Promoting Renewable Electricity: Targets, Strategies, by Technology (2005 - 2019)

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CONTENT

Abstract

This paper has the objective to present the current and future energy panorama of Austria and the Czech Republic to analyze and understand the enforced support schemes for RES development. Here, the two countries are to be compared and analyzed together to understand how each country is undergoing the energy transition to renewable energy sources. The roles and responsibilities of the three social spheres (Industry, Government and General population) will be defined and constraint to determine the success or failure of the support schemes within the countries. The promotion of the RES depends on more than one factor and the reactiveness of the agents will be challenged to identify where the most change can be done and where the efforts should be focused.

Introduction

Some of the alarming problems in today's world are global climate change, air pollution, high fuel import dependence, and rising electricity demand. All of these threats contribute to the increase in the use of renewable energy, as well as promoting renewable electricity in recent years. One of the most important benefits of clean energy is that there is little to no contribution to greenhouse gases, which are responsible for global warming. Since we are facing the most severe climate crisis, the promotion of renewable electricity is very important. Besides the problem of greenhouse gases, the use of renewables would solve some other problems. One of those is the improvement in public health. Coal and gas power plants have a very high influence on air pollution which is associated with numerous health problems. Therefore, wind and solar energy would propose a helpful solution, since they do not have any impact on air or water pollution. Another crucial advantage of renewable energy is that this type of energy is inexhaustible. Since nowadays the demand for electricity is higher than ever and the demand will only increase it is time to start using renewable resources as much as possible. In addition to that, renewable energy can help stabilize energy prices, as it operates at a low cost.

Having all of these advantages in mind, most EU countries have already created policies to promote the generation of electricity from renewable energy resources.

As the strong motivation behind this topic is already stated, in the following paper emphasis will be put on different strategies that are used by Austria and the Czech Republic in promoting renewable electricity and how efficient are those. In addition to that, the strategies of these two countries will be compared with other EU states, the measures these countries are taken so far, and possible actions in the future. In the end, we are going to state whether or not our hypothesis was correct and describe the results.

Renewable energy promotion, in our view, is done in three different social spheres. All of them follow their interests, so the promotion of new energy sources has to find the middle ground between them. These three parts are the government, industry (either developers or consumers), and the general public. One of the objectives of this paper is to show how European countries, especially Austria and the Czech Republic, have tried to find this common ground between the three parties. During this initial analysis, we will present the evolution of the RES promotion to their current state and point out the pros and cons of the chosen strategies. Following this, we will test the efficiency of each of these schemes from the perspective of each of the three parties involved. The means to do the testing will be in the form of costs, newly installed capacity, LCOEs, and public acceptance. Finally, we would like to use this information and try to describe a future panorama for RES support in Austria and the Czech Republic.

The literature to be used will be mainly from official European sources as well as the International renewable energy agency (IRENA). Past commitments and objectives (before the current green deal) will be taken in count as well, as the perspective has changed and the view on the future has been updated accordingly. The public sector will be the hardest to analyze as the information is not readily accessible and the interworking of the political structure of each country is hard to grasp. The scope in this particular area will be only limited to Austria and the Czech Republic (in

the sense of the surveys) and/or to any consideration the support schemes have written into them such as participatory investment or any other mechanism that promotes the participation of the general public.

Figure 1

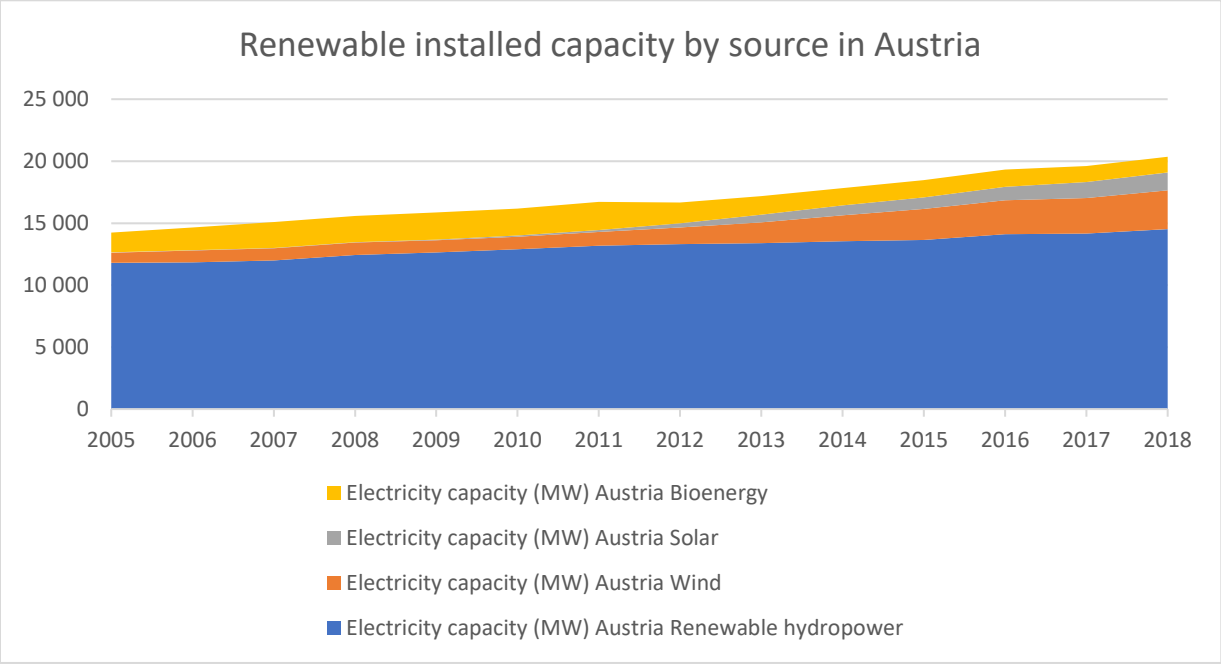

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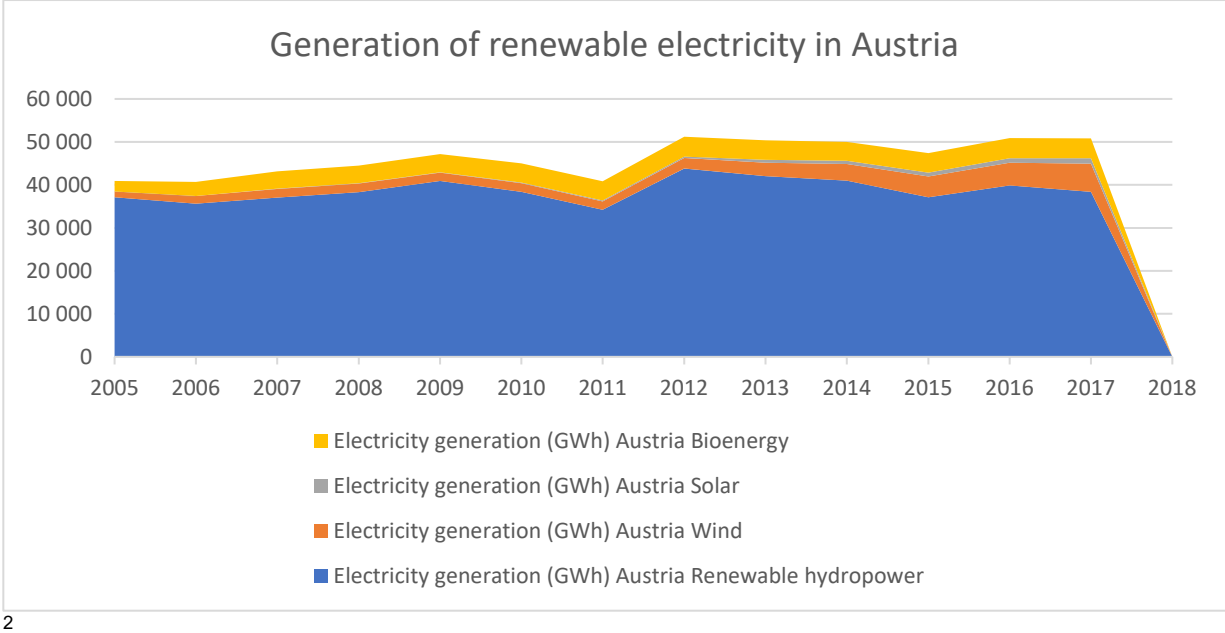
Figure 2



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[1] IRENA
[2] IRENA

Comparison between figures 1 and 2 with respect to 3 and 4, there is a clear difference between the two countries in question. First, the renewable hydropower that is available in Austria dwarfs the resource availability present in the Czech Republic. So, comparing both counties based only on installed capacity and/or electricity generated by renewable sources would not only be incomplete but unfair. For solving this, the evaluation will be made more in the compromise that both countries have, measured by initiatives, legislation and regulation of renewable energy sources. This is complementary of the three social spheres mentioned earlier, as it englobes and considers all three of them.

Figure 4

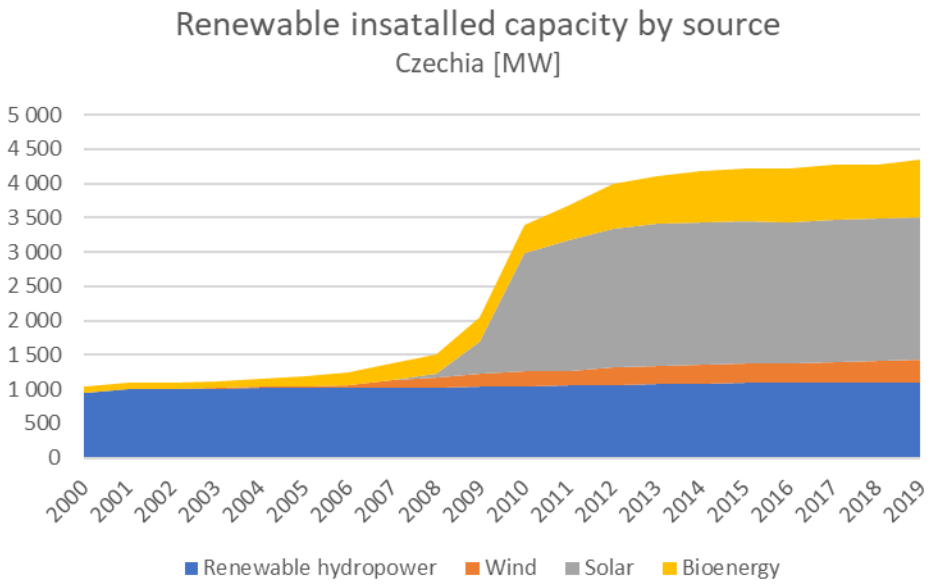
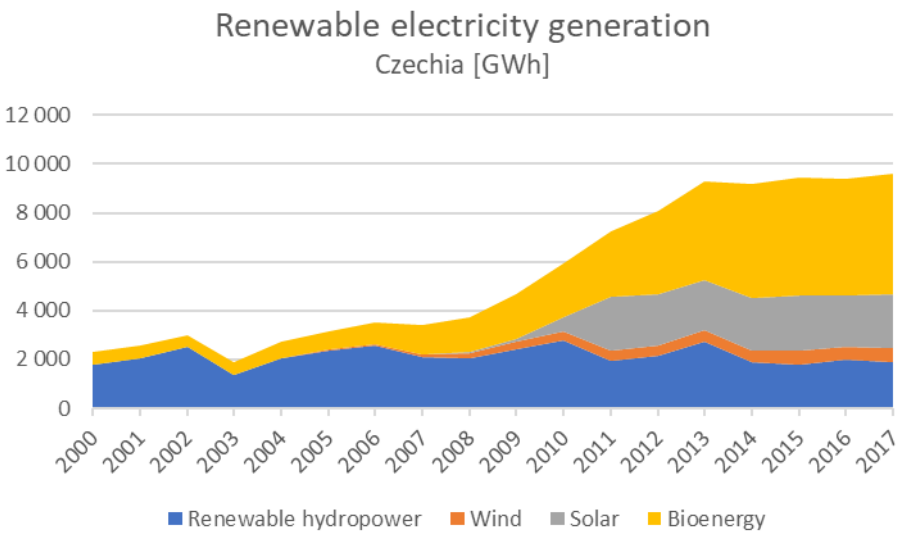


Figure 4



Targets Austria

Austria has set up several different renewable energy targets; electricity, heating and cooling, transport, and total final energy consumption. EU Climate and Energy Policy 20/20/20 Targets, among others include that 20% of energy consumption has to come from renewable resources. In case of Austria this target means that share of renewable energy has to be 34% by 2020. For heating and cooling the aim is to achieve that 33% of heat consumption is met by renewable resources. Also, 71% of electricity should be generated from renewable energy sources, while for transport 11.5% of energy demand should be met by renewable energy sources. In addition to that energy efficiency has to be increased by at least 32.5%.

Austria has set different targets for different parts of the country, as well. For Burgerland, the target was to obtain 100% of its electricity from local, renewable sources by 2020. The generation of renewable electricity in this region started in 1992 when one of the locals wanted to install a wind turbine on this land. Already in 1994 municipality decided to create a company for managing this project. In 2001 the Austrian electricity market was open, in 2002 Burgerland established a wind power plant, and in 2003 the Green Act was adopted. By 2009, an energy team was gathered to set an energy-sufficient target which should be achieved by 2050. This target was achieved already in 2013 when Burgerland managed to supply 100% of its electricity needs through wind power. Additionally, it is estimated that 4500 new jobs were created with the development of wind power in Burgerland.

In Carinthia three targets were set; to use 100% renewable electricity, to use 100% renewable heating by 2025, and to have 100% renewable transport by 2035. This part of Austria is one of the leading renewable energy regions in Europe. They use 100% renewable electricity from local water power, which means that the first target is achieved. Already in 2013 55% of their total energy supply was coming from renewable sources. Currently, they are using 70% renewable energy from biomass for heating, and they need to expand that to 30% more to achieve the second target by 2025. As for the third target, they use 12% renewable transport and have to reach 100% by 2035. They were also able to achieve a 45% reduction in CO_2 in the period from 1990 to 2011, even though that was the period of the increased building.

The next Austrian town to set up a similar target is Güssing. Their goal was to have 100% renewable energy self-sufficiency. They produce renewable energy from biomass gasification technology. They developed an energy efficiency program in 1990. The first step was switching the streetlight to LED and they reconstructed public buildings by placing new windows and insulation. One of the decisions was to stop using the power which is produced by fossil fuels. Town's agriculture and forestry provided organic material for fueling heating grids, and they started producing electricity and biogas, and thus they developed the world's first full-functioning FICFB (Fast Internally Circulating Fluidized Bed) plant. In 2013 the whole region had enough locally produced electricity to cover demand.

The town Hartberg has set a somewhat different goal than previous regions. Their target was to be 100% CO_2 neutral by 2020. This target includes all buildings, industry, and private households. The measures which were taken to achieve this goal are: supplying heat to all buildings through

a district heating system that runs on woodchips, purchasing only renewable electricity from hydro-, wind- and solar power stations, installing solar-thermal energy and covering all available roof-surfaces with photovoltaic-cells.

In Kötschach-Mauthen, in Austria, the target was 100% energy independency by 2020. This region is known as an energy-independent community since 2007, as they have a long history with renewable energy, and they had built the first water power plant in 1886. Today they have 21 small hydropower plants, 3 ecological storage lakes, 4 district biomass heating plants, 1 wind power plant, 1 biogas plant, several big and private photovoltaic, and solar power plants. However, their target is not yet achieved; their energy-self-sufficiency has reached 75%, up to date.

Region Mureck/Steiermark set a target to have 100% renewable energy. This region focuses on renewable and decentralized energy, and also on taking actions against climate change. The region exceeds energy demand for heat, electricity, and fuel by 160% through the use of renewable energy. They are also exporting energy. Renewable energy is produced by a biodiesel plant, a biomass district heating system, a biogas plant, and a photovoltaic plant. Almost 95% of total heat demand in Mureck is covered by 2 MW biomass heat boiler, while biogas plant generates 8000 MWh of electricity annually. Mureck also reached a reduction of 60000t of CO_2 and 20000t of crude oil per year. This was achieved with the use of renewable energy.

The target for Lower Austria is to have 100% renewable electricity. This target was achieved in November 2015. Further, plans are to generate 50% of the total energy demand of Lower Austria through renewable sources by 2030. They will increase the production of biofuels for transportation and heating/cooling needs. Currently, 63% of electricity is generated from hydroelectric power, 26% from wind energy, 9% from biomass, and 2% from solar. The success in renewable energy was responsible for the growth of employment in the RES sector, and it is expected that the number of jobs will increase to 12000 by 2030.

Upper Austria has also set a similar goal; to have 100% renewable electricity and heat by 2030. This goal is still in progress, as currently 80.7% of Upper Austria total electricity consumption is generated from renewable sources, and 44.5% of total heat consumption. Around 30% of municipalities in this region use biomass for heating. However, to achieve this goal by 2030, Upper Austria has implemented many initiatives. This was the first Austrian state to implement the EU Energy Efficiency Directive, which requires all new residential buildings to meet energy efficiency standards. Also, some university programs were introduced such as Green Energy Engineering and Green Energy Installation, also a successful “energy poverty” program was implemented. This region will reduce the consumption of fossil fuels by 41% until 2030, compared to 2005 levels. This is very important since this region has a strong car manufacturing industry. Upper Austria has a program for promoting the production of electric vehicles called “The Clean Motion”.

In Waldviertler Kernland the target is to reach energy-self-sufficiency by 2030. To achieve this goal, the region has to extend renewable energy supply form 256 MWh to 409 MWh per year, while total energy demand has to decrease from 666 MWh to 409MWh per year. Many regional studies were conducted in 2011, and also an energy plan. The energy team is realized, which

decides upon implementing necessary renewable energy infrastructure and energy efficiency projects. This target also has origins in the climate protection initiative. The region currently uses hydropower and biomass energy for the generation of renewable energy.

Targets Czech Republic

The core directive that drives the Czech renewable development, as in other EU states, is known as the *National Renewable Energy Action Plan* (NREAP). Within this document, the targets are set for the long-term horizon of the energy panorama for the Czech Republic. Presented in 2010, it set the goals for the timeframe of 2020 and has not been renewed since then.

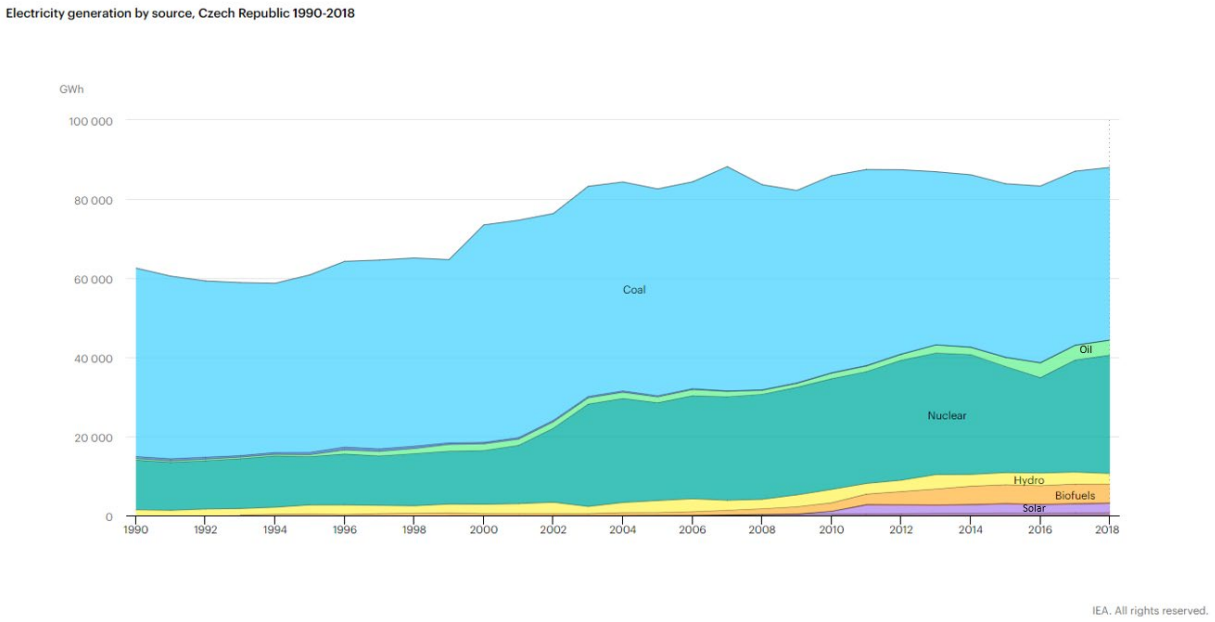
The Czech Republic renewable energy 2020 targets are as follows:

- Overall target: 13.5% of share of energy generated from renewable sources in gross final energy consumption;
- Heating and Cooling; 14% of demand met by renewable energy sources;
- Electricity: 14% of electricity demand met by electricity generated from renewable energy sources;
- Transport: 11% of energy demand met by renewable energy sources;

If we analyze figure 5, we can observe that regarding the electricity generation, the goal is expected to be met. Even though the 2020 targets are met, with the current legislation and incentives, the Czech RES sector is bound to be stagnated as it has been during the last decade. Some decisions have to be made taking in count the resource availability within its borders to reduce the coal share, that as of 2018 is suppling near 50% of the electricity in the country.

Targets can be easily enforced in the Czech Republic as the mayor utility CEZ is owned in its majority by the Czech state. This can enhance the possibility of the country to look for more ambitus targets for the future. Till date, the Czech energy panorama has been somewhat stagnated and with higher and higher trend to go for a more nuclear option. This will inherently diminish the capacity of the state and CEZ to reactivate the RES development as the nuclear path is capital intensive.

Figure 5



Strategies Austria

Support schemes for the promotion of renewable electricity in Austria are the following: feed-in tariff, successive rate to the feed-in tariff for biogas plants, investment subsidy for hydro, investment subsidy for PV on buildings, investment subsidy for off-grid installations, investment subsidy for small PV, investment subsidy for PV installations in the agricultural and forestry sector.

"Feed-in tariffs (FIT) are fixed electricity prices that are paid to renewable energy producers for each unit of energy produced and injected into the electricity grid."[3] Feed-in tariff applies to all technologies for the generation of renewable energy, but the plant has to be recognized as a "green electricity plant". For a power plant to be eligible for a feed-in tariff it has to meet certain requirements. For solar power plant installation capacity has to exceed 5 kWp. Geothermal energy and biogas and biomass powerplants have to reach an efficiency of at least 60%. Hydro-power plant is eligible if the plant's capacity does not exceed 2 MW. For electricity generation from wind, there are not any requirements.

The successive rate of the feed-in tariff for biogas plants is granted if the plant is not qualified for a regular feed-in tariff. The budget for this scheme was € 11.7 million per year on average until 2021.

Austria supports the construction of small and medium-sized hydropower plants, with a small power plant indicating that maximum capacity does not exceed 10 MW, while a medium-sized

[3] "Feed-in Tariffs (FIT)." *energypedia*, https://energypedia.info/wiki/Feed-in_Tariffs_(FIT). 20. Apr. 2020.

power plant indicated that the maximum capacity is between 10 MW and 20 MW. Funds for small plants were € 20 million per year in 2018, and for medium one available funds were € 50 million.

Investment subsidy for PV on buildings included a maximum of 30% investment costs, which means that up to 250 € per kWp is granted for these installations. Also, grants for battery storage systems are available as of 2017. To be eligible for this grant power plant's installation capacity cannot be more than 500 kWp.

Companies that build off-grid power plants with the purpose of self-supply can benefit from investment subsidies that are granted for these installations. These subsidies can also be granted for storage devices for electrical energy. Small hydropower plants, wind power plants, solar power plants, and biogas power plants are entitled to this grant.

In addition to larger PV on buildings, also small PV installations can benefit from investment subsidies. Requirements for subsidy are PV systems with a maximum of 5 kWp. However, private individuals are entitled to the grant, and funds can be accessed for a maximum of 5 kWp per capita and 30 kWp in total.

Exception from the above-mentioned scheme is PV installations in the agricultural and forestry sector since different investment subsidies apply for those. Eligible PV installations between 5 and 50 kWp in the agricultural and forestry sector include rooftop, ground-mounted, or building-integrated installations. Investment subsidy for rooftop and ground-mounted installations is € 275 per kWp, while for building-integrated systems this amount is € 375 per kWp.

Strategies in Austria are oriented towards developing a sustainable energy system. The system would make energy services available for private consumption, but also businesses. Core objectives include security of supply, environmental compatibility, cost-effectiveness, competitiveness, and social compatibility.

In April 2009 a comprehensive stakeholder process was launched, and this strategy has three important goals.

1. Improvement in energy efficiency, e.g. new and refurbished buildings, sustainable mobility, implementation of energy management systems, spatial planning
2. Renewable energy with a focus on hydropower, wind power, biomass and PV
3. Increase the security of supply and get the highest possible degree of cost-effectiveness, e.g. district heating and cooling, new transmission networks, diversification of supply sources and routes, gas storage, smart grids, and smart metering

Austrian Energy Strategy also focuses on building refurbishment acceleration, from a rate of 1.2% to 3% by 2020. The strategies target mostly individual sectors, transport, and electricity production.

Strategies Czech Republic

It can be observed in figure 3 that between the years 2008 to 2010 almost all of the RES generation capacity was installed within the Czech borders and somewhat stagnated from there. This can be shown as an example when the necessities of the three social spheres are not met and that lacking legislation meets with unexpected market variations.

Here is where smart legislation, in hand with an improvement of the social perception of renewables should enter into place to ensure the development of the RES sector in the country. Although, the lack of action in the matter can be evidence of not only a lack of interest of the Czech state to increment the RES generation capacity but also that the Czech general population are not particularly interested in the subject. To make a complete analysis we have to involve the last sphere as well, the investors. While companies can decide to “go green” (meeting their energy needs with RES) and can incentivize some investment in the sector, by the means of guaranteed contracts, it’s not enough and bounded to the decision of the company and usually done as a public relations strategy. The investors or companies will only act if there’s some value to the fact of investing in RES. Hence rendering them as the most reactive of the three social spheres as it only acts if enforced by one of the other two.

This leave us with the government and the people to make the main decisions of RES development. The State as the lawmaker and the people that finance the initiatives through taxation. This indirectly means that the people have to have some level of support and trust in the schemes implemented by the state in order to accept the taxation. This is of particular interest in the Czech Republic because the legislation passed in 2008 (feed-in-tariff with a maximum reduction per year) combined with exponential solar LCOE decrease created exceptional market conditions generating extra value for the investors. The Legislation was not able to adapt dynamically to the market conditions and left the population paying the tax, giving the RES a bad reputation in the country.

So, what is the Czech Republic currently doing? The Czech Republic centers its strategy with 4 mayor support schemes:

- Feed-in-tariff (FiT): RES Plants operators have that comply with the following specifications can apply to a FiT. (1) Photovoltaic plants with an installed capacity of up to 100 kW (30 kW in the case of roof or facades installations or 10 MW in the case of hydroelectric plants). Solar and biogas plants can only apply if they are commissioned before December 31, 2013. Wind, hydro, geothermal or biomass plants up to 100 kW can apply if they were commissioned before December 31, 2015 and the construction permit was issued before October 2, 2013. The FiT are payed by the “mandatory purchaseurs” set by the Ministry of Industry and Trade. In August 2013, an amendment was made to Act No. 165/2012 (Act No. 310/2013 Coll.), which eliminated the feed-in tariff support scheme for all technologies except small hydropower since the end of 2013. New PV installations and biogas plants are only being supported if put into operation before 31 December 2013 (§ 4 par. 10 Act No. 165/2012).

- Green bonus: RES producers can select the premium rate option. RES operators receive this bonus annually or hourly, in addition to the regular market price of electricity. Operators that generate renewable electricity to cover only their own requirements are also entitled to a bonus payment. Solar and biogas plants are only eligible if they were commissioned before December 31, 2013. Wind, hydro, geothermal or biomass plants are only eligible if the building permit was issued before October 2, 2013.
- Subsidies: small hydro power plants, up to 10 MW, can receive subsidies under the Operational Program "Entrepreneurship and Innovation for Competitiveness" 2014-2020 (OP PIK).
- Tax regulation mechanism: RES operators are exempt from the real state tax.

As we can see, the Czech state is lacking in support schemes for utility size RES installations and as seen in figure 3, the effect has been that the installed capacity has stagnated for the better part of the last decade. Here we can see the reactiveness of the industry to lack of supportive legislation.

Technologies for Renewable Energy in Austria

Most of the electricity in Austria, 60%, is generated by hydropower. There are 150 large-scale and around 3000 small-scale hydropower plants. These small hydropower plants are the most efficient thermodynamic way to produce electricity. Austria is the number one country in Europe with the utilization of hydropower. These power plants are money makers in Austria since this industry alone generated 2 billion euros in 2016. Also, a lot of solutions for hydroelectric power plants are implemented worldwide by Austrian companies.

Solar energy is a big deal in Austria. From 2002 to 2010, the annual production of solar collectors increased almost four times. By the end of 2014, 3616 of thermal output was generated from clean solar energy. Innovation is a plus-energy building; a building that supplies energy for basic functions, such as heating, cooling ventilation, and lighting. One of the buildings of TU Vienna is an example of the Plus-Energy Office High-Rise Building which also supplies enough energy for the work of computers, printers, phones, etc. This was a real challenge since the building is 11 stories high, and generally, it is harder for the taller buildings to produce enough energy as proportionally less surface area is available for the production of energy concerning a given level of energy consumption. The roof and two facades of the building are equipped with PV panels, making this the largest PV plant ever integrated into a building in Austria. The total capacity is 328.4 kWp, with a total area of 2199 m^2. Lift is used to improve energy balance. When lift brakes drive functions are used to convert the kinetic energy of lift cabin into electricity. If there is still insufficient energy, then power can be drawn from the grid. When it comes to heat, this can be provided by waste heat from the server room. For cooling the heat from the server is released via two-hybrid cooling towers. The building also has an automatic night ventilation system which helps to cool the building down.

The generation of electricity through PV systems was 40 GWh in 2009. In 2017 the generation reached the amount of 1269 GWh. Also, CO_2 emissions were reduced by 920653 tons with the help of PV systems. This is a growing industry in Austria, as one Austrian company provided panels for the generation of solar energy for the Beijing Summer Olympics. Another company has exported over 85% of solar collectors to more than 40 countries worldwide.

Wind energy in Austria also shows an increasing trend; in 2009 1954 GWh of electricity was generated through wind power, in 2017 this number has increased to 6574 GWh. There is a total of 1260 wind power plants in Austria, which are providing electricity of 1.75 million households. Interestingly, every second turbine in the world is equipped with Austrian technology. Because of wind energy, Burgerland is energy self-sufficient since 2013.

Yet another positive trend is seen in bioenergy. This is the most important renewable energy source, which has a 59% share, which makes it a third most used source for electricity production, right after wind and hydropower. Innovations are implemented in this industry as well. Austrian company built the first commercial biodiesel plant which converts different raw materials into biodiesel. The raw materials include vegetable oils, animal fats, and used oil for cooking. Vienna University of Technology is developing process that would generate electricity and heat form residues of olives. Also, one of the Austrian companies is one of the biggest producers of pellet heating systems in Europe.

Nuclear Ban in Austria

Austria has one nuclear power plant located in Zwentendorf near Vienna. The power plant is completely built; however, it was never put into operation. Because of the oil crises in 1973 and growing energy consumption, the Austrian government decided to strengthen the nuclear stance. Besides this one, two more nuclear reactors were planned to be built, but the construction of the two never started, as a strong anti-nuclear movement developed during the 1970s. This movement started with small protests when Switzerland planned to build a nuclear reactor near the Austrian-Swiss border in the early 1970s. These small-scale protests developed into a national movement, with over 8000 activists protesting near Zwentendorf plant in June 1977. This led to a referendum on banning nuclear power. Since the majority of votes were against nuclear power, the government passed a law by which is forbidden to use nuclear power for energy generation. Zwentendorf power plant is still on its site, and it is used as a filming setting for movies, TV shows, or commercials. However, it got a new purpose in 2009 when a PV plant was built on the roof of the outer part on the plant. These solar panels provide 180000 kW of electricity per year on average. The initial nuclear plant would have provided 732 MW of electricity, which is enough electricity for 1.8 million households.

Resource availability in the Czech Republic

The Czech energy matrix is heavily reliant on coal as shown in figure 5. What is harder to see is if this capacity can be substituted either fully or partially by RES. Leaving aside the intermittent nature of photovoltaic and wind energy, leaves the inherent geographical constrains tied to RES. The RES potential is limited by the natural conditions of the Czech Republic such as: climate, geology and soil. Also, environmental protection requirements like soil, water, landscape character, flora and fauna limit the RES development.

Table 1: Estimated available energy sources

	Fossil fuels			Nuclear	Renewables	
	Solid	Liquid	Gas	Uranium	Hydro	Other renewable
Total amount in specific units*	1051.8 kt	1664 kt	4660 mil. m^3	338 t	1.8 TWh	49 TWh
Total amount in exajoules (EJ)	0.6898	0.,3858	0.3389	0.3436	0.006 EJ	0.2 EJ

Source: IAEA

As we can see form the Table 1. Not even using the whole estimated available resources could meet the Czech electricity demand (~61 TWh in 2017 leaving aside electricity exports). This leaves the Czech Republic in a situation where a not even maximizing the exploitation of the renewable sources can guarantee the security of supply, which is the energy's sector main directive. This can be a decisive factor that can steer the future of RES development within the country.

Future Plans for Renewable Electricity in Austria

EU climate and energy targets for 2030 have already been set; reducing greenhouse gas emissions by at least 40%, increasing energy efficiency by at least 32.5%, increasing the share of renewable energy to at least 32% of EU energy use and guaranteeing at least 15% electricity inter-connection levels between the neighboring Member States.[4] The goal for Austria concerning renewable energy is to have a 100% renewable electricity system by 2030. This ambitious plan provides opportunities for interactions with energy efficiency and energy security. Austria also provided a range of shares for renewable energy of ross final energy consumption in 2030, which is from 45% to 50%. Additionally, a range was provided for energy efficiency, which is based on the optimistic and pessimistic forecast, which is 30% and 25% in 2030. Energy security is also important for Austria, as there is a need for an increase in storage capacity for gas and electricity. Experts in Austria focus on smart grids and have a goal to install smart meters in 80% of households in Austria.

[4] *Integrated National Energy and Climate Plan for Austria*. Federal Ministry for Sustainability and Tourism, December 2019

Future Plans for Renewable Electricity in the Czech Republic

As of the writing of this paper, no evidence was found that the Czech Republic has updated its renewable energy goals. Taking in count the analysis mad in this paper, and the current political panorama, RES development will continue to be stagnated in the country for the foreseeable future. Even though that some roof and Façade solar installations are being built, their size and the popularity its not enough. The government and the citizens have both lost fate on renewable energy and start to consider ever more strongly to expand the existent nuclear park.

Res development in Czech Republic can help diversify the energy matrix and be less and less dependent on coal and Russian fossil fuel imports. These two improvements alone should be motivation enough to jumpstart the Czech RES support schemes and earn the favor of the citizens.

References

"Austria." *100% Renewable Energy Atlas*, 3 Sept. 2019, www.100-percent.org/tag/austria/. 08. May 2020

Austria - A Global Leader in Green Technologies. Federal Ministry of Science, Research and Economy, May 2017.

Buchanan, William. "Zwentendorf and the Austrian Anti-Nuclear Movement." *Stanford University*, 6 Feb. 2019, http://large.stanford.edu/courses/2018/ph241/buchanan2/. 02. June 2020

"*Energy Strategy*." *energy-innovation-austria*, www.energy-innovation-austria.at/article/energy-strategy/?lang=en. 28. May 2020

France-Presse, Agence. "All Electricity in Austria's Largest State Now Produced from Renewables." *The Guardian*, Guardian News and Media, 6 Nov. 2015, www.theguardian.com/world/2015/nov/06/all-electricity-in-austrias-largest-state-now-produced-from-renewables. 08. May 2020

Gómez, L., 2019. *Renewable Energy in Austria*. https://www.wko.at/service/aussenwirtschaft/2_BARRETO.pdf

"National Energy Action Plan of Austria." *Eurosolar EN*, www.eurosolar.de/en/index.php/sections-eurosolar/austria-eurosolar-sections/780-national-energy-action-plan-of-austria. 07. May 2020

"Renewable Energies in Austria." *Invest in Austria*, https://investinaustria.at/en/sectors/environmental-technologies/renewable-energies.php. 31. May 2020

"Renewable Energy in Austria." *Wikipedia*, Wikimedia Foundation, https://en.wikipedia.org/wiki/Renewable_energy_in_Austria. 18. March 2020

Sternkopf, Tim. "Feed-in Tariff (ÖSG 2012)." *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/single/s/res-e/t/promotion/aid/feed-in-tariff-green-electricity-act/lastp/94. 20. Apr. 2020

Sternkopf, Tim. "Promotion in Austria." *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/tools-list/c/austria/s/res-e/t/promotion/sum/91/lpid/94/. 20. Apr. 2020

Sternkopf, Tim. "Subsidy I (Investment Subsidy for Hydro)." *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/single/s/res-e/t/promotion/aid/subsidy-investment-subsidy/lastp/94/. 20. Apr. 2020

Sternkopf, Tim. "Subsidy II (Investment Subsidy for PV on Buildings)." *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/single/s/res-e/t/promotion/aid/subsidy-ii-investment-subsidy-for-pv/lastp/94/. 20. Apr. 2020

Sternkopf, Tim. “Subsidy III (Investment Subsidy for Offgrid Installations).” *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/single/s/res-e/t/promotion/aid/subsidy-ii-investment-subsidy-for-offgrid-installations/lastp/94/. 20. Apr. 2020

Sternkopf, Tim. “Subsidy IV (Investment Subsidy for Small PV).” *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/single/s/res-e/t/promotion/aid/subsidy-iii-investment-subsidy-for-small-pv/lastp/94/. 20. Apr. 2020

Sternkopf, Tim. “Subsidy V (Investment Subsidy for PV Installations in the Agricultural and Forestry Sector).” *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/single/s/res-e/t/promotion/aid/subsidy-v-investment-subsidy-for-pv-installations-in-the-agricultural-and-forestry-sector/lastp/94/. 20. Apr. 2020

Sternkopf, Tim. “Successive Rate to the Feed-in Tariff (Biogas).” *RES LEGAL*, 18 Dec. 2018, www.res-legal.eu/search-by-country/austria/single/s/res-e/t/promotion/aid/successive-rate-to-the-feed-in-tariff-biogas/lastp/94/. 20. Apr. 2020

“There Is a Nuclear Power Plant in Austria That Has Never Been Used.” *ECHOES*, 27 June 2017, www.echoes-project.eu/news/there-nuclear-power-plant-austria-has-never-been-used. 02. June 2020

Valach, Boris. “Legal resources on renewable energy.” RES LEGAL, 10 Jan 2019, http://www.res-legal.eu/search-by-country/czech-republic/summary/c/czech-republic/s/res-e/sum/120/lpid/119/

Habadová, Silvia. “Country Nuclear Power Profiles 2018 Edition” IAEA, 2018, https://www-pub.iaea.org/MTCD/Publications/PDF/cnpp2018/countryprofiles/CzechRepublic/CzechRepublic.htm

“National Energy Action Plan of Czech Republic.” *Eurosolar EN*, https://www.ebb-eu.org/legis/ActionPlanDirective2009_28/national_renewable_energy_action_plan_czechrepublic_en.pdf

OECD. “Fossil fuel support country note” OECD April 2019, file:///C:/Users/Arturo%20Montes%20de%20Oca/Downloads/EN_CZE_Country_Brief_Apr2019%20(1).pdf

ERU. “Yearly Report on the Operation of the Czech Electrical Grid 2017”, 2017, https://www.eru.cz/documents/10540/4580209/Yearly_report_electricity_2017.pdf/a4042a98-8750-4524-bb3c-f172ecba2f3b