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IMPACT OF FINANCING INSTRUMENTS AND STRATEGIES ON THE WIND POWER PRODUCTION COSTS: A CASE OF LITHUANIA

V. Bobinaite [1], I. Konstantinaviciute [1,2]
[1] Lithuanian Energy Institute,
3 Breslaujos Str., Kaunas, LT-44403, LITHUANIA
e-mail: viktorija.bobinaite@lei.lt
[2] Kaunas University of Technology,
48 Studentu Str., Kaunas, LT-51367, LITHUANIA

The paper aims at demonstrating the relevance of financing instruments, their terms and financing strategies in relation to the cost of wind power production and the ability of wind power plant (PP) to participate in the electricity market in Lithuania. The extended approach to the Levelized Cost of Energy (LCOE) is applied. The feature of the extended approach lies in considering the lifetime cost and revenue received from the support measures. The research results have substantiated the relevance of financing instruments, their terms and strategies in relation to their impact on the LCOE and competitiveness of wind PP. It has been found that financing of wind PP through the traditional financing instruments (simple shares and bank loans) makes use of venture capital and bonds coming even in the absence of any support. It has been estimated that strategies consisting of different proportions of hard and soft loans, bonds, own and venture capital result in the average LCOE of 5.1–5.7 EURct/kWh (2000 kW), when the expected electricity selling price is 5.4 EURct/kWh. The financing strategies with higher shares of equity could impact by around 6 % higher LCOE compared to the strategies encompassing higher shares of debt. However, seeking to motivate venture capitalists, bond holders or other new financiers entering the wind power sector, support measures (feed-in tariff or investment subsidy) are relevant in case of 250 kW wind PP. It has been estimated that under the unsupported financing strategies, the average LCOE of 250 kW wind PP will be 7.8–8.8 EURct/kWh, but it will reduce by around 50 % if feed-in tariff or 50 % investment subsidy is applied.

Keywords: *case study, financing instrument, financing strategy, levelized cost of energy, Lithuania, wind power*

1. INTRODUCTION

The Lithuanian National Energy Strategy is under debate [1]. There are a lot of open questions on how energy sectors should be developed and transformed in order to satisfy the increasing energy demand, achieve the target of greenhouse gas emissions reduction, assure the sufficient level of energy supply security and improve the competitiveness of the country [2]. In this context, the question of the development of the competitive domestic power production capacities remains of high importance in Lithuania.

Following the European Commission's Energy Roadmap 2050 [3], it becomes evident that power producing systems would have to undergo structural changes in a way that the share of Electricity from Renewable Energy Sources (RES–E) reached 64 % under the high energy efficiency scenario and 97 % – under a high renewables scenario. This means that high fuel and operational cost fossil fuel-based power systems would have to be replaced by the renewable energy systems, whose functioning is based on high capital expenditure and low fuel cost.

Lithuania makes efforts to transform its power sector and increase the share of RES-E [4]. In 2016, the share of RES–E was 16.8 % in Lithuania [5]. Prior to the implementation of EU Directive 2009/28/EC on the Promotion of the Use of Energy from Renewable Sources [6] and the Law on Renewable Energy Sources [7], the share of RES–E did not exceed 6 % in the country. Lithuanian scientists [2] forecast that during 2020–2030 the share (from total) of RES–E could increase to 24–27 %. E. Norvaiša & A. Galinis [2] argue that in future renewable Power Plants (PP) could be constructed in Lithuania, since they would be competitive in the international electricity market. Furthermore, the results of modelling demonstrated that implementation of renewable energy technology would be a reasonable choice under any energy policy case.

However, it remains unclear, at which cost the renewable PPs could generate electricity in the long term in Lithuania. Moreover, there is little known, who should and could finance them, which financing instruments and strategies should be applied, under what financing terms the renewable PPs would be competitive in the international market and what additional terms (for example, support measures) should be requested to improve the competitive position of renewable PPs in the market. Knowing that renewable PPs are capital-intensive and requirements for high initial investment are set, this issue becomes relevant and worth being investigated. Thus, the present article deals with this issue.

The paper aims at substantiating the relevance of financing instruments, their terms and financing strategies in relation to the cost of wind power production and the ability of wind PP participating in the electricity market in Lithuania in the long-term perspective.

Wind PPs have been selected due to their increasing and meaningful role to Lithuanian power system [2]. In 2016, there were installed 509 MW of wind PPs (for comparison purposes, 423.7 MW in 2015 and 288 MW in 2014) in Lithuania [8], [9]. They produced 1135.9 GWh of electricity. This is 11.7 % of gross inland electricity consumption [9]. Lithuania committed itself to increase wind power production capacities to 500 MW till 2020 [7]. When 500 MW is installed, the government takes the responsibility of drawing up new procedures and targets for wind power sector development in relation to Lithuania's international commitments for reduction of greenhouse gas emissions and assurance of energy supply security [7]. However, the development plan for wind power is not foreseen so far in Lithuania. In [10], several wind power sector development barriers are identified, including a lack of clarity for investment decisions, shortage of renewable energy policy continuity, insufficient conditions for construction of wind PPs in the farms, communities and for social business, as well as an irrelevant approach of the authorities regarding the connection of wind PP to the distribution grid. In relation to the barriers, identified in [10], particularly to the barrier of clarity for investment decision, the topic of the present research is relevant.

2. DATA AND METHODOLOGY

2.1. Data

Data relevant for the research have been collected from the databases of the Lithuanian Transmission System Operator [8], the National Control Commission for Energy and Prices [11], the Lithuanian Environmental Investment Fund [12], EU Structural Funds 2014–2020 [13], the Bank of Lithuania [14], publications in Lithuanian press and scientific papers.

2.2. Methodology

2.2.1. Method

The concept of the Levelized Cost of Energy (LCOE) is well presented by the International Renewable Energy Agency [15], "…the LCOE is the price of electricity required for a project where revenues would equal costs, including making a return on the capital invested equal to the discount rate. An electricity price above this would yield a greater return on capital, while a price below it would yield a lower return on capital, or even a loss…". M. Keith et al. [16] summarised the concept of LCOE by arguing that LCOE is the price at which energy could be sold over the lifetime of the technology. F. M. Ragnarsson et al. [17] and U.S. Energy Information Administration [18] defined the LCOE as a measure applied to estimate the energy technology costs and assess the competitiveness of various energy generating technologies.

The LCOE is measured by dividing the present value of all expected lifetime costs (including, construction, investment, O & M, fuel, taxes, etc.) by the present value of the expected volume of energy produced over the energy project's lifetime. In the present article, an extended approach to the LCOE is applied. The LCOE is computed as follows:

$$LCOE = \frac{\sum_{t=0}^{T} \frac{I_t + O\&M_t + F_t - SEP_t - IS_t}{(1+d)^t}}{\sum_{t=0}^{T} \frac{C_I \cdot 8760 \cdot LF}{(1+d)^t}}, \qquad (1)$$

where $LCOE$ is the levelised cost of energy, EUR/kWh;
I_t is the investment cost at time step t, EUR;
$O \& M_t$ is the operation and maintenance cost at time step t, EUR;
F_t is the fuel cost at time step t, EUR;
SEP_t is the subsidy for energy production, EUR;
IS_t is the investment subsidy, EUR;
C_I is the installed capacity, kW;
LF is the load factor, %;
d is the discount rate, %;
t is the time period, years.

The subsidy for energy production is calculated as follows:

$$SEP_t = FiT_t - P_{F,t} \, , \tag{2}$$

where FiT_t is the feed-in tariff for a unit of electricity produced in time t, EURct/kWh;
$P_{F,t}$ is the forecasted electricity selling price in time t, EURct/kWh.

The feature of the extended approach to the LCOE is that it takes into account both lifetime cost and revenue from the support measures applied to foster the renewable energy sector development. The SEP t and IS t are included in the LCOE to demonstrate how the competitive position of wind power plant improves if support to electricity production or asset acquisition is available.

The approach used in the analysis is based on a discounted cash flow analysis. This approach of measuring electricity production cost is based on the discounting financial flows, taking into consideration the time value of money.

Three levels of the LCOE for wind power are modelled. The minimum $LCOE_{min}$ $(i_{min}; t_{max})$ is modelled taking into account that wind PP is financed through the financing strategy consisting of financing instruments, which have the softest financing terms, i.e., the lowest interest or coupon rate (i_{min}) and the longest investment period (t_{max}). The maximum $LCOE_{max}$ $(i_{max}; t_{min})$ is modelled considering the hardest financing terms, i.e., the highest interest or coupon rate (i_{max}) and the shortest investment period (t_{min}). Finally, the average $LCOE_{av}$ $(i_{av}; t_{av})$ is modelled taking into account the most possible values of interest or coupon rates and investment periods.

2.2.2. Technical and Economic Parameters

LCOE for wind power is calculated based on data presented in Table 1.

Table 1

Technical and Economic Parameters of Wind PPs [8], [19]–[27]

Variable More than 350 kW		The category of wind PP	
		10–350 kW	
Technical	Electric capacity, kW	2000	250
	Load factor, %	32	23
	Lifetime of WPP, years	25	20
Cost	Investment cost, EUR/kW	1350.0	1448.0
	Fixed cost, EUR/kW-yr	13.50	14.48
	Variable cost, EUR/MWh	0.29	0.29
	Fuel cost, EUR/MWh	0.00	0.00

2000 kW and 250 kW wind PPs are analysed; each is attributed to the respective category of wind PPs receiving support for electricity production. Actually, these are the most typical wind PPs installed and expected to be installed in future in Lithuania.

2.2.3. Support Measures

250 kW and 2000 kW WPP could be supported through the feed-in tariff or investment subsidies in Lithuania. Parameters of support measures are presented in Table 2.

Table 2

The Analysed Support Measures and Their Parameters [7], [28]–[30]

Parameters	Feed-in tariff	Investment subsidy
Provider / payer	Final electricity consumers	EU Structural Funds 2014–2020
Support level	5.6 EURct/kWh (2000 kW) 10.426 EURct/kWh (250 kW)	20 % of total investment cost (2000 kW) 30 % of total investment cost (250 kW)
Support period	12 years	

2.2.4. Financing Strategies

Single and mixed instrument financing strategies are analysed. They differ in financing instruments, proportions of financing instruments included in the strategy, investment period and required profitability. Besides, cash flows related to instrument specific financing are modelled differently.

When modelling LCOE, two points are taken into account. Initially, the LCOE is modelled considering the international statistics, which is justified with the theory of financing instruments and well reflects the long-term financing perspective in Lithuania. Later, the LCOE is modelled considering the regional or domestic statistics, which is short-term and significantly differs from international data. There is some doubt as to how long the regional / domestic statistics will be relevant in the longer perspective when the investors and owners of the wind PP have acquired greater experience.

Single instrument financing strategies include hard loan, corporate bond, equity and venture capital financing. V. Bobinaite & D. Tarvydas [31] discussed the peculiarities of single instrument financing. The parameters of single instrument financing based on the international and regional / domestic financing conditions are presented in Table 3 and Table 4, respectively.

Table 3

The Parameters of Single Instrument Financing Strategies Based on the International Financing Terms [34]–[37], [39]–[41]

	HLF: Hard loan financing	CBF: Corporate bond financing	EF: Equity financing	VCF: Venture capital financing
Instrument	Bank loan	Bonds	Simple shares	Simple shares
Required profitability	5.0 %, 5.25 % and 5.5 %	5.5 %, 5.75 % and 6.0 %	10 %, 12 %, 15 %	15 %, 17 %, 20 %
Investment period	8, 10 and 12 years	5, 7 and 8 years	Unlimited	6, 7 and 8 years

Table 4

The Parameters of Single Instrument Financing Strategies Based on the Regional / Domestic Financing Terms [14], [32], [33], [38], [39]

	SLF: Soft loan financing	HLFD: Hard loan domestic financing	GBF: Green bond financing	EF: Equity financing	VCF: Venture capital financing
Instrument	Soft loan	Bank loan	Green bonds	Simple shares	Simple shares
Interest rate, coupon rate	3.0%	2.782 %, 3.1 %, 3.4 %	1.9 %, 3.2 %, 4.5 %	10 %, 12 %, 15 %	15 %, 17 %, 20 %
Investment period	20 years	9 years	7 years	Unlimited	6, 7 and 8 years

Mixed instrument financing strategies include combinations of financing instruments with the parameters presented in Table 4 and Table 5. The analysed mixed instrument financing strategies are summarised in Table 5.

Table 5

The Mixed Instrument Financing Strategies*

Abbreviation of the strategy		Description of the strategy
International financing terms	Domestic / regional financing terms	
EF15_HLF85	EF15_HLFD85	15 % of equity financing; 85 % of hard loan financing
EF15_VCF10_HLF75	EF15_VCF10_ HLFD75	15 % of equity financing; 10 % of venture capital financing; 75 % of hard loan financing
EF15_VCF10_HLF60_ CBF15	EF15_VCF10_ HLFD60_GBF15	15 % of equity financing; 10 % of venture capital financing; 60 % of hard loan financing; 15 % of corporate / green bond financing
EF20_HLF40_SLF20_ CBF20	EF20_HLFD40_ SLF20_GBF20	15 % of equity financing; 40 % of hard loan financing; 30 % of soft loan financing; 15 % of corporate / green bond financing

* in case an investment subsidy is included as a support measure, the share of hard loan financing is reduced by 20 % (2000 kW) or 30 % (250 kW).

The proportions of financial instruments in the strategy are selected considering the observations for the wind power projects; usually the proportion of equity to loan is 20:80 or 15:85 in Lithuania [38].

2.2.5. Modelling Methods of Financing Instruments

Investment costs of wind PPs are financed through various financing instruments. The payments related to specific instrument financing are modelled based on the theory of financing instruments and approach of cash flows.

The zero-growth rate dividend valuation model is applied to model dividend payments, when simple shares as a financing instrument are used. Dividend payments are calculated as follows:

$$D = P_0 \cdot i \,, \tag{3}$$

where D is the dividend payment, EUR;
P_0 is the intrinsic value of equity, EUR;
i is the required rate of return, %.

Dividend payments related to the venture capital financing are modelled based on Eq. (3). However, it is considered that after the investment period ends, venture capitalist sells all his equity.

The bond financing related payments are modelled considering the fact that during the investment period the coupon payments are made and at the date of maturity the nominal value of bond is paid. Coupon payments are calculated as follows:

$$C = N_0 \cdot i \, , \tag{4}$$

where C is the coupon payment, EUR;
N_0 is the nominal value of bond, EUR;
i is the coupon rate, %.

The loan financing related payments are modelled considering the annuity payment method:

$$AP = L_0 \cdot \frac{i/m}{1-(1+i)^{-n \cdot m}} \, , \tag{5}$$

where AP is the annuity payment, EUR;
L_0 is the loan, EUR;
i is the annual interest rate, %;
n is the term of loan, years;
m is the number of times the annuity payments are made per year.

It is assumed that capital structure is fully formed at the end of wind PP construction period. Interest rate during construction is also computed.

2.2.6. Other Parameters

The discount rate is used to calculate the present value of future cost and revenue received from the support measures. Weighted Average Cost of Capital (WACC) is taken as a measure of the discount rate [42]. It is calculated by Eq. (6):

$$WACC_l = R_{E;l} \cdot \frac{E_l}{E_l + D_l} + R_{D;l} \cdot \frac{D_l}{E_l + D_l} \cdot (1 - T_{income}), \tag{6}$$

where $WACC_l$ is the weighted average cost of capital of the financing strategy l;
$RE;_l$ is the cost of equity, %;
E_l is the amount of equity financing, EUR;
D_l is the amount of debt financing, EUR;
$R_{D;l}$ is the cost of debt financing, %;
T_{income} is the income tax, %.

$WACC_i$ for wind PPs calculated by Eq. (6) and applied in the research is presented in Table 6.

Table 6

Ranges of the Estimated Discount Rates Subject to Different Financing Strategies and Financing Terms (made by the authors of the paper)

Financing strategy	2 MW wind PP		250 kW wind PP	
	Regional financing terms	International financing terms	Regional financing terms	International financing terms
EF15_HLF85 // EF15_HLFD85	3.5–5.2	5.1–6.6	3.5–5.5	5.1–6.8
EF15_VCF10_HLF75 // EF15_VCF10_HLFD75	4.8–7.3	6.2–8.5	4.8–7.9	6.2–9.1
EF15_VCF10_HLF60_CBF15 // EF15_VCF10_HLFD60_GBF15	4.7–7.5	6.3–8.6	4.7–8.1	6.3–9.2
EF20_HLF40_SLF20_CBF20 // EF20_HLFD40_SLF20_GBF20	3.8–6.1	5.2–6.8	3.8–6.5	5.2–7.1

The Subsidy for Electricity Production (SEP) is calculated considering the forecasted long-term electricity price of 5.4 EURct/kWh. The price is the simulated price of Energinet.dk [43]. It corresponds to an average electricity price for Sweden, with which Lithuania has a 700 MW power link.

3. RESULTS

3.1. LCOE of 2000 kW Wind PP

3.1.1. Single Instrument Financing

The analysis of single instrument financing is performed seeking to identify the ranges of the highest and lowest LCOE of 2000 kW wind PP. Equity and hard loan financing strategies are applied to model the LCOE, respectively. The results of modelling are summarised in Fig. 1.

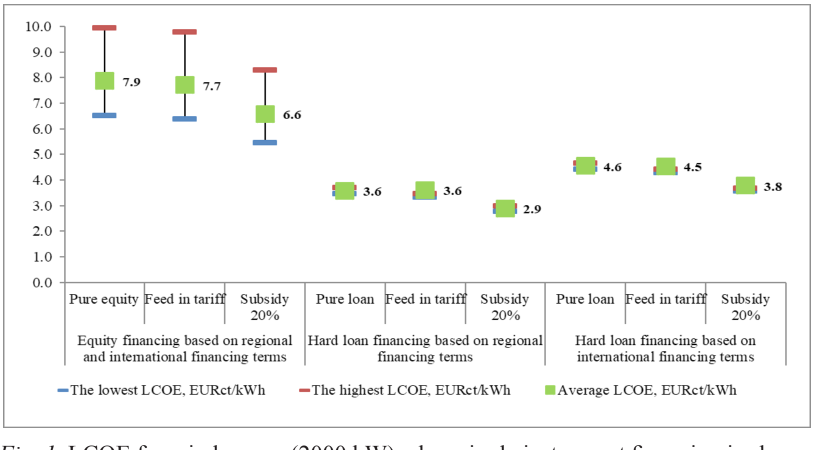

Fig. 1. LCOE for wind power (2000 kW) when single instrument financing is chosen (calculations are made by the authors of the paper)[1].

[1] In case an investment subsidy is included as a support measure, the share of hard loan financing is reduced by 20 %.

The results presented in Fig. 1 have shown that financing the acquisition of wind assets purely through the equity may cause the highest LCOE, with an average value of 7.9 EURct/kWh, if the desired return on equity is 12 % a year. If the rate of return on equity increased to 15 %, the LCOE could grow up by 27 % to 10.0 EURct/kWh, but could go down by 18 % to 6.5 EURct/kWh, if the rate of return on equity reduced to 10 %. Support measures – the feed-in tariff or 20 % investment subsidy – can decrease the average LCOE of equity financing by 2.0 % and 16.0 % to 7.7 EURct/kWh and 6.6 EURct/kWh, respectively, but the decrease is not sufficient to make a 2000 kW wind PP profitable today, when the electricity market price is 3.7 EURct/kWh or less, and in the future, when it is expected that the price will increase up to 5.4 EURct/kWh.

It is expected that if a 2000 kW wind PP is financed purely through the hard loan, an average LCOE is 3.6 EURct/kWh (the regional financing terms are considered) and 4.6 EURct/kWh (international financing terms are relevant). According to the strategy, the support measures are not critical, since the LCOE is modelled lower than the expected electricity selling price in future. This shows that a 2000 kW wind PP could be profitable under the hard loan financing in the near future or long-term perspective in the absence of the support.

3.1.2. Mixed Instrument Financing

Due to high investment costs and risks related to project implementation, the single instrument financing is not sufficient. A variety of financing instruments should be used and various types of investors / financiers should participate. Figures 2–3 summarise the LCOE strategies based on the mixed instrument financing.

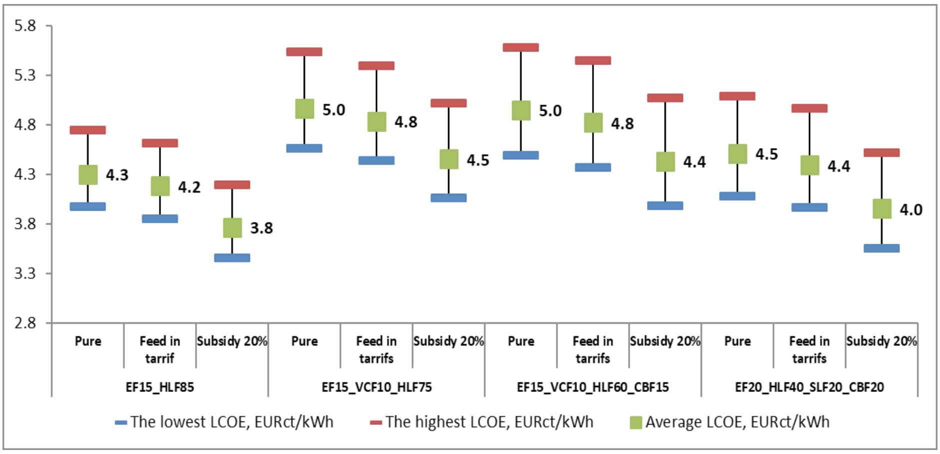

Fig. 2. LCOE for wind power (2000 kW) financed with the regional financing terms (calculations are made by the authors of the paper).

As it is shown in Fig. 2, in the absence of any support, the strategies of mixed instrument financing could cause an average LCOE vary in the range of 4.3–5.0 EURct/kWh. This shows that a 2000 kW wind PP could be profitable in the long term, when the expected electricity market price – 5.4 EURct/kWh, but nowadays at a market price of 3.7 EURct/kWh the full cost recovery would not be available for this wind PP.

The feed-in tariff and investment subsidy could improve the profitability of 2000 kW wind PP, as the average LCOE could reduce by 2–12 %. The impact of 20 % investment subsidy on LCOE is more relevant than the effect of the feed-in tariff, since subject to 20 % investment subsidy the average LCOE is 3.8–4.5 EURct/kWh but 4.2–4.8 EURct/kWh in cases if the feed-in tariff is applied.

It has been found that the financing strategies with higher shares of equity (EF15_VCF10_HLFD75 and EF15_VCF10_HLFD60_GBF15) could affect higher LCOE compared to strategies encompassing higher shares of debt financing (EF15_HLD85 and EF20_HLFD40_SLF20_GBF20), i.e., 4.4–5.0 EURct/kWh vs. 3.8–4.5 EURct/kWh.

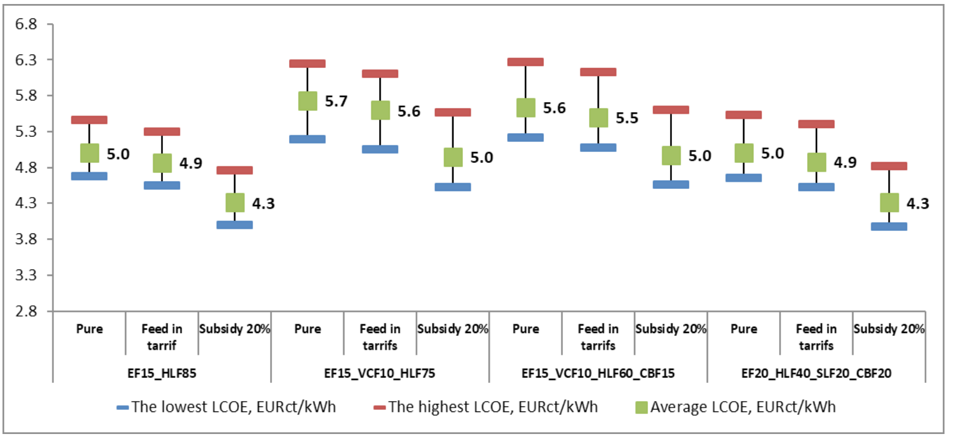

Fig. 3. LCOE for wind power (2000 kW) financed with international financing terms (calculations made by the authors of the paper).

As it is shown in Fig. 3, stricter and harder international financing terms increased the average LCOE by 9.1–16.3 % in comparison with regional terms. The pure (unsupported) strategies with higher shares of equity – EF15_VCF10_HLF75 and EF15_VCF10_HLF60_GBF15 – increased the average LCOE to 5.6–5.7 EURct/kWh, which remained higher than the expected electricity selling price in the long term (5.4 EURct/kWh). Higher LCOE could complicate the wind PP to fully recover its cost. Thus, the strategies could be used either with the investor's reduced requirements for profitability or through the use of support. However, the selected rate of the feed-in tariff would not be sufficient for the full cost recovery, since it causes the average LCOE drop to 5.5–5.6 EURct/kWh. However, 20 % investment subsidy could reduce the average LCOE to 5.0 EURct/kWh. Financing of 2000 kW wind PP with the resources acquired in the debt markets through the strategies EF15_HLF85 and EF20_HLF40_SLF20_GBF20 could assure that even without any support the full cost recovery would be possible, since the average LCOE would be 5.0 EURct/kWh. Support in a form of feed-in tariff or investment subsidy would create preconditions to trade wind power at low prices (4.3–4.9 EURct/kWh) and earn profit (before taxes).

3.2. LCOE of 250 kW Wind PP

3.2.1. Single Instrument Financing

Due to a lower load factor and higher investment costs per installed kW, the average LCOE of 250 kW wind PP was found higher than of 2000 kW wind PP. The estimated ranges of the LCOE for wind power of 250 kW in case of a single instrument financing are presented in Fig. 4.

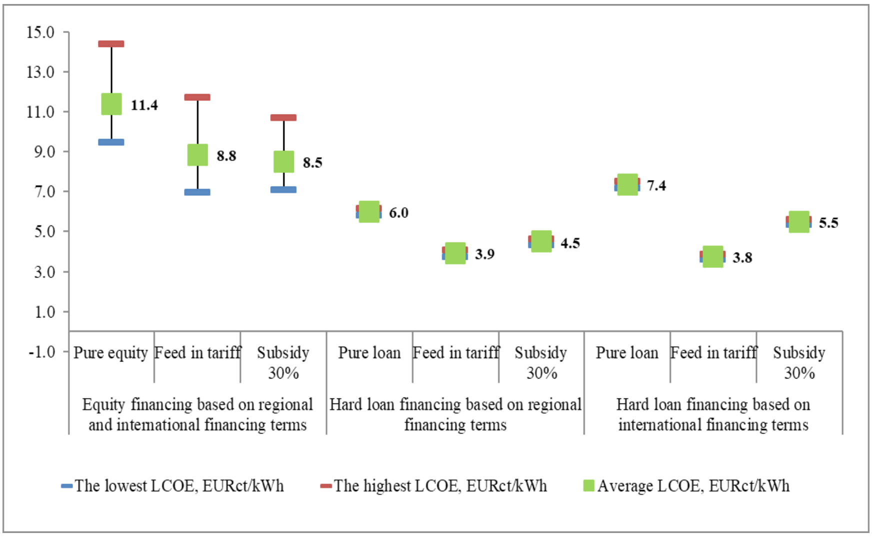

Fig. 4. LCOE for wind power (250 kW) when a single instrument financing is chosen (calculations made by the authors of the paper).

As it is seen in Fig. 4, the LCOE could be 9.5–14.4 EURct/kW, with an average value of 11.4 EURct/kW, if 250 kW wind PP were financed only through the pure equity strategy. The strategy of hard loan financing could cause the average LCOE dropping to 6.0 EURct/kWh (if regional financing terms were applied) and 7.4 EURct/kWh (if international financing terms were used). Seeking to finance wind PP through the hard loan financing, a feed-in tariff instead of investment subsidy should be chosen, since it creates possibilities to earn more profit before taxes.

3.2.2. Mixed Instrument Financing

Figures 5 and 6 present the LCOE for wind power of 250 kW when strategies of mixed instrument financing are applied.

As it is seen in Fig. 5, a feed-in tariff would be much more favourable than 30 % investment subsidy, if financial resources were received on the regional financing terms. The strategies of mixed instrument financing accompanied with a feed-in tariff would result in the average LCOE of 3.4–4.2 EURct/kWh. 30 % investment subsidy would not be sufficient, since it would cause an average LCOE of 5.5–6.5 EURct/kWh, which would exceed the electricity selling price of 5.4 EURct/kWh.

If support measures were not applied, the average LCOE would increase to 6.9–7.8 EURct/kWh. Seeking to promote 250 kW wind PP generator to use a variety of financing instruments and participate in debt and equity markets at a larger scale, a priority should be given to quite high feed-in tariff.

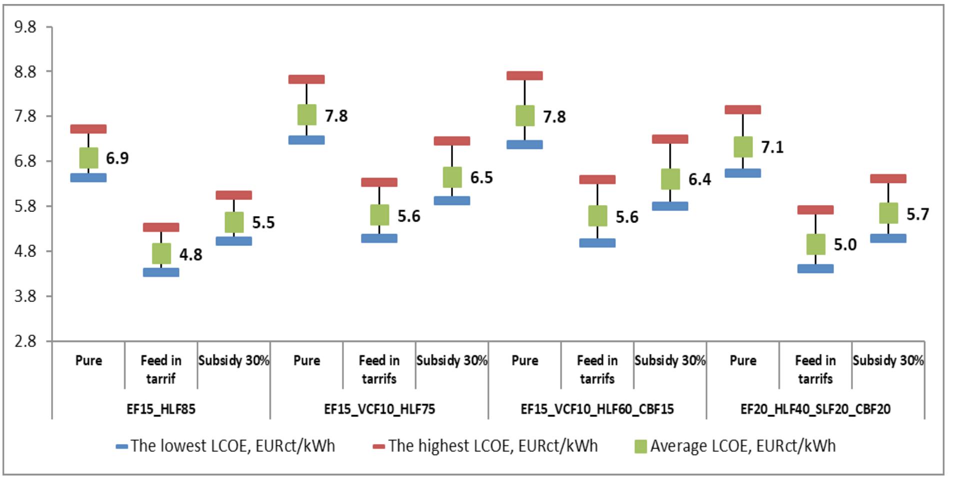

Fig. 5. LCOE for wind power (250 kW) financed with regional financing terms (calculations made by the authors of the paper).

Similar results were achieved if strategies were implemented on the international financing terms (Fig. 6).

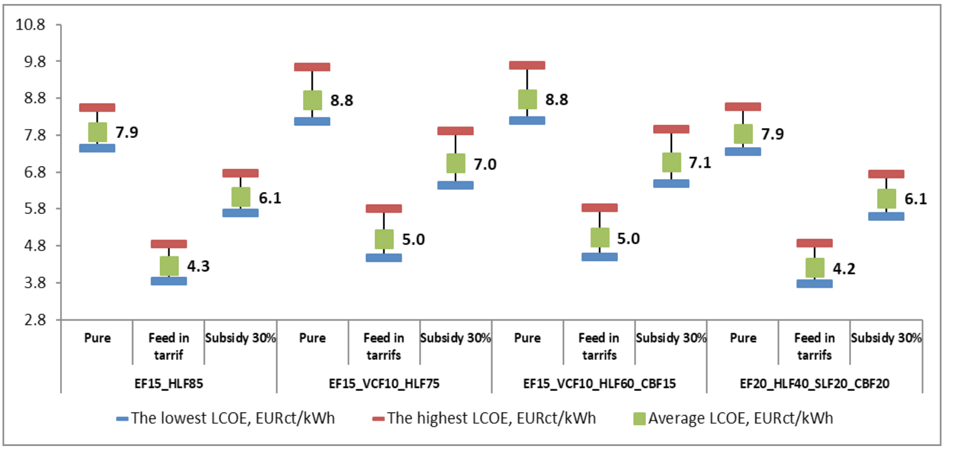

Fig. 6. LCOE for wind power (250 kW) financed with international financing terms (calculations made by the authors of the paper).

As it is shown in Fig. 6, the strategies of mixed instrument financing accompanied with a feed-in tariff could create preconditions for 250 kW wind PP to recover the total costs and earn profit before taxes in the long-term perspective, since LCOE could be 4.2–5.0 EURct/kWh.

4. CONCLUSIONS

The research has investigated the impact of financing instruments and strategies on the LCOE for wind power under the tight, average and soft financing terms based on regional and international statistics, which describe the development of financing terms in the near future and long-term perspective in Lithuania, respectively.

The research results obtained through the analysis of 2000 kW wind PP have shown that subject to the strategies of mixed instrument financing and the regional financing terms, the average LCOE for wind power would be 5.1–5.4 EURct/kWh. This shows that, although nowadays such a wind PP could not be competitive in the electricity market where the price is 3.7 EURct/kWh, its competitiveness would evidently improve in the future, when the price would increase to 5.4 EURct/kWh and even more. Subject to the strategies of mixed instrument financing and the international financing terms, support to 2000 kW wind PP should be provided to make the wind PP competitive in the market in the future. The feed-in tariff or investment subsidy could cause the average LCOE for wind power to decrease to 4.1–4.5 EURct/kWh.

The research results obtained through the analysis of 250 kW wind PP have demonstrated that despite the globally reducing investment cost (EUR/MW) and appearance of new financing instruments offering the alternative financing options, the investors to 250 kW wind PP will require additional support to produce electricity at competitive prices in the near future and long-term perspective. It has been estimated that the average LCOE for wind power can reduce to 4.4–4.6 EURct/kWh (if regional financing terms are applied) or 4.4–5.4 EURct/kWh (if international financing terms are used) due to the feed-in tariff.

The research results have shown that financing of 2000 kW wind PP with traditional financing instruments (equity and bank loan) makes use of venture capital and bond even in the absence of any support. The formation of 2000 kW wind PP's assets portfolio through a variety of instruments and in the absence of support could impact the average LCOE of 5.1–5.7 EURct/kWh depending on the financing terms. Availability of support measures could be a good motivating factor and attract various types of investors into 250 kW wind PP.

It has been found that a feed-in tariff or investment subsidy would be appropriate 2000 kW wind power support measures, but a priority to a feed-in tariff instead of 50% investment subsidy should be provided to increase the competitiveness of 250 kW wind PP in the market.

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FINANSĒŠANAS INSTRUMENTU UN STRATĒĢIJU IETEKME UZ VĒJA ENERĢIJAS RAŽOŠANAS IZMAKSĀM: LIETUVAS PIEREDZE

V. Bobinaite, I. Konstantinavičiūte

K o p s a v i l k u m s

Raksta mērķis ir parādīt finansēšanas instrumentu, to nosacījumu un finansēšanas stratēģiju atbilstību vēja enerģijas ražošanas izmaksām un vēja elektrostacijas spējai piedalīties elektroenerģijas tirgū Lietuvā. Pētījumā izmantota paplašinātā pieeja izlīdzinātajām elektrības izmaksām (LCOE).

Paplašināto pieeju raksturo tas, ka tiek ievērotas visa ekspluatācijas perioda izmaksas un ieņēmumi, kas saņemti no atbalsta pasākumiem.

Pētījuma rezultāti apstiprināja, ka finansēšanas instrumenti, to nosacījumi un stratēģijas ietekmē LCOE un vēja elektrostacijas konkurētspēju.

Tika konstatēts, ka vēja elektrostacijas finansēšana, izmantojot tradicionālos finanšu instrumentus (akcijas un banku aizdevumi), ir saistīta ar riska kapitālu un obligācijām pat bez jebkāda atbalsta. Tika aprēķināts, ka izmantojot stratēģijas, kas iekļauj nelabvēlīgos aizdevumus un atvieglojumus, obligācijas, pašu kapitālu un riska kapitālu, vidējās izlīdzinātās elektrības izmaksas sastāda 5,1–5,7 EURct / kWh (2000 kW), kad paredzamā elektroenerģijas pārdošanas cena ir 5,4 EURct / kWh. Finansēšanas stratēģijas ar lielāku pašu kapitāla daļu varētu paaugstināt izlīdzinātās elektrības izmaksas par 6 %, salīdzinot ar stratēģijām, kas paredz lielākas parādsaistības. Tomēr, cenšoties motivēt riska kapitālistus, obligāciju turētājus vai citus jaunus finansētājus, kas ienāk vēja enerģētikas nozarē, atbalsta pasākumiem (ieguldījumu tarifi vai ieguldījumu subsīdijas) ir būtiska loma 250 kW vēja elektrostacijas gadījumā. Tika aprēķināts, ka, izmantojot neatbalstītās finansēšanas stratēģijas, vidējās izlīdzinātās elektrības izmaksas sastādīs 7,8–8,8 EURct / kWh 250 kW vēja elektrostacijā, bet tās samazināsies par aptuveni 50 %, ja tiks piemēroti ieguldījumu tarifi vai 50 % ieguldījumu subsīdijas.

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