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DO ECONOMIC INSTRUMENTS IN THE CZECH REPUBLIC SUPPORT GENERATION OF RENEWABLE ENERGY?

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Abstract:
This paper is focused on analysing the impacts brought by economic instruments of energy policy in the Czech Republic towards generation of renewable electricity. The main area of analysis will be the effects of both feed-in tariffs and grants. Firstly, a description of how generation of renewable energy is supported is provided, followed by an overview of used literature. For the purposes of the paper, correlation and regression analysis methods are used. Based on the results, there is a dependence mainly between minimal feed-in tariffs and generation of electricity from both biomass and wind power plants. As for grants, dependence lies between State Environment Fund grants and generation of electricity from both biogas and wind power plants.

Key words:
Renewable energy sources, economic instruments, energy policy, feed-in tariffs, grants, Czech Republic.

***JEL Classification*:** H23, Q48

Introduction

1.1 Support for generation of renewable electricity

Energy efficiency and renewable energies have a great potential for economic development in Europe's regions by boosting energy security, creating jobs and increasing regional autonomy, as well as helping to fight climate change (Hunkin et al., 2014). The European Union has contributed greatly to the growth of these sectors in Europe, with the Europe 20/20/20 targets setting the mid-term policy framework, and a variety of programmes and tools providing finance and support for regional development.

The countries and regions of central Europe vary greatly in their policy frameworks and have a wide disparity in their current performance and 2020 targets, regarding electricity generation, almost all countries are on track for meeting their commitments (more in Hunkin et al., 2014).

In the Czech Republic, one can find different kinds of public support for renewable energy sources. Currently, there are the following economic instruments (MIT, 2015): grants on investments, feed-in tariffs, green bonuses, tax exemptions, tax reductions and refund of taxes. With a 13 percent target for renewable use by 2020, the Czech Republic put a particular focus on biomass and biogas for electricity and heat generation; a sector with substantial growth potential (Hunkin at al., 2014).

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Focusing on more details in grants on investments, we can distinguish the public support from (MIT, 2015):

State programmes - State programme supporting energy savings and use of renewable energy sources regulated by the Ministry of Industry and Trade, New green savings programme regulated by the Ministry of the Environment and Programme for the replacement of boilers regulated by both the Ministry of the Environment and selected regional offices.

Operational programmes – Operational programme OPPIK regulated by the Ministry of Industry and Trade, Operational programme OPŽP regulated by the Ministry of the Environment and Operational programme OPRV regulated by the Ministry of Agriculture.

Regarding feed-in tariffs and green bonuses, there are annual tariffs for producers of both electricity and heat generated from renewable energy sources.

Focusing on more details in the exemption, reduction or refund of taxes, we can find special tax depreciation for renewable energy sources, exemption for electricity generated from renewable energy sources (since 1.1.2016 with limited power installation up to 30 kW) from electricity tax, exemption for land connected with particular power station from property tax (excluding photovoltaic energy) and exemption for buildings after changing the heating system from fossil fuels system to a system using RES for five years from property tax (MIT, 2015).

1.2 Literature overview

Focusing on relevant scientific papers in this area, one can find studies analysing and evaluating public policies and public support of renewable energy sources and their success in European countries as a whole (Albrech et al., 2015, Marques and Fuinhas, 2012) or selected USA countries (Bedsworth and Hanak, 2013); however most of the studies are represented by national case studies evaluating domestic economic instruments and state public policies supporting renewable energy sources, for example in Romania (Zamfir et al., 2016), Lithuania (Bobinaite and Tarvydas, 2014) or Spain (Ortega et al., 2013).

In the Czech Republic, Ryvolová and Zemplinerová (2010) deal with the economics of renewable energy sources, precisely by presenting an analysis of costs regarding the growth of wind energy supply. Pawliczek (2011) analysed the Czech photovoltaic sector and its development, with focus on sustainable advancement. Zimmermannová and Menšík (2013) examined the impact of the introduction of environmental taxation on electricity generated from renewable energy sources. Průša et al. (2013) analysed consumer loss in Czech photovoltaic power plants in the period 2010–2011 and Janda et al. (2014) focused on the total historical and future costs of supporting photovoltaic electricity generation in the Czech Republic. The model estimation of such costs is accompanied by a methodologically unified comparison with the costs of supporting other renewable energy resources.

In the Czech Republic we can find mainly studies focused on analysing electricity generated from wind and photovoltaic. In contrast, there is a general lack of studies analysing simultaneously the development of electricity generated from renewable sources and the progress of public support for renewable electricity, including analysis of economic impact of this public support in more detail.

Accordingly, the main goal of this paper is to analyse the effects of economic instruments of energy policy on generation of renewable electricity in the Czech Republic, especially the impacts of feed-in tariffs and grants. Partial goal is to find out a possible dependency between 1) electricity generated from selected renewable energy sources and relevant feed-in tariffs and 2) electricity generated from selected renewable energy sources and relevant grants.

Pilot results of our research were presented at the international conference Theoretical and practical aspects of public finance in April 2016 in Prague (further information in Zimmermannová and Jílková, 2016). More detailed analysis that is presented in the following chapters is consequently also based on the feedback from the conference and additional research of the authors.

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Methods

For the purposes of this paper, data from the Energy Regulatory Office (ERO, 2016) were used, precisely feed-in tariffs for electricity generated from renewable energy sources in CZK per MWh in the period 2003 – 2014. Further data come from the Ministry of Industry and Trade (MIT, 2016), regarding gross production of electricity from renewable sources in MWh in the period 2003 – 2014. This paper also presents statistics released by the Ministry of Finance (MF, 2016), specifically relating to grants for energy saving and renewable sources in thousand CZK in the period 2010 – 2014. Finally, data included also originate from the State Environmental Fund (SEF, 2016), precisely grants for investments from the Operational Programme OPŽP for renewable energy support in thousand CZK in the period 2008 – 2014.

Research presented on the following pages is based on a standard economic methodology, consisting of the methods of analysis, comparison, deduction and synthesis, together with the use of correlation and regression analysis (see Hendl, 2012).

For the purposes of the correlation analysis, Pearson's correlation coefficient was deployed:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sum_{i=1}^{n}(y_i - \bar{y})^2}} \qquad (1)$$

Linear regression model was used in regards to regression analysis:

$$y = \alpha + \beta x + e \qquad (2)$$

The following research assumptions were defined to contextualize the main target achievement:

1. Renewable electricity generation is positively influenced by minimal feed-in tariffs;
2. Renewable electricity generation is positively influenced by grants.

Results

1.3 Minimal feed in tariffs

Variables depicted below were used to analyse economic impacts of feed-in tariffs on generation of renewable electricity: generation of electricity in MWh from small water electricity (SWE), biomass in total (BMT), chips (CH), cellulose (CEL), plant materials (PM), pellets and briquettes (PB), liquid biofuels (LB), biogas in total (BGT), municipal wastewater treatment plants (MWTP), industrial wastewater treatment plants (IWTP), biogas stations (BGS), landfill gas (LG), biodegradable fraction of solid municipal waste (BFSMW), wind power plants (WPP), photovoltaic power plants (PPP) and maximal feed-in tariff for small water electricity (MF SWE), maximal feed in tariff for biomass in total (MF BMT), maximal feed-in tariff for biogas in total (MF BGT), maximal feed-in tariff for wind power plants (MF WPP) and maximal feed-in tariff for photovoltaic power plants (MF PPP).

The results of the correlation analysis for the Czech Republic are showed in the following Table 1.

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Table 1: Correlation analysis – feed-in tariffs vs generation of renewable electricity

	Year	SWE	BMT	CH	CEL	PM	PB	LB	BGT	MWTP	IWTP	BGS	LG	BFSMW	WPP	PPP	MF SWE	MF BMT	MF BGT	MF WPP	MF PPP
Year	1																				
SWE	0,507899	1																			
BMT	0,984616	0,450814	1																		
CH	0,972862	0,430129	0,992731	1																	
CEL	0,961461	0,449123	0,947453	0,933471	1																
PM	0,831693	0,458026	0,801615	0,770215	0,699894	1															
PB	0,8721	0,38398	0,923151	0,898439	0,785921	0,757759	1														
LB	0,501105	-0,03471	0,527731	0,538596	0,409531	0,598861	0,500996	1													
BGT	0,881286	0,372719	0,816334	0,803684	0,859222	0,723603	0,650234	0,39782	1												
MWTP	0,964572	0,648268	0,953513	0,943497	0,888675	0,862995	0,868346	0,547945	0,793455	1											
IWTP	0,852316	0,329493	0,817378	0,816854	0,859931	0,664849	0,639082	0,395285	0,931482	0,769566	1										
BGS	0,86958	0,359478	0,803176	0,790157	0,848888	0,712244	0,637241	0,389563	0,999669	0,778573	0,929047	1									
LG	0,908719	0,599149	0,897728	0,902378	0,864412	0,785894	0,759802	0,467085	0,670781	0,923301	0,666913	0,651805	1								
BFSMW	0,865806	0,244533	0,845311	0,836453	0,774233	0,810141	0,784124	0,734526	0,875265	0,825883	0,821505	0,870426	0,700129	1							
WPP	0,982026	0,443459	0,983099	0,973156	0,944675	0,776354	0,902025	0,53623	0,84737	0,944703	0,802248	0,836285	0,860386	0,860029	1						
PPP	0,86301	0,227979	0,84379	0,835999	0,769749	0,809901	0,784221	0,731736	0,876422	0,820449	0,818813	0,871883	0,692876	0,999226	0,859066	1					
MF SWE	0,973503	0,55311	0,963899	0,945109	0,924019	0,844854	0,880259	0,482988	0,771556	0,962455	0,75299	0,756007	0,947824	0,793653	0,950414	0,78756	1				
MF BMT	0,917983	0,436844	0,952833	0,94389	0,897019	0,692618	0,910435	0,461675	0,662343	0,898096	0,646636	0,646826	0,862776	0,699826	0,95359	0,698034	0,934736	1			
MF BGT	0,907686	0,42123	0,942054	0,93317	0,877938	0,708029	0,903144	0,450389	0,64907	0,887995	0,631399	0,633607	0,852192	0,682589	0,9433	0,681648	0,930007	0,995855	1		
MF WPP	0,99285	0,440895	0,984027	0,966258	0,961156	0,818877	0,890825	0,509967	0,888514	0,941735	0,85032	0,878465	0,862491	0,877172	0,988954	0,876032	0,956184	0,923266	0,913705	1	
MF PPP	0,85711	0,398028	0,864648	0,846503	0,871018	0,701148	0,758617	0,372265	0,591953	0,80453	0,582606	0,574735	0,90956	0,599489	0,83395	0,592201	0,915493	0,893013	0,893952	0,843775	1

Source: Own work, based on data ERO, 2016; MIT, 2016.

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Arguably, there is a strong positive correlation mainly between maximal feed-in tariff for biomass in total (MF BMT) and generation of renewable electricity from biomass, particularly from biomass in total (BMT), chips (CH), cellulose (CEL), pellets and briquettes (PB). Moreover, there is also a strong positive correlation between maximal feed-in tariff for wind power plants (MF WPP) and generation of renewable electricity from wind power plants (WPP).

Based on these results, more detailed focus can be exerted on the following: (1) relationship between generating renewable electricity from biomass in total (BMT) and maximal feed-in tariffs for biomass in total (MF MBT) and (2) relationship between generation of renewable electricity from wind power plants (WPP) and maximal feed-in tariff for wind power plants (MF WPP). For the purposes of more detailed analysis, the method of regression analysis was used.

The following Table 2 shows the results of the regression analysis, where the independent variable is maximal feed-in tariffs for biomass in total (MF MBT) and the dependent variable is generation of renewable electricity from biomass in total (BMT).

Table 2: Regression analysis – feed-in tariffs vs generation of renewable electricity from biomass

Regression statistics	
Multiply R	0,95283294
Value of Reliability R	0,907890612
Adjusted Value of Reliability R	0,898679674
Error of the Mean	176249,5223
Observations	12

ANOVA

	Df	SS	MS	F	Sig.
Regression	1	3,0619E+12	3,06E+12	98,56657	1,69822E-06
Residues	10	3,1064E+11	3,11E+10		
Total	11	3,3725E+12			

	Coefficients	Std, Error	t	P	Lower Bound 95%	Upper Bound 95%
Constant	-930645,54	220829,421	-4,21432	0,001788	-1422684,153	-438607
Biomass	563,59	56,7674064	9,92807	1,7E-06	437,1051007	690,0764

Source: Own work, based on data ERO, 2016; MIT, 2016.

Subsequently, we can derive the following regression equation:

Y = -930645, 54 + 563, 59*feed-in-tariff for biomass (3)

Based on this regression equation (3), one can establish that when generation of renewable electricity from biomass in total (BMT) in MWh is portrayed as the dependent variable and maximal feed-in tariffs for biomass in total (MF MBT) in CZK per MWh acts as the independent variable, the following relationship can be observed between the two variables: if the feed-in tariff for biomass increases by 10 CZK per one MWh of generated electricity, it causes an increase in generation of renewable electricity from biomass by approximately 5636 MWh.

The following Figure 1 presents the results described above in a graphical expression.

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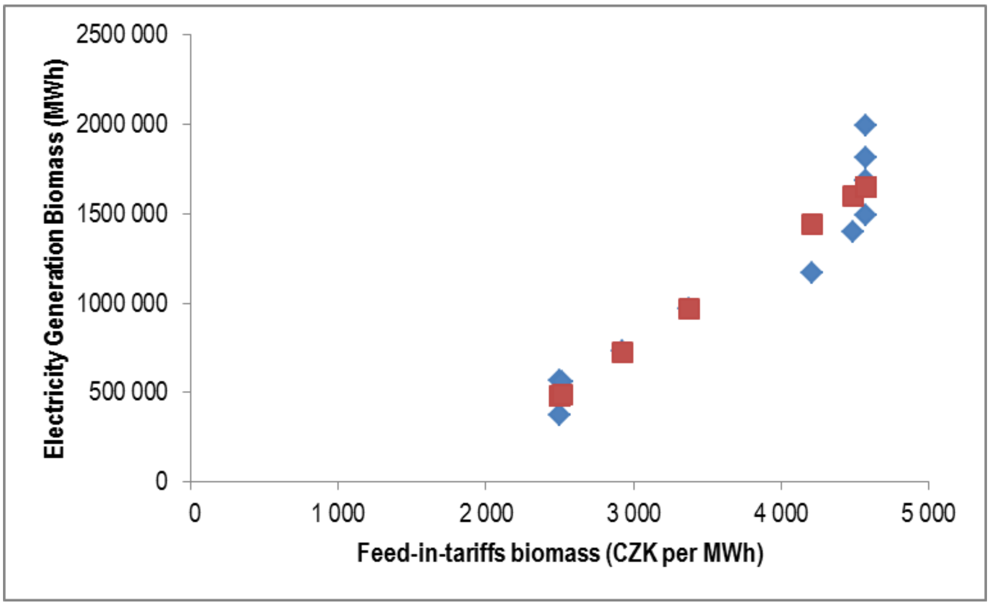
Figure 1: Regression analysis – feed-in tariffs vs generation of renewable electricity from biomass



Source: Own work, based on data ERO, 2016; MIT, 2016.

The following Table 3 shows the outcomes of regression analysis, where the independent variable is maximal feed-in tariffs for wind in total (MF WPP) and the dependent variable is generation of renewable electricity from wind in total (WPP).

Table 3: Regression analysis – feed-in tariffs vs generation of renewable electricity from wind

Regression statistics	
Multiply R	0,988954
Value of Reliability R	0,978031
Adjusted Value of Reliability R	0,975834
Error of the Mean	29133,3
Observations	12

ANOVA	*Df*	*SS*	*MS*	*F*	*Sig.*	
Regression	1	3,78E+11	3,78E+11	445,1834	1,27E-09	
Residues	10	8,49E+09	8,49E+08			
Total	11	3,86E+11				
	Coefficients	*Std, Error*	*t*	*P*	*Lower Bound 95%*	*Upper Bound 95%*
Constant	-1968227	104872,4	-18,7678	3,99E-09	-2201898	-1734557
Wind	658,5563	31,21213	21,09937	1,27E-09	589,0113	728,1012

Source: Own work, based on data ERO, 2016; MIT, 2016.

Accordingly, the following regression equation is at place:

Y = -1968227+ 658, 5563*feed-in-tariff for wind (4)

Based on this regression equation (4), one can argue that when generation of renewable electricity from wind in total (WPP) in MWh operates as the dependent variable and maximal feed-in tariffs for wind in total (MF WPP) in CZK per MWh is the independent variable, the following relationship between the variables can be observed: if the feed-in tariff for wind increases by 10 CZK per one MWh

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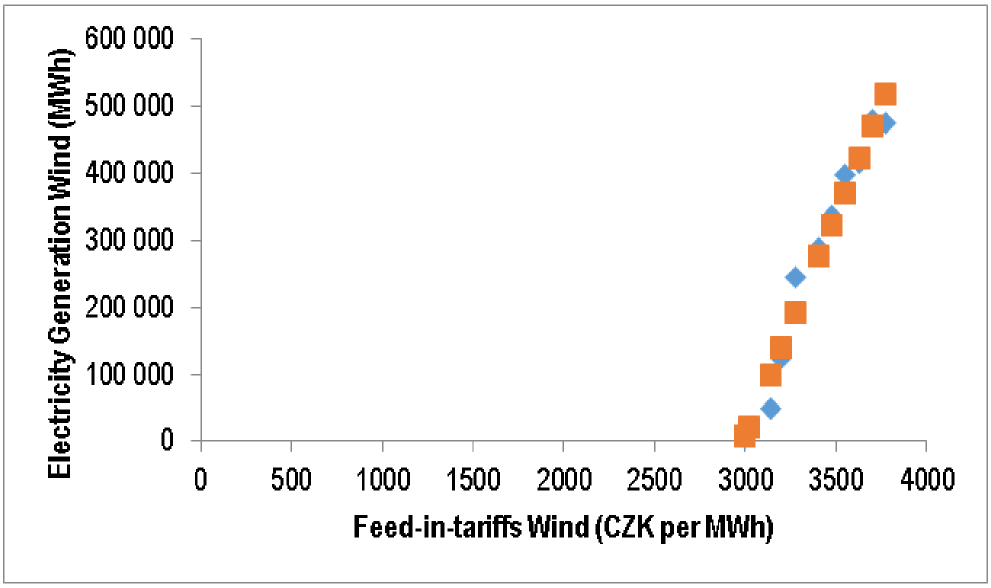
of generated electricity, it causes an increase in the generation of renewable electricity from wind by approximately 6585 MWh.

The following Figure 2 shows the results described above in a graphical expression.

Figure 2: Regression analysis – feed-in tariffs vs generation of renewable electricity from wind



Source: Own work, based on data ERO, 2016; MIT, 2016.

1.4 Grants

In order to analyse the economic impacts of grants on generation of renewable electricity the following variables were used: generation of electricity in MWh from small water electricity (SWE), biomass in total (BMT), chips (CH), cellulose (CEL), plant materials (PM), pellets and briquettes (PB), liquid biofuels (LB), biogas in total (BGT), municipal wastewater treatment plants (MWTP), industrial wastewater treatment plants (IWTP), biogas stations (BGS), landfill gas (LG), biodegradable fraction of solid municipal waste (BFSMW), wind power plants (WPP), photovoltaic power plants (PPP), investments grants from the State Environmental Fund (SEF GI), non-investments grants from the State Environmental Fund (SEF GN), total grants from the State Environmental Fund (SEF TOT), grants under the account MF 2115 Energy saving and renewable sources paid by the Ministry of Industry and Trade (MF MIND), grants under the account MF 2115 Energy saving and renewable sources paid by the Ministry of the Environment (MF MENV), grants under the account MF 2115 Energy saving and renewable sources paid by the State Environmental Fund (MF SEF) and grants under the account MF 2115 Energy saving and renewable sources in total (MF TOT). The results of the correlation analysis for the Czech Republic are showed in the following Table 4.

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Table 4: Correlation analysis – grants vs generation of renewable electricity

	Year	SWE	BMT	CH	CEL	PM	PB	LB	BGT	MWTP	IWTP	BGS	LG	BFSMW	WPP	PPP	SEF GI	SEF GNI	SEF TOT	MF MIND	MF MENV	MF SEF	MF TOT
Year	1																						
SWE	0,238948	1																					
BMT	0,945093	0,072852	1																				
CH	0,905892	-0,1484	0,963138	1																			
CEL	0,919874	0,317465	0,829529	0,801268	1																		
PM	0,832105	0,084359	0,887606	0,803634	0,64413	1																	
PB	0,459072	0,099673	0,647955	0,518328	0,184132	0,684118	1																
LB	0,311817	-0,38657	0,402634	0,452183	0,128101	0,605437	0,272622	1															
BGT	0,969463	0,264753	0,852394	0,83876	0,950617	0,697759	0,253591	0,172145	1														
MWTP	0,92436	0,340728	0,902266	0,801712	0,803603	0,924609	0,573018	0,502916	0,829825	1													
IWTP	0,881558	0,097798	0,861223	0,889055	0,941054	0,581306	0,248288	0,176359	0,890847	0,724255	1												
BGS	0,967989	0,267058	0,849488	0,835839	0,950597	0,693985	0,249657	0,166176	0,999976	0,826801	0,889878	1											
LG	0,912337	-0,07097	0,869729	0,910098	0,754361	0,807692	0,385624	0,570746	0,872533	0,841572	0,772631	0,869818	1										
BFSMW	0,883786	-0,03314	0,894011	0,895167	0,672044	0,878794	0,569127	0,659176	0,785959	0,891737	0,702443	0,782029	0,967083	1									
WPP	0,9843	0,246914	0,915214	0,866734	0,863497	0,874406	0,467017	0,408592	0,942382	0,951662	0,797206	0,940518	0,934323	0,919667	1								
PPP	0,884557	-0,05817	0,897394	0,902163	0,67009	0,886549	0,570008	0,655132	0,788239	0,884793	0,699083	0,784387	0,970507	0,998823	0,920047	1							
SEF GI	0,876046	0,28531	0,695771	0,679931	0,874289	0,665996	0,051939	0,239823	0,935977	0,780704	0,725977	0,936479	0,818772	0,707124	0,892709	0,712531	1						
SEF GNI	0,316742	0,288208	0,036944	0,029575	0,254321	0,213342	-0,30556	0,157102	0,423512	0,304395	0,025377	0,425394	0,405405	0,295909	0,42743	0,298762	0,670798	1					
SEF TOT	0,872779	0,286454	0,690614	0,674814	0,870291	0,663184	0,047874	0,239769	0,933501	0,778056	0,720439	0,934022	0,817023	0,704966	0,890629	0,710364	0,999961	0,677337	1				
MF MIND	-0,56839	0,520298	-0,42892	-0,52789	-0,26145	-0,86692	0,267622	-0,41455	-0,54139	-0,53858	-0,20836	-0,53932	-0,87668	-0,87042	-0,74421	-0,87999	-0,66383	-0,64926	-0,6662	1			
MF MENV	0,740219	-0,05234	0,728668	0,676355	0,898291	0,386849	-0,54549	0,059963	0,707574	0,82583	0,915235	0,705237	0,51456	0,399391	0,625629	0,374395	0,584859	-0,07001	0,578	-0,07349	1		
MF SEF	0,700591	-0,01844	0,676629	0,625445	0,879436	0,359966	-0,5835	0,081906	0,673559	0,824093	0,882583	0,671244	0,476358	0,361915	0,593352	0,334778	0,571909	-0,05734	0,565357	-0,04156	0,997106	1	
MF TOT	0,735704	-0,04803	0,724168	0,671408	0,89645	0,381386	-0,54647	0,059138	0,703473	0,823514	0,912929	0,701147	0,50851	0,393355	0,620593	0,368186	0,581221	-0,07253	0,574364	-0,06696	0,999972	0,997539	1

Source: Own work, based on data MF, 2016; MIT, 2016; SEF, 2016.

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There is a strong positive correlation mainly between grants from the State Environmental Fund and generation of electricity from biogas in total (BGT) and biogas stations (BGS). In addition, similar correlation is present between grants under the account MF 2115 Energy saving and renewable sources and generation of electricity from industrial wastewater treatment plants (IWTP). There is also a strong positive correlation between grants from the State Environmental Fund and generation of electricity from wind power plants (WPP).

Based on these results, one can exercise focus on the following in more detail: (1) relationship between generation of renewable electricity from biogas in total (BGS) and grants from the State Environmental Fund on renewable energy sources in total (SEF TOT) and (2) relationship between generation of renewable electricity from wind power plants in total (WPP) and grants from the State Environmental Fund on renewable energy sources in total (SEF TOT). For the purposes of more detailed analysis, the method of regression analysis was applied.

The following Table 5 shows the results of the regression analysis, where the independent variable is the grant on renewable energy sources from the State Environmental Fund in total (SET TOT) and the dependent variable is generation of renewable electricity from biogas in total (BGS).

Table 5: Regression analysis – grants vs generation of renewable electricity from biogas

Regression statistics	
Multiply R	0,933501
Value of Reliability R	0,871425
Adjusted Value of Reliability R	0,84571
Error of the Mean	359083,9
Observations	7

ANOVA

	Df	*SS*	*MS*	*F*	*Sig.*
Regression	1	4,37E+12	4,37E+12	33,88773437	0,002112694
Residues	5	6,45E+11	1,29E+11		
Total	6	5,01E+12			

	Coefficients	*Std, Error*	*t*	*P*	*Lower Bound 95%*	*Upper Bound 95%*
Constant	15920,51	248956,6	0,063949	0,951488801	-624042,9306	655883,9
Biogas	0,080741	0,01387	5,821317	0,002112694	0,045087486	0,116395

Source: Own work, based on data MIT, 2016; SEF, 2016.

It is then suitable to deploy the following regression equation:

Y = 0, 080741*grants for RES (5)

Based on this regression equation (5), one can argue that when generation of renewable electricity from biogas in total (BGS) in MWh is the dependent variable and grants on renewable energy sources in total from the State Environmental Fund in total (SEF TOT) in thousand CZK acts as the independent variable, we can observe the following relationship between the variables: if grant on renewable energy sources increases by 1 million CZK, it causes an increase in the generation of renewable electricity from biogas by approximately 80,741 MWh.

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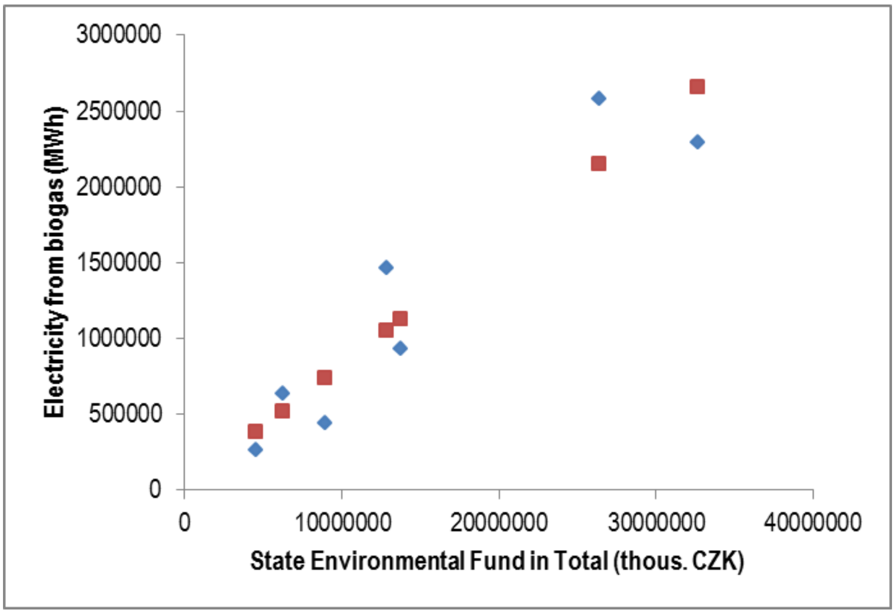
The following Figure 3 depicts the results described above in a graphical expression.

Figure 3: Regression analysis – grants vs generation of renewable electricity from biogas



Source: Own work, based on data MIT, 2016; SEF, 2016.

Table 6 shows the results of regression analysis, where the independent variable is the grant on renewable energy sources from the State Environmental Fund in total (SET TOT) and the dependent variable is generation of renewable electricity from wind power plants in total (WPP).

Table 6: Regression analysis – grants vs generation of renewable electricity from wind

Regression statistics						
Multiply R		0,890629				
Value of Reliability R		0,79322				
Adjusted Value of Reliability R		0,751863				
Error of the Mean		45326,22				
Observations		7				
ANOVA						
		Df	*SS*	*MS*	*F*	
Regression	1	3,94E+10	3,94E+10	19,18024	0,007158	
Residues	5	1,03E+10	2,05E+09			
Total	6	4,97E+10				
	Coefficients	*Std, Error*	*t*	*P*	*Lower Bound 95%*	*Upper Bound 95%*
Constant	261494,6	31425,14	8,321191	0,00041	180713,7	342275,5
Wind	0,007668	0,001751	4,379525	0,007158	0,003167	0,012168

Source: Own work, based on data MIT, 2016; SEF, 2016.

Accordingly, the following regression equation can be applied:

Y = 261494, 6 + 0, 007668* grants for RES (6)

According to the principles of this regression equation (6), one can argue that when generation of renewable electricity from wind power plants in total (WPP) in MWh is the dependent variable and grants on renewable energy sources in total from State Environmental Fund in total (SEF TOT) in

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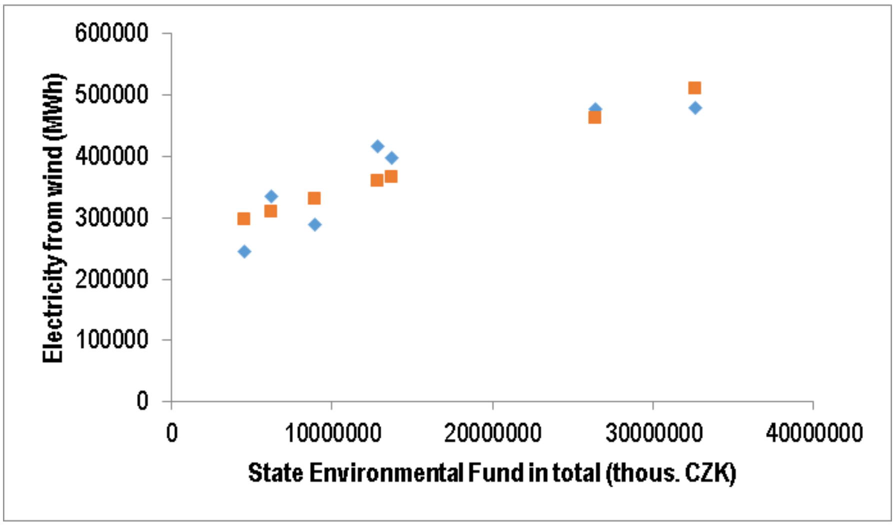
thousand CZK act as the independent variable, the following relationship between the variables can be observed: if grant on renewable energy sources increases by 1 million CZK, it causes an increase in generation of renewable electricity from wind by approximately 7,67 MWh.

Figure 4 below shows the results described by the regression equation in a graphical expression.

Figure 4: Regression analysis – grants vs generation of renewable electricity from wind



Source: Own work, based on data MIT, 2016; SEF, 2016.

Discussion

In the methodology chapter two research assumptions were defined and thus should be focused upon first.

1. Generation of renewable electricity is positively influenced by minimal feed-in tariffs – one can say that this assumption can be confirmed in two cases: in the case of electricity generated from biomass and in the case of electricity generated from wind power plants;

2. Generation of renewable electricity is positively influenced by grants – we can say that this assumption can be confirmed also in two cases: in the case of electricity generated from biogas and in the case of electricity generated from wind power plans.

The structure of generation of renewable electricity along with its development in the Czech Republic is depicted in Figure 5 on the following page.

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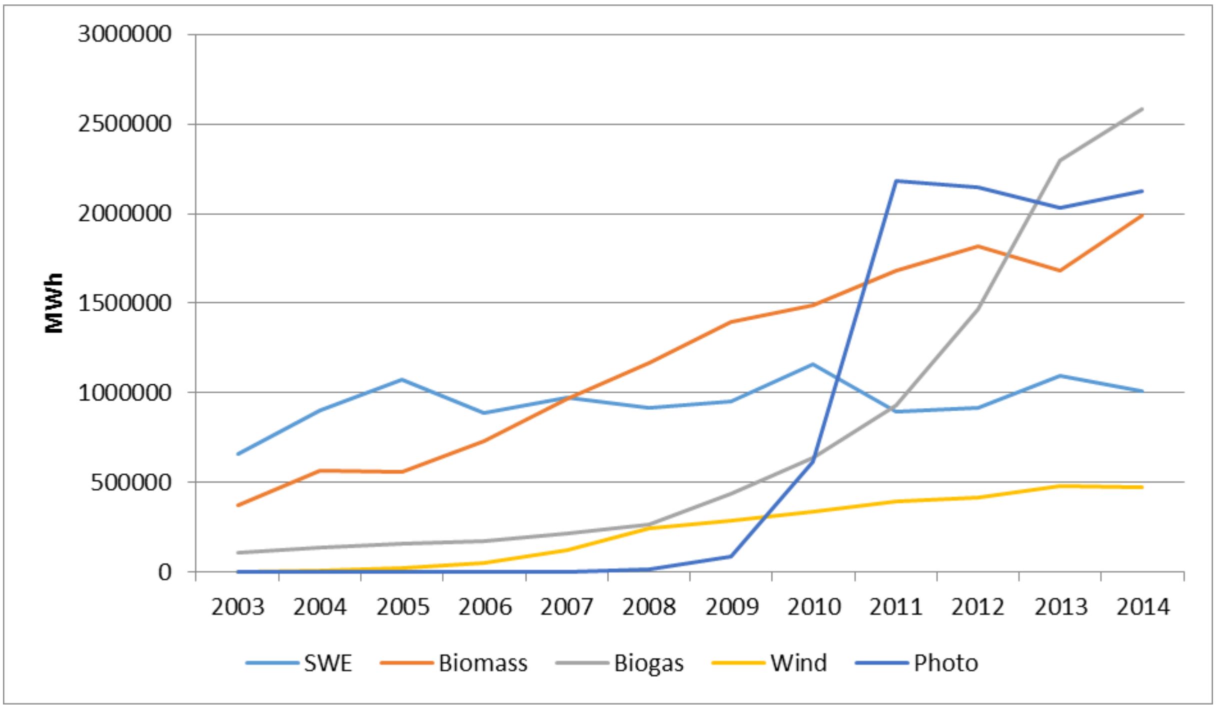
Figure 5: Development of generation of electricity from renewable energy sources



Source: Own work, based on data MIT, 2016.

The highest share of electricity from RES in year 2014 was produced by biogas, photovoltaic and biomass generators. On the other hand, one can also observe a different development for particular renewable energy sources. The most stable increase is visible in the cases of electricity generated in biomass, wind and biogas generators. On the other hand, in the case of small water electricity generators, the electricity generation fluctuated around 1 mil. MWh in the analysed period. Regarding photovoltaic generators, the effects of excessive public support is notable in the period 2009 – 2011.

Based on the development of generation of renewable electricity during the period 2003 – 2014 and the results of the regression analysis presented in this paper, both feed-in tarrifs and grants had positive impacts on generating renewable electricity in the Czech Republic. As Hunkin (Hunkin et al., 2014) also analysed, with a 13 percent target for renewable energy sources use by 2020, the Czech Republic put a particular focus on biomass and biogas for electricity and heat generation; a sector with substantial growth potential.

Focusing on the weaknesses of the analysis presented in this paper, the first problem is caused by data structure and its consequent availability. When it comes to feed-in tariffs, the main problem is once again with data structure and regular annual changes in feed-in tariffs. Therefore, one can observe that the same kind of electricity generation has different public support throughout individual years. For the purposes of analysing the support for renewable electricity, we can use maximal feed-in tariffs or the last year feed-in tariffs. Moreover, the development of time series of feed-in tariffs is different for particular renewable electricity.

The following Figures 6 and 7 show the development of maximal feed-in tariffs and the last year feed-in tariffs for specific renewable energy sources in the period 2003 – 2014.

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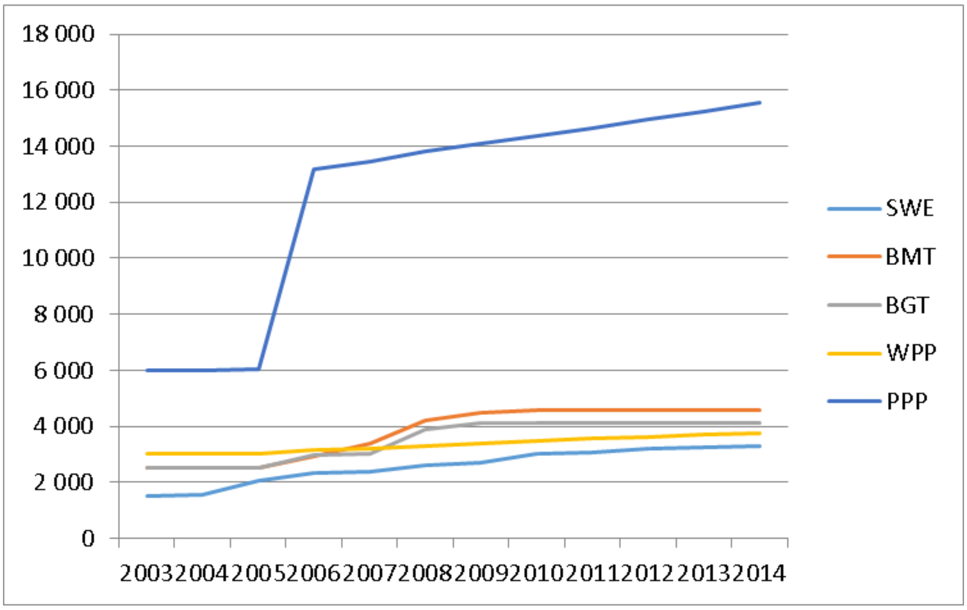
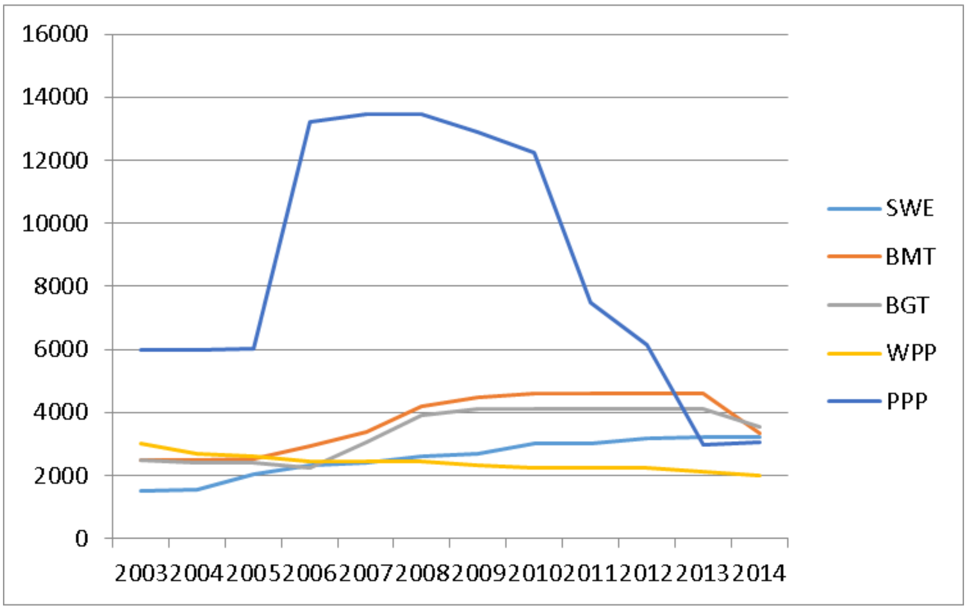
Figure 6: Development of maximal feed-in tariffs



Source: Own work, based on data ERO, 2016.

Focusing on the development of both maximal feed-in tariffs and the last year feed-in tariffs, one can see that support for photovoltaic power plants, which were installed mainly in the period 2006 – 2010, exceeded the support of other power plants more than 3-times. Czech photovoltaic power plants, their support and impacts of this support are analysed mainly in studies of Pawliczek (Pawliczek, 2011) Průša (Průša et al., 2013) and Janda (Janda et al., 2014).

Figure 7: Development of the last year feed-in tariffs



Source: Own work, based on data ERO, 2016.

Comparing the development of both maximal feed-in tariffs and last year feed-in tariffs, the most stable, with the lowest fluctuations, are the time series for feed-in-tariffs for biomass, biogas and wind power plants. Therefore, the results of regression analysis presented in this paper can be judged as valuable.

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The second weakness of the research presented is linked with the data in the area of grants. There is a problem with the availability of longer time series of particular grant support, moreover there are different time series from individual offices with distinctive structures and contrasting periods. Some of the data is not available directly, only upon request. As for the impact of grants on investments to renewable electricity generators, there can be a delay between granting some project and final electricity generation. Based on the consultations with responsible officers from the Ministry of Industry and Trade, the delay can take one, two or even three years. If the grant recipient has own financial sources, the delay is not so long.

Regarding any following research, more detailed analysis should be done, since there is a lack of analyses in the area of renewable energy sources along with the area of the impacts of public support on energy sector in the Czech Republic. As the development of renewable energy sources and the structure of public support can differ in other countries, any comparative analysis will be also valuable.

Conclusions

The main goal of this paper was to analyse the impacts of economic instruments of energy policy on generation of renewable electricity in the Czech Republic, mainly the impacts of feed-in tariffs and grants. Partial goal was to find out a possible dependency between 1) electricity from selected renewable energy sources and relevant feed-in tariffs and 2) electricity from selected renewable energy sources and relevant grants.

Based on the results, there is a dependence between minimal feed-in tariffs for electricity from biomass and generation of electricity from biomass. In addition, there is also a dependence between minimal feed-in tariffs for electricity from wind power plants and generation of electricity from wind power plants. Regarding grants, a dependence between grants for electricity from biogas and generation of electricity from biogas can be observed, along with the dependence between grants for electricity from wind power plants and generation of electricity from wind power plants.

In connection with the target for renewable energy sources use by 2020, one can say that the public support for electricity generated by renewable energy sources in the Czech Republic represents an important tool of positive motivation. The current support is effective mainly in the cases of electricity generated from biomass, biogas and wind.

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