends in the balancing requirement and trader - system operator engagement in resolving imbalances in the case of the large consumers of the two Polish balancing zones. Here I found trends in efficiency improvement in balancing requirement in the smaller balancing zone, while in the larger balancing zone the balancing requirement did

not decrease, but traders have significantly engaged in resolving this balancing need during the renomination process. I proposed several hypotheses for the reasons.

Finally, on the Czech data, I made an analysis of the Internal Adjustment and its counterpart the Aggregate Imbalance indicators. In the analysis I showed that with the use of my new indicators it was possible to find out more about the functioning of the balancing system than compared to what the use of the indicators developed by ACER revealed about the functioning of the system. Based on the results, the Czech gas market became more and more efficient, but the balancing requirement itself increased during the period.

With my country examples, I have shown that with the help of my indicators, we can get a deeper insight into the balancing system of a country compared to what the application of indicators suggesed by the literature would provide.

I.

IV. Summerizing the results

My dissertation was about the theory and practice of balancing regulation on the gas market. By now, both European regulation and the academic sector consider the balancing system as one of the key points to the success of gas market liberalization. The balancing regime is a multilayer regulatory package, its toolset needs to be cautiously sorted by knowing the effects according to the degree of market development. The effect of the selected tool should be measured, and the forthcoming regulatory cycle should reflect the results of this evaluation. This cyclical process is thus progresses towards until the introduction of a full market-based balancing regime.

At present, a significant number of EU Member States are still in this cyclical regulatory period. Member States will have to identify the transitional instruments to be introduced to achieve a market-based balancing regime and will also have to assess the effectiveness of these instruments. Regarding the evaluation methodology a European-wide discourse is developing.

ACER is currently working on laying down a generally applicable analytical framework for assessing the effectiveness of the implementation of the European balancing regulation. With the use of the framework it aims to assess the efficiency of national balancing systems and to also make cross-sectional comparisons.

In the European gas balancing regulation, measuring the effectiveness of the implemented rules with such a comprehensive framework is a significant new approach.

With my dissertation I want to contribute to this task.

Through the testing of my indicators on three country-cases I have illustrated that with the application of the methodology I have developed a deeper insight can be gained on the efficiency of the balancing systems compared to the literature so far, and they can be used regardless of the level of development of the gas market and the balancing setup of the Member State. Thus, the developed indicator-system provides a generally usable analytical framework for researchers, regulators and professional organizations.

I first summarized this methodology in my research paper submitted for the ERRA[5] Regulatory Research Award in May 2017. The international professional jury granted me the first prize, and according to the jury's explanation, my results can be useful for energy regulators dealing with gas market liberalization.

This dissertation is partly based on this ERRA paper.

I hope that through my dissertation I can contribute to the European discourse on the functioning of the gas markets and to the improvement of the applied methodology by regulators.

5 ERRA - Energy Regulators Reagional Association: a voluntary organization of regulatory authorities from Europe, Asia, Africa, Middle East and the US.

V. Key references

ACER (2016): *ACER Report on the implementation of the Balancing Network Code.* http://www.acer.europa.eu/official_documents/acts_of_the_agency/publication/acer%20report%20on%20the%20implementation%20of%20the%20balancing%20network%20code.pdf

ACER (2017): *ACER Report on the implementation of the Balancing Network Code Second Edition.* 16 November 2017.

ACER - ENTSOG (2014): *Acer - ENTSOG Report on the early implementation of the Balancing Network Code (BAL NC).* 22 October 2014.

https://www.acer.europa.eu/en/Gas/Framework%20guidelines_and_network%20codes/Documents/ACER-ENTSOG_Report_BAL_NC_Early_Implementation-Final_22-Oct-2014.pdf

ACER – ENTSOG (2015): *Second ACER-ENTSOG Report on the status of the implementation of the Balancing Network Code.* 2015. november 5. http://www.acer.europa.eu/official_documents/acts_of_the_agency/publication/second%20acer-entsog%20report%20on%20the%20status%20of%20the%20implementation%20of%20the%20balancing%20network%20code.pdf

Bender, C. M. – **Götz**, G. – **Pakula**, B. (2011): *Effective Competition: Its Importance and Relevance for Network Industries Process* **in:** Intereconomics: "Effective Competition" in Telecommunications, Rail and Energy Markets. pp. 4-10. https://doi.org/10.1007/s10272-011-0362-y https://archive.intereconomics.eu/year/2011/1/effective-competition-in-telecommunications-rail-and-energy-markets/

CEPA (2015): *Implementation monitoring and evaluation of the impact of the gas network codes and guidelines on the internal market. Final Report.* ACER/OP/DIR/08/2013/LOT 2/SC06. https://www.acer.europa.eu/en/Gas/Market_monitoring/Documents/CEPA%20FinalReport_Monitoring%20%20Evaluation%20of%20Impacts%20of%20Gas%20NCs_FINAL_Oct%2715.pdf
commission.org.uk/rep_pub/reports/2003/480centrica.htm

Creti, A. – **Pontoni**, F. (2016): *Natural gas balancing, storage, and flexibility in Europe: Assessing the recent literature.* Current Sustainable/Renewable Energy Reports 3 pp. 18-22. DOI: 10.1007/s40518-016-0046-0

Dickx, L. – **Miriello**, C – **Polo**, M. (2014): *Balancing Systems and Flexibility Tools in European gas markets.* Research Report Series – ISSN 2036-1785

ECDGC (European Commission DG Competition) (2007): *DG Competition Report on Energy Sector Inquiry*

ENTSOG (2016): *BAL NC Implementation Monitoring Report 2015.* https://www.entsog.eu/public/uploads/files/publications/Implementation

%20Monitoring/2016/BAL0605-16_160126_BAL%20NC%20Implementation %20Monitoring%20Report%202015_Final.pdf

ENTSOG (2017): *BAL NC Monitoring Report 2016*. https://www.entsog.eu/public/uploads/files/publications/Implementation %20Monitoring/2017/ENTSOG_IMR_BAL_NC_2016_web.pdf

Glachant, J.M. – **Hallack**, M. – **Vazquez**, M. (2013): *Building competitive gas markets in europe*. Cheltenham: Edward Elgar Publishing

Haase, N. (2008): *European gas market liberalization: Are regulatory regimes moving towards convergence?* Oxford Institute for Energy Studies. NG 24. https://ris.utwente.nl/ws/portalfiles/portal/5183881

Heather, P. (2015): *The evolution of European traded gas hubs*. OIES Paper NG 104 https://www.oxfordenergy.org/wpcms/wp-content/uploads/2016/02/NG-104.pdf

Hunt, P. (2008): *Entry-exit transmission pricing with notional hubs: can it deliver a Pan-European wholesale market in gas?* OIES Paper: NG 23 https://www.oxfordenergy.org/wpcms/wp-content/uploads/2010/11/NG23-Entry-ExitTransmissionPricingwithNotionalHubsCanItDeliverAPanEuropeanWholesaleMarketInGas-PaulHunt-2008.pdf

Joskow, P. L. (2005): *Vertical integration* in: Ménard, C. – Shirley, M. M. szerk: *Handbook of new institutional economics*. Springer ISBN 978-0-387-25092-2

Kaderják P. – **Kiss** A. – **Paizs** L. – **Selei** A. – **Szolnoki** P. - **Takácsné** Tóth B. (2013): *Infrastrukturális fejlesztések szerepe a gázpiaci integrációban. Elemzések a Duna-régió gázpiaci modellel* in: Valentiny P. – Kiss F. L. – Nagy Cs. I. szerk.: Verseny és Szabályozás 2012. MTA KRTK Közgazdaság-tudományi Intézet. ISSN 1789-9702 pp. 256-282.

Kaderják, P. (2014): *Az olajindexált gázárazásról a piaci árazásra történő áttérés feltételei Magyarországon*. PhD tézis. Budapesti Corvinus Egyetem Gazdálkodástani Doktori Iskola

KEMA – **COWI** (2013): *Study on Entry-Exit regimes in gas*. Project for the European Commission - DG ENER. ENER/B2/267-2012/ETU/SI2.628337. https://ec.europa.eu/energy/sites/ener/files/documents/201307-entry-exit-regimes-in-gas-parta.pdf

KEMA – **REKK** (2009): *Study on methodologies for gas transmission network tariffs and gas balancing fees in Europe*. Submitted to the European Commission - DG TREN. TREN/C2/240-241-2008. http://rekk.hu/downloads/projects/study_on_methodologies_for_gas_transmission_network_tariffs_and_gas_balancing_fees_in_europe.pdf

Keyaerts, N. – **D'Haeseleer**, W. (2014): *Forum shopping for ex-post gas-balancing services*. Energy Policy, 2014. Vol. 67. pp. 209-221. DOI: 10.1016/j.enpol.2013.11.062

Keyaerts, N. – **Hallack**, M. – **Galchant**, J.M. – **D'Haeseleer**, W. (2011): *Gas market distorting effects of imbalanced gas balancing rules: inefficient regulation of pipeline flexibility*. Energy Policy, Volume 39, Issue 2. February 2011, pp. 865-876 https://doi.org/10.1016/j.enpol.2010.11.006

Keyaerts, N. (2012): *Gas balancing and line-pack flexibility.* PhD Thesis. Faculteit Ingenieurswetenschappen KU Leuven ISBN-10: 9460185673

Kiss F. L. (2008): *Bevezetés a szabályozás gazdaságtanába*. Verseny és Szabályozás 2007. Szerkesztette Valentiny Pál • Kiss Ferenc László. pp. 11-95. MTA Közgazdaságtudományi Intézet. ISBN 978-963-9796-09-6

Littlechild, S. (2011): *The Nature of Competition and the Regulatory Process* **in:** Intereconomics: "Effective Competition" in Telecommunications, Rail and Energy Markets. pp. 10-17. https://doi.org/10.1007/s10272-011-0362-y https://archive.intereconomics.eu/year/2011/1/effective-competition-in-telecommunications-rail-and-energy-markets/

Meeus, L . – **D'Haeseleer**, W. – **Keyaerts**, N. (2008): *Natural gas balancing: appropriate framework and terminology*. TMEWP series: EN 2008-003. K.U.Leuven Energy Institute https://www.mech.kuleuven.be/en/tme/research/energy_environment/Pdf/WPEN2008-03

Miriello, C. – **Polo**, M. (2015): *The development of gas hubs in Europe.* Energy Policy 84 (2015) pp. 177–190 http://dx.doi.org/10.1016/j.enpol.2015.05.003

Newbery, D. - **Twomey**, P. - **Green**, R., **Neuhoff**, K. and (2009): *A Review of the Monitoring of Market Power: The possible roles of a transmission system operators in monitoring for market power issues in congested transmission systems*. Reprinted from: The Journal of Energy Literature XI. 2. 2005, pp. 3-54. Center for Energy and Environmental Policy Research MIT

Pápai Z. (2011): *A verseny kérdése a szélessávú oligopolpiacon*. in: Verseny és szabályozás 2010. Szerk.: Valentiny, P.- Kiss, F. L. – Nagy, Cs. I., 2011. pp. 228-273. MTA Közgazdaságtudományi Intézet ISBN 978-963-9796-09-6

Petrovich, B. (2016): *Do we have aligned and reliable gas Exchange prices in Europe?*OIES Comment Paper, April 2016. https://www.oxfordenergy.org/wpcms/wpcontent/uploads/2016/04/Do-we-have-aligned-and-reliable-gas-exchange-prices-in-Europe.pdf

Shuttleworth, G. (2000): *Opening European electricity and gas markets*. http://www.nera.com/content/dam/nera/publications/archive1/3730.pdf

Stern, J. – **Rogers**, H. V. (2014): T*he dynamics of a liberalised European gas market The Oxford institute for energy studies*. OIES Paper: NG 94

Szolnoki P. – **Mezősi** A. – **Takácsné Tóth** B. (2008): *A gáztárolói verseny kialakulásának lehetőségei Magyarországon*. REKK Műhelytanulmány. http://gvh.hu/data/cms1000571/3_tanulm%C3%A1ny.pdf

Szolnoki P. (2011): *The economic value of increased supply security.* In Kaderják P. szerk: Security of energy supply in central and south-east Europe. Aula Kiadó, ISBN 978-963-503-447-5. pp. 46-91

Szolnoki P. (2017*): Monitoring natural gas balancing markets. A practicl guide for regulators on how the performance of the implemented balancing mechanisms can be assessed.* ERRA Regulatory Research Award 1. helyezés

VI. The author's publications

Scientific book, book chapter

Book chapters in Hungarian:

Verseny és Szabályozás 2012

Kaderják Péter – Kiss András – Paizs László – Selei Adrienn - Szolnoki Pálma – Tóth Borbála (2013): Infrastrukturális fejlesztések szerepe a gázpiaci integrációban. Elemzések a Duna régió gázpiaci modellel. **in:** Valentinyi Pál – Kiss Ferenc László – Nagy Csongor István (szerkesztők) (2013): Verseny és Szabályozás 2012. MTA KRTK Közgazdaságtudományi Intézet, Budapest, pp. 256-282. ISSN: 1789-9702

Kaleidoszkóp

Szolnoki Pálma – Takácsné Tóth Borbála (2008): A magyar villamosenergia-piac helyzetképe 2008 elején. **in:** Laki Mihály – Voszka Éva (szerkesztők) (2008): Kaleidoszkóp: Versenyhelyzet Magyarországon 2007-ben. Pénzügykutató Rt. Budapest, pp. 129-162. ISBN: 978-963-7406-57-7

Verseny és Szabályozás 2007

Szolnoki Pálma – Tóth András István (2008): Szolgáltatóváltás a magyar lakossági árampiacon 2008-ban. **in:** Valentinyi Pál – Kiss Ferenc László (szerkesztők) (2008): Verseny és Szabályozás 2007. MTA Közgazdaságtudományi Intézet, Budapest, pp. 197-227. ISBN: 978-963-9796-09-6

Book chapters in English:

Security of Energy Supply in Central and South-East Europe

Szolnoki Pálma (2011): The economic value of increased supply security. in: Kaderják Péter (szerkesztő): Security of Energy Supply in Central and South-East Europe. Aula Kiadó, Budapest, pp. 51-96. ISBN: 978-963-503-447-5

Impact of the 2004 enlargment on the EU Energy Sector

Peter Cameron – Kaderják Péter – Mezősi András – Szolnoki Pálma – Tóth András István (2008): Disruptions and security of supply. **in:** Dr Michael LaBelle – Kaderják Péter (szerkesztők)(2008): Impact of the 2004 enlargment on the EU energy sector. Regionális Energiagazdasági Kutatóközpont. Budapest, pp. 25-114, ISBN: 978-963-503-381-2

Mezősi András – Pál Gabriella – Pató Zsuzsanna – Szolnoki Pálma (2008): Renewable energy sources. **in:** Dr Michael LaBelle – Kaderják Péter (szerkesztők)(2008): Impact of the 2004 enlargment on the EU energy sector. Regionális Energiagazdasági Kutatóközpont. Budapest, pp. 179-219, ISBN: 978-963-503-381-2

Journals:

Paper in English:

Szolnoki Pálma - Ilyés Márton - Gulyás László – George Kampis (2016): Who Should be my Facebook Partner? Analysis of the Relationship between Hungarian Large-scale Facebook Pages1. Procedia Computer Science. 101. pp. 86-95. 10.1016/j.procs.2016.11.012.

Research and professional studies

ERRA Regulatory Research Award 1. prize

Szolnoki P. (2017*): Monitoring natural gas balancing markets. A practical guide for regulators on how the performance of the implemented balancing mechanisms can be assessed.*

Conference proceedings:

Hungarian:

Szolnoki Pálma (2008): Mekkora kárral jár egy áramkimaradás? Doktoranduszok Országos Szövetségének Kiadványa: Tavaszi szél 2008. Budapesti Károli Gáspár Református Egyetem. pp. 181 – 197., ISBN: 978-963-87569-2-3

English:

Szolnoki Pálma – Tóth András István (2008): Forecasting the market outcome on the Hungarian household electricity market after liberalization. Spring Meeting of Young Economists, University of Lille. 2008. április 17-19. p. 80.

Working papers

Working paper in Hungarian:

Kaderják Péter – Mezősi András – Paizs László – Szolnoki Pálma (2010): Energiapolitikai ajánlások 2010. A hazai árampiaci szabályozás kritikája és javaslatok a továbblépésre. publikáció helye: REKK honlap. http://www.rekk.eu/images/stories/letoltheto/wp_2010_1.pdf

Mezősi András – Szolnoki Pálma – Takácsné Tóth Borbála (2008): A gáztárolói verseny kialakulásának lehetőségei Magyarországon. publikáció helye: REKK honlap. http://www.rekk.eu/images/stories/letoltheto/wp2009-1.pdf

Kiss András – Mezősi András – Pál Gabriella – Szolnoki Pálma – Tóth András (2008): A szivattyús energiatározás kérdésének közgazdasági elemzése. publikáció helye: REKK honlap. http://www.rekk.eu/images/stories/letoltheto/wp2008-8.pdf

Kaderják Péter – Kiss András – Mezősi András – Szolnoki Pálma (2008): Összefüggések Magyarország és a balkáni régió villamos-energiapiacai között. publikáció helye: REKK honlap. http://www.rekk.eu/images/stories/letoltheto/wp2008-3.pdf

Pató Zsuzsanna – Szolnoki Pálma – Takácsné Tóth Borbála (2008): Gázforrás- és kitermelési szerződés árverési programok hatása a gázpiacok fejlődésére. publkicákó helye: REKK honlap. http://www.rekk.eu/images/stories/letoltheto/wp2008-2.pdf

Working paper in English:

Szolnoki Pálma (2008): Potential implementation of demand side approach methods in ERRA countries. ERRA Licencing and Competition Committee. Case Study Paper. http://pdf.usaid.gov/pdf_docs/Pnads306.pdf

Textbooks:

Textbooks in English:

Pató Zsuzsanna – Szolnoki Pálma [2011]: Inogate Textbook. Renewable Energy Regulation. http://www.rekk.eu/images/stories/letoltheto/res_textbook.pdf

Szolnoki P. **- Kaderják** P. – **Pál**, G. – **Tóth** B. (2008c): *Textbook on natural gas and district heating regulation*. Prepared for the Energy Regulators Regional Association

Articles

Szolnoki Pálma (2011): Mekkora biztonsági gázkészletre van szüksége hazánknak. Publikáció helye: Portfolio.hu.

http://www.portfolio.hu/vallalatok/energia/mekkora_biztonsagi_gazkeszletre_van_szuksege_hazankna k_rekk.146104.html