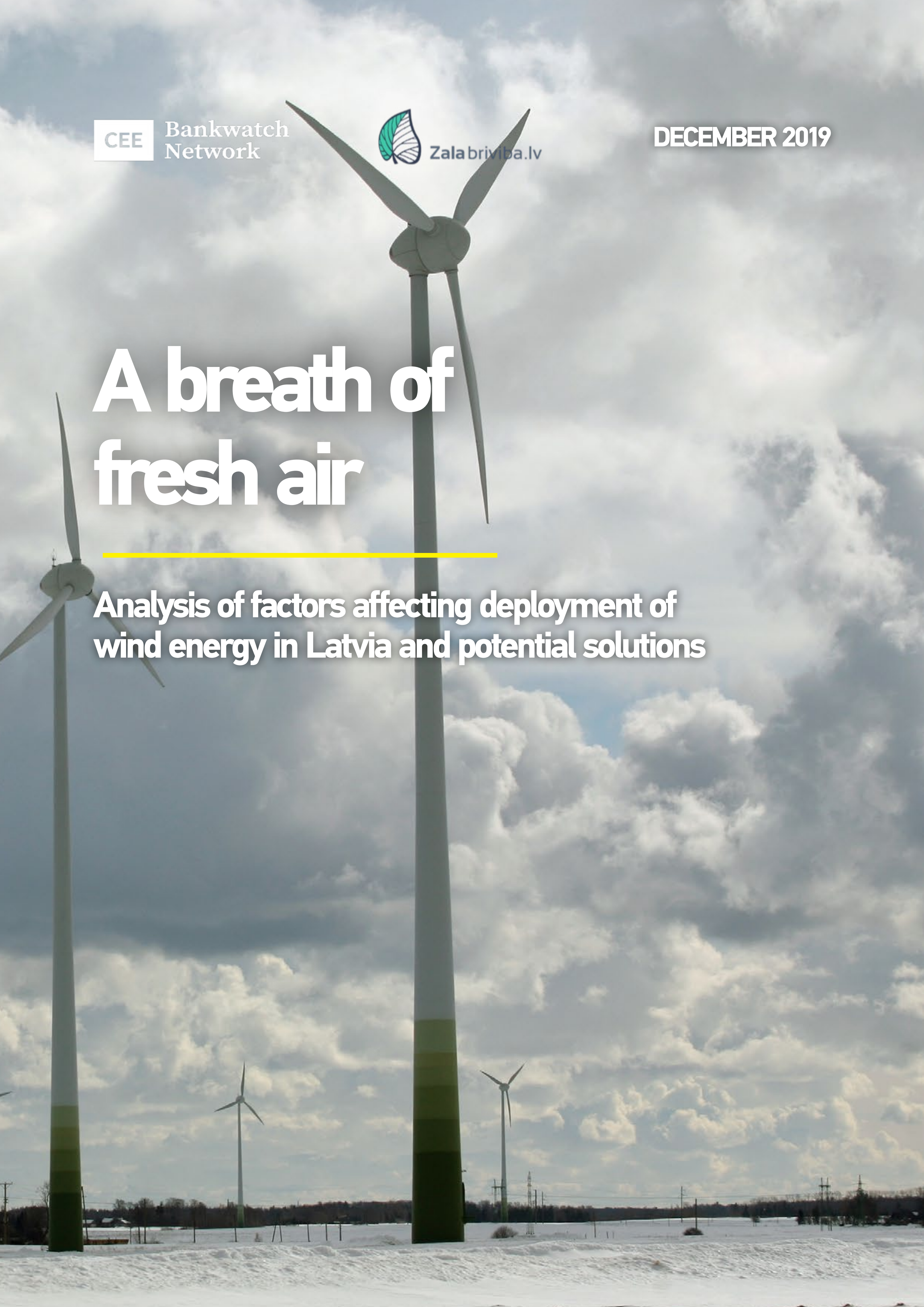

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DECEMBER 2019

A breath of fresh air

Analysis of factors affecting deployment of wind energy in Latvia and potential solutions

CONTENTS

INTRODUCTION

This analysis focuses on factors affecting the deployment of onshore wind power generation technologies in Latvia. It looks at the role of renewable energy and other energy resources, as well as transmission and distribution infrastructure in Latvia's energy portfolio, and examines obstacles and opportunities to deploy wind power.

Total wind power capacity installed in Latvia by end of 2018 is between 66 MW (official figure from Wind Europe) and 80 MW (unofficial estimate from the wind energy industry) and wind energy constituted a mere one per cent of the final electricity demand in Latvia in 2018. The theoretical potential of wind power could be up to 1,000 MW of installed capacity, but more moderate figures of around half of this theoretical potential are more realistic due to various barriers to deployment.

This analysis concludes that the main obstacles to deployment of wind power plants are social, regulatory and political. Social barriers are related to the low level of acceptance of wind energy infrastructure by local communities. Several wind projects have faced strong opposition, predominantly from residents claiming that wind farms would have negative impacts – visual presence, noise, flickering, and falling property value, among others. Other studies acknowledge these as the main impacts, and add the economic impact of the farms' non-marketable effects to the list. Existing studies do not show consensus regarding the actual impact of wind farms on property prices. Although some studies claim that the presence of wind farms within a distance of one to three kilometres from residential areas does not change property prices, other studies indicate that the perceived noise, lighting effects and impact on the landscape can decrease the value of property by as much as 20 to 30 per cent [1]. Residents remain concerned about the visual presence of wind turbines and the altered landscape.

Regulatory barriers to wind power deployment involve limitations on the use of land. A combination of factors – ownership fragmentation, the relatively small area of land lots and limitations on the minimum allowed distance for a wind turbine from a populated place – limits the available land where wind farms could be erected. To address this issue, the state could consider allowing the deployment of wind energy in forested areas that belong to the state. There are many studies on this topic, which show that the scale of impact depends on the scale of projects and several other key factors, like topography, type and status of the forest and existing road and power infrastructure. Some of the potential negative impacts stem from the building of new roads and power lines, and the main reasons for concern might be the resulting negative impact on forest ecosystems, vegetation and animals and the decrease of the forests' value. On the other hand, the deployment of wind turbines in commercial forest plantations would have the advantage of placing turbines further away from farmsteads and other populated places, thus resulting in less impact on human life in terms of noise, flickering, vibration, unwanted visual presence and other effects. This analysis indicates that from among the possible scenarios, enabling wind energy projects in forest areas would have the biggest impact, but it needs to be approached carefully to avoid unacceptable impacts.

There are also limitations on the use of land categorised as agricultural land of national importance, with the purpose of protecting high-quality agricultural land from being designated for purposes other than agriculture. Since the regulations target particular administrative territories, norms could be amended to introduce a more elaborate framework and stipulate the conditions under which agricultural land with the status of national importance could be re-designated for particular additional activities, such as the deployment of a wind turbine, thus increasing the flexibility of the use of land.

Political barriers are primarily related to the mixed messages sent by decision-makers about renewable energy. On one hand, Latvian decision-makers are proud of having a relatively high share of renewable energy (in the form of hydropower), but the country lacks a comprehensive and sustainable plan for the future development of the energy sector, including renewable energy, and politicians regularly resort to populist campaigns against the renewable energy support scheme and its costs for households. More effort from authorities is needed to explain that the renewable energy support scheme is not the main reason for high electricity bills and that these can be reduced by households choosing their electricity supplier.

To tackle these barriers, developers of wind energy need to make more effort in public affairs, including consultations with and involvement of local communities in planning and decision-making about the intended projects. Reviewing the current regulatory barriers can also facilitate the diffusion of wind power throughout Latvia. Latvia could provide more opportunities to add renewable sources to its energy portfolio by considering the possibility to use forest areas for wind power development (primarily those forest areas which are already exploited), making the conditions for changing the status of agricultural land of national importance more flexible, and by changing the conditions for limitations on the proximity of wind power to populated places or fine-tuning the definition of a populated place to allow for deployment in rural areas. Any of these would need to be done carefully, to avoid adding to public disquiet about wind energy or increasing its environmental impacts. This analysis therefore seeks to kick-start a debate about the most appropriate way to increase wind power in Latvia.

THE ROLE OF ENERGY RESOURCES AND INFRASTRUCTURE

Around two thirds of Latvia's electricity is produced locally, and around one third imported, so there is certain level of dependency on electricity imports. Heat, however, cannot be imported; it has to be produced and consumed locally. In terms of power production, roughly one third of electricity is produced using large hydropower plants on the Daugava river, approximately one third is produced by large combined heat and power (CHP) plants in Riga (CHP-1 and CHP-2) and the rest is imported. These proportions change depending on the availability of water resources in the Daugava and the outside temperature during the heating season, which determines the need for district heating. The three largest hydropower plants were built on the Daugava during the 20th century: Ķegums in 1939 (currently installed capacity 264 MW), Pļaviņas in 1968 (883 MW) and Rīga HPP in 1975 (402 MW). These make up most of what is considered renewable power production in Latvia.

Historical role of natural gas

The presence of natural gas in Latvia's energy portfolio has historically been determined by several factors – the need for district heating (5-7 months a year), the ability of gas to cover approximately one third of electricity production in a technologically efficient way, and the strong influence of the natural gas lobby in Latvia's politics and therefore also energy policy.

The capital city Riga houses approximately one third of the country's population, which means that there are many apartment buildings that require a supply of heat for an average of six months annually. The district heating supply model of Riga has historically been based on two large gas-fired cogeneration power plants– Riga CHP-1 and Riga CHP-2, which have two production units totaling 832 MW (in cogeneration mode) or 881 MW (in condensation mode) of electrical and 1124 MW (including hot water boilers) heat capacity. State-owned company Latvenergo, the operator of these large power plants, argues that gas CHPs ensure a secure supply of energy, guarantee energy security and provide the lowest production costs per unit of energy after large hydroelectric power plants. However, it has been debated whether Latvenergo should also consider going into the wind energy business [2], [3], just as Eesti Energia, the biggest energy producer in Estonia (also state-owned), has done in recent years.

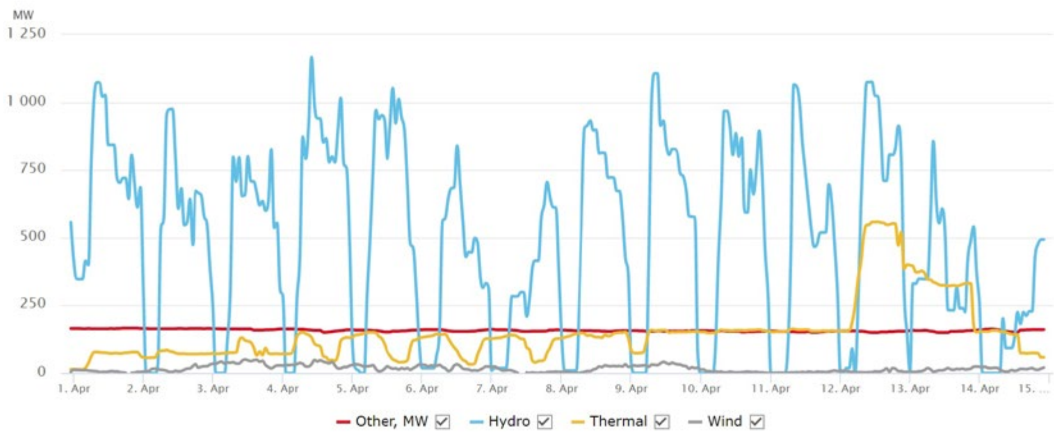


Figure 1. Electricity generation by source, 1-15 April 2019
Data: Augstsprieguma tīkls, transmission system operator

Relatively stable large hydropower resources

Latvia likes to position itself as one of the EU countries with the highest share of electricity generation from renewable energy resources. This situation is only possible owing to the three large hydropower plants on the River Daugava, which provide a relatively stable supply of electric power annually. Most of their production occurs in springtime (see Fig. 1). Usually there are pronounced seasonal changes in output, which depend on hydrological conditions in the Daugava. If winter in the Daugava basin, including Belarus, has experienced plenty of snow and rainfall, then the three power plants can run at full capacity and contribute significantly to covering the demand. However, if winter has been mild and rainfall has been moderate, then the three run-of-the-river plants can produce much less electricity. Dry winters negatively affect power production in particular during the subsequent spring, when most of the annual electricity production in hydropower plants typically takes place.

Electricity import from neighbouring countries

If enough electricity cannot be produced locally or it is economically advantageous to import electricity instead of producing it, then the share of imports grows. Theoretically, Latvia could cover all of its demand itself, but the price would be an issue. According to Augstsprieguma tīkls, the electricity transmission system operator (TSO), electricity and capacity self-sufficiency in 2019 will reach approximately 87 per cent and 100 per cent respectively [4]. However, self-sufficiency is not a necessity whatever the cost, especially if electricity import is physically possible. This explains why, on average, just about two thirds of electricity is produced locally.

Changes in electricity imports have a seasonal character: gas-fired CHPs produce most electricity during the colder half of the year when a large volume of heat is in demand owing to the well-developed district heating system in Riga. The colder the winter, the higher the demand for heat, the more electricity is produced along with heat. According to empirical evidence, the best season for wind power is winter and the least favourable is summer (see Table 1). This means that the best time for producing electricity from wind energy coincides with the period when there is strong competition from CHPs. Despite increasing production capacity, wind power plants still constitute a relatively small share of total electricity production even in winter months. Modern combined cycle gas turbine (CCGT) CHPs have high efficiency when used also for heating, and the production costs are low (if the price for natural gas is low). Thus, high volumes at low production cost drive the prices down and other technologies have to be able to compete on the market. However, if the demand for electricity is high, all low-cost producers can earn a profit. This is true for CHPs and wind turbines in winter and large hydropower plants during springtime.

Role of interconnections and capacity of the power transmission system

Interconnections play an essential role in ensuring the availability of capacity from electricity generation sources outside Latvia. Latvia has seven 330 kV interconnections with its neighbours: two overhead high-voltage alternate current (OH HV AC) power lines with

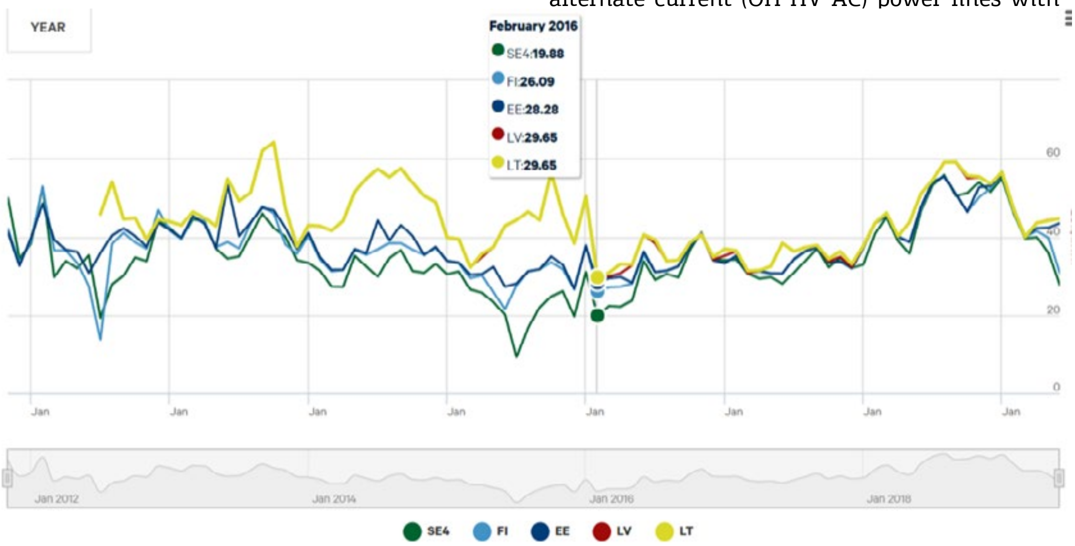


Figure 2. Power prices in Nord Pool price areas SE4 (South of Sweden), FI (Finland), EE (Estonia), LV (Latvia) and LT (Lithuania) before and after the introduction of the NordBalt HV DC submarine cable interconnection between Sweden and Lithuania Source: Nord Pool, website: www.nordpoolgroup.com

Estonia, four OH HV AC with Lithuania and one OH HV AC line with the Russian Federation. A third OH HV AC interconnection with Estonia was under construction in summer 2019 [4]. Latvia, unlike Estonia and Lithuania, does not have an interconnection with any of the Scandinavian countries. Experience shows that an interconnection can increase power supply and decrease power prices: once the Swedish – Lithuanian high-voltage direct current (HV DC) cable began its operation in February 2016, power prices in Lithuania and Latvia dropped significantly and levelled out with the prices in Scandinavia. The price in Sweden's SE4 price area of the Nord Pool power exchange slightly increased while the electricity price in Lithuania and Latvia decreased (see Fig. 2). The prices in these countries have remained similar, with the exception of May, June, July and August 2019 (when this study was concluded), as production limitations in Estonia and Lithuania started to have a significant impact on power prices in the Baltic States.

Several projects are currently being implemented aimed at increasing the capacity of the local transmission system as well as cross-border transmission capacity. Kurzemes loks, a new 330kV OH HV AC power line, is making it possible to connect new wind infrastructure on land to the grid and creates the technical preconditions for taking in potential offshore wind capacity (if and when deployed) in addition to strengthening the overall stability of the power supply in the Kurzeme region. According to estimates from TSO Augstsprieguma tīkls, the transmission system has the capacity to convey at least 1000 MW of additional capacity [3], which could be wind energy on land or off the Baltic Sea shore of the Kurzeme region.

Wind energy in the energy portfolio

The presence of wind energy facilities has evolved from stand-alone windmills servicing predominantly the food industry and water supply systems to sophisticated wind parks supplying hundreds of thousands of electricity consumers with power. However, local acceptance of wind energy in Latvia has decreased and is especially low in places where people have not had any previous experience with wind farms or standalone wind turbines [5], [6].

A typical calculation of costs for a wind turbine on land is between EUR 1.2 and 1.5 million per 1 MW of installed capacity depending on the type of turbine and on the scale of the wind park [7]. The levelized cost of electricity for onshore wind turbines is between 36 and 82 EUR/MWh [8], [9]. Thus, onshore wind turbines are on average among the least expensive energy technologies and the cost of production is comparable to or even lower than that of wind's traditional rivals– natural gas cogeneration and at times even HPPs. There is, however, a difference between installing wind turbines on land and at sea – offshore wind can be two to three times more costly.

With the recent rapid development of wind energy technologies, growing efficiency and decreasing costs, it has become cost effective to install onshore wind turbines with little or no state support, because the technology has become competitive under market conditions [9]. For example, EOLUS is planning to build and operate a new wind park in Latvian town Dobele and parish Pienava without state support. Wind turbines can produce an abundance of electricity with low production costs when there are strong winds.

There are 145 wind turbines of various capacities installed in Latvia in 2018 and although the official total installed capacity stands at 66 MW (Wind Europe), according to the Latvian Wind Energy Association the actual installed capacity could be in the range of 70-80 MW. The difference occurs because some of the smaller capacity wind turbines that do not receive subsidies remain off the radar [7]. This capacity can provide only a symbolic contribution to overall energy production. According to Wind Europe, the main wind industry organisation in Europe, the average of the share of wind energy in final electricity demand in Latvia in 2018 was just one per cent, whereas it was seven per cent in Estonia and nine per cent in Lithuania [10], [11].

By the end of July 2019, there were only two sizeable wind parks in Latvia. The largest one is in Tārgale parish, operated by Winergy SIA, and its total installed capacity is 20.7 MW. The second largest is in Grobiņa parish, operated by Vēja parks SIA, and its total installed capacity is 19.8 MW. The third largest wind producer, Vides enerģija SIA, has 6.9 MW of installed capacity in Medze parish in Grobiņa county, with three turbines of 2.3 MW capacity. This producer and Winergy SIA are the only two that have wind turbines with more than 2 MW capacity, which also illustrates the low efficiency of use of land available for wind energy production, which could be utilized more efficiently by replacing turbines with newer ones. The fourth biggest wind energy producer is W.e.s. SIA in Priekule and Alsunga parishes, which has 4.8 MW of installed capacity consisting of 20 wind turbines of 0.2 and 0.25 MW capacity. Thus, although it has the characteristics of a wind park in terms of the number of installed production units, it can barely be called a wind park in terms of capacity. In 2018, 53 wind energy producers with a total

Table 1. Power generation by source, average and as a percent of total generation
Data: Augstsprieguma tīkls (TSO), analysis by the author

	Small power plants (biomass, biogas CHP, hydro) (<10MW)	%	Hydro electric PP, MW	%	Cogeneration (>10MW), MW	%	Wind power, MW	%	Max % of wind generation on any given day during the selected period
2018 OCT 01-14	142.76	36.08	60.72	9.06	358.49	50.78	17.33	4.08	17.32
2019 JAN 01-14	151.84	26.60	90.14	11.59	406.56	58.17	17.49	3.63	25.94
2019 APR 01-14	156.88	25.14	494.66	51.03	148.46	21.29	15.69	2.54	15.21
2019 JUL 01-14	95.08	25.63	57.58	9.14	260.24	61.32	15.88	3.91	16.09

installed capacity of 64.85 MW received feed-in tariff (FIT) payments totaling EUR 11.97 million for 113.2 GWh of electricity [12].

As Table 1 illustrates, other types of small power generators outperform wind power in terms of volume: in 2018 and 2019, small power plants produced a steady volume of electricity at almost all times, typically ranging between 120 and 170 MW, but falling to 100 MW over May, June and July 2019 (albeit still with a stable trend line). Table 1 shows that during the four selected intervals of two weeks during different seasons (one in 2018 and three in 2019), wind generation had a variable contribution, with average values reaching 16 MW, or between 2.5 per cent and 4 per cent of total generation during the period of two weeks. However, the maximum values of the share of wind energy in any given hour during the day reached between 15 per cent and 25 per cent (on 1 January 2019, for example). In addition, fluctuations during a 24-hour period can vary—for example, they might range between 0 and 20 per cent. This indicates several things.

First, wind is a free (costless) resource, but also indeed a variable energy resource that depends on the overall climate in the region. Second, the share of wind in total production is directly related to the share of other energy sources. For example, in April, the share of electricity from large hydroelectric power plants (51 per cent) was significantly higher than that of any other resource (see Fig. 1 and Table 1), including wind. Even if wind conditions are good for production, most of the water resources are available during this period, and the hydropower plants have been operational for many decades, so production costs are comparatively low and associated only with maintenance of the facility and the upgrade of turbines. Similarly, as shown in Table 1, the share of CHPs in January (58 per cent) was higher than that of other technology or type of resource because it is more cost effective to run the plants in cogeneration mode. Third, the share of wind energy has a bit of a "lottery element". If there is optimum wind on Sunday or on a public holiday when electricity demand is lower than during weekdays, and if it is not particularly cold or is not flood season, then there is a good chance that the share of wind energy in total daily production will reach or exceed 20 per cent.

There are certain benefits to having wind power in country's energy portfolio – it does not have to be imported, unlike natural gas which is 100 per cent imported, and it does not create CO_2 emissions (yet a certain volume of CO_2 occurs when producing and recycling the wind turbines themselves) or particulate matter, unlike solid fuel (including biomass). Furthermore, wind energy is inexhaustible and available on a more or less permanent basis, although volatile at times. In the EU, for example, wind parks use on average 35 per cent of capacity on land and 50 per cent offshore [13].

Long term perspective of a modern energy system

There is a need to undergo an energy transition towards a more sustainable and environmentally friendly system. Mostly this means switching from fossil to renewable energy resources (RES) for energy production, as well as recycling and decreasing the amount of waste generated. The main idea behind energy transition is to phase out and stop using fossil fuels and technologies that contribute to CO2 and other harmful emissions. More widespread use of RES means lower CO_2 emissions, and can – depending on the technology and adherence to sustainability criteria – mean less negative anthropogenous influence on the environment, a healthier and more sustainable environment and better quality of life. RES can also replace imported fossil fuels, thus decreasing dependence on foreign suppliers and influences and facilitating local economic activity. More local energy resources also means better energy security.

A switch from fossil resources to renewables goes hand in hand with distributed power generation, which, in combination with smart management of the energy system, changes the model from a centralised to a responsive network.

Progressive energy systems are becoming smarter: more interconnected, manageable, flexible, oriented towards integration of the roles of consumer and producer, and better able to tap into the unused resources of consumers, thus decreasing the need for additional energy production when there is plenty of energy around. The integration of smaller generators in a wider power grid is part of the future energy system, along with the use of big data (real-time as well as historical data about the functioning of the energy system, including the behavior of energy consumers) and artificial intelligence to process increasingly sophisticated patterns of consumption.

Numerous factors will affect the future energy portfolio: the need for (district) heating and the preference for the lowest-cost RES technologies are among the most important. Wind power facilities on land have proven to be the most efficient and cost-effective solution to deploying new RES capacity and decreasing reliance on imported fossil fuels like natural gas. Wind cannot immediately replace gas-fired CHPs to provide district heating, especially in big urban centres like Riga. However, flexible solutions like wind power in combination with heat pumps for centralised and individual heating are the way forward. The energy system needs to have the flexibility to ensure effective use of wind energy and other types of distributed power generating sources [14].

Failure to implement a smooth transition to the broader use of RES will result in negative environmental and climate effects, which in turn will have economic and social consequences, such as payments for high CO2 emissions costs and hidden health costs for treatment of the impacts of pollution. Using carefully sited wind energy has proven to be one of the most progressive and affordable ways to mitigate climate change through CO2 reduction, and it has quickly evolved towards being commercially competitive without the need for special support from the state, at least for onshore facilities.

WIND POWER OBSTACLES AND OPPORTUNITIES

There are four groups of main factors that influence deployment of wind energy (assuming there are financial resources to invest): the regulatory environment, the political environment, public opinion and availability of physical space. Each of the four groups have many facets that can either facilitate or work to the detriment of wind energy.

Lack of political support is a concept that is both vague and specific at the same time. It is vague because political support can be volatile and experiences regular fluctuations. It depends on other identifiable but similarly vague factors like public opinion, local opposition, the proximity of local and general elections, and what political parties think and say about it. It is specific because it can be translated into written words in the form of policy documents – strategies and development plans, both general and industry specific. Thus, the presence or absence of political support for renewable energy in general and wind energy specifically is passed on to the regulatory framework. The land use regulatory framework for wind energy is specific and subject to exact measurements and evidence consistent with the practice elsewhere in Europe [15]. Public opinion also has a key role to play in the decision to continue or stop the implementation of a wind energy project.

Role of regulatory and political environment in RES deployment

Wind energy has been among the technologies that have benefited from RES support systems in many EU member states, including Latvia. In the EU, decisions taken ten and more years ago have achieved their goal. A fuel switch has taken place – coal has been supplanted by other types of fuel and technology, predominantly natural gas and wind. Although the share of natural gas is still growing, electricity production from RES is gaining ever stronger ground. Most of the growth is in wind energy (see Fig. 3), and studies show its significant unused potential [16]. Massive investment has been made in wind parks on land and offshore. The development and deployment of technology has stimulated the development of electricity networks both in terms of accessibility of infrastructure and smart management of power systems. Separate EU member states and the EU as a whole have progressed significantly towards achieving energy and climate goals.

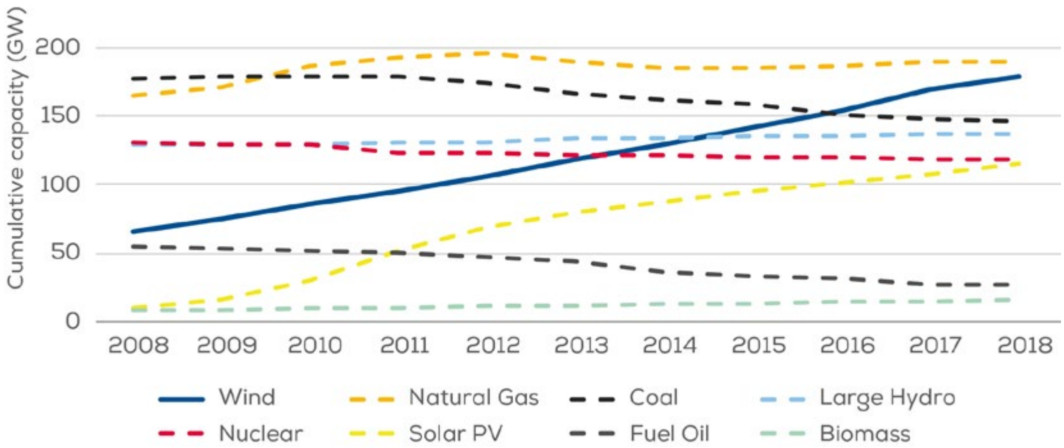
Regulations on support to RES in Latvia have been present for 25 years – since 1995, when the first legislation was adopted stipulating the so-called double tariff for a period of eight years for electricity produced by wind turbines and small hydro-electric power plants. In 2013, a political decision was made to introduce a moratorium on any type of support to new RES initiatives, as well as to decrease the existing support to a minimum by introducing a tax on subsidised energy for projects that qualify for FIT support. This led to a decrease in profit and caused problems especially for those projects that borrowed money to cover all investment costs: their borrowed money suddenly became more expensive.

One of the key reasons for the decision to limit support to RES was that many regarded certain decisions about support to energy production as untransparent and as having been inspired or having had too much influence from interest groups associated with investment in RES.

Despite conceptual support to RES, in reality the support system has experienced dynamics that have not facilitated energy production from RES and have discredited the whole idea of energy production from RES in the eyes of the public. The fact that only 66 MW of wind power capacity has been deployed is indicative of three issues.

First, at the time when support schemes (both for RES and fossil energy production from natural gas) started functioning, the efficiency of wind power technologies was not as high as it is in 2019 and the cost of technology (and levelized cost of electricity) was higher. There was no general drive towards wind energy compared to other technologies.

Figure 3. Power production capacity in the EU, 2008-2018
Source: Wind Europe



Second, investing in other types of renewable resources and also small capacity gas-fired cogeneration power plants appeared more lucrative and technically easier to implement than a wind energy project. Other technologies also have a less visible impact on the surroundings and have less controversy surrounding them (except for small hydroelectric power plants, which have a significant impact on the environment).

Third, the general political environment has been unfavourable to investment in any RES with the regulatory framework introducing ever new barriers to disincentivise investment in RES, including wind energy. The RES sector and energy sector more broadly requires a fundamental revamp of the legal and regulatory framework. More market-based instruments are expected to replace the FIT system that continues to function in 2019, albeit with limitations.

Populistic approach to overall energy policy

The regulatory environment for energy production has been volatile, with frequent amendments to existing legal norms and the continual adoption of new norms. This is indicative of the lack of a systemic approach that would allow a predictable, comprehensible, stable and reliable environment for entrepreneurship. The official attitude towards investment in energy projects that would qualify for support can be characterised by a quotation from a 2015 Constitutional Court case in which the Cabinet of Ministers claimed in its response to the Court's inquiry that "relying on the stability of the regulatory framework over time has no ground" because as market conditions change, the regulatory framework can also change.

The State has altered the legal framework for entrepreneurship in the energy sector (and RES in particular) more than 55 times since 1995. Experience in other European countries illustrates that high volatility of RES policy constitutes a serious non-economic barrier to deployment of new RES capacities [17]. While it is natural that legislation changes when needed, taking this to extremes creates confusion. If every next decision in such a changing environment is an attempt to rectify a previous decision without taking into consideration the broader context, the situation becomes increasingly complicated with every new decision. Such an approach to regulating the energy production support system has created a fuzzy and unpredictable environment for future investment. If the goal of the many amendments and new legislation has been to create unfavourable conditions for investment and development of RES, then one can say that the goal has been achieved. Regular changes of ministers responsible for the energy sector has not helped either – Latvia has had 35 ministers responsible for energy since 1991.

The idea of support to RES has suffered blows every time a general election approaches. Most recently, in 2018 before the general election, a massive campaign was rolled out by political parties across the political spectrum against renewable energy alleging that it makes consumers pay too much for electricity. In fact, the impact of support to RES has had only a marginal effect on consumers' bills (Constitutional Court, Case No 2018-16-03) [18]. Emphasising RES as the cause of high energy bills is just a political tactic to divert voter's' attention from other outstanding issues, since the average citizen and energy consumer is already frustrated by high energy costs.

Lack of leadership in promoting RES despite overall green economy rhetoric

Although green economy, climate change and energy efficiency have been the highlights of EU energy policy for almost 10 years now, decision-makers in Latvia have been exercising policies and views contrary to these European and, indeed, global trends.

The highly dynamic regulatory environment in recent years reflects the pressure on the

Government to deal with situations in energy production that are the consequence of previous decisions.

Decision-makers are still failing to plan for the future of renewable energy. This is jeopardising the sustainable development of the energy industry and affecting other sectors of the economy, like forestry, agriculture and environment. Lack of political will to address the substance of these issues hampers any new development. Because of the highly politicised perception of support to energy production in Latvia, no politician has been willing to become a public ambassador for renewable energy, as that would almost certainly mean the end of a successful political career due to renewable energy's negative connotations in the country.

Role of information, knowledge and mixed messages in RES deployment

Although today certain technologies, like onshore wind, no longer require financial support to be competitive in Latvia, the deployment of RES still often requires some sort of support measures to make renewable energy competitive with fossil fuels. This is especially true in energy systems where a significant share of power is produced from fossil fuels in a monopoly situation and where fossil fuels receive direct or indirect subsidies. Latvia used to be and to a certain extent still is a country with such an energy system, as approximately one third of the power in Latvia is produced by large gas-fired CHPs owned by the State.

Latvia has also had a system of support to energy production in place for many years, based on compensating investment in energy production through a feed-in tariff (FIT). The problem with the FIT system, however, has been that the support has been provided not only to producers of electricity from RES, but also to producers who use "efficient cogeneration" by burning natural gas. This means that the two biggest gas-fired CHPs in Latvia have been receiving FIT payments both for the electricity produced as well as for the installed capacity. These so-called capacity payments are considered the legitimate subject of a support scheme only under very specific circumstances regulated at the EU level by State aid guidelines on energy and environment and should be included in the electricity transmission tariff.

There are two problems, therefore: state support to fossil energy production, even if with the stated aim of ensuring energy security, and damage to the public perception of the FIT system. It should also be borne in mind that electricity prices are a controversial issue in Latvia more generally, and due to the country's pre-1991 socialist economic system, which offered heavy subsidies for energy and energy products, some people still consider that electricity should be provided "almost for free". Broader society associated FIT costs with green energy for only a short period: in 2013, when the government finally began to make information about the recipients of FIT payments publicly available, it turned out that two thirds of FIT had actually been supporting natural gas. The damage to the public image of RES had already been done, and it has escalated further with revelations during 2018 and 2019 that many recipients of FIT payments have not been fulfilling the requirements for receiving the payments. For example, contrary to regulations, some recipients have been receiving payments for all generated electricity, including for self-consumption on top of the volume fed into the grid. As of the time of publication (2019), the system is undergoing serious scrutiny by the Ministry of Economy and law enforcement authorities.

The problem has been further escalated by politicians who have made populistic pledges to make electricity cheaper by fighting the FIT system and green energy producers, who they claim want to get rich at the expense of society. Indications from the authorities responsible for RES policy point towards possibility that any new RES deployment will happen only based on the principles of technologically neutral support and quotas for new production capacity. The development of Latvia's National Energy and Climate Plan is still in process and ought to be finalised and submitted to the European Commission by the end of 2019, which leaves some time for the authorities to discuss a broader range of policy instruments aimed at increasing the share of RES in energy production.

Very few electricity consumers have taken the time and effort to find out what their payment for electricity at the end of month consists of and understand each component's share in their overall electricity bill. The fact that few households have changed their power plan to a product based on the market price of electricity four years after power market liberalisation for households illustrates the inertia in thinking that the price of the electricity bill can only be altered via political and administrative decisions. Forty per cent of electricity users have chosen to do nothing after the liberalisation of power market for households [19] and have automatically become and remain clients of the Public Trader, which supplies electricity to clients as part of a product called the universal service tariff, which is by far the most expensive electricity one can buy. Only one per cent of households have chosen a product based on the market price of electricity [20].

The FIT for RES represents just about seven per cent on the bill, while the power price represents about one third of the electricity bill for households that choose to buy electricity at the market price. However, the message that users can influence the power price portion of the electricity bill every day on an hourly basis does not reach the user. Instead, electricity users more often complain about energy bills than engage in energy efficiency activities, and tend to demand the political and administrative regulation of energy costs, a solution that would not encourage energy-efficiency conscious behaviour [5].

As should be clear from the analysis above, public communication from the responsible authorities and politicians contains mixed messages, which leads to both confusion in the public's perception of renewable energy resources and instability for potential investors. On one hand, it is alleged that support for RES is bad because it makes electricity expensive, and therefore support for RES must cease because consumers need to pay less for energy. This message, of course, runs contrary to the facts about the share of FIT in the bill. On the other hand, officials boast that Latvia is the greenest country in the world, and that it is among the leaders in green energy production. The uncomfortable truth is that Latvia has done little to add to its renewable energy production capacity since 1991. The example of wind energy is illustrative. Latvia's neighbours Estonia and Lithuania have installed over 310 and 530 MW of wind capacity respectively [11], while Latvia has barely 66 MW and there has been little progress made towards increasing this. As illustrated above, part of the reason is lack of political support to RES energy and lack of balanced policy instruments, which have also failed to stimulate new investment in wind power.

Public participation and opinion

Investors' approach to developing wind energy: Big ambition, little investment in stakeholder engagement

Over the last few years EOLUS, a wind energy developer of Swedish origin, has been working on a new wind farm project in the Dobele and Tukums counties in Latvia with a planned investment of over EUR 200 million in at least 35 wind turbines with total capacity over 100 MW. It prepared and submitted the Environmental Impact Assessment report in 2018 [21], and in July 2019 the Latvian State Environmental Bureau gave the green light to the project's environmental assessment [22], [23].

The project faces notable local opposition from several regional businesses and local residents. It deserves a separate study of its own on the acceptance of wind energy by local communities, as it highlights a number of issues— the lack of a well-planned public affairs plan being the key one. Complaints from the local community groups indicate that the main issues of concern are noise, infrasound, ultrasound and vibration, and they claim their adverse impacts on human health and quality of life as far as 20 kilometres from the wind farm [24].

Yet even early involvement of local residents does not guarantee public acceptance, as demonstrated by another EOLUS wind park initiative in Eleja in Jelgava county. EOLUS announced the initiative in February 2019 [25], and local residents subsequently announced the collection of signatures against the wind park initiative in March 2019, blaming the municipality for late involvement of its inhabitants and insufficient transparency of information and processes during the initial public consultation [26].

A slightly older initiative by TCK company to deploy a wind farm of up to 66 MW capacity (initial estimates) in Ventspils county faced relatively low opposition. The reasons are not completely clear, but it may just have been a matter of lack of organisation by those opposed to the project. Also, the project received positive conclusions from the Latvian State Environmental Bureau in 2013, which allowed it to proceed with the project but limited its capacity to 44 MW [27]. The project, however, has not been implemented by the developer, although according to informal information it has not been cancelled either.

Insufficient investment in public affairs during the inception phase makes it easier for competing/opposing interests to counteract. This aspect should not be underestimated, and work must be carried out well ahead of the first public debate on a new wind energy project. The importance of information during the early stages of a project prior to going public includes, in addition to stakeholder involvement, approaching not only local officials and citizens, but also entrepreneurs who are already established in the area. "Measuring the temperature" before taking any conclusive action may save time and resources during the later stages of the project. All stakeholders can benefit from the use of aids developed to improve community engagement in wind energy projects [28].

The results of an opinion poll commissioned by the Latvian Federation of Renewable Energy early in 2019 surprisingly indicates that the Latvian population in general is positive towards renewable energy [29]. This is contrary to our observations in practice about the general public's reaction to any new renewable energy initiative historically and even today, except for, perhaps, solar energy.

However, even a generally positive attitude towards issues like nature conservation, energy efficiency and renewable energy does not necessarily translate into action because of both the internal and external barriers of individuals [5]. When people are asked whether they are ready to physically face a new RES energy facility close to their place of living they are more likely to respond with the infamous "yes, I am positive, but not in my back yard" reaction, which may be based on either real expected impacts or irrational concerns [30], [31], [32].

If timely planning of public affairs and community relations is ignored, it can turn out that during later stages of the project, resources are mostly spent on fighting the consequences of insufficient information, consultation and education activities instead of on preparing a suitable environment beforehand. Every project owner should carefully consider the importance of investing a relatively small amount of finances in a well-prepared public affairs plan for a project where the intended investment amounts to tens if not hundreds of millions of euros.

Dealing with unprepared target audiences locally

Many barriers to deploying wind energy can be dealt with through arguments, evidence, science and logic. Most such barriers are related to the physical impacts that wind turbines have or can have on health and the environment. Such influences are dealt with in environmental impact assessment (EIA) reports mandatory for any new wind energy project. However, human resistance to wind turbines and wind parks may also involve irrational thinking that the regulatory environment cannot influence. A prospective wind farm can have a positive EIA, but inhabitants can still object to the initiative for reasons that can only be identified and measured through a preliminary analysis of risks to a project.

Public resistance has the potential to singlehandedly derail a wind energy project if it manages to exercise enough pressure on local municipal authorities. Studies show that negative attitudes towards new wind energy projects can delay the implementation of a project or even stop a project [33], [30]. Unless there is a very strong will to invest in a project whatever it takes, waiting for extensive periods of time increases the likelihood of the project failing, while the investment possibility and probability decrease.

Research literature shows that when it comes to wind energy there is a rather broad variety of attitudes ranging from active non-acceptance to ambivalence to active acceptance [34]. The factors influencing non-acceptance or acceptance are associated with perceived side-effects, process-related variables, personal characteristics and technical and geographical issues [35]. Certain factors have the ability to shift a person's perceptions. For example, those who live or have lived in the proximity of wind turbines are more likely to accept new projects than those who have no previous experience with wind turbines. According to research the distance between wind turbines and the place of residence of a person does not necessarily have a crucial influence on acceptance [34]. However, information, consultation, cooperation, financial participation, as well as procedural and distributive justice if properly taken into account increase the acceptance of new wind energy projects.

Factors such as fear of infrasound, fake participation (local residents being consulted only for formal reasons with no actual intention to take their views into account) and lack of involvement in decision-making have a negative influence on the acceptance of wind energy. Fear of infrasound is akin to the fear of something that we do not know but presume can possibly have a negative effect on us, so we attempt to avoid the causes of this unknown influence. Providing information and exercising communication works to mitigate and possibly dissipate anxieties and mistrust related to wind energy technologies as well as suspicion towards wind energy entrepreneurs [36], [35], [37], [34], [6], [38], [39], [40], [41].

Studies show that the involvement of the local community is essential for the successful implementation of a wind power project. Engaging local residents in a meaningful dialogue and cooperation mechanisms, providing objective information and communication on a personal level can significantly improve awareness of wind energy and the gains it can bring [5]. Stakeholder involvement in debating plans is a universally applicable strategy and can take different forms, and it is up to project owners to decide about the most appropriate tactics of stakeholder relations and public affairs. The common truth is that the more (and the earlier) one invests in public affairs, the less one will have to invest in public relations in case of distinct non-acceptance. There is one important thing to remember – the later stakeholders are approached, the less likely the smooth development of the project and the bigger the need to invest in damage control measures, which per se never have a positive connotation [33], [31], [35].

Wind energy entrepreneurs in Latvia have dedicated a certain amount of effort to spreading knowledge about wind energy and factors affecting its deployment by producing a wind energy guide [42], and thus contributing to general education and information about wind energy.

Given the importance of community relations, the first step of a wind energy project would be, for example, a neutral opinion poll (finding out people's opinions, values, beliefs), which includes also questions about attitudes towards renewable energy and allows more detailed insight into attitudes towards specific energy technologies. Such preliminary research should target respondents in the vicinity where the investment is planned to take place. It should be up to professional sociologists to carry out this task in a neutral manner— the investor's own initiatives might create prejudice and damage the process already at its pre-inception phase. The rest of the steps in stakeholder relations should stem from the results of the survey. In-depth analysis through specific interviews of local residents may be required prior to drawing conclusions about attitudes towards wind energy.

Limitations on the use of land, regulatory and administrative barriers and policy consistency

Regulations on spatial planning (Vispārīgie teritorijas plānošanas, izmantošanas un apbūves noteikumi) set limits on the minimum proximity of wind turbines to houses in different conditions [43], [44]. Complex but standard procedures like environmental impact assessment guidelines for wind power plants have been in place since 2009 [45] and provide a wealth of information about any new wind power infrastructure project. The Protection Zone Law [46] spells out the details on all the conditions related to distances of infrastructure from residential areas, thus covering mandatory requirements for physical placement of individual wind turbines and wind parks.

Another set of regulatory requirements includes the so-called detailed plan of a municipality (detālplāns): it can allow or prohibit the erection of wind turbines in particular geographical locations in a given municipality. Unless there are restrictions stemming from these three sources (EIA, Protection Zone Law, Detailed plan of the territory of a municipality), the owners of a project can seemingly prepare for actual construction works.

However, public opinion and community engagement can play a crucial role in an investor's ability to actually implement a project, as demonstrated in the case of the EOLUS wind park project in Dobele and Pienava. It is the municipality's responsibility to decide whether to allow implementation of a project [47].

The use of land

According to Government Regulation No. 240 on territorial planning, wind turbines cannot be erected closer than two kilometres to populated places. Although Latvia has plenty of rural space, the land lots are relatively small and ownership is fragmented, so there are seldom situations where one owner has several lots of land next to each other. A farmstead (viensēta) is considered a populated place in the current regulations. A combination of these two factors – fragmentation of land lots and limitations regarding the minimum allowed distance for a wind turbine from a populated place – limits the availability of land where wind farms could be erected.

There are also limitations set on the use of land categorised as agricultural land of national importance [48], in order to protect high-quality agricultural land from being designated for purposes other than agriculture. The decision to designate this status to agricultural land is the prerogative of local municipalities. The respective government regulations allow the changing of the status of this specially designated land for construction of communications and road infrastructure. Since the regulations target particular administrative territories, norms could be amended to introduce a more elaborate framework and stipulate the conditions under which agricultural land with the status of national importance could be re-designated for particular additional activities, such as the deployment of a wind turbine, thus increasing the flexibility of the use of land. Limitations associated with these government regulations have influenced, for example, the deployment of several wind turbines of the EOLUS wind park in Dobele county. The State Environmental Bureau has pointed out that the construction of wind power plants on land designated as being of national importance is not permitted. [23] From the point of view of potential impact on wind power capacity, one barrier less can have a stimulating effect. On the other hand, it can be assumed that introducing more flexibility in regulation and procedures pertaining to the change of status of agricultural land of national importance would not be a crucial development for more widespread or mass deployment of wind power plants as such changes would affect only limited territories.

The General Regulations for Planning, Land Use and Building could be amended to allow wind turbines to be erected closer than the currently set distance from a populated place, or the definition of a populated place could be specified to accommodate a spectrum of situations, such as farmsteads which have been uninhabited for decades and are decaying, but still formally qualify as populated places [43], [44]. To avoid the potential negative effects of flickering on health, these regulations should elaborate detailed rules on the operation procedures of wind turbines installed in close proximity to populated places, for example, by limiting the work of wind turbines outside the time slots when flickering can affect (by casting shadow) a residential building (an individual house or an apartment building) or a building with public function (school, municipal services, social and health services, and similar).

Deployment of wind turbines in forest areas

A potential scenario for consideration would be the possibility to deploy wind turbines in forest areas, specifically in areas that belong to the state, namely the state forest company Latvijas valsts meži (LVM). Currently available wind turbine technologies allow for erecting wind turbines above the forest thus eliminating the need for a clear field around a single wind turbine or a system of wind turbines [49].

The topic of wind energy in forested areas has been studied, with cases covering countries ranging from India to Germany, to several states in the USA, to Sweden [49], [15], [50], [51]. Several conclusions in the studies coincide. First, generally, the deployment of wind power plants in forested areas is a regulated business, and it has its limits. Second, implementation is crucial, as regulations have been ignored in some areas and in some cases, much depends on the monitoring of wind power projects and the capacity of authorities to carry out the monitoring function. Third, deployment of wind power in forested areas has an impact on the environment and there are not only gains, but also downsides to such projects [52].

It is worth shortly elaborating on the latter conclusion. The scale of impact depends on the scale of projects and several other key factors, like topography, type and status of the forest, existing road and power infrastructure. The main concerns about negative effects differ: whereas in some places the main reason for concern is the negative impact of wind power on the forest ecosystem, vegetation and animals [49], [53], in other places the main concern is that wind power plants might decrease the value of their forests – an unaltered forest is considered to be more valuable than the gains from power production from renewable energy sources [15], [49].

Some of the negative impacts stem from building new roads (this is a particular concern in forests that have not previously been designated for commercial activity) and power lines - the extent of the impact depends on technological solutions – overhead lines have more impact than underground cables. Such infrastructure objects that are needed for access to installation sites cause linear fragmentation of forested areas and, depending on terrain and other conditions, can have almost no impact on wildlife [54] or a very negative impact by creating physical obstacles to animal migration routes [53]. It must be noted, however, that each case deserves individual attention as conditions on the ground differ from place to place.

Another interesting aspect is that the statistical territory for wind power projects differs from the actual space required for the installation and maintenance of wind turbines. The difference can be up to a thousand times and occurs because the land for wind farms in forested areas is usually leased, not purchased: as small pockets of forest are not subject for lease, wind energy developers lease whole forest areas. In other words, tree felling for the purpose of harvesting wind power can in practice be very limited although statistically a larger forest area is designated as associated with a wind power project. In one case a project leased a total of approximately 8 900 hectares of land for a wind farm project where the actual area needed for sites and access roads was only 80 hectares [55]. Still, tree felling remains a concern, especially where monitoring and supervision is insufficient or weak. The actual physical impact of cut trees against installed MW of capacity can differ significantly; the range of cut trees in case studies ranges from 2 300 trees per MW to just a dozen of trees per MW depending on the density and type of forest, presence of infrastructure, rules and regulations and how the latter are actually observed [53].

Different conditionalities can be imposed in order to ensure wind power projects in forested areas avert deforestation, such as, a "cut and plant" requirement, minimum MW capacity requirements to ensure efficient use of forest land and others. When it comes to protection of wildlife, some simple solutions like the painting of the tips of windmills, using cables as opposed to overhead power lines to connect to the grid (this requirement has been included in the opinion of the State Environmental Bureau regarding the Environmental Impact Assessment report on the Dobele wind farm), and benefit sharing with local communities can minimize any potentially negative effect.

The Forest Stewardship Council (FSC), which promotes and ensures sustainable forest management principles, recognises that here is a growing public interest in wind turbines, their social and environmental costs and benefits, and the role that they play in the global effort to reduce carbon emissions. Due to an increasing frequency of inquiries about the deployment of wind turbines in forests, FSC has issued an advice note on wind turbine deployment within

FSC certified areas. The note was developed in consultation with stakeholders in Sweden and elsewhere and through field visits to affected regions.

Although in principle FSC does not categorically oppose the deployment of wind turbines in forests, it clearly states that deployment of wind turbines may result in excision of FSC certification if the proposed establishment of wind turbines and subsequently the affected area does not meet the requirements of the applicable FSC standard. The advice note provides that in such situations, those in charge of the forest management unit (FMU) shall make all reasonable effort to avoid any negative impact of the excised area on the certified territory. Criterion C6.10 of the advice note contains conditionalities that must be observed if forest land is to be converted to non-forest land use while maintaining FSC certification. It provides that forest conversion to non-forest land uses shall not occur, except in circumstances where conversion a) entails a very limited portion of the forest management unit; b) does not occur on high conservation value forest areas; and c) will enable clear, substantial, additional, secure, long-term conservation benefits across the forest management unit. The Advice further states that demonstrating compliance with the criterion C6.10 may be a challenge given the nature of the deployment of wind turbines. One example for acceptable evidence of compliance would be strong stakeholder support, including from local communities, on the clear, substantial, additional, secure, long-term conservation benefits that wind turbines may deliver to a particular forest management unit [56].

Attempts to finalise Latvia's local forest stewardship standards continued in 2018; however, the draft (as of September 2019) does not contain references to the potential deployment of wind energy in forests [57]. In the above context, it is also important to note that the state-owned company LVM, as shown in Table 2, is by far the biggest single owner of forest land in Latvia and therefore could have the biggest impact in terms of availing forest areas for wind energy projects.

In addition to being the biggest owner of forests, LVM has bigger clusters of forest management units available, thus making it a potentially better choice for wind project development than areas with smaller FMU clusters. From this perspective, deployment of wind turbines in forests would have the advantage of having turbines further away from farmsteads and other populated places and thus having less impact on human life in terms of noise, flickering, vibration, unwanted visual presence and other effects.

Renewable energy policy

In terms of energy policy, progress has to be made to achieve changes in RES policy. Further amendments to the existing legal framework regulating the production of energy would be counterproductive, and new policies and legislation on renewable energy are needed to establish a clear set of rules for all stakeholders, be it technology-specific or neutral support. Information about the current support system is publicly available and provides a reasonably good overview of the volume of support to different energy technologies and producers. At the same time, a new regulatory framework for RES would probably not be as crucial for onshore wind energy (but still crucial for offshore wind, which is more expensive), because it has reached a situation when it can compete on the market with other technologies without support.

Table 2. Forest ownership in Latvia, 2019
Data: Latvijas valsts meži

Owners	ha	%
Total area of forests	3,800,000	100%
Latvia's State Forests (LVM)	1,600,000	42%
Sodra grupa	125,000	3%
IKEA group	90,000	2%
Rīgas meži	60,400	2%
Isnaudas mežs	26,600	1%
Other owners	1,898,000	50%

CONCLUSIONS

Overall, the land use regulatory framework and public opinion are two major factors affecting the success and deployment of wind power projects in Latvia. Renewables support policy is changing too often and driving away investors. The National Energy and Climate Plan (NECP) is an opportunity to set a clear new policy for Latvia's energy transition in long-term.

Antipathy towards wind energy has increased over last few years due to populist rhetoric on electricity prices – a public campaign may be needed on how to change energy supplier and the real costs and benefits of certain types of renewable energy.

Public affairs during the inception phase of a project is a critical element of any new wind turbine initiative unless the owners of a project are willing to face pronounced public non-acceptance. The key notion here is meaningful participation as opposed to superficial participation (see section Dealing with unprepared target audiences locally above), which can damage relations with communities instead of ensuring a tolerant and informed attitude.

The possibility of increasing deployment of onshore wind power plants in Latvia should be looked at from a neutral point of view through the prism of possible scenarios, rather than through insisting on a particular solution. Having reviewed barriers and causes of barriers, this analysis indicates that there are three potential directions of activity that could facilitate interest in wind energy and the implementation of actual wind energy projects in Latvia: 1) amending the regulations or elements in existing regulations pertaining to the requirement on distance from residential areas; 2) considering deployment of wind turbines in forest areas, primarily using already exploited forest plantation areas; and 3) making the change of the status of agricultural land of national importance more flexible. This analysis indicates that from among the possible scenarios, enabling wind energy projects in forest areas would have the biggest impact, but it needs to be approached carefully to avoid unacceptable impacts.

Guidelines when elaborating a wind project

Community relations deserve special attention and a comprehensive approach, but it is worth sharing at least a few basic points to take into consideration when thinking about a new wind park:

- A general umbrella rule: prepare a comprehensive public affairs plan and invest adequate resources (time, finances, people) in a project worth millions.
- Identify local moods and attitudes well ahead of going public with the initiative for the first time.
- Work with the target audience well ahead of approaching it with the plan for the first time (loyalty quest).
- Have a clear strategy and scenarios on how to involve/engage the local community.
- Be clear and realistic on what benefits the local community will and will not enjoy from the project. Is there an option for local shareholding in the project?
- Do not pursue backdoor tactics by lobbying the local authorities and ignoring residents.
- Provide information and evidence and be ready to comment.
- Be open for individual consultations, if required, to establish communication channels without intermediaries.
- Keep the local community proactively updated on all developments that may concern its interests.

Potential changes in the regulatory environment

Several things can be done to decrease barriers for deploying wind energy in Latvia from the regulatory point of view:

- Consider making deployment of wind energy possible in forested areas that belong to the state (LVM) without risk of deforestation, primarily using already exploited forest plantation areas.
- Ensure that the NECP sets clear directions for efficient and sustainable use of Latvia's renewable energy resources.
- Amend the Territorial Planning regulations or elements in existing regulations pertaining to the requirement on distance from residential areas, e.g. review the situation and the definition of what constitutes a populated place.
- Amend regulations on Agricultural Land of National Importance, to add flexibility to the municipality's ability to change the status of land or partition it with a subsequent change of status.

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