RENEWABLE ENERGY AUCTIONS IN KAZAKHSTAN: DESIGN ELEMENTS AND ATTRACTIVENESS

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Abstract

The thesis is focused on analyzing renewable energy auctions held in Kazakhstan. More specifically, on their role in the energy policy of the country and the attractiveness of specific design elements for project developers. Since Kazakhstan introduced the renewable energy law in 2009, the country changed the support scheme several times. In 2013 feed-in tariffs were introduced, while in 2016 their annual indexation was allowed. Realizing that overinvesting can take place, the country switched support scheme to auctions in 2017 and held the first round of auctions a year later. Auctions provide the government with more control over the volume amounts, project location and renewable energy type choice. The project developer who suggests the lowest price for the energy produced gets the project, which results in lower investments driven by targeted optimization. The research question is whether this switch was justified and if so, to what extent are the auctions attractive and driving competition among the project developers. Four years of auctions provided insights about the attractiveness of the design element given the volume demanded by the potential project developers and the degree of price reduction driven by the bidders. The auction format and design elements were evaluated in comparison to the alternatives in other countries. The auction results were analyzed in accordance with the degree of price reduction and the mismatch between the supply and demand. The prices were reduced in each renewable energy type, except for bio power plant projects, but the main reduction is seen in the first auction and then price is similar in consecutive auctions. Higher volume demand was evident in some types of renewables, so it is recommended to use multi-criteria volume selection method. Specific suggestions were also made in terms of the design improvement for providing better pre-conditions that should attract more participants and possibly result in even lower bids. The analysis and suggestions were made in attempt to assist in reaching the renewable energy targets of 50% by 2050 stated in the national documents.

Acknowledgements

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Renewable Energy Auctions in Kazakhstan: Design Elements and Attractiveness

Introduction

Today climate change is a well-recognized problem worldwide and a lot of things will depend on countries' ability to shift their energy production to environmentally sustainable sources to limit global warming to well below 1.5°C (IPCC 2014). The figure 1 below shows that the main sector greatly contributing to greenhouse gas emissions in the world is electricity and heat production and the trend has been increasing: if in 1990 the contribution of this sector was 8.5 billion tonnes, in 2018 it amounted to 15.59 billion tonnes.

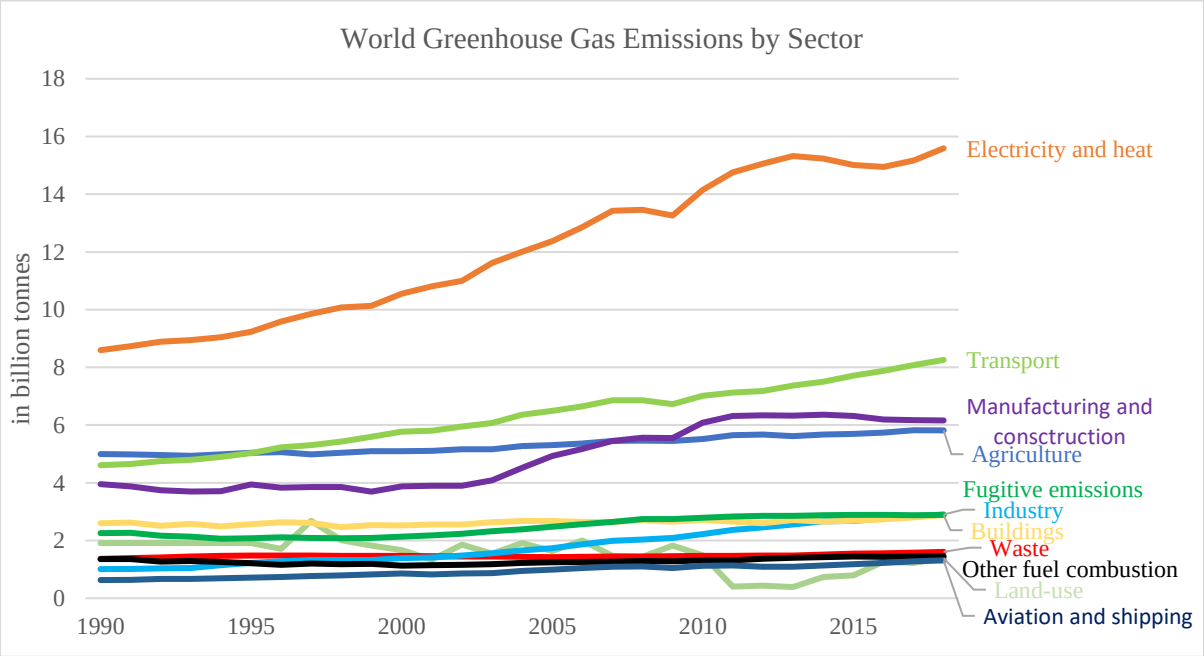

Figure 1: World Greenhouse Gas Emissions by Sector. Source: Our World in Data 2022

Electricity and heat production in Kazakhstan is also the main contributor of greenhouse gas emissions as it is highly dependent on non-renewables. Kazakhstan today is a large oil and coal extracting country, and it is easier to produce electricity and heat from these non-renewables compared to renewable energy sources (hereinafter, RES), because of the comparative advantage arising from the abundance of the former and the old infrastructure which is based on burning non-renewables. As energy and heat production is the biggest contributor, the aim of shifting energy production to RES is written in the long-term national

plan of the country and will require significant investments (Conception of green transition until 2050 (2013)). The motivation of reducing political dependency on oil exporters globally is also arising (Acevedo and Lorca-Susino 2021). Therefore, it is also important to diversify the energy and electricity production sources in the country.

The country has cut direct consumer subsidies for energy, but indirect and implicit consumer support is still present. These market distortions have negative impact in both environmental and socio-economical point of view (Kalkabayeva 2020). The country was ranked 18th according to per capita CO2 emissions in 2018, which is 12.06 metric tons per capita (The World Bank 2018). Despite that RES (solar and wind power) have high potential in Kazakhstan, the country is still under carbon lock-in situation. Kazakhstani case would highly depend on the success of governmental activities in creation of good preconditions for attracting investments to develop RES infrastructure.

The policy to support RES infrastructure development should also be optimally structured in order not to endanger the population and the economy. Kazakhstan introduced feed-in tariff scheme in 2013 in order to support investors in RES, but then changed the support scheme to auctions (also called tenders) in 2017. There were also amendments in 2013 to the Energy Law, introduced in 2009 (Mouraviev 2021), which also brought uncertainty to the investment climate.

Under auction scheme certain capacity is auctioned based on the lowest possible price per unit of electricity. In other words, auction participants submit bids with a price per unit of electricity at which they will be able to realize the project. The reason for the shift towards auctions was that under feed-in tariff scheme, Kazakhstan did not limit the volume of RES eligible for support at first, creating the risk of overinvesting (Boute 2020). There was no mechanism to have the amount of investment under control and no differentiation of support based on regional differences. It also did not allow Kazakhstan to benefit from rapidly falling

costs for solar and wind technologies. Although the introduction of online and unilateral auction mechanism in 2017 was expected to solve those issues in theory, the real effect of this policy in Kazakhstan is yet to be studied as auctions performance differs across countries due to the country specific circumstances and the flexibility allowed in the auction design. Countries like Germany, Spain, Mexico or Zambia have been introducing it comparatively recently, while the study analyzing Brazil, France, Italy and South Africa showed some country-specific differences in effectiveness of some design elements despite showing the reduction of prices in general (Bayer et al 2018). Moreover, support mechanisms need continuing adaptation and stable investment environment should be maintained.

Despite the superiority of the auctions to feed-in tariffs in this sense, the performance of this policy differs across countries, partly because of the local market and legal specificities as well as the differences in auction design in particular country. Bayer et al. made comparison between tender results in Brazil (wind), France (PV), Italy (wind) and South Africa (wind and PV) (2018) and commented that the prices have been falling steadily in each country, but some factors like exchange rate and auction design elements like deadlines, renumeration logic (MW or MWh), penalties, responsibility for grid connection, technological requirements, RES potential, financing opportunities and infrastructure are very important; Pablo del Río (2017) analyzed various RE auction designs across countries and commented on the effectiveness of different design elements; a study by del Río and Linares (2016) showed that auctions result in comparatively low renumeration rates, but usually have low completion rates, which is the case in Brazil, Ireland, Portugal, Peru and United Kingdom.

The aim of my thesis is to evaluate the performance of the RES auctions held in Kazakhstan with regards to price reduction and attracting investors, to assess whether the design features follow the best-known practices that ensure competition among bidders and

finally, give policy recommendations for policymakers on auction design improvement and organizational matters. First, the energy transition plans of the country will be discussed together with the up-to-date results. Second, the role of RES auctions in this plan will be investigated. Third, current design features will be assessed in comparison to other alternatives in order to evaluate the attractiveness for investors and the government aiming to reach the targets stated in transition plans. Fourth, auction results in Kazakhstan will be analyzed. As first RES auction in Kazakhstan was announced in February 2018 and the completion of the projects is still underway, the emphasis will be put on the auction participants and their bids as to what extent they have lowered the electricity price generated by RES. Obviously, it is not fair to say that this is only due to auctions as an econometric analysis considering several factors would be necessary, but this policy provides an opportunity for the government to reduce price based on market demand and still retain control over the location and project sizes. The attractiveness for the investors basically should represent the market demand. Finally, policy recommendations will be given based on the analysis of the performance and auction design considerations.

Chapter 1: Renewable energy prospects in Kazakhstan and transition plans

Kazakhstan as a member of many international organizations has also declared its willingness to participate in stabilizing greenhouse gas emissions that will prevent the global temperature from dangerous 1.5°C above pre-industrial levels (Gao et al 2017). Kazakhstan ratified the United Nations Framework Convention on Climate Change (UNFCCC) in May 1995, the Kyoto Protocol in March 2009, the Paris Agreement in August 2016 (Kalkabayeva 2020). The main documents in the country addressing the structural change in the economy for reducing greenhouse gas emissions is the Kazakhstan's Conception of green transition until 2050 (2013) and the Law on Support the Use of Renewable Energy Sources (2009).

The steps to join the worldwide movements aiming to prevent global warming though tackling dangerous anthropogenic interferences represents Kazakhstan's stance of a supporting party despite being a major producer of fossil fuels. The ongoing developments of strategic documents on green transition until 2050 and national plan for adaptation to climate change are expected to stimulate the transition process. The targets for the RES in total energy shares are 3% by 2020, 10% by 2030 and 50% by 2050 (The Concept of Transition towards Green Economy until 2050, 2013). Nevertheless, the energy mix previously did not show much diversification.

The energy demand of Kazakhstan is only ½ of the total energy production in the country. The energy mix of the country in 2018 approximately consisted of 50% coal, 25% oil and 25% natural gas (Statistics Committee 2021). High dependence on non-renewables will probably have severe consequences on environment, public health, and the economy due to the lack of diversification.

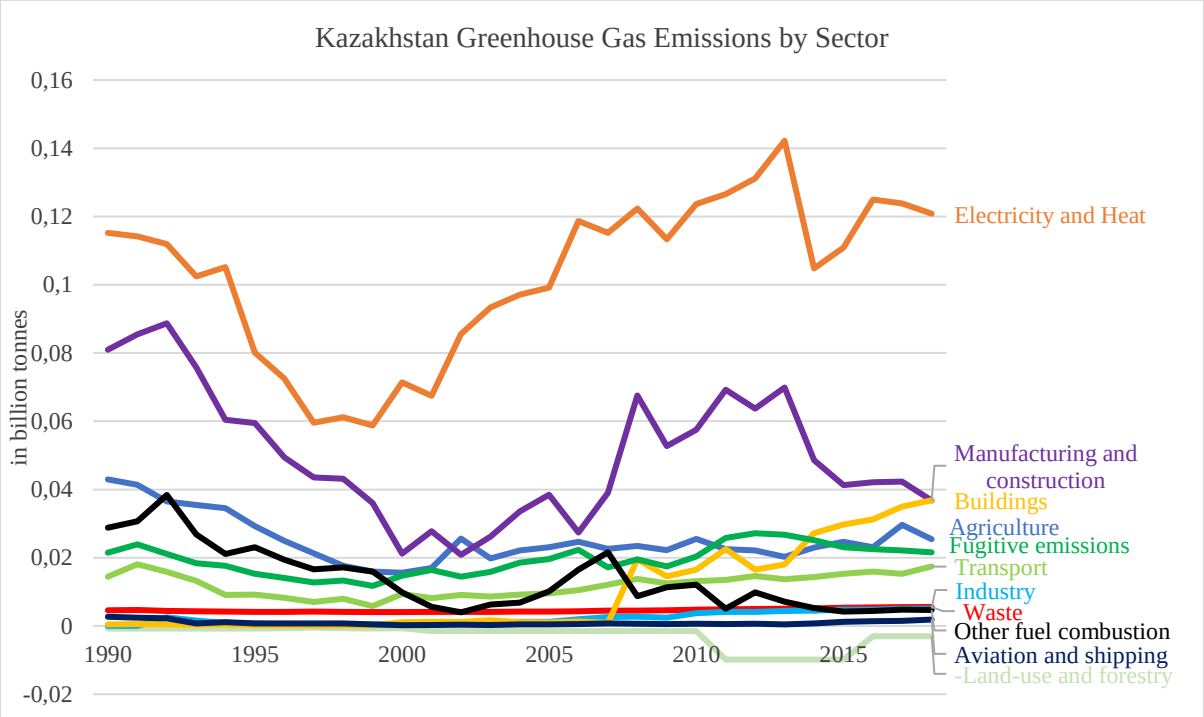

Figure 2: Kazakhstan Greenhouse Gas Emissions by Sector. Source: Our World in Data 2022

Similarly to the global figures, the figure 2 above shows that the main sector which produces highest greenhouse gas emissions in Kazakhstan is electricity and heat production. If in 1990 the contribution of this sector was 0.11 billion tonnes, it decreased down to 0.05 billion tonnes in 1999 due to economic downturn and power market transformation, and has been increasing since then and peaked at 0.14 billion tonnes in 2013. Compared to the increasing global figures, the fluctuating nature of emissions in Kazakhstan that have not exceeded 0.14 billion tonnes, could be reduced by substituting the electricity and heat production technology by greener alternatives, especially in warmer regions. The electricity in the country is mainly generated from coal and natural gas, 81% and 9% respectively. The rest is generated from RES. Currently it is mainly hydropower (around 9%), but since 2011 the share of wind and solar power plants has been slowly increasing.

The transition in Kazakhstan will require a structural change and it is important to take into account local specificities as well as the international experience. While the issue of consumer energy support in Kazakhstan and the need for the transition towards green economy will require important reforms in the direction of discarding the sources of emission, there is also a need for a green substitution of energy sources. The current usage of RES in Kazakhstan that could serve as an alternative is very low despite high potential and will require significant investments (Conception of green transition until 2050). The crucial role in attracting green investments is played by governmental policies and activities performed in supporting green transition.

The law No. 588-II ‘On Electric Power Industry’ (the “Electric Power Law”) passed in 2004 was the completion of transformation of power market from the post-Soviet era to the modern power market system (Koulouri and Mouraviev 2018). Due to this transformation, today the number of private market players, i.e. independent power producers (IPPs) is increasing. Power generation, transmission and distribution are now separate operations and

are open to foreign investors as the licensing system is cancelled. Public-private partnerships are also possible. The national electricity market system is under direct management of the Ministry of Energy, which controls its establishment and operation. Transmission and distribution services are for the most part provided by Kazakhstan Electricity Grid Operating Company ("KEGOC").

Currently, there are 134 operating RES projects with total capacity of 2010 MW (The Ministry of Energy of the Republic of Kazakhstan 2021). Wind Power Plants (WPP) have 684 MW capacity, Solar Power Plants (SPP) - 1038 MW capacity, Hydro Power Projects (HPP) – 280 MW and Bio Power Plants (BioPP) constituted 8 MW capacity. The development dynamics of the total capacity as well as the yearly increase in the number of facilities can be seen in the figure 3 below. While in 2014 there were only 26 renewable energy facilities in Kazakhstan with only 178 MW of installed capacity, at the end of 2020, there were 115 operating renewable energy facilities in Kazakhstan with total installed capacity of 1634.7 MW. The projection to 2025 is no less than 3000 MW. Despite this positive dynamics of increasing total capacity of RES, only 4,2 billion kWh of electric energy was generated by RES projects in 2021, while the total amount of electricity generated in the country was 114.3 billion kWh.

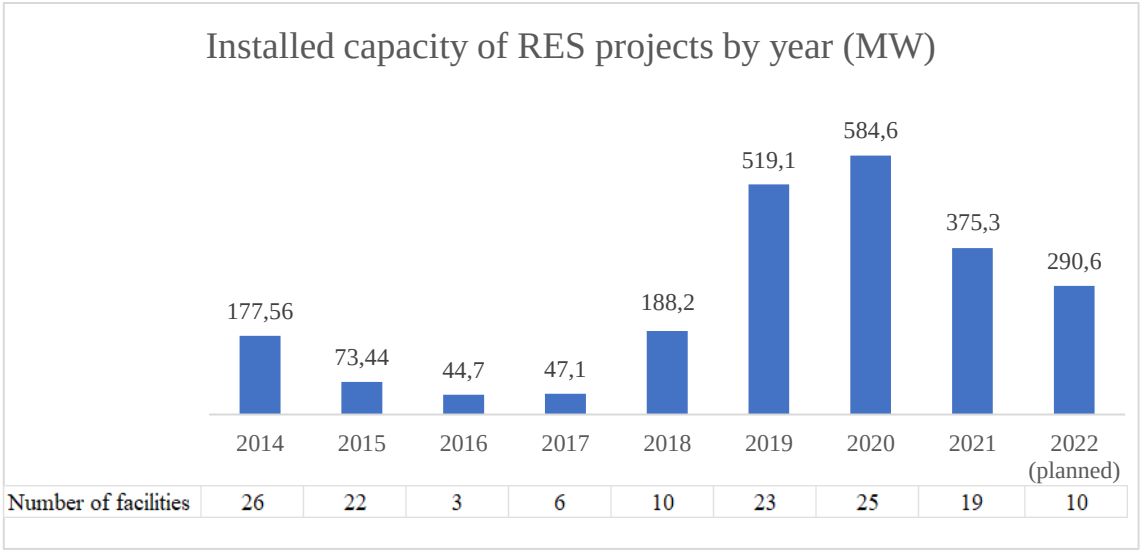

Figure 3: Installed capacity of RES projects by year in MWs. Source: Ministry of Energy of the Republic of Kazakhstan

As one can see, the shares of renewables in total electricity production in the country is very low. The figure below represents the dynamics of change of the shares of wind and solar power plants in total electricity production between 2015 and 2019:

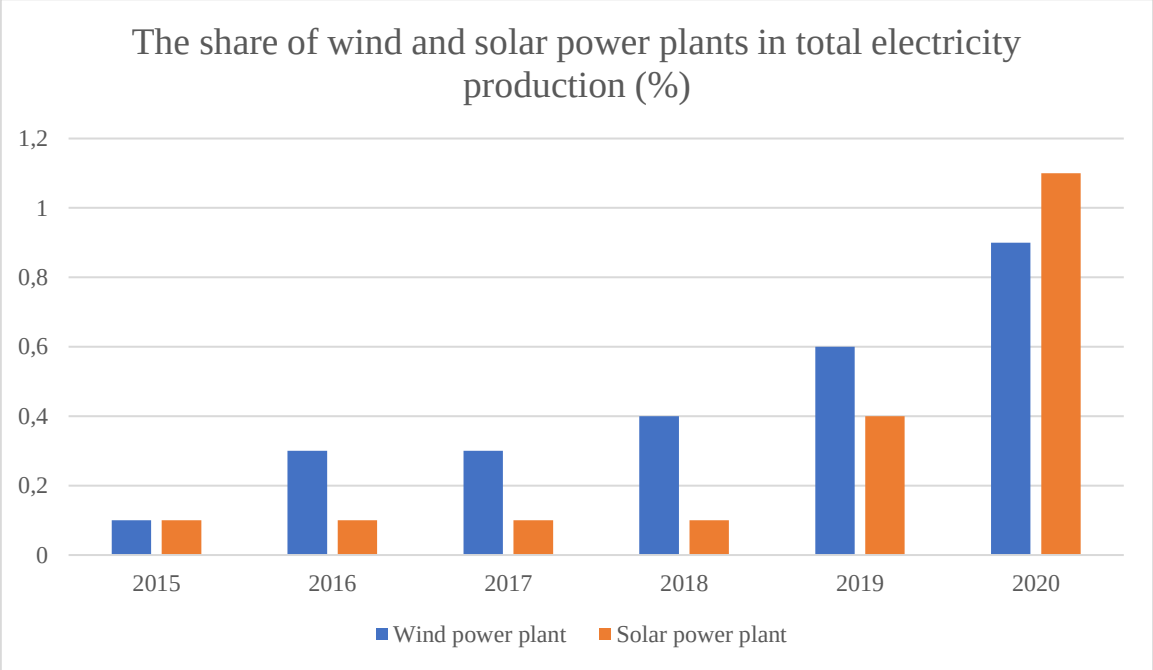

Figure 4: The share of wind and solar power plants in total electricity production. Source: Bureau of National statistics 2022

The increase in the share of wind and solar power plants between 2015 and 2020 is around 0.8%, and 1% respectively. Despite recent positive dynamics, these are comparatively very low increase, taking into account the potential of RES in Kazakhstan. First, the wind power has significant potential in Kazakhstan as wind speeds of 4-6 meters per second at an elevation of 30 meters is typical in around 50% of the country with an estimated potential of around 760 GW (Karatayev and Clarke 2014). Second, the number of solar hours in the country is 2,200-3,000 per year, allowing the production of 1300-1800 kW/m² annually (Karatayev and Clarke 2014). Despite the high potential, current reality with underdeveloped RES infrastructure and high dependance on export of non-renewables puts Kazakhstan under carbon lock-in situation.

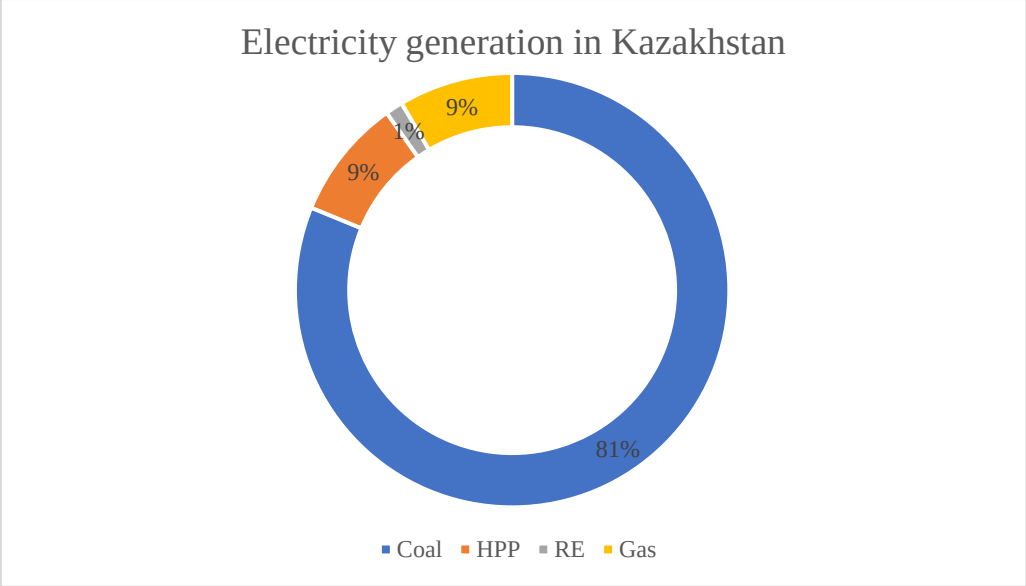

Figure 5: Electricity generation in Kazakhstan. Source: Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan 2021

Taking into account comparatively small population density of 7 per km^2, the emission per capita of 12.06 metric tons (The World Bank 2018) is also a worrisome figure. The main component of this figure are the greenhouse gas emissions generated from the combustion of non-renewables. Due to small and slow progress in switching towards renewables, Kazakhstan was ranked to be the worst performer (64^{th} in the list of 64 countries) according to the climate change performance index (New Climate Institute 2022).

The need for committing to international agreements, resolving the dependance of the energy prices on market fluctuations as well as the main benefits of the transition such as avoidance of climate impact, improvement of air quality, job creation, provision of energy access should further drive Kazakhstani energy transition. However, the evidence has shown that geopolitics of renewables is still a geopolitics of oil and gas (Koch and Tynkkynen 2021). Political and financial elites are shortsighted in prefering quick returns on their investments.

Kazakhstani case would highly depend on the success of governmental activities in creation of good preconditions for attracting investments. The most important assisting party

in energy transformation is the European Bank for Reconstruction and Development (EBRD), who also worked with the government in introducing the first legal framework in 2009 - Kazakh renewable energy law (Koch and Tynkkynen 2021). This was insufficient as the law lacked regulatory component and the lack of support scheme for renewables, which simply were not able to compete with traditional energy sources with low electricity prices driven by the state support. EBRD's legislative support allowed the introduction of new tariff system in 2013, guaranteing the competitive market for RES for 15 years, exempting producers using RES from transportation costs, and establishing the "Financial Settlement Center of Renewable Energy", which was supposed to purchase and sell renewable energy generated by renewables. EBRD was also a big finance provider of most of Kazakhstan's large-scale RES projects.

According to the Conception of green transition in Kazakhstan until 2050, it is expected that the volume of annual investments on green technology should be 1-1.8% of GDP, which is $3-4 billion (2013). The biggest portion of the yearly investment (around 1.8% of GDP) is expected for years 2020-2024 (the Conception of green transition in Kazakhstan until 2050, 2013).

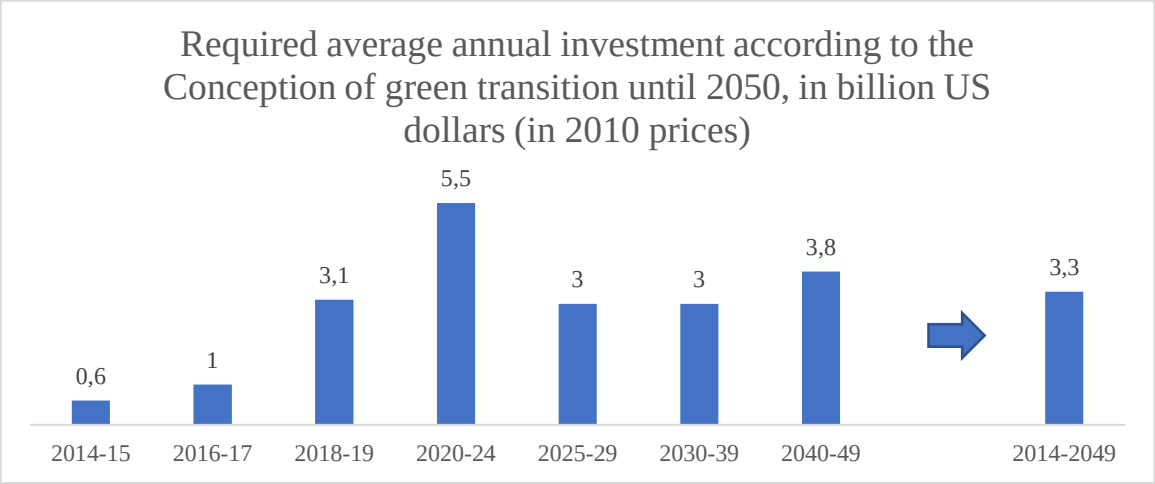

Figure 6: Required average annual investment by period in billion US dollars (2010 prices). Source: The Conception of Green Transition in Kazakhstan until 2050, 2013

The ambitious plan to produce 50% of energy through RES by 2050 might require even higher amounts. Although civil society organizations can have lobbying opportunities to promote energy transition, the possibility of being outnumbered by more powerful energy corporations is present (Nest and Mullard 2021). The possibility of corruption is also high, especially in the area of government expenditure (Kotchegura 2018).

Although governmental plans are generally characterized with the investment amounts counted as the percentage of GDP, the real amount depends on the performance of the economy (GDP) and the source of these investments are usually left open. In the case of Kazakhstan, it is said that majority of this money is to be attracted from private investors after 2024 (the Conception of green transition in Kazakhstan until 2050, 2013).

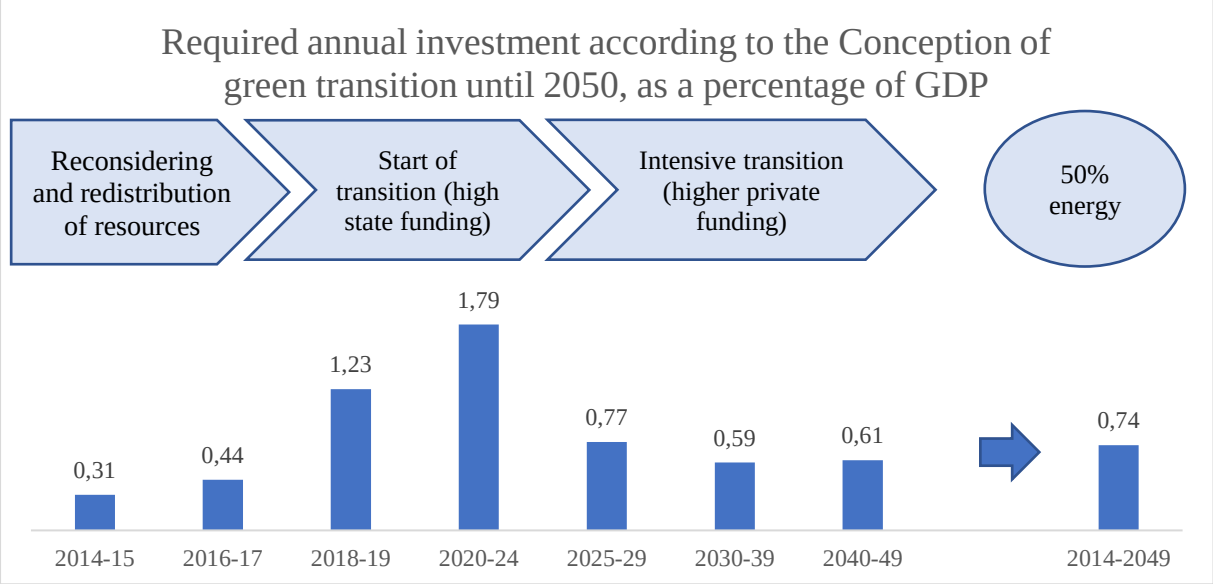

Figure 7: Required annual investment by period, as a percentage of GDP. Source: The Conception of Green Transition in Kazakhstan until 2050, 2013

75% of total investments is to be spent on improving efficiency and development of RES and gas infrastructure. Although burning gas still produces CO_2, moving to gas from coal is expected to significantly reduces the emission amounts. These activities require the major part of financing and to be provided by the government. The advantage of the governmental participation in infrastructure formation is the emergence of new jobs in mostly

skilled labor. Moreover, the plans target the major sectors of greenhouse gas production, which should have an effect on the emission performance (see figure 7 below).

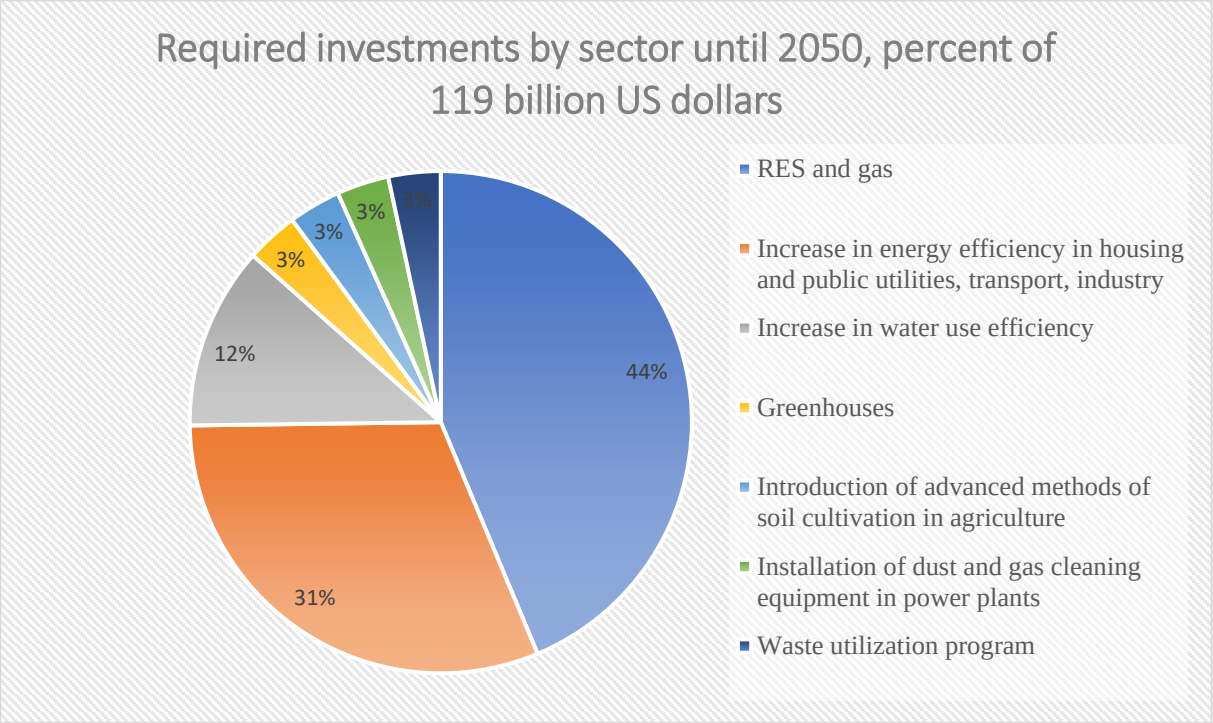

Figure 8: Required investment by sector. Source: The Conception of Green Transition in Kazakhstan until 2050, 2013

However, comparison of real investment to the required amounts shows rather pessimistic insights. The figure below presents the investment amounts in tenge until 2020:

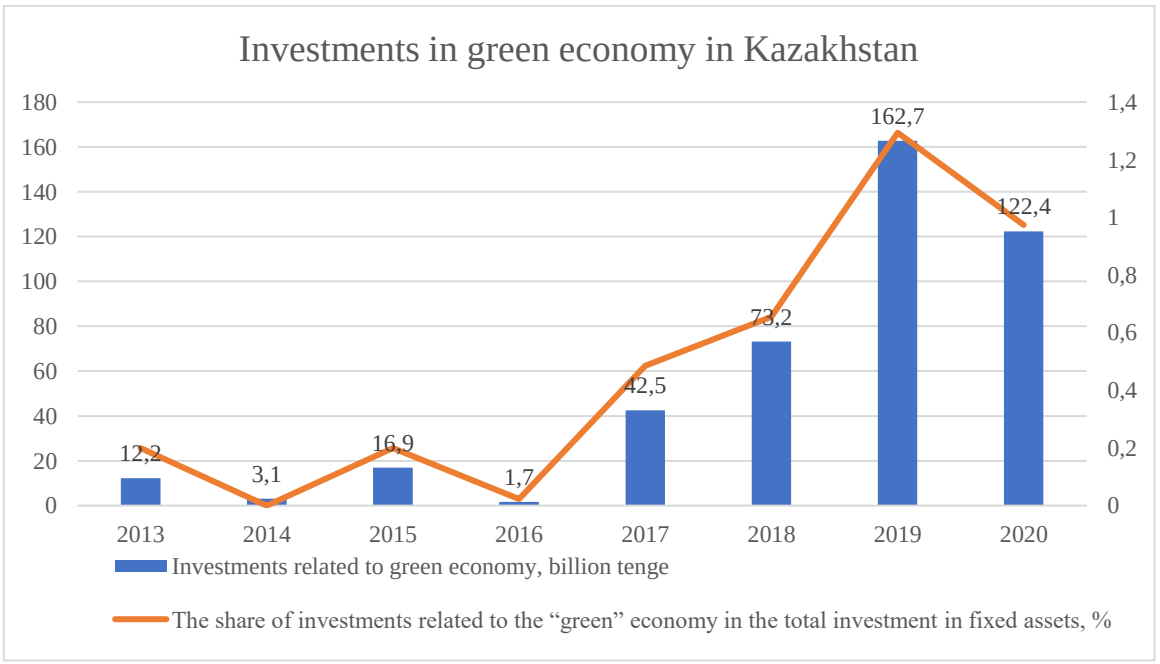

Figure 9: Investment in green economy in Kazakhstan. Source: Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan

The investments in green economy have been increasing since 2016 and it peaked in 2019 reaching 162.7 billion tenge, which was 1.29 % of the total investment in fixed assets. It is seen that important work of attracting investments has been made, but in 2020 there has been some decrease, which could be attributed to covid-19. However, in order to compare these amounts to the plan written in the Conception of Green Transition, which was also given in figure-6, these investment amounts were converted to US Dollars in 2010 prices (av. 1USD= 147,78KZT) and the figure-10 below was constructed to show that the country is lagging in terms of investments.

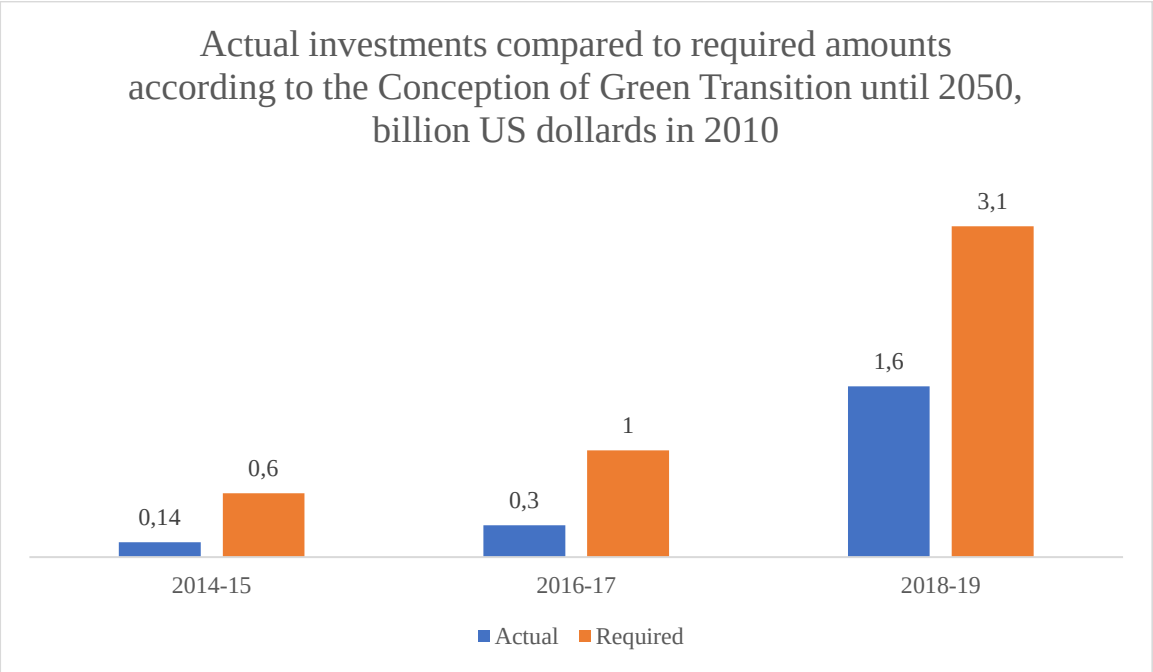

Figure 10: Realized investment compared to required investment. Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan; The Conception of Green Transition in Kazakhstan until 2050, 2013

It is clearly seen that the actual amounts are much lower than the required amounts in each period. The actual amounts are increasing, but the difference from the required amounts is widening. While the difference between actual and required investment in years 2013-15 is around $460 million, the difference in years 2016-17 and 2018-19 is around $700 million and $1.5 billion, respectively. The issue of investment attractiveness of RES market in Kazakhstan should be addressed with proper policies. Moreover, potentially lower amounts of investments should be properly optimized. Without such interventions, it is likely that the

transition to the 50% targets for RES in total energy shares will not be met by the year 2050 and there would be some delays unless something unexpected happens.

Chapter 2: Why Renewable Energy Auctions?

Generally, there are two broad categories of renewable energy support schemes by the government: Price and Quantity based instruments (Menanteau et al 2003). Price-based instruments usually take the form of investment subsidies or payments for the generated energy, while quantity-based instruments set minimum targets in the energy mix and hold certain parties responsible for achieving them. Auctions are hybrid instruments that involve both price and quantity in the design. As it was mentioned in the introduction, Kazakhstan introduced feed-in tariff scheme in 2013 in order to support investors in RES, but then changed the support scheme to auctions in 2017 and a year later had the first round of auctions.

Feed-in tariff is an example of the price-based instrument. It guarantees a fixed price for the energy fed into the grid. Until recently feed-in tariff model was one of the main support schemes for renewable energy projects. The renumeration payments are guaranteed to each operator of the renewable energy production if certain requirements and obligations are met, usually by long term contract. Administrative regulations determine the support amount under this model, and it is typically based on cost-based purchase prices.

One of the disadvantages is that electricity generated from RES under feed-in tariff scheme can end-up having higher price than electricity generated from fossil-fuels. The main advantages of this model are the simplicity and the ability of policymakers to customize the scheme to target specific technologies and some other sectors (e.g. farmers, households, etc.). Investors do not face significant risk under this scheme. Moreover, the entry of new players is incentivized and there is a production maximization incentive as well. However, there are

some disadvantages as well: mainly, there is no incentive to respond to market signals as they are absent, which results in market failures such as high utility costs for the customers. Moreover, detecting the most appropriate feed-in tariff amount and provision scheme could be challenging for each country. This support mechanism can also be very costly for the budget as each project qualifying is supported so there is less control over the installed quantity. Although they are highly attractive for investors, Boute (2020) argues that feed-in tariffs are paradoxical in that they also cause significant regulatory instability. Policymakers usually change the regulation of such schemes to avoid overcompensation and protect end-consumers. As a result, investors try to mitigate the risk of changing regulation by international investment protection treaties (Boute 2020).

Before explaining the advantages and disadvantages of RES auctions, it is worth to mention the renewable purchase obligations – a quantity-based instrument, which imposes a minimum quota for renewable energy share in the supply of each producer (Menanteau et al 2003). This instrument often accompanies renewable energy market where renewable energy certificates are traded.

The RES auctions are hybrid instruments to support renewable energy production, i.e. both quantity and price are determined in the price bidding process before the start of the project (Fitch-Roy et al 2019). It guarantees a stable revenue for the project owners and aims to meet of the renewable energy targets at the same time. However, it is impossible to ensure that the targeted expansion rates will be achieved, which is the potential disadvantage of this scheme. There is also potential risk of market concentration in the hands of competitive actors, who are usually big players, which might result in the market power and excessive rates of return (Kruger et al 2021). As there are relatively high costs associated with administrative procedures, it acts as a barrier for new and smaller players (Lucas et al. 2013). Additionally, there might arise the problem of delays and underbuilding, because of the

aggressive bidding in the auction. Excessive optimism and underestimation of financial aspects might be the causes of this aggressive bidding. The main advantages of auctions are the benefits of market competition such as cost efficiency and revelation true market price of technologies (Haufe and Ehrhart 2018). The competition associated with auctions creates cost pressure and lower the bidders' expectations on their returns, thus minimizing the support costs. Flexibility of control mechanism, cost-efficiency and price discovery possibility as well as the transparency makes auctions more attractive than feed-in tariffs.

The above-mentioned advantages and disadvantages of the auction scheme are not universal. The auction organizer can effectively avoid some of the drawbacks by altering the design of the auction, using combination of several design elements, which will be discussed in Chapter 3.

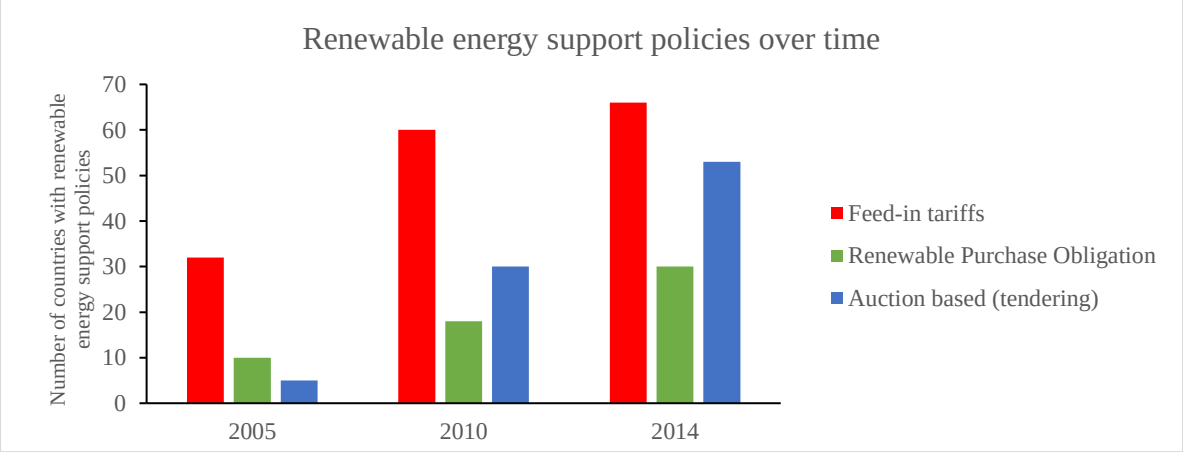

Figure 11: International trend in renewable energy support policies. Source: Wuester, H., 2016. Advanced Renewable Incentive Schemes, Berlin: IRENA.

With the increase of RES polemics, more countries have been introducing renewable energy targets – the number of countries that introduced at least one target rose from 43 in 2005 to 164 in 2015 (IRENA 2015). The figure above shows that feed-in tariffs used to be and remained in 2014 as the most widely used support tool, but auction-based models have been gaining more weight internationally and Kazakhstan was not an exception.

The first ever round of renewable energy auctions in Kazakhstan was from May 23 to June 7, 2018. Starting from November 2019, International Renewable Energy Agency (IRENA) is assisting in the selection of renewable energy projects using a market auction mechanism. Under feed-in tariff scheme, Kazakhstan did not limit the volume of RES eligible for support at first, creating the risk of overinvesting (Boute 2020). Investors in solar, wind and hydropower were expecting significantly higher revenues compared to existing coal-fired power plants. The established Renewable Energy Financial Settlement Centre (FSC) was expected to purchase all the electricity produced from RES (Boute 2020). The Financial Settlement Center is a subsidiary of the Kazakhstan Electricity Grid operating Company JSC (KEGOC) and serves the function of guaranteed offtaker and the single buyer of the electricity produced by the renewable energy (Boute 2020). It also makes financial settlement of imbalances. However, the purchases were financed by the power plants that use coal, gas, raw materials containing sulfur, oil products and nuclear fuel (so called conditional consumers) and there were no guarantees that payments will be provided because of the high risk of regulatory, policy and institutional change in Kazakhstan. Moreover, the feed-in tariffs were in local currency in 2014-2017, the years of high inflation and currency fluctuation. Investment climate was unstable and unpredictable (Boute 2020).

Renewable energy law as of April 2016 required annual indexation of RES tariffs to reflect inflation and this law became especially important in creating higher confidence of investors in the cases of inflation risk, which has been high (Boute 2020). Moreover, the Law guarantees the duration of the renewable energy tariffs for fifteen years and fixes the tariff amount as of the date of the agreement. Additionally, it makes sure that regulatory changes will not be applied for already completed agreements. Nevertheless, the indexation was 70% for consumer price index (CPI) and 30% for foreign currency exchange rate, which again

might repel some investors. As investors consider previous regulatory and institutional changes, the risk of judicial problems might also repel some investors.

The introduction of online and unilateral auction mechanism was expected to solve the issues associated with control mechanism and was expected to lower the price. Particularly, by providing the mechanism for limiting the capacity of new RES projects if there was an excessive and chaotic supply. The flexibility in this case is more about allocating support under market-based mechanism and limitation of the quantity of RES eligible to support and provision of locational signals (Boute 2020). Ministry of Energy could now determine the quantity of support on a yearly basis and projects had to compete in auction on revenue basis. This now allows the acceleration of the progress to meet the renewable energy targets and benefit from falling costs. The thermal producers are still required to buy the electricity produced from RES but are not participating in the auction. The bids, include the price per Kwh, the capacity of the project and the location. The control over location was provided by reserving land plots and grid connection points for the auction winners and the main criterion was the lowest price, which is also regulated by a cap. Auctions held in Kazakhstan are sealed-bid auctions – the bids are submitted directly to the organizer and kept undisclosed. The highest tariffs indicated as successful bids in previous round are used as the caps for the subsequent round. There was also additional attractiveness provided such as exemption from tax duties and value added tax on imported equipment and some state grants. KOREM JSC provides an electronic trading platform and acts as the auction organizer. By 2020 power purchase agreements for 2900 MW were signed by the offtaker, i.e. Financial Settlement Center (FSC).

It is clear that despite Kazakhstan has introduced the Conception of Green Transition until 2050 and renewing the electricity market, the policies supporting RES projects were not carefully planned, bringing regulatory instability and endangering investor confidence. The

previous contracts that were made before the introduction of the auction scheme were not affected, so that the judicial and arbitration proceedings were avoided. The replacement of feed-in tariff scheme with auctioning resulted in a significant reduction of the subsidy levels. However, the comparison of the total cost savings requires the calculation of all projects' electricity generated multiplied by the project specific prices. Boute calculated the 23% decrease in yearly costs (2020). The switch towards auction mechanism can be considered justified given the advantages of market signals and support control mechanism for the government. The next chapter will assess the design features.

Chapter 3: Auction design

There are different auction formats and designs, determining how they take place. Generally, there is no exact blueprint for good auction design (Gephart et al. 2017), but Kazakhstani case can be examined, and targeted improvements can take place. Renewable energy auctions held in Kazakhstan are sealed-bid auctions, where potential suppliers submit their bids directly to the organizer through online platform (Boute 2020). The potential supplier offers are kept undisclosed until the deadline to prevent players from benefitting from privileged information. Bidders offer their prices with the projected capacity. After the demand has been met, the bids are ranked in accordance with the prices they offered and the bidders within the ranked list of demanded capacity become auction winners. Obvious advantages of this format are the simplicity as it is straightforward, that player coordination is more difficult, that supply and demand curves are fully known. The disadvantages include inability of participants to react to market and it is not the best option in terms of transparency (IRENA 2015).

There are possible alternatives like auctions involving iterative process so that bidders gradually disclose their bids during the auctioning round. These types of auctions are called dynamic auctions and they can lead to better price discovery due to dynamic evolution of the

bids. However, evidence has shown that it is rarely the case in practice (IRENA 2015). More important issue for the organizer here is the possibility of strategical interaction that might lead to higher renumeration rates. The most common dynamic auction used for renewable energy auctioning is the descending clock auction, when starting renumeration is high and bidders offer volume they wish to provide at that renumeration (Haufe 2018). The auctioneer lowers the renumeration if the volume to be procured is lower than the cumulative volume offered. The bidders again have a choice to reduce volume or to stay with already declared one. The process stops when quantity to be procured matches the quantity offered and the winner is the participant still wishing to provide that volume.

There are also hybrid types like in Brazil, where descending clock auction is followed by sealed-bid auction (IRENA 2015). The idea behind this structure is the discovery of market price using the descending clock mechanism and then choosing the winner in a sealed-bid auction.

By choosing the sealed-bid auction format Kazakhstan decided to stick with the simplest format, reduce collusion as much as possible and have a proper understanding of the supply and demand for RES projects in the country. At the same time, this format is slightly worse in terms of transparency and does not provide bidders with the possibility to react. These drawbacks could be resolved by introducing the hybrid format. Nevertheless, current auction format could still be improved by altering the design.

According to Pablo del Río (2017), who analyzed various RE auction designs across countries, renewable energy auctions can be differentiated in the following design elements: volume, timing, diversity, participating conditions, support conditions (types and forms of renumeration), selection criteria, auction format, auction type, pricing rules, price ceilings, realization period and penalties. The design of RES auctions in Kazakhstan will be assessed

based on these features in accordance with some measures of effectiveness. One of those measures of effectiveness include static (allocative) efficiency, which is about reaching the target at lowest costs, which include generation costs, costs resulting from delays, back-up costs and grid related costs such as reinforcement or extension, distribution and congestion. The other measure of effectiveness is the dynamic efficiency referring to innovation and cost-reduction. Moreover, there are additional considerations such as money needed for support of technology, effect on value chain, employment, the diversity of actors and sociopolitical feasibility.

The Volume of an auction can be set in capacity (MW), generation (MWh), or budget and the choice among them should depend on the main aim of the organizer. If the main aim is to reach specific renewable energy targets, then setting generation-based volume target would be better as the other two options would make it more difficult. Nevertheless, capacity-based volume is a more widespread option, while budget-based one is least attractive one in this regard as it does not provide certainty on the amount of capacity installed and electricity generation. However, if the main aim is to minimize the support cost, then budget-based volume should be preferred, while capacity-based volume is the least attractive option in this case. It is also argued that the metrics used as the volume does not affect the realization of the project winning the auction. There are some advantages of each option such that generation-based volume makes it easier to manage the grid, while capacity-based one provides market signals for the manufacturers on future market sizes, providing opportunities for the innovational and supply chain improvements. Overall, if support cost is the main priority budget-based target should be chosen, if effectiveness, then generation-based, if local supply chain, then capacity-based (del Rio 2017).

In Kazakhstan the Ministry of Energy dictates the amount of installed capacity (MW) to be auctioned, which is the capacity-based volume option. While the development of local

supply chain and helping RES technology manufacturers could be an interesting option, it would be very difficult to compete with neighboring Chinese providers, who can offer cheaper and more competitive offers. Alcorta et al. argue that global competition for RES technology became so harsh that Chinese firms contributed to the bankruptcies in Germany (2021, 151). Although there is an option to require specific share of the total volume to be developed through locally manufactured equipment, there is no such requirement in Kazakhstan, so that the auction winners can stick to their own providers. Therefore, based on international experience and national plan for green transition described in the previous chapter, the option with volume seems to be a better option, which can better accommodate the aim of reaching specific renewable energy targets.

It is also very important to set the appropriate volume amount as setting it too high would most likely result on lack of competition and high bids, while setting the volume amount too low would result on more aggressive bidding, underbidding and ineffectiveness (del Rio 2017). The problem of high bids can be solved by using price ceilings. Moreover, the problem of aggressive bidding, underbidding and ineffectiveness associated with low volume amounts in an auction round could be addressed by using specific design elements that can lower the competition. Too large volumes are also not good in terms of static efficiency (reaching the target at lowest generation costs) and support cost. In South Africa, for example, there was not any capacity limitation in the first round other than 3725 MW target for the whole five-round program, so demand was higher than supply (IRENA 2015). Setting the cap in the second round led to higher competition and price reduction.

Two alternatives to announcing fixed volume amounts are (1) using price-sensitive demand curve mechanism; and (2) multi-criteria volume setting method (IRENA 2015). When setting the volume in a price-sensitive demand curve mechanism, the volume auctioned will basically become the function of equilibrium price and result in more desirable

outcomes, i.e. if the auction equilibrium price is lower than the government's pre-estimates, the demanded volume could be increased in response and vice versa. If the cost of technology is changing faster, it would better for the government to use price-sensitive demand curve mechanism. The disadvantage of the method is the difficulty associated with communicating the demanded volume to the market, while the advantage is the improvement is resource allocation. The Netherland, for example, the volume amount is set as a budget, but the more interesting part is about auction rounds: support levels increase from one round to the next (IRENA 2015). Therefore, lower cost technologies submit their bids first and receive support on a "first come, first served" basis. Higher cost technologies, on the other hand, wait for subsequent bidding rounds, which are held until all budget is allocated, and have the risk of being out of the support.

Generally, the multi-criteria volume setting method is a more complex method and involves multiple demand bands, e.g., in Brazil the volume depends on the number and capacity of potential suppliers (IRENA 2015). These two alternatives allow the incorporation of some flexibility to the contracted quantity, based on budget limitation or other objectives. Currently Kazakhstan is setting the auction volume unilaterally in fixed amounts by the government. These alternative methods are less attractive options due to the uncertainty brought to the investor confidence, so it is better to adhere to the fixed volume amounts in Kazakhstan.

The disclosure of the volume amount is an additional decision to be made by the organizer as knowing the amount would provide certainty, transparency, and reliability of potential bidders, resulting in lower risks, higher participation, and competition, allowing lower bids and support costs, while not disclosing the volume would result in allocative inefficiencies due to higher risks and underestimation of competition levels (der Rio 2017). Volume disclosure is also beneficial in terms of dynamic efficiency as it was already

mentioned due to innovation and supply chain improvement opportunities. Despite those benefits, some countries like Brazil and South Africa decided not to disclose the volume amount aiming to increase competition and prevent strategic behavior of participants (IRENA 2015).

The periodicity of auctions should depend on the energy policy. There are two options: (1) standalone scheme, without commitment to hold them in future; and (2) systematic auctioning scheme, involving long-term planning. Expectation of more rounds mitigates the risk of underbidding, positively affecting effectiveness. Dynamic efficiency is also positively affected by provided regular schedule. In order to encourage participation sufficient timing is also necessary for the investors and regularity allows this planning. Nevertheless, stand-alone auctions are more widespread as they provide government with flexibility to adjust to the schedule in response to changing market conditions (del Rio 2017).

In Kazakhstan auctions were conducted each year with varying volume amounts disclosed beforehand by the Ministry of Energy (KOREM JSC and the USAID 2021). This is a good option as by committing to hold auctions each year, the government is providing preconditions for investors and their financial planning. Moreover, by retaining control over the volume amount announcements, the Ministry has flexibility to adjust based on expectations of market performance.

The next design feature is the diversity. Policymakers can use auctions to increase in diversity with respect to technologies, locations, actors and installation sizes (del Rio 2017). Some countries hold technology-neutral auctions with allow the deployment of least cost-efficient technologies, e.g. RES technology was competing with natural gas Brazil in 2011 (IRENA 2015). Obviously, there is a higher participation rate in technology-neutral auctions, which reduces the risk of undercontracting. However, technology specific auctions are more

advantageous in further price reduction of electricity generated from specific technology, despite being more problematic in terms of attracting bidders.

In Kazakhstan, RES auctions are technology specific in a sense that for each alternative (wind, solar, hydro, bio) the auction capacity is predetermined, and the starting price is different for each alternative as well (KOREM JSC and the USAID 2021). The locations are also known in advance, as special land use plan is formulated jointly by The Ministries of Energy, National Economy and Investment and Development and local governments (Boute 2020). The project companies need to further clarify the land use requirements through investigation and design, studies and submit them for the authorities' approval. After this procedure they can enter into land purchase or lease agreement and register the real estate rights with the competent authorities. Additionally, the Ministry of Investment and Development has the right to grant land use right free of charge, which allows preferential treatment of some actors and increase in diversity if needed (USAID 2021). However, land transfer or leasing fees are considerable expenditure, which could be reduced by provinding the project companies land use rights for their operating duration.

The location of grid connection points is announced before the scheduled auctions (USAID 2021). KEGOC is responsible for upgrading and transforming the power grid for power plants to get connected if the power plants are above 10MW and regional transmission companies are responsible if the power plants are below 10MW. They should reserve adjacent grid connection points in accordance with the distribution plan of RES power plants released by the Ministry of Energy.

The electricity from RES facilities are guaranteed to be provided with access to the electric grid. The producers are exempt from paying electricity transmission services to KEGOC or regional transmission companies and getting electricity generation licenses

(USAID 2021). These costs make up around 3-12% of RES tariffs (King & Wood Mallesons 2022).

Participating conditions or requirements are also important as they directly influence the investors and their decision of participation as well as the project realization itself and scheduling, resulting in high transaction costs (del Rio 2017). Reduction of entry barriers positively affects competition, reducing the risk of collusion. The organizer can do this by changing prequalification requirements and the compliance rules in accordance with the market, reducing administrative procedures and by providing accurate and comprehensive information on time (IRENA 2015).

Prequalification requirement to the bidder in Kazakhstan is the financial guarantee that they are capable of finishing the project. For these projects loans are allowed and the creditors are granted rights for project management (step-in rights). Pre-qualification criteria for the auction trading session is the provision of financial guarantee at the rate of 5,000 KZT/kW and 2,000 KZT/kW of installed capacity for auctions with and without project documentation respectively. For the auction to be considered valid there should be at least two bidders and the total amount of applications should be more than 130% of announced capacity (USAID 2021). Obviously there would not be any big price decrease with only two bidders, therefore it is in the organizers interest to attract more participants. In order to show their commitment to finish the project on time the company also has to submit a performance bond at the rate of KZT 10 million/MW (around US$ 30,000/MW). The required construction periods are different for each type: Solar Power Plants (SPP) – 24 months, Wind Power Plants (WPP) and Bio Power Plants (BioPP) – 36 months, Hydro Power Plants (HPP) – 60 months, but it can be extended to one year if the readiness is not less than 70% by the end date. If the project starts generation only within 12 months after the PPA execution, 30% of the performance bond will be deducted and retained by the FSC. The full amount will be

retained by FSC if the company fails to meet deadline of 24 months for photovoltaic power plants, 36 for wind and bio power plants, and 48 months for hydropower power plants (USAID 2021).

As it was described above, there are several administrative procedures that are meant to ensure the bidders' commitment in Kazakhstan, which might repel the potential participant. It should be an easier and shorter process, still retaining the aim of ensuring the construction on time, for example by setting up a one-stop-shop for document submission. By streamlining the administrative procedures organizer may highly facilitate the participation by reducing the costs for investors as it was the case in Denmark and South Africa (IRENA 2015). Nevertheless, auction participants in Kazakhstan still has some concession in terms of grid access and provision of permits for auction winners.

Transparency and open communication is a key for encouraging participation. The information rules and obligations as well as any adjustments should be equally communicated to all of the participants. The organization of a conference before the beginning of the auction became a good practice in South Africa (IRENA 2015).

Support conditions for the IPPs include support in terms of electricity revenue, already described project land use and power transmission. Financial Settlement Center (FSC) will pay the monthly tariffs in Kazakhstan's local currency (KZT) for the supplied electricity at the rates indicated by auction winning bids in 15-year purchase period, so it is subsidized by the state. Starting from 2021, PPA term was extended from 15 to 20 years. The tariffs are also subject to monthly adjustments according to the consumer price indexes (CPI) published by Kazakhstan's statistics agency.The usage of foreign currency loans also allows reconsideration based on exchange rate fluctuations. The ratio of weight of the CPI to exchange rate fluctuation indexes is 7:3 (USAID 2021). This is supposed to reduce the

investor risk perception, by lowering the risk arising from inflarion and exchange rates. Although this is better than with no indexation as it was the case before 2016, the ratio considered could still be troublesome for the foreign companies in terms of financial risk management, because of the high exchange rate fluctuation possibilities. There are actually examples of auctions held in foreign currency like Chile, where contracts are denominated in US dollars and periodically adjusted in accordance with US CPI, so both interest rate risks and inflation risks are mitigated (IRENA 2015).

There are alternative contracting schemes that might in theory affect the project developer confidence. Contracting for engineering, procurement and construction of a power plant without including it's operations and maintenance for an extended period of time in the contract should attract some of the developers who were not ready for the long term partnership. This case was implemented for wind and hydro in Morocco until 2010 (IRENA 2015). Involving government in the project's equity would be another option and this was the case in Dubai so that government entity had 51% equity share in the project (IRENA 2015). Although government-backed contracts are usually very credible, the downside of such government involvement is the presence of a greater bureaucracy.

Companies registered as local legal persons and involved in power generation are allowed to apply for tariff reliefs and subsidies of any kind. However, according to the Private Enterprise Law, subsidies obtained by project companies should not exceed 30% of all of the fixed asset value (USAID 2021). There are also preferential policies for project companies registered in any special economic zones and meet relevant requirements. The Ministry of Investment and Development has the right to exempt project companies from import duties such as duties on imported equipment and material for the project use for the period of up to five years (USAID 2021). This should in theory significantly reduce construction and transportation costs.

The disputes are to be resolved by the court at the location of the buyer, i.e. the FSC, but there is an opportunity to resolve disputes in Astana International Financial Center (AIFC), which claims to use international best practices in arbitration regulation and this is very important for international investors (USAID 2021).

Overall, the design elements of renewable energy auctions in Kazakhstan follow good practices in terms of volume disclosure, periodicity, differentiating technologies by type, dispute resolution mechanism and support conditions like exemption from licensing, import duties and electricity transmission services, but some of the elements could be improved to make them more attractive, including format, volume choice mechanism, bureaucracy, responsibilities. Moreover, foreign investors are usually more concerned with the exchange risks, so it would be very attractive if the remuneration was made in US dollars with the annual indexation. Additionally, project developers could be provided with land use right for the duration of their operation, thus reducing their expenditures.

Chapter 4: Auction results

Auctions held in 2018

The Ministry of Energy announced first auctions for Renewable Energy projects in February 2018. The total installed capacity declared was 1000 MW, the majority of which was the WPP with 620 MW capacity and the SPP with 290 MW capacity. The remaining 90 MW was HPP (75 MW) and BioPP (15 MW). The bidders made bids for the total installed capacity of 3,422 MW and this demand was 3.4 times higher than supply (KOREM JSC and the USAID 2021).

The starting auction prices in 2018 were as follows (at the level of feed-in tariffs):

RES	In KZT	In USD
WPP	22.68 KZT/kWh	5.4 US cents/kWh
SPP	34.61 KZT/kWh	8.2 US cents/kWh
HPP	16.71 KZT/kWh	4 US cents/kWh
BioPP	32.23 KZT/kWh	7.7 US cents/kWh

There were 20 auctions planned: 11 for small and 9 for large projects. However, seven of them were recognized as invalid due to insufficient number of bidders and/or applications. Overall, 36 renewable energy projects were selected in 2018 with total installed capacity of 857.93 MW (KOREM JSC and the USAID 2021). The composition by type of the selected projects can be seem in the figure below:

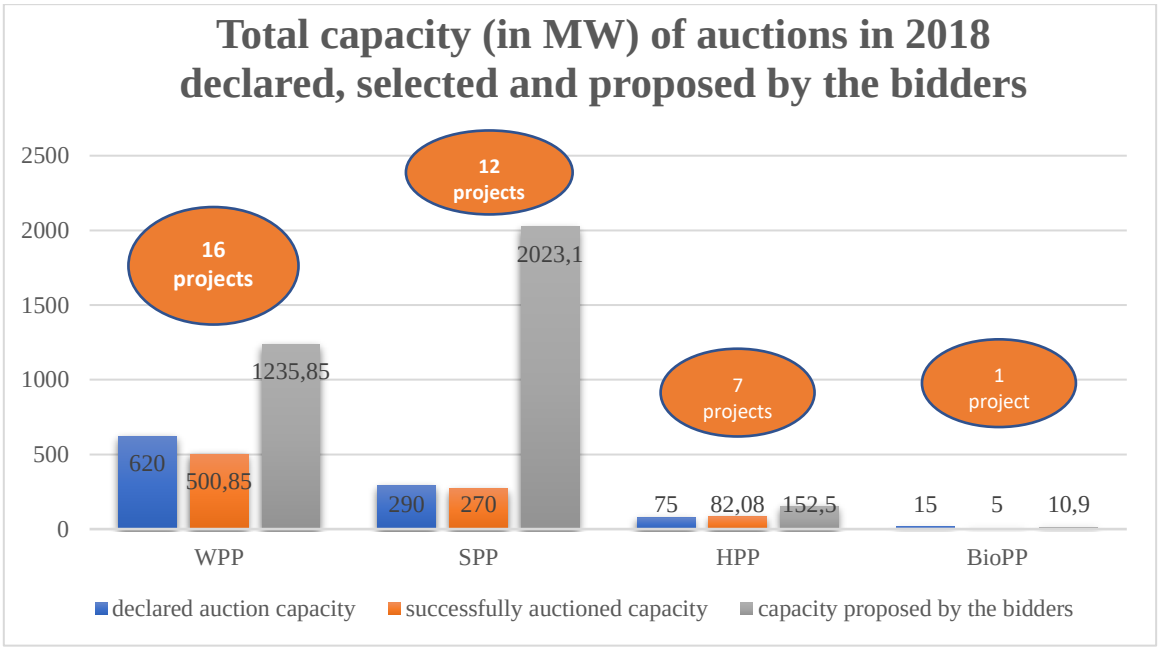

Figure 12: Declared, selected and proposed capacity 2018. Source: KOREM JSC and the USAID 2021.

There were 113 participating companies from nine countries: Kazakhstan, Russia, China, Turkey, France, Bulgaria, United Arab Emirates (UAE), Italy and the Netherlands (KOREM JSC and the USAID 2021).

As can be seen from the proposed capacity by the bidders in figure 12 and the price changes in figure 13, the highest demand was met in SPP projects. The largest auction price

decreases in 2018 were WPP - 23.3%, SPP – 48%, small HPP – 23.4%, BioPP – 0.2% (figure 13).

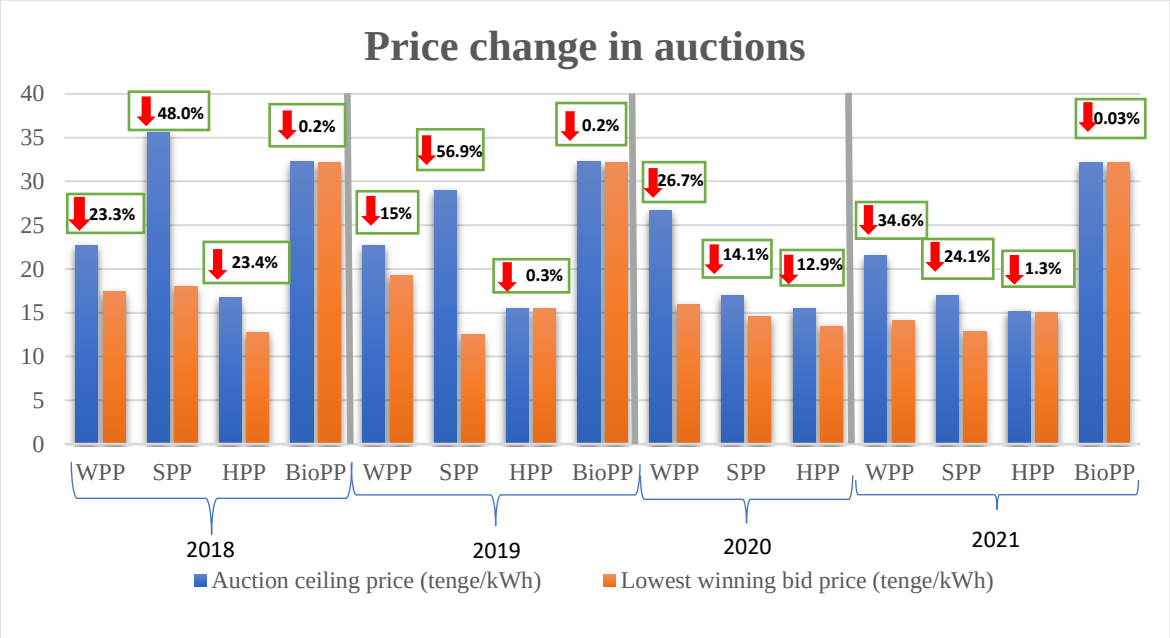

Figure 13: Price decrease in auctions. Source: KOREM JSC and the USAID 2021.

Auctions held in 2019

The total installed capacity declared in 2019 was 255 MW, the majority of which was the WPP with 100 MW capacity and the SPP with 80 MW capacity. The remaining 75 MW was HPP (65 MW) and BioPP (10 MW). The bidders made bids for the total installed capacity of 818.99 MW and this demand was 3.2 times higher than supply (KOREM JSC and the USAID 2021).

Eight auctions were planned and held – four small and four large projects. The new thing in 2019 was the introduction of projects with documentation. One out of those eight auctions were with documentation (KOREM JSC and the USAID 2021).

The project with documentation auction was introduced by the Auction Rules amendment of 2019. The project was 50 MW SPP auction in Shaulder Village. The financial guarantee for the auction with documentation including assessment of potential and risks,

land plots, environmental impact increased from 2000 to 5000 KZT/kW of installed project capacity. 14 companies registered to participate in the online platform of KOREM JSC, but only seven were admitted as others could not provide the financial guarantee. The participants were from Kazakhstan, Italy, Russia, Germany, China and the Netherlands. The initial price was 29 KZT/kWh and after 95 price quotations the final price was 12.49 KZT/kWh, which 2.3 times lower than the initial price ceiling (KOREM JSC and the USAID 2021).

Overall, 13 renewable energy projects were selected in 2019 with total installed capacity of 212.89 MW. The composition by type of the selected projects can be seem in the figure below:

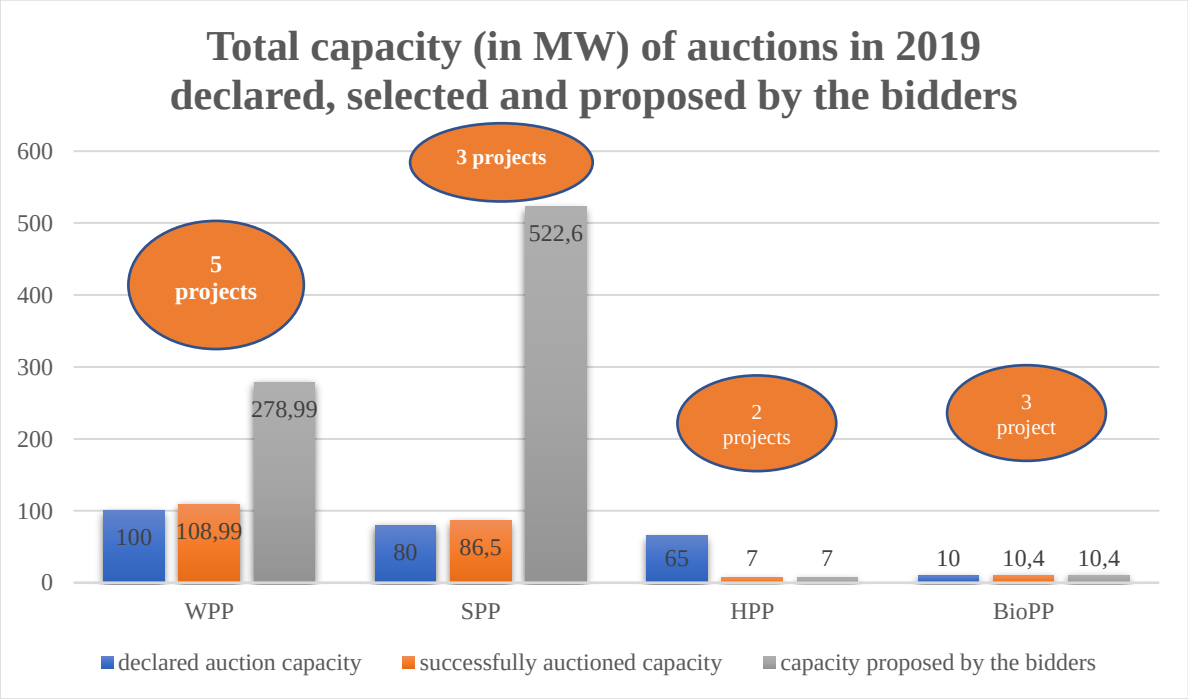

Figure 14: Declared, selected and proposed capacity 2019. Source: KOREM JSC and the USAID 2021.

There were 32 participating companies from eight countries: Kazakhstan, Russia, China, Germany, Malaysia, Italy, Spain and the Netherlands (KOREM JSC and the USAID 2021).

The highest demand was again met in SPP projects. The largest auction price decreases in 2019 were WPP - 15%, SPP – 56.9%, small HPP – 0.3%, BioPP – 0.2% (figure 13).

Auctions held in 2020

The total installed capacity declared in 2020 was 250 MW, the majority of which was the HPP with 120 MW capacity, WPP with 65 MW capacity and the SPP with 55 MW capacity. The remaining 10 MW was BioPP. The bidders made bids for the total installed capacity of 493.9 MW and this demand was 2 times higher than supply (KOREM JSC and the USAID 2021).

Eight auctions were planned – four small and without documentation, two large without documentation, two large with documentation. Two auctions were declared invalid as there were insufficient number of participants (large HPP and BioPPs).

Overall, 16 renewable energy projects were selected in 2020 with total installed capacity of 147.95 MW. The composition by type of the selected projects can be seem in the figure below:

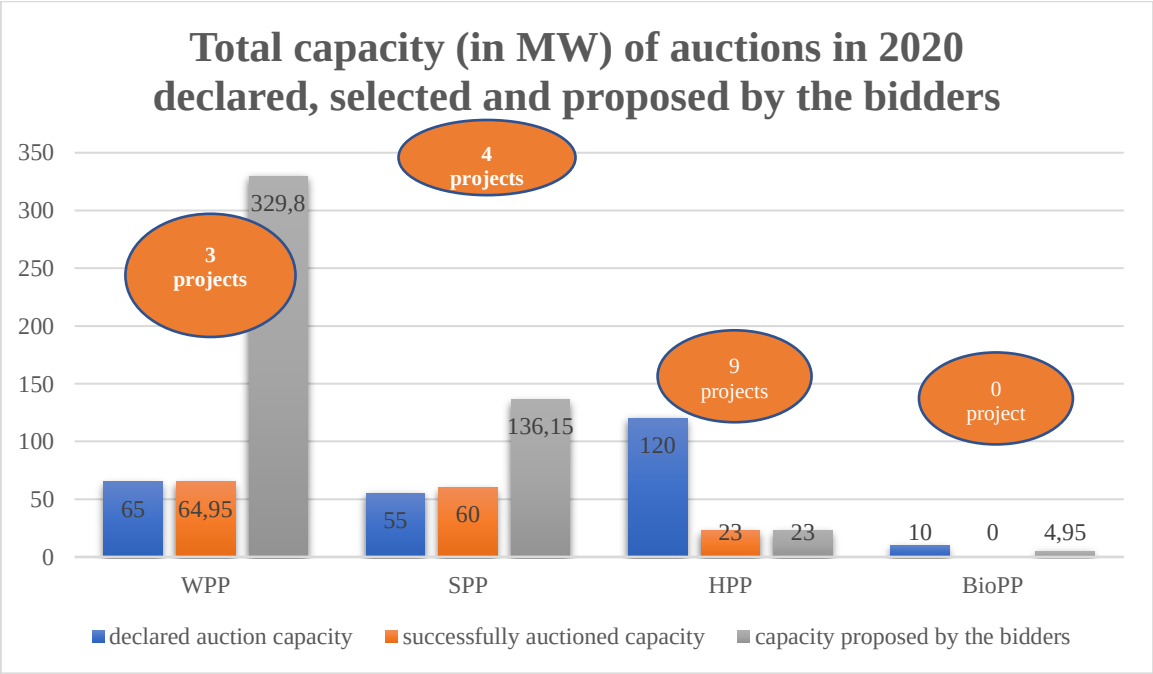

Figure 15: Declared, selected and proposed capacity 2020. Source: KOREM JSC and the USAID 2021.

There were 27 participating companies from four countries: Kazakhstan, Russia, Germany and the Netherlands. The highest demand was now met in HPP projects. The largest auction price decreases in 2019 were WPP - 26.7%, SPP – 14.1%, small HPP – 12.9% (figure 13).

The highest demand was now met in WPP projects. The largest auction price decreases in 2020 were WPP – 26.7%, SPP – 14.1% and HPP – 12.9% (figure 13).

Auctions held in 2021

The total installed capacity declared in 2021 was 200 MW, the majority of which was the HPP with 120 MW capacity, WPP with 50 MW capacity and the SPP with 20 MW capacity. The remaining 10 MW was BioPP. The bidders made bids for the total installed capacity of 626.95 MW and this demand was 3 times higher than supply.

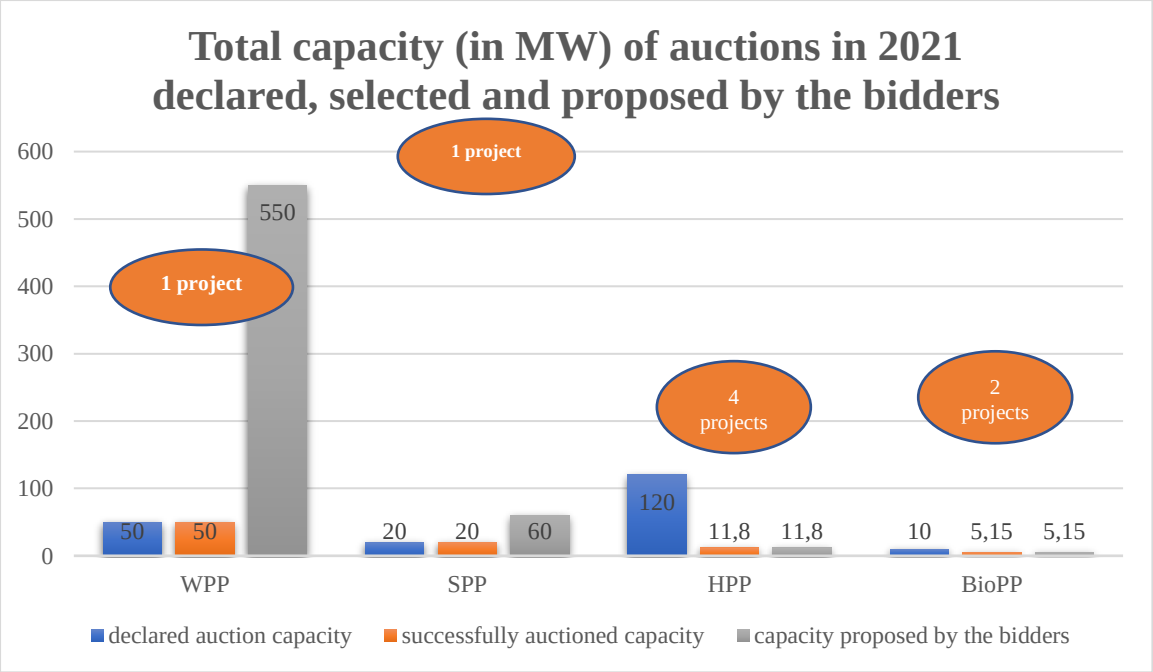

Figure 16: Declared, selected and proposed capacity 2020. Source:

24 companies from Kazakhstan participated in auctions. Five auctions were planned and held. Two small and two large project auctions were held in a regular mode, while one auction for large HPP was declared invalid due to insufficient number of bidders.

The highest demand was met in WPP projects – almost eleven times higher than supply. SPP projects and small HPP also had demand almost three times greater than supply. The largest auction price decreases in 2021 were WPP – 34.6%, SPP – 24.11%, HPP – 1.31%, BioPP – 0.03% (figure 13).

Auction Remarks

According to these results of four years, the price of electricity produced by RES were reduced, except for the BioPP. However, it seems that further reduction will depend on the technology improvement as there was not much negative price dynamics since the country switched to auctions, i.e. the prices did not decrease further (see figure-17 below). It could also be the case that external factors have affected the price.

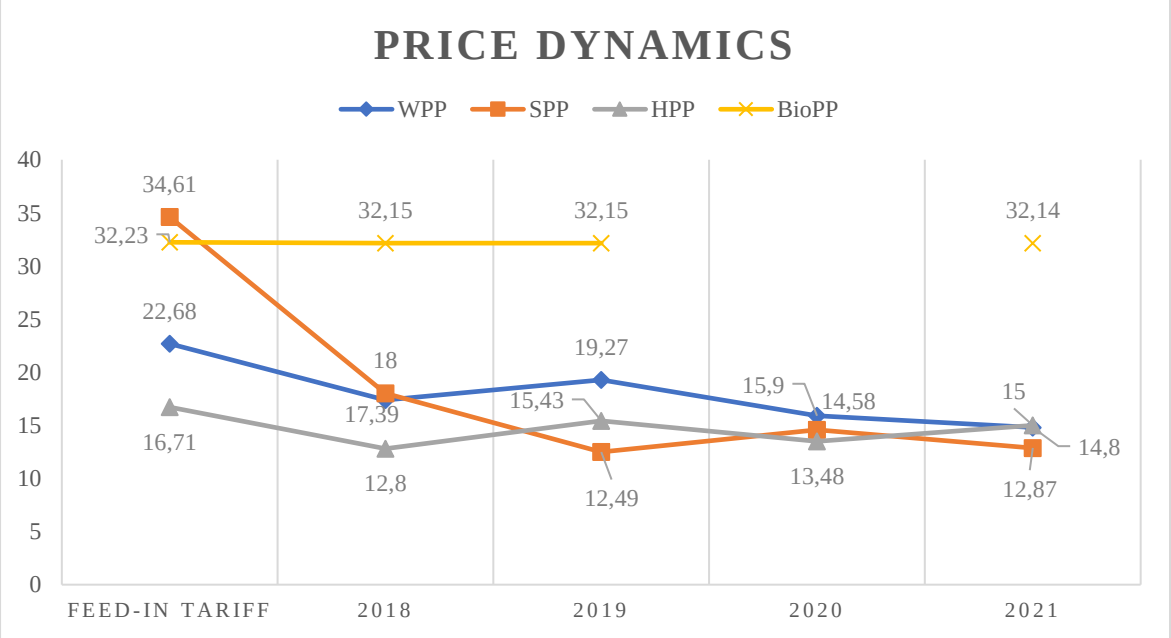

Figure 17: Price dynamics. Source: Report on Kazakhstan Renewable Energy Auctions 2018-2021

According to the variety of participating countries, there seems to be a decrease in international investor interest: while there were participants from nine countries in 2018, eight in 2019, four in 2020 and in 2021 there were only Kazakhstani participants. Even though high volume amounts were declared for 2018, investors were still interested the next year as well despite the reduction of declared volumes. The possibility of Covid-19 affecting

the participation of some foreign investors and subsequent consequences of the pandemic can not be eliminated.

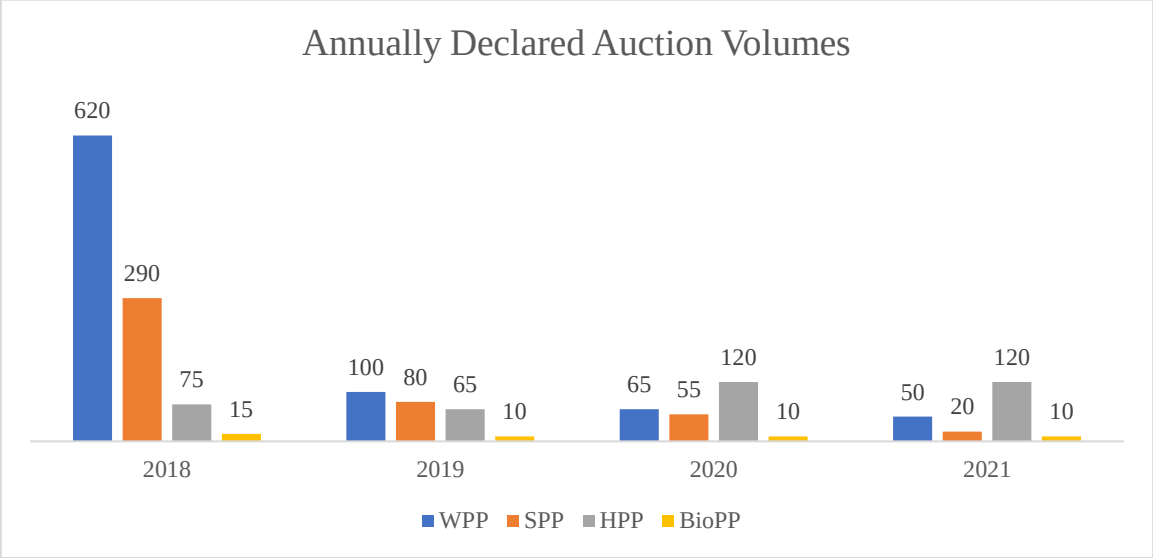

Figure 18: Annually Declared Auction Volumes. Source: Report on Kazakhstan Renewable Energy Auctions 2018-2021

The introduction of auctions with documentation appears to be a good practice. Provision of more information should reduce risks anticipated by investors.

The mismatch between the demanded auction volume by the participant and the volume supplied by the organizer requires attention in terms of auction design. There are bigger demands in some of the RES types, i.e. demand for WPP and SPP were higher than the supply each year, while demand for HPP and BioPP was mostly below auctioned volume. The volume auctioned should become the function of multiple criteria and taking into account the participant expectation and the prices offered.

Conclusion and Recommendations

As a member of international organizations, Kazakhstan has made important steps that aim switching energy and electricity production towards more sustainable path by ratifying international conventions and setting ambitious targets. The benefits of diversification of the energy mix by increasing the share of RES include better environment and health of the population, job creation as well as the lower dependance of the economy on global fuel prices. The country introduced important

national documents and laws that became a precondition for green transition. Many processes were eased for independent power producers and international investors. Power generation, transmission and distribution operations were separated, allowing more smaller participants. However, the negligence in energy law introduced in 2009 did not include support for renewable energy so that it was losing to traditional energy sources in terms of prices. Second, although Kazakhstan introduced feed-in tariffs in 2013, the annual indexation component, which mitigated the inflation risk for investors, was added only in 2016. Finally, auctions replaced feed-in tariffs in 2017, so the Kazakhstani energy market could be perceived unstable in terms of regulation by the investors even though previous contracts were not affected by the changes. The comparison of required investment predicted in the Conception of Green Transition until 2050 with the actual investments in green economy showed that although the work towards attracting investments is paying off and there was an increasing trend, the actual amounts are much lower than the required amounts in each subperiod.

Despite the regulatory instability brought by consecutive changing of the support scheme, the switch towards renewable energy auctions can be considered justified as it provides the control mechanism for the government and the market price revelation, which should change in accordance with the technology improvement and competition.

Kazakhstan has shown commitment to hold auctions each year since 2018. This thesis work attempted to evaluate the attractiveness of already held auctions and the design element as well as the effectiveness in price reduction for the electricity produced by renewables. Auction results showed that the project developers were actually ready to receive lower renumeration for the electricity produced by renewables compared to the feed-in tariff amounts previously declared in Kazakhstan. The price decreased until a certain point and stayed roughly in the same level, meaning that further decrease would be reached only if there is a significant technology improvement. Nevertheless, it would be better to allow descending clock auction mechanism that would promote bidders' reaction. Auctions also allow optimization of potentially lower investments in terms of chosen location and renewable energy type.

The renewable energy auction design in Kazakhstan mostly followed best practices, including volume disclosure, periodicity, differentiating technologies by type, dispute resolution mechanism and support conditions like exemption from licensing, import duties and electricity transmission services. Nevertheless, this work recommends reconsideration of the auction format to further improve the outcome and the attractiveness for the investors. First, instead of using sealed-bid format, which is the least transparent format and does not allow the bidders to react, it would be better to introduce the mechanism providing this possibility by switching to hybrid auction format. Second, it would be better if the volume auctioned is set in generation (MWh) rather than in capacity (MW) as generation-based option can better accommodate the aim of reaching energy targets. Third, it was seen in the auction results section that demand exceeded supply in some renewable energy types, so fixed volume amounts to be auctioned were sometimes much lower than the supplied amount. Additionally, some auctions were deemed invalid due to the lack of bidders. Therefore, it is recommended to use multi-criteria volume selection method that would also require consideration of additional places and amounts to be reserved and distributed if the volume supplied exceeds the demanded amount and if the potential supplier is ready to provide the service for the similar price. The complexity of this scheme could be outweighed by the higher possibility of being among the winners. Addressing the problem of deficiency of bidders, organizers should communicate with potential participants more and possibly invite all of them to a conference held beforehand.

Moreover, to make participation even more attractive for international developers it is recommended to adopt the international practice of making remuneration in US dollars with the annual indexation. Provision of land use rights for their operating duration should also reduce their expenditures. Although pre-qualification requirements are necessary, the procedures should be streamlined. Separation of 15-20 year power-plant operation and maintenance services from the project developer contract, who does the engineering, procurement and construction, and assigning a separate organization for operation and maintenance should attract more players capable of providing competition, who were repelled by long-term contracting.

Despite that there was a criticism of the Kazakhstani government, who changed green energy legislation too often the last decade, the renewable energy policy needs to be updated to improve the situation. Switching the support scheme from feed-in tariffs to renewable energy auctions was one of those updates that provides controlled expansion of RES projects. The volumes auctioned in Kazakhstan are substantial, so a lot of work should be done in attracting project developers and investors. Reconsideration of auction design must address potentially problematic aspects that might repel potential participants and improve the efficiency in terms of price reduction and volume division. Project developers capable of providing competition should be encouraged to participate. Good preconditions should be made to make the bidders feel safe. The ultimate goal of these actions is reaching the targets written in the Conception of Green Transition until 2050. This will raise Kazakhstan's reputation in terms of international cooperation and contribution towards fighting global warming. Population would also benefit from lower greenhouse gas emissions. In conclusion, my thesis tried to address the auction design elements and their attractiveness for the project developers. The improvement of this policy tool should help in achieving the ambition targets set in the Conception of Green Transition until 2050.

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