Entry and exit strategies in the power generation sector[1]

Vivien Csapi – Bernadett Mohácsi
University of Pécs

Motivated by the controversies and debates, this paper attempts to address the entry and exit strategies in the power generation sector, with a special focus on entering into a renewable power generation market, or leaving a traditional market. First we summarize the trends that shape the demand and supply side of the market, than describe possible market entry barriers, reasons of exit, and finally, introduce the existing strategies. Upon examining electrical energy projects, the planning of electrical energy composition, which can contain both entry and exit decisions, one has to deal with a problem complex from multiple aspects. The difficulties arise from the particularities of investments in the sector (irreversibility, uncertainty, long lifetime), moreover the features of the sector itself (numerous players with varying preferences and risk attitudes, changing regulatory and market environment, the special nature of electric power as a product) and all this things result in the complexity of entry and exit related decision making (Csapi 2013). But what makes the market so unpredictable, so risky and still worth to enter? Internationalization is what covers almost every aspect of human life, including politics, culture, science, financial systems and lifestyles. This increasing cross-border flow of capital and goods from different countries has fostered globalization. Trade liberalization, production internationalization, and financial and technological saturation are the major drivers behind what shapes the power generation sector today. Now, we try to summarize those trends that affect a company's future strategy, development and innovation process, and influence product and technology planning..

TRENDS SHAPING THE POWER GENERATION SECTOR

Demand Side

A growing population and improving economic conditions in the world will raise energy consumption during the next decade. The anticipated economic growth and an improved standard of living are expected to *drive the electricity demand.* Because of the improved efficiency measures, market specialists expect a decrease in residential electricity consumption, despite the mentioned population growth. An increase is expected in the commercial consumption as demand for new electrical equipment exceeds energy gains from efficiency improvements. Finally thanks to the on-site, small size, mostly renewable technology solutions, and improved efficiency, we can expect a decline in the industrial sector also.

Supply Side

The balance between world supply and demand drives the oil and gas industry. Various geopolitical factors and regional trends impact the fuel industry, and it is essential to target the opportunities of growth. There is a growing need to increase the supply of energy, which brings increased self-sufficiency and greater *security of supply.* As technology transforms itself to fit today's business requirements, several challenges need to be addressed from the supply side of the market: *environmental challenges, price decrease* due to increased competition and technology developments. These are some of the key factors that all industry participants need to cope with so they can survive in a fast-changing market.

Technology

Electricity is an extremely flexible energy carrier: the spectrum of available generation technologies goes from CO_2-free technologies, like renewables and nuclear, to medium-CO_2 emitting technologies, such as Combined Cycle Gas Turbine (CCGT) and ultra-supercritical coal plants. McGarvey et al. (2007) collected *fourteen possible electricity generation technologies:*

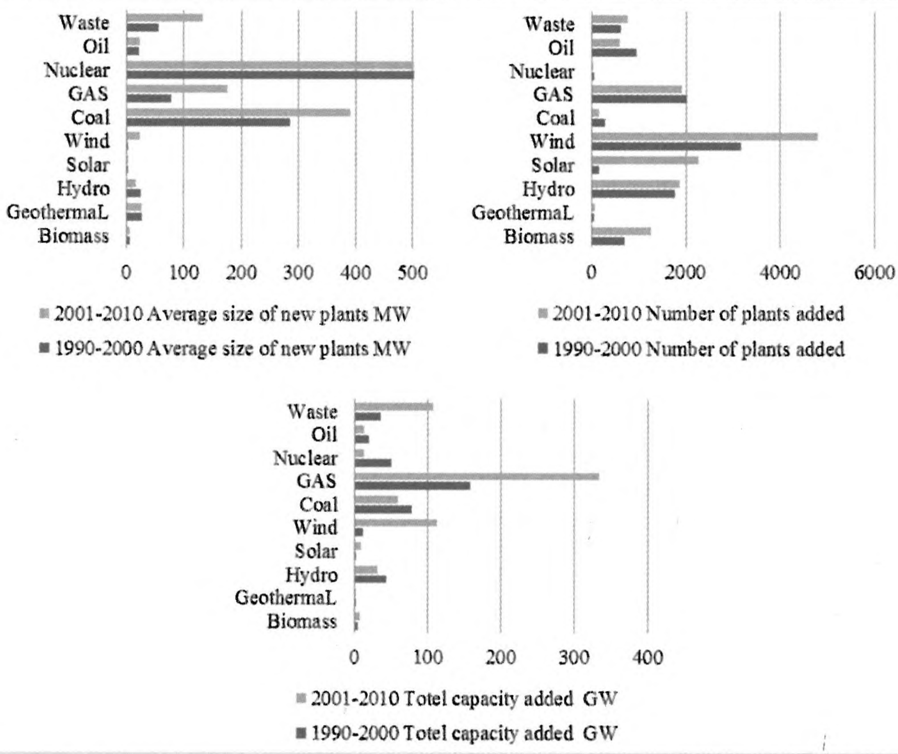
1. Combined cycle gas turbines
2. Combustion gas turbines
3. Pulverized coal generation
4. Fluidized bed combustion
5. Integrated gasification combined cycle (IGCC) generation
6. Nuclear generation
7. Wind generation
8. Pumped-storage hydropower
9. Photovoltaic
10. Concentrated solar power
11. Biomass power
12. Geothermal power
13. Barrage and ocean current generation
14. Fuel cells

Today's societies, energy and transport systems are addicted to fossil fuels. Fossil or carbon based fuels are used to generate well over one-half, according to the International Energy Agency (2014) about 62%, of the electricity produced worldwide. Renewable fuels (e.g. solar, wind, water) provide a relatively small percentage (hydro 14%; wind/solar/other 6%), and nuclear still 18%, although the share of renewable energy sources in electricity generation varies considerably from region to region.

The energy industry is already challenged to meet current energy demands, and forecasted increases in population and GDP per capita over the next 10 years means even greater stresses on the electric grid. The focus is on adopting renewable energy sources and clean coal technology, with nuclear energy also emerging as an option for the long-term energy needs. Areas for technology development to reduce carbon dioxide emissions include coal upgrading, improving efficiency in existing power plants, integrating gasification combined cycle (IGCC), and utilizing carbon capture and storage (CCS). Increases in renewable energy sources for electricity, will be at the demise of oil usage, mostly due to oil price volatility and environmental concerns. Hydropower, the most mature form of renewable energy is expected to be the leading renewable energy source worldwide, but because of high initial investment costs, long payback period, and environmental concerns regarding its impact on the aquatic life, wind and solar is expected to be the fastest growing technologies in the years ahead (see Figure 1).

We have to note here, that there are different ways to generate power sustainably, but each faces challenges in the economic, technical and logistical senses *(higher cost, less manageable output, limited fuel).* In very general terms *sustainable electricity generation* can be defined as those technologies that reduce environmental impacts, are socially acceptable and can be economically competitive. Pfeuti et al. (2002) classified sustainable energy into four main groups: renewable energy, distributed energy systems, natural gas and demand-side energy efficiency. The four groups meet the requirements of the definition of sustainable energy better than fossil- or nuclear-based power technologies in that they usually reduce environmental impacts, tend to be more socially acceptable and have a good chance of being economically competitive, especially if environmental externalities are internalized (Moore & Wüstenhagen 2004).

Figure 1: Average size of new plants, capacity added and number of plants by subsectors



Source: OECD 2014

ENTRY STRATEGIES

A wide range of market features will affect a firm's ability to enter the market. Some features relate to the fundamental structure of supply and demand conditions, others are the result of the behaviour of firms already in the market. The empirical literature on market entry and exit focusing on the generation segment of the electricity industry is limited.

Four types of barriers may restrain entry into markets for power generation: structural, regulatory, uncertainty-related, and strategic barriers. *Structural barriers* include high economies of scale, large capital requirements, high sunk costs, long lead times, minimum efficient scales, absolute cost advantages, and very long asset lives (Kwoka 2008; CEG 2012).

Structural barriers

There are factors that make entry into electricity generation especially risky for investors relative to entry into other industries. Empirical studies have shown that *sunk costs*, also called *irreversible investments* are a key factors affecting entry. Most electricity generation technologies have high up-front sunk costs and very long asset lives (see Table 1 and 2).

Sunk costs are investments that cannot be recovered if a firm exits the market. Types of sunk costs include investments in highly specialised equipment, acquiring and training specialised staff, spending on advertising to build a brand name in an industry and industry-specific R&D. Sunk costs affect entry in several ways. They raise the risks of entry. If sunk costs

Table 1: Instalment cost of traditional and renewable power generation technologies

		Instalment cost			
		Min	Max	Average	Sd
Technology		$/KW			
Traditional technologies	IGCC	1 431	5 050	**2 680**	1 213
	Coal (PC)	1 200	5 350	**2 170**	1 103
	Oil	800	1 000	**883**	104
	CCGT	500	1 300	**849**	263
	Gas CHP	411	1 094	**645**	389
	Nuclear LRW	1 510	7 550	**3 665**	2 210
	Nuclear advanced	3 000	3 700	**3 305**	358
Renewable technologies	Hydro	2 000	3 226	**2 393**	425
	Biomass	1 750	4 300	**2 626**	865
	Biomass/Coal CHP	2 385	2 385	**2 385**	-
	Onshore wind	500	2 500	**1 617**	565
	Offshore wind	1 000	30 000	**6 216**	10 557
	Solar PV	3 000	6 000	**4 805**	1 097
	Solar thermal CSP	2 000	7 000	**4 413**	1 580
	Wave	4 927	4 927	**4 927**	-
	Geothermal	1 150	10 000	**3 121**	2 257

Source: Own calculation based on EERE 2008, AEO 2009, Stretton 2010; IEA 2010

Table 2: Lead time and asset life of traditional and renewable power generation technologies

		Lead time				Asset life			
		Min	Max	Average	SD	Min	Max	Average	Sd
Technology		yr				yr			
Traditional technologies	IGCC	3	4	**4**	0,6	30	60	**41,25**	14,36
	Coal (PC)	3	4	**4**	0,5	25	60	**37,5**	12,54
	Oil	3	3	**3**	0,0	30	30	**30**	0
	CCGT	2	3	**2**	0,3	20	45	**29,29**	7,868
	Gas CHP	3	3	**3**	0,0	25	30	**26,25**	2,5
	Nuclear LRW	7	9	**8**	1,4	30	60	**50**	12,91
	Nuclear advanced	9	10	**10**	0,7	40	60	**47,5**	9,574
Renewable technologies	Hydro	4	6	5	1,4	50	60	**56,67**	5,774
	Biomass	4	4	4	0,0	25	45	**35**	9,354
	Biomass/Coal CHP	4	4	4	0,0	25	25	**25**	0
	Onshore wind	1	3	2	1,0	20	30	**24,29**	4,499
	Offshore wind	1	3	2	1,2	20	30	**23,33**	4,082
	Solar PV	1	2	2	0,6	20	40	**30**	6,325
	Solar thermal CSP	1	3	2	1,2	25	30	**29**	2,236
	Wave	3	3	3	0,0	25	25	**25**	0
	Geothermal	3	4	4	0,7	20	50	**32**	10,95

Source: Own calculation based on POWER SWITCH 2003; MiniCAM 2008; NREL-SEAC 2008; Risto, Aija 2008; Stretton 2010 are large, then an entrant may face large losses if they enter and then find that their revenues are insufficient to cover their costs including the costs of entering.

Even the fastest-built and least capital intensive types of power generation technologies, such as CCGT technology, or gas-fired peaking plants, have lead times of around two or three years. Usually the necessity of additional transmission infrastructures in the face of entry may cause the increase in lead times and capital requirements, and thereby impose further barriers for potential entrants (see Table 2).

Absolute cost advantages arise where the firms already in the market have lower costs than an entrant. That could be for many reasons (Kwoka 2008), for example, the firms in the market may have better access to capital markets or have taken the best locations or the best employees. They could also have a patent over the best technology. This absolute cost advantages can lead to a price above the costs but below the costs that would be faced by an entrant.

Regulatory barriers

Regulatory barriers may further limit the entry decision, increase the lead time, increase instalment costs and so on. Environmental, land use and other regulatory compliances could be and usually are necessary when a firm plans to enter into a market (Cichanowicz 2008, Kwoka 2008). The regulatory process related to grid connection of a new generator may also be considerably lengthy. The administrative burdens imposed by the necessary procedures of regulation may hence be considered as additional restrictions to entry. Furthermore, the legislation with regards to the share of grid connection costs borne by the entrant may also affect the entry decisions (OECD 2014).

Uncertainty-related barriers

Among the uncertainty related barriers first, transmission uncertainty needs to be considered. In the face of uncertainty about future transmission availability, generators account for the probability of not being able to deliver. Another, maybe the most obvious risk factor is related to the wholesale electricity prices. This reflects uncertainty about the future of generation fuel costs and the future of generation technology over the life of the asset. Another important source of uncertainty is associated with regulatory risk. Public policies and regulations are often subject to unpredictable changes. If the option value of waiting for policy or regulatory uncertainty to be resolved is large enough, investments should be delayed in time, if not cancelled. Environmental policy uncertainty may have detrimental effects on investments in both fossil fuel power plants and renewable power plants. For instance, the uncertainty surrounding the carbon policy is a crucial factor (Deloitte 2011).

Strategic barriers

Strategic barriers to entry can arise from over-investment in generation capacity, pricing behaviour, contractual arrangements, reputational effects, network concentration effects. For example firms already in the market can use *contractual arrangements* to make entry more difficult. If customers are forced to enter into long-term contracts, then few customers may be coming out of a contract. The renewable power generation market is still dominated by independent power producers, whose output, the electricity itself is sold long-term power purchase agreements.

RENEWABLE ENERGY MARKET

Why is it worth to enter into the renewable energy market?

Renewable energy is a vital and growing component of the worlds, Europe's and Hungary's diverse energy mix. Renewable energy is probably the category most often associated with the term sustainable energy. Renewable energy refers to energy resources that occur naturally and repeatedly in environment and can be harnessed for human benefit. Examples of renewable energy systems include solar, wind, hydro and geothermal energy (getting energy from the heat in Earth). Biomass, rivers, and even garbage (waste generated) are also source to renewable energy (Raghuvanshi et al. 2008). By their nature, renewable energy sources are generally carbon-free or carbon neutral. Many renewable energy technologies have matured over the last decade and moved from being a passion for the dedicated few to a major economic sector attracting large industrial companies and financial institutions. The renewable energy sector promises continued growth for the foreseeable future, reaching $7 trillion of expected cumulative global private-sector investment between 2012 and 2030. Despite some short-term challenges, growth is expected in each renewable energy subsector, including wind, solar, geothermal, biomass, hydropower, and renewable fuels – albeit at different rates (ITA 2014).

There are at least four reasons for integrating renewable energy in the generation-mix: *first,* society relies mainly on fossil fuels, which are limited and non-renewable; *second,* fossil fuels will be exhausted in a foreseeable future; *third,* the use of fossil fuels has generated environmental effects that negatively affect social well-being; *fourth,* renewable energy sources could satisfy the needs of the industrial society in terms of consumption and environmental impact (Zamfir 2009). Renewable energy also promises some strategic improvements in the security of supply; reduces the long-term price volatility and the reliance on imported fossil fuels; and as renewable energy produces very little carbon or other greenhouse gases, it plays an important part in tackling climate change. Last but not least, renewable energy also facilitates improvement in the economic and social prospects of rural and isolated regions in industrialized countries.

We can state, that the renewable energy production technologies have improved substantially in the last decade. The main drivers for this growth have not only been the economic efficiency and technology breakthroughs in renewable power production, but also been the favourable national and international government support due to environmental concerns, higher oil and natural gas prices (Wiser et al. 2007).

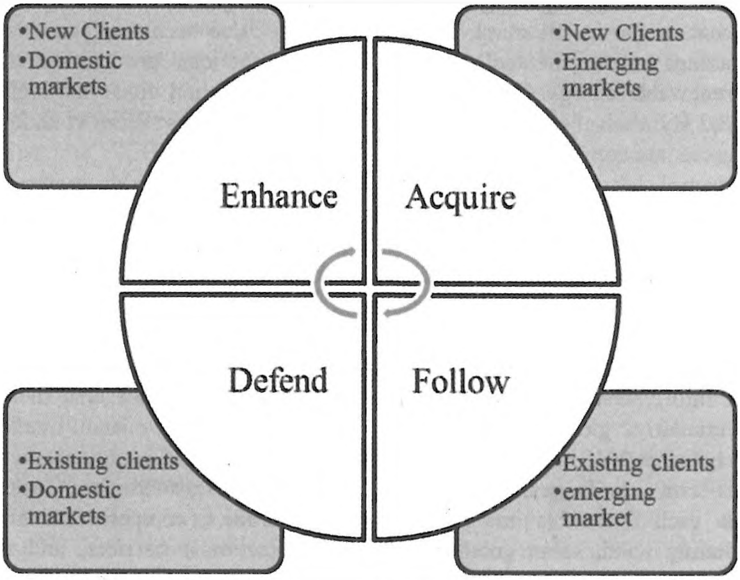
Entry into a renewable energy market

According to ITA (2014) if a company plans to enter into a large renewable energy market it is a good starting point to find considerable interest in purchasing products or services, to focus on meeting as many potential buyers or partners as possible. If a company realizes, that the company's nation has a relative small market share in a large renewable energy market it is necessary to understand if this lack of market share is due to competitiveness constraints or protectionist barriers, and find niche opportunities for products in markets without protectionist policies in place. If the potential renewable energy market is small, the company's job is to participate in market development activities, and position the company early for when market begins to develop.

Following existing clients or partners into new markets is often a good point to start, as it reduces expansion costs and risks, while giving companies a chance to scout different markets before settling down on the most attractive ones. For companies that get most of its turnover from a limited number of clients, following key accounts into emerging markets might not even be an option but rather a necessity.

One of the biggest risks of a market expansion operation, especially for smaller companies, is to overlook domestic markets. This holds particularly true for the renewable energy sector. A good market strategy will often balance domestic and emerging markets, as well as existing and new clients: retaining and acquiring clients in domestic markets offers a lower business development cost, while expanding into new markets presents an opportunity for faster growth (see Figure 2).

Figure 2: Market strategy with a client and market focus



Source: X&Y 2013

For business development purposes, the most talked-about emerging markets are often not the most interesting ones. Renewable energy market buzz is mostly generated by ongoing procurement programs and announced projects, meaning that at that stage the company with an entry intention is already probably too late.

Although it can be quite expensive, the value of local presence is unquestionable. A growing number of countries have local content requirements for renewable energy projects, favouring projects that use elements developed or manufactured locally.

EXIT STRATEGIES

When we consider exit strategies in the power generation sector, most of the examples come from the traditional technology side. We can talk about the nuclear phase out and about the fossil fuel power plant phase out, aka fossil fuel power plant decommissioning. Since most of the possible base load power plants *(plants with a load factor about 75%, where the capacity or load factor of a power plant is the ratio of its actual output over a period of time, to its potential output)* are among the traditional technologies, a decommissioning decision is crucial from a security of supply point of view. Only two renewable power generation technologies have a load or capacity factor above 75%, namely biomass and geothermal plants.

New and proposed regulations to climate change related emissions, cooling water use and coal combustion residues continue to drive the decommission projects. Even with more rigorous air emissions requirements on the horizon, another market dynamic may play an even bigger role in power plant decommissioning: the growing supply of cleaner burning natural gas. Shale gas production alone is expected to increase four times of today's level till 2035. Thanks to the new regulations and the high cost of retrofitting coal-fired plants, companies are, and probably will be closing plants, or convert them to more efficient combined cycle gas turbine technology. This shift from coal to gas is due to low natural gas prices and relatively low capital construction costs (see Table 1).

Whether choosing to abandon, convert or replace an existing power plant facility, decision makers face a complex set of choices in determining the best course of action. The steps they must think through vary from asset valuation and cost studies to deconstruction scoping, site remediation and possible redevelopment (Burns & McDonnell, 2012).

Beside fossil fuel phase out we have to mention a recent change, and recently pursued exit strategy in the traditional power generation sector, namely the phase out of nuclear power. We say recent trend, because the world faces it since the summer of 2011, since the nuclear meltdown in Fukushima Daiichi. Germany was the first country to announce a full phase out of nuclear plants till 2022, since then Switzerland, Italy, Taiwan, and Japan have either started serious debates or actively resolved to forego nuclear power in the next decade or two.

This was a good news for environmental activists, for groups and individuals against nuclear power, but we must state, that the developed world still needs nuclear power, and not only because the security of supply. Due to the German phase out plan the country's grids will have to rely heavily on the neighbouring nuclear import (French), on coal and natural gas until renewable energy technologies are strong enough to run the planet's fourth-largest industrial nation. This would mean, that the country' energy system will be the most energy-efficient and green in the world, and could be a model for everyone else.

Another trend is in favour of this plan, namely the recent initiative from the industry. Mega firms, national service providers all over the world *(BT, Commerzbank, FIA Formula E, H&M, IKEA, KPN, Mars, Nestle, Philips, Reed Elsevier, J. Safra Sarasin, Swiss Re and Yoox, Deutsche Bahn, etc.)* are searching for a way to run their factories, plants, trains on local based renewable plants (mostly wind, hydroelectric and solar energy)[2]. This is part of an international multi-year initiative to encourage major companies to commit to using 100% renewable power. The RE100 campaign will highlight the business and reputational ben-

Table 3: Load factor of traditional and renewable power generation technologies

		Load factor			
		Min	Max	Average	Sd
Technology		%			
Traditional technologies	IGCC	80	87	**82,3**	2,92
	Coal (PC)	80	85	**83**	2,45
	Oil	50	54	**52**	2,83
	CCGT	40	87	**79**	14,9
	Gas CHP	30	50	**40**	14,1
	Nuclear LRW	89	90	**89,9**	0,35
	Nuclear advanced	90	90	**90**	0
Renewable technologies	Hydro	34	57	**46,6**	9,37
	Biomass	20	90	**76,8**	20,2
	Biomass/Coal CHP	70	70	**70**	0
	Onshore wind	22	47	**36,2**	8,27
	Offshore wind	26	45	**35**	7,62
	Solar PV	10	73	**28,9**	16,2
	Solar thermal CSP	18	50	**26,8**	9,27
	Wave	15	40	**30**	13,2
	Geothermal	70	95	**85,7**	6,94

Source: POWER SWITCH 2003; AEO 2008; NREL-SEAC 2008; MiniCAM 2008; EERE 2008; EIA 2010 efits enjoyed by companies who make the commitment to use power exclusively from renewable energy sources. It will also help companies who wish to switch to renewables by providing guidance on selecting and implementing the best approach to utilizing renewable power, and information on the financial implications, risks and rewards of different options (RE100 campaign)[3].

CONCLUSION

Increases in population, economic growth, energy independence, innovation to zero, and the need for increased energy supply and sustainable sources are the trends connected and inter-twined. It is important to understand the synergy and interrelation among these trends to maximize growth opportunity, ease market entry and necessary exit. In order to understand all factors that boost growth, influence market entry and exit, the companies must focus on not only meeting energy needs, security of supply, but gaining energy independence and reducing environmental impact also.

We found that four types of barriers may restrain entry into markets for power generation. They are: structural barriers, regulatory barriers, uncertainty related and strategic barriers. In this paper we focused on the renewable energy sector when examining entry strategies, and on the traditional technologies while describing recent exit strategies. We found, that the renewable energy market has great growth potential not only because of the economic efficiency and technology breakthroughs, but also because of the favourable national and international government support mainly due to environmental concerns, higher oil and natural gas prices.

When talking about exit strategy, we found that two recent developments, the climate change related fossil fuel phase out, and the security and partly environmental related nuclear phase out, is currently on the way. We believe, that the world needs traditional technologies, the world needs fossil fuel and nuclear plants, but according to the new developments in clean technology research and energy efficiency the traditional power plants may shift from coal to gas fired stations, and from nuclear to gas fired and renewable plants.

NOTES

1 This research was supported by the European Union and the State of Hungary, co-financed by the European Social Fund in the framework of TÁMOP 4.2.4. A/2-11-1-2012-0001 National Excellence Program.

2 Source: http://www.greenbiz.com/blog/2014/09/22/ikea-swiss-re-mars-hm-make-100-renewable-energy-pledges, Downloaded: 11th of november 2014

3 Source: http://there100.org/, Downloaded: 11th of november 2014

REFERENCES

AEO (2008), *Annual Energy Outlook 2009*, DOE/EIA-0383, March 2009, http://www.eia.doe.gov/oiaf/archive/aeo09/, (Downloaded, 11th November 2014

Burns & McDonnell (2012), *Power Plant Decommissioning, A Noble past, many possible futures*, http://www.burnsmcd.com/Resources/Article/Power-Plant-Decommissioning-A-Noble-Past-Many-Possible-Futures, Downloaded, 11th November 2014

CEG (2012): *Barriers to entry in electricity Generation, A report outline for the AEMC*, http://www.aemc.gov.au/Media/docs/CEG-Report-ece57d9c-399c-4724-b5f0-a6ba319dca83-0.PDF, Downloaded, 11th November 2014

Cichanowicz, J. E. (2008): *Discussion and Examples of Entry Barriers in the Electricity Generation Market*, Report to the American Public Power Association, July.

Csapi V. (2013): "Applying Real Options Theory in the Electrical Energy Sector", *Public Finance Quarterly*, **58** 4, pp.469-83

Deloitte (2011): *Electricity Generation Investment Analysis*, Final Report.

EERE (2008): *EERE Renewable Energy Data Book*. http://www1.eere.energy.gov/maps_data/pdfs/eere_databook.pdf (Letöltve: 2012.01.10)

EIA (2010), *Updated Capital Cost Estimates for Electricity Generation Plants*. Washington, DC: EIA. http://www.eia.gov/forecasts/aeo/assumptions/pdf/electricity.pdf (Downloaded, 6th November 2014)

International Energy Agency (2010): *Projected Cost of Generating Electricity*, IEA, NEA, OECD, http://www.iea.org/textbase/nppdf/free/2010/

projected_costs.pdf, (Downloaded, 11th November 2014)
International Energy Agency (2014), *Monthly Electricity Statistics, August 2014,* http://www.iea.org/media/statistics/surveys/electricity/mes.pdf (Downloaded, 11th November 2014)
Kwoka, J. (2008): *Barriers to New Competition in Electricity Generation,* Report to the American Public Power Association, Northeastern University
McGarvey, J., Costello, K., Potter, R. S., Murphy M., and Laurent, P. (2007), *What Generation Mix Suits Your State? Tools for Comparing Fourteen Technologies across Nine Criteria.* The National Regulatory Research Institute. Ohio State University
Minicam (2008), *Co_2 Emissions Mitigation and Technological Advance: An Updated Analysis of Advanced Technology Scenarios,* Pacific Northwest National Laboratory, http://www.pnl.gov/science/pdf/pnnl18075.pdf, (Downloaded, 11th November 2014)
Moore B. & Wüstenhagen R. (2004): *Innovative And Sustainable Energy Technologies: The Role of Venture Capital,* University of St. Gallen, Switzerland
NREL-SEAC (2008): *ReEDS Model Documentation,* http://www.nrel.gov/analysis/reeds/pdfs/reeds_documentation.pdf (Letöltve: 2012.02.10)
OECD (2014), *The Patterns of Entry in the Generation Segment of the Electricity Supply Sectors of OECD Countries,* Working Party on Integrating Environmental and Economic Policies, OECD, ENV/EPOC/WPIEEP(2014)8/FINAL
Pfeuti, R, Flatz, A, Moor, M, Wüstenhagen, R, and Zamboni, M. (2002): *Changing Climate in the Energy Sector – a New Wave of Sustainable Investment Opportunities Merges, 2/e,* SAM Sustainable Asset Management: Zollikon-Zurich. http://www.sam-group.com/SAM_pdf/SAM_sust_studies/Energy_Studie_e.pdf (Downloaded, 11th November 2014)
POWER SWITCH! Scenarios and Strategies for Clean Power Development in the Philippines, University of the Philippines Solar Laboratory for the Kabang Kalikasan, 2003, http://my1thing.com.ph/download_file/view/85/75/, (Letöltve: 2012.02.10)
Raghuvanshi, S. P., Raghav A. K., and Chandra A. (2008): *Renewable Energy Resources For Climate Change Mitigation.* Indian Institute of Technology Delhi, Hauz Khas, New Delhi, India.
Risto, T. & Aija, K. (2008): *Comparison of Electricity Generation Costs,* Lappeenranta University of Technology http://www.doria.fi/bitstream/handle/10024/39685/isbn9789522145888.pdf, (Downloaded, 11th November 2014)
Stretton S. (2010), *A Short Guide To a Secure Future,* Cambridge, UK http://www.stephenstretton.org.uk/c/CompleteBook.pdf, (Downloaded, 11th November 2014)
Wiser, R, Namovicz, C, Gielecki, M., Smith, R. (2007): *Renewables Portfolio Standards: A Factual Introduction to Experience from the United States,* Lawrence Berkeley National Laboratory.

Vivien Csapi, PhD, Assistant Professor
csapiv@ktk.pte.hu

Bernadett Mohácsi, Assistant Lecturer
mohacsib@ktk.pte.hu

University of Pécs
Faculty of Business and Economics