

**ELECTRICITY SUPPLY SIDE DEVELOPMENT IN UZBEKISTAN:
A COMPARATIVE STUDY WITH THE REPUBLIC OF KOREA**

By

AVAZOV, Shokhrukh Normurodovich

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

MASTER OF DEVELOPMENT POLICY

2015

**ELECTRICITY SUPPLY SIDE DEVELOPMENT IN UZBEKISTAN:
A COMPARATIVE STUDY WITH THE REPUBLIC OF KOREA**

By

AVAZOV, Shokhrukh Normurodovich

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

MASTER OF DEVELOPMENT POLICY

2015

Professor Chang-Yong Choi

**ELECTRICITY SUPPLY SIDE DEVELOPMENT IN UZBEKISTAN:
A COMPARATIVE STUDY WITH THE REPUBLIC OF KOREA**

By

AVAZOV, Shokhrukh Normurodovich

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

MASTER OF DEVELOPMENT POLICY

Committee in charge:

Professor Chang Yong CHOI, Supervisor



Changyong Choi

Professor Sherzod SHADIKHODJAEV



Professor Si Wook LEE



Approval as of December, 2015

ABSTRACT

ELECTRICITY SUPPLY SIDE DEVELOPMENT IN UZBEKISTAN: A COMPARATIVE STUDY WITH THE REPUBLIC OF KOREA

By

SHOKHRUKH, Avazov

As a transitioning economy, the energy sector of Uzbekistan is expected to play a pivotal role in the development of a market-based economy in the future. Uzbekistan has enough resources to develop its energy sector, including electricity sector. However, there are organizational and institutional issues that remain critical challenges to the modern economy and society. This study looks at the South Korean experience of the development of its electricity sector following the Korean War, including notable reforms and projects implemented throughout its evolution, through comparative study with Uzbekistan's development history following independence. In identifying the organizational and structural challenges of Uzbekistan's electricity sector and associated source factors, cross-national comparison method and a case study of South Korea will be used whilst suggesting solutions based on the South Korean experience.

Detailed analysis shows that the Five Year Power Expansion Plan, the establishment of required institutions and Saemaul Undong (New Village Movement) of South Korean Government were implemented effectively and led to the improvement of the energy sector, infrastructure and quality of life of people. Moreover, the privatization of the national power corporation – KEPCO – had a positive impact on the improvement of the power of the market in South Korea. I suggest best practices and reforms that Uzbekistan can adopt from South Korea.

Copyright by
Shokhrukh Avazov Normurodovich
2015

Dedicated to
my wonderful Parents,
Dr. Murod Avazov and Mrs. Mavluda Avazova
my beautiful wife Mrs. Feruza Avazova and our future children
my Brother and Sister

LIST OF TABLES

1. Energy structure of Korea (1965-1973).....	8
2. Annual rural household income (1970–1979) in 2014 US dollars	11
3. Comparison of Korean and Uzbekistan’s institutions related to the electricity sector	22
4. Uzbekistan and South Korea’s Electricity Statistics for 2012	24

LIST OF FIGURES

1. The electricity generation source structure of Uzbekistan 2002-2011.....	16
2. Uzbekistan New Development Goals on Industrial Transformation Towards 2030	18
3. Uzbekistan’s Demographic Change Forecast for 2030	18
4. Korean Power Market Operation Procedure	23
5. Electricity consumption per capita of Korea and Uzbekistan in kWh from 1971 to 2011	26
6. Total population growth trend of Korea and Uzbekistan from 1965 to 2015 ...	27

TABLE OF CONTENTS

I. Introduction.....	1
II. Pursuing Korea’s Energy Independence	7
2.1. Government Policy.....	7
2.2. Rural Electrification: One Step towards Industrialization	9
III. Pursuing Uzbekistan’s Sustainable Power Supply	13
3.1. Government Policy.....	13
3.2. Does institutional structure matter?	19
3.3. Findings.....	23
IV. Conclusion and Policy recommendation.....	28
Bibliography.....	30
Appendices: Organizational Structure of Uzbekenergo.....	34

Chapter I. Introduction

What is a soul? It's like electricity –
we don't really know what it is,
but it's a force that can light a room.

Ray Charles

The global leaders to maintain achievement Millennium Development Goals (MDGs) committed that there is a strong relationship between access to electricity and poverty. The world realized that without a major form of energy – electricity, nowadays economic development and prosperity could not be achieved properly. For example, imagine how students can study at the universities or access to the internet and how factories can manufacture without electricity. The electricity become an integral part of our lives.

According to the International Energy Agency (2011), 1.3 billion people in the world do not have access to electricity. It is a pivotal issue for developing countries, where the majority of these 1.3 billion live.

As a developing and transitioning country, Uzbekistan is experiencing population growth and income growth, which along with infrastructural development, has led to a greater energy demand. Uzbekistan is a former Soviet Union republic where natural resources were used inefficiently to supply the old planned economy. This legacy of inefficiency demands action from the current and future government in order to implement newer technologies and renewable sources of energy. Unless Uzbekistan takes action and policy reforms today to improve its supply side electricity sector with modern technologies, new sources of energy, human capital development, high capacity stations and energy

management systems, it could face an energy crisis, harming economic growth in the long run.

To avoid such a harm the government of Uzbekistan could learn from other national policy reforms in electricity sector of developed countries to achieve sustainable practices. There are a lot of countries who have successful electricity sector development experience, in which they achieved stable electricity supply. Nowadays, government officials' big question is how to ensure energy security both today and for future generations. To do that, we need to study experience of countries that had a transition period from developing to fully developed status. South Korea (Korea) is a good example of it.

Furthermore, one of the Asian Tigers – Korea also achieved sustainable electricity generation and management which could be good example for Uzbekistan. In addition to that, Uzbekistan and Korea has a huge number of successful infrastructural projects, especially in the energy sector. I would like to say based on my analysis of Korea's Economic Development experience that, there are a huge number of reforms made by Korean Government applicable to Uzbekistan where the government of Uzbekistan could adapt considering the national interest and economic potential of the country to develop the economy.

At the aim of this I will focus on what policies, infrastructural and management reforms has been done in Korea's electricity sector. Moreover, I will show that what Uzbekistan could adapt from Korea to develop its electricity sector and what kind of gaps we have to fill.

Research question

This research will be achieved by investigating and evaluating the Electricity sector of Uzbekistan and Korea and by studying successful practices of Korean Electricity Sector

reforms to make policy recommendations for Uzbekistan's Electricity sector reforms. The further major research questions are:

- What kinds of policies were done to diversify electricity generation and sustain an energy supply?
- What kinds of policies have done to develop electricity generation and supply villages and manufacturing sector in Korea?
- What kinds of reforms have done in Korea to develop electricity sector in Korea?
- What policies and institutional reforms from experience of Korea can Uzbekistan adapt to develop electricity sector?

Research Method

There is notable similarity in the transitioning period of both countries. According to the World Bank (2015) Korea's GDP per capita in 1960 to 1985 increased from 155.6 USD to 2542.04 USD. Uzbekistan had an almost similar situation after the Soviet Union collapse, where Uzbekistan's GDP per capita in 1991 to 2014 was increased from 658.66 USD to 2038 USD. As the above period includes 25 years' development, I will look at the development period, policies and reforms in electricity supply of Korea from 1960 to 1985, simultaneously do the same for Uzbekistan for 1991 and 2014 period of development by using a cross – national comparison method and a comparison of change over time method (Lor 2011, 5). As a source of data, policy papers, periodicals, and books related to energy policies of Uzbekistan and Korea will be referred to.

Literature Review

The Role of Electricity in Development

Ferguson et al. (2000, p.1) quoted in their preliminary study that in “the G7 group of countries as a whole (USA, Japan, Germany, France, UK, Italy and Canada), constituting two-thirds of the global economy, there was a well correlated relationship between electricity use and wealth creation”. Stern (2011) provides robust evidence that energy is one of the major and essential factors for production in all economic activities in society.

Sang-Yong Han et al. (2004, p1.) spoke about how the electric power industry had pivotal role in the miraculous economic development of Korea. Specifically, this was represented by an average annual growth rate of 6.8% in the real gross domestic product during the last three decades of economic development of Korea. In addition, Korean electricity capacity tremendously enlarged from 7.7 thousand gigawatt-hours (GWh) in 1970 to 214.2 thousand GWh in 2000. On the other hand, Korea’s GDP per capita increased from 292 USD in 1970 to 11948 USD in 2000 which depicts huge change in well-being of the Korean people (the World Bank Database, 2015).

History and Current Status of Korean Energy Policy

Korea’s experience goes back to the 1960s when sustainable energy sources were needed to develop the economy after the Korean War (1950-1953). The Ministry of Trade, Industry and Energy and Korea Resources Economics Association (2013) divided the energy sector development into four decades from the 1960s to 2000s where the government’s main target was to make the country energy secure. Each decade included policy packages according to the social and economic situation. In the 1960s, the government’s target was to make sure that energy supply was enough to boost the economic growth, and the next decades 1970s and 1980s were to relieve the energy system from the external shocks (e.g. Oil

shocks in 1973 and 1979). Then, from the 1990s South Korea's policy agenda changed to reducing environmental harm and climate change, caused by excessive use of fossil fuels during industrialization.

The Korean Government to reach policy goals, implemented couple of huge infrastructure projects to supply the nation with reliable power. The study of Ministry of Knowledge Economy (2012) shows that in the framework of the First 5-Year Power Resources Development Plan the National Power Grid Construction was started. According to the study, the Power Grid loss was one of the carefully configured construction project to increase the efficiency of the power supply.

Byrne et al. (2004) analyzed the national policies of the Korea towards electricity where they were aggressively used to transform the country's economy from an agrarian to industrialized economy. It succeeded in the 1980s by the development of the nuclear power industry which achieved the growth goals of the Korea and provided electricity at low prices (US \$0.03 per kilowatt hour (kWh)). According to International Energy Agency (2012), the Korea's gross electricity production was 515.5 terawatt-hours (TWh) and demand was 458.7 TWh in 2010, which depicts balance in the supply and demand side of the electricity sector.

Nowadays, as put by Woo (2014), South Korea is continuing its policy towards decreasing environmental harm – “green economy”, developing renewable energy and simultaneously keeping the country energy secure.

The Electricity Sector in Uzbekistan

Uzbekistan's experience starts after the collapse of the Soviet Union in 1991. Mukhamedkhanova (2012) divides energy policy analysis into three stages from 1991 to present. The Uzbek government's goal at the first stage, which included 1991 – 1996, was to provide energy independence and change in the fuel market. The next stage, from 1997 –

2002, included attracting domestic and foreign investment to the energy sector. After the second stage, the government's goal changed to increasing energy efficient technologies and replacing fossil fuels with alternative energy sources.

Eshcanov (2006) and The World Bank (2013) closely looked at the energy sector of Uzbekistan by each type of energy, where they found that energy is mainly generated by using fossil fuels. According to the World Bank (2013), Uzbekistan generated 51,100 GWh and consumed 39,055 GWh of electricity in 2010.

Further, Eschanov (2006) argues whilst there is a balance of electricity supply, rural and less industrial areas have a shortage of it because of electrification issues. The reason for this, Uzbekistan is trying to be self – sufficient without decreasing its net export of electricity. In addition to that, the World Bank (2013) claims that old infrastructure and lack of investments have badly impacted in sustainable electricity supply in recent years and accrued reliability problems for people.

Specifically, unsustain power supply created economic losses for households and business of Uzbekistan in amount of 52 million USD. The World Bank (2013) considered this unreliable power supply as a third major obstacle to the business and ranked the getting electricity indicator of Korea at 1 out of 189 and Uzbekistan at 145 out of 189 economies. This discrepancy in turn creates huge barriers for entrepreneurs in Uzbekistan. Moreover, these factors in Uzbekistan harm development of the electricity sector.

Based on the analysis of the above scholars in the field of energy sector development, this study I will focus on Korean electricity development efforts and critically compare with the current actions of Uzbekistan. Moreover, I will offer valuable suggestions and policy implications by covering what Uzbekistan can learn from Korea to achieve energy security, while simultaneously continuing to export electricity.

Chapter II. Pursuing Korea's Energy Independence

2.1. Government Policy

The first step taken in the period (1960-1985) to develop the electricity sector was the Oilization Policy Regime. President Park Jung-Hee was a leader of this regime and it was implemented in the framework of the first five-year economic development plan (1962 - 1966). This policy regime included oil consumption policy packages focused on the energy and manufacturing sectors to implement the export-oriented economy. Firewood and coal were inefficient, and technology from that time to supply the energy demand of the growing Korean economy was old and outdated. That is why oil consumption promotion policy became one of the key parts of the development plan of Korea. There were incentives such as free import for oil using technologies and subsidies as an investment to the oil industry. Moreover, the appearance of the electricity supply crisis in 1967-1968 sped up the oilization process. Evidence of this was building more oil based power plants instead of coal based plants, as well as the new Honam and Gyuengin oil refinery plants (The Ministry of Trade, Industry and Energy and Korea Resources Economics Association, 2013).

This policy gave positive outcomes to the Korean economy. The growth rate stood at 10.2% and electricity consumption grew at 9.6% annually during the period of 1966-1973. Table 1.1 below shows the significant change in the energy structure of Korea during the above period.

However, the Oilization Policy Regime had negative outcomes as well. It created oil dependence as 100% of oil was imported from the Middle East and 82.3% of electric power was generated by oil consumption. Consequently, during the 1970's there was "the first Oil shock" and "the second Oil shock" where Korean currency depreciated rapidly, foreign debt increased and high inflation rates led to an increase in the price of products.

Table 1. Energy structure of Korea (1965-1973).

	1965	1973	
Energy structure (%)	Firewood	42.8	14.7
	Coal	43.6	30.2
	Oil	12.1	53.8
	Hydro	1.5	1.3
	Total	100.0	100.0

Source: The Ministry of Trade, Industry and Energy and Korea Resources Economics Association, 2013.

Then the Korean government responded to the crisis with energy security policy measures:

- Diversification of energy sources to decrease oil dependency;
- Promotion of energy conservation;
- Promotion of strategic oil reserves.

In addition to that, the Korean government's best response was to create new institutions. For conservation purposes KEMCO (Korea Energy Management Company) and independent Ministry of Energy and Resources was established in January 1978. Later, the Korea Energy Economics Institute for research and development in energy policy issues was established in May 1986 (The Korea Energy Economics Institute, 2015). These institutions brought a lot of structural adjustments. For example, as the electricity sector was the second largest oil consumer, the deoilization policy was implemented to change the source of electricity generation in power plants. The oil based plants were transformed to coal or LNG (Liquefied natural gas) based power plants. Thus, there was huge policy promotion of Nuclear Energy as the Korean government strived for the limitless energy dream. The first

nuclear power plant – Kori Unit One with 587 MW capacity was built in January of 1968 which was a breakthrough in the electric sector (The Ministry of Trade, Industry and Energy and Korea Resources Economics Association, 2013).

In October 1978, two oil crises and electricity crisis led the Korean government decision to implement its Five-Year Power Expansion Plan, which was targeted to the development of Nuclear Energy in Korea. Furthermore, this policy action was strengthened by establishment of the Electric Power Development Promotion Law in December 1978. As a result four additional nuclear power plants started construction and the share of oil in the electric power sector fell to 10% while nuclear energy rose to 53.1% in 1987 (The Ministry of Trade, Industry and Energy and Korea Resources Economics Association, 2013).

2.2. Rural Electrification: One Step towards Industrialization

I would like to talk about the experience of rural electrification of Korea in the 1960-1980s as agriculture has an 18.8% share in Uzbekistan's GDP (the World Bank, 2014). According to the Ministry of Knowledge Economy of Korea (2012), rural areas were involved in businesses which considerably impacted economic growth. In 1965, development of the rural areas were very important for Korean Government as 60% of the whole population were living there. And this development would bring a balanced economic growth at that time for Korea. As electricity has both lighting and production input in the lives of rural households, rural electrification had a pivotal role in Korean Economic Development as well. As the Korean economy was growing rapidly in the 1960s-1980s, rural development and improvement of rural households also was one part of the development strategy of the government. As a result the Rural Promotion Act (1965), Five year Electrification Plan and (1965-1969) and the Long-term Rural Electrification Project Scheme (1970– 1979) were enacted to achieve targets towards political, social and economic modernization in these areas.

These legal documents have included the unelectrified areas to supply power in everyday life of rural habitants for their industrial and residential purposes.

Furthermore, the Rural Electrification Project's target was to install distribution and transmission facilities, internal wires and substation construction projects. These project focused not only electricity coverage of rural areas, it targeted also simultaneously building partial transmission amenities.

Additionally, the Five-year Electrification Plan had detailed how rural electrification projects should be funded. Unlike most projects of Saemaul Undong (New Village Movement), rural electrification was not funded by government directly. It was funded by the Korea Electric Power Corporation (KEPCO), rural households, loans from International Banks, foreign aid from Italy and Japan. The implementation of projects was done by KEPCO and the Ministry of Commerce and Industry of Korea. Although this plan was successful there were some issues such as selection of villages, repayment period was too burdensome for rural people (19 years), and some elderly villagers who were selected to be electrified refused to give up on their old traditions (Pak and Gamble, 1975).

The long-term Rural Electrification Project Scheme covered the period of 1970-1979. In this period, the Korean government tried to work on the previous weaknesses of the Five-year Electrification plan, villages that had outstanding involvement in Saemaul Undong were selected to develop electrification. In order to do this, KEPCO created the "Nationwide Rural Electrification Committee" to survey the areas without power supply to succeed in rural electrification of whole rural areas. To achieve such a huge survey, Korean Government trained 11,510 surveyors. According to the Ministry of Knowledge Economy of Korea (2012) the nationwide rural electrification coverage was 21% of whole rural area and remaining 79% of it without power supply. From beginning and to the end of 1970 they were sent to villages

to conduct surveys through rural areas of Korea without electricity. The survey helped to focus on the exact targeted houses and regions should be included to the project. Further, the Ministry of Commerce and Industry of Korea established a special agency to implement this scheme. As a result 98% of households were electrified by 1979 (Gevelt, 2014).

This project brought real positive economic outcomes. It changed rural society significantly where people came to have access to modern-day technology. They could use electric lights and candles. Moreover, power supply diversified their economic activities and increased their income. From Gevelt’s (2014) study we can see that from 1970 to 1979 rural inhabitants’ income increased almost ten times from 249 USD to 2172 USD (Table 2).

In addition to that, the Ministry of Knowledge Economy of Korea (2012) explains how many social changes and improvements electrification brought to the rural areas. First of all,

Table 2. Annual rural household income (1970–1979) in 2014 US dollars.

<i>Year</i>	<i>Household income</i>	<i>Agriculture income</i>	<i>Non-agriculture income</i>
1970	USD 249	USD 189	USD 60
1973	USD 469	USD 381	USD 88
1976	USD 1128	USD 898	USD 229
1979	USD 2172	USD 1493	USD 649

Source: Gevelt, T. 2014. Rural electrification and development in South Korea.

Power supply made their working hours longer, and people could now work in off-season periods and produce goods. Secondly, with the help of power supply farmers could use equipment which diversified their production. For example, farmers could use dryers which could help them cultivate the tobacco and pepper. Moreover, chicken farms benefited from an

increased amount of production of eggs and dairy product producing farmers saw a higher output of milk with electric milk machines. The fact that, the International Energy Agency (2010) also says that rural electrification strategy will lead to the virtuous growth cycle beneficial to both power generators and rural habitants.

To conclude the chapter, I would like to emphasize Asian Development Bank's study (2012) on inclusive growth where the energy infrastructure is one of the major players to eradicate the poverty and supporting pillar for inclusive growth in the developing countries. From above analysis, we can see that the Korean Government realized this and responded with bottom up approaches to develop their economy and transform their society.

Chapter III. Pursuing Uzbekistan's Sustainable Power Supply

3.1. Government Policy

As with Korea, at the time Uzbekistan, as a member state of the Soviet Union, was importing almost all of its energy supply from Russia, while exporting its main natural resource – gas – to other Soviet republics (Sagdullaev, 2005). After the collapse of the Soviet Union, a now independent Uzbekistan focused energy policies towards development of local energy sources as Korea did after its separation with North Korea, as almost all power plants were in its territory. Here we can see an almost identical energy context for both countries, but in a different time and political context.

According to Salikhov (2006), in the first step the Uzbek government energy policies of the period of 1991-1997 and comprises of below components:

- “*Geopolitical component*” – the energy freedom is one of the main goal. As mentioned above Uzbekistan was part of Soviet Union, where each country had its own specialty industry and agriculture was a main industry. In the main, energy was imported from Russia, thus Uzbekistan sought to be energy independent to achieve economic growth;
- “*Social component*” – providing access to the energy carriers to the population;
- “*Economic-social component*” – controlling of low prices for fuels to support the local manufacturers and the population. The Uzbek model of development included a gradual transition from centrally planned economy to market-based economy. To achieve said transition, the population has to have access to the energy which is one of the inputs to the manufacturing and commercial service;

- “*Technical component*” – providing sustainable and reliable power supply of the consumers and the residents. As we know energy sector based on huge infrastructure technologies to generate, transmit and distribute power to the population and consumers. This component is also considered as important because without reliable technology it is not possible to implement the policies in the practice.

Furthermore, the Uzbek government started institutional changes creating the new institutions for the energy sector such as *Uzbekneftegaz* (oil and gas sector), *Uzbekenergo* (electricity sector) and its legal entity *Uzbekugol* (coal mining sector) which are the main pillars of the energy sector development of Uzbekistan.

In this period, several oil and gas fields were discovered, refinery plants were built and old plants were reequipped by foreign aid and loans, in order to meet development goals. For example, one of the biggest oil and gas reserves were found in Fergana Valley and Bukhara-Khiva fields where new oil and gas refineries were built (Sagdullaev, 2005).

Since 1998, the second step of the energy policy begun to be realized. The “economic component” of this second step was dedicated to reform the complex of fuel energy of the country gradually:

1. The oil-and-gas sector reforms since 1998;
2. The power sector reforms since 2001.
3. The coal sector reforms since 2002.

It is to be noted that investment component of the energy policy was actively developing during the second stage of the energy policy in actualization reforms of the fuel energy sector. A favorable investment climate for attraction of domestic and foreign investments to fuel energy sector of the country was created at this stage (Salikhov, 2006).

The next stage (1998-2003) of energy policies were systematic reformation of the

energy sector with implementation of market based economy mechanisms. Additionally, the reforms in this sector also included institutional changes and establishment of new legal and regulatory framework.

Consequently, as Uzbekistan has decided to develop gradually rather than through shock therapy during its economy's transformation to a market-based economy, energy policies were focused on keeping the prices at a low level in the first stage. The policy was designed so that energy prices would rise not only to further power sector development, but industrial development as well.

The third stage of the energy policy has been realized since 2003. The task of this period is to increase efficiency of use of energy resources and to create necessary conditions for realization of energy saving measures providing preservation of energy independence and export potential of the country (Salikhov, 2006).

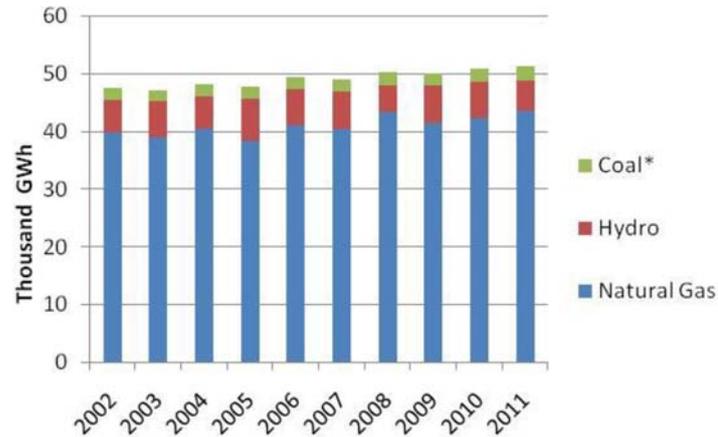
According to the World Bank (2013), energy structure of electricity generation consists of natural gas (82%), followed by hydropower (12%) and coal (5%). Below Figure 1 shows the electricity generation source structure of Uzbekistan. As is shown in Figure 1, Uzbekistan is highly dependent on natural gas to generate electricity.

From 2003 to present Uzbekistan Energy policy changed to diversify electricity generation by renewable sources of energy and using energy efficient technologies. The reason of energy policies change towards to the diversification were forecast of natural gas depletion of gas reserves in 28-30 years and coal reserves in 50 years as well (Mukhamedkhanova, 2012).

In the framework of this policy, they are implementing several projects of the World Bank (construction of combined cycle of gas turbine in the Navoi Thermal Power Plant), Asian Development Bank (expansion of Talimarjan Thermal Power Plant, first Central Asian Solar Power Plant 100MW), and Chinese loans to Uzbekistan (construction of generating unit

in Angren Thermal Power Plant) to meet the rising electricity demand of the country (Kochnakyan A. et al, 2013).

Figure 1. The electricity generation source structure of Uzbekistan 2002-2011.



Source: Uzbekistan - Energy and power sector issues note, 2013.

According to the Centre for Economic Research of Uzbekistan (2012), an ultimate goal of industrial policy and an important component of development strategy in Uzbekistan is progressive structural transformations, maintaining the shift of the focus from production of relatively low value-added commodities to finished goods with high value-added. Introduction of green development pattern is one of the optional ways to be in the context of global and national trends and challenges to stimulate structural reforms and ensure sustainable development.

From the Figure 2 it can be seen that share of the services in the GDP structure will increase from 45.1% in 2012 to 55% in 2030 and processing industry’s share will increase from 9% in 2012 to 22% in 2030 alternatively¹. Whilst transformation of enterprises to the value added goods production will meet considerable shift of large firms from 39% to 44.5% and for medium firms from almost 8% to 32.3% respectively. This is due to Uzbek

¹ Forecast of Centre for Economic Research of Uzbekistan, 2015.

government's ultimate goal to achieve 7-8% of sustainable growth each year. Moreover, the Figure 3 demonstrates that there will be demographic changes in the society and income of the population will increase.

All this developments will transform the demand for resources and infrastructure which means industrial and residential sector will consume more electricity in the near future. For this reason, the Uzbek government has chosen to develop solar power energy to fulfill the future demand for electricity (Mukhammedova, 2012).

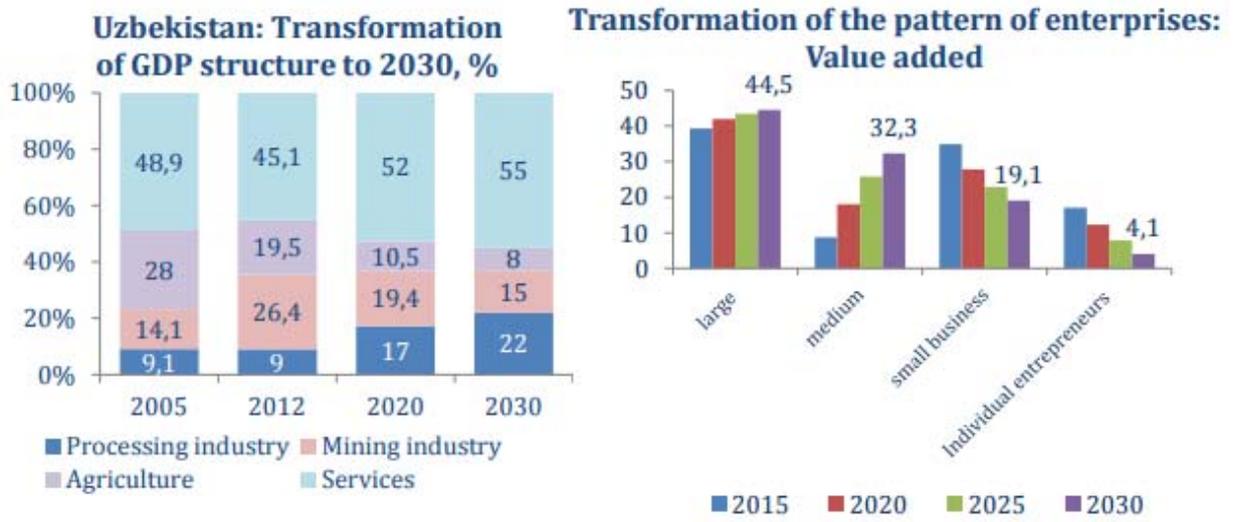
Specifically, further industrial development in Uzbekistan will require more energy input which might raise a deficit in the future if "Green Economy" policies are not actualized. Considering this, a "Green Economy" strategy has been chosen for the sustainable development of Uzbekistan.

The Uzbek government's current energy strategy's key priorities are energy security, affordability, and efficiency. Focusing on this, policy and legal frameworks were adopted by the government to eliminate power losses and energy intensity, make institutional reforms and attract more investment to energy sector.

The Uzbek government has targeted to implement following goals:

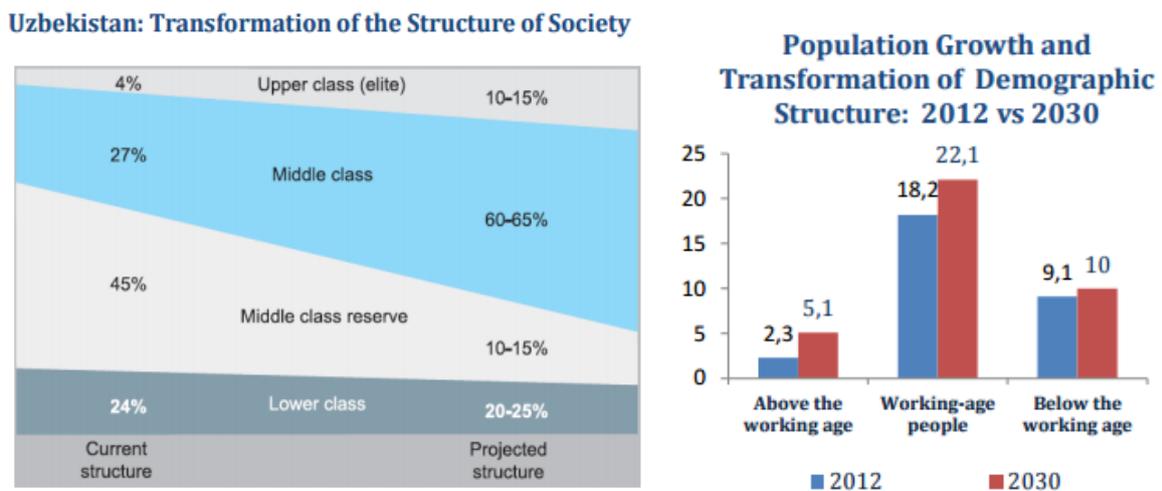
- promotion of rational use and integration of clean energy technology to maximize savings;
- to harmonize national planning with energy efficiency policies;
- commercializing utility operations to improve sector performance;
- increase of participation of private sector;
- promote a commercial energy exports.

Figure 2. Uzbekistan New Development Goals on Industrial Transformation Towards 2030



Source: Centre for Economic Research, Transition to a Resource-Efficient Pattern of Growth in Energy Sector, 2015

Figure 3. Uzbekistan’s Demographic Change Forecast for 2030



Source: Centre for Economic Research, Transition to a Resource-Efficient Pattern of Growth in Energy Sector, 2015

Furthermore, Uzbekistan has a huge area, abundant sunshine and plenty of skilled human resources to develop a solar power sector. Thus, Uzbek government has the intention to generate 21% of all the energy needs by using renewable sources, especially solar, of energy by 2031. In this sense, the Uzbek government has announced to base three a large scale solar power plant projects with total 300 MW capacity in Samarkand, Namangan and Surkhandarya regions with total investment of nearly 700 million of USD. Uzbekenergo is responsible for implementation of the project while Asian Development Bank and Uzbekistan Fund for Reconstruction and Development will finance the project. All solar power plants are planned to start to operate by 2020 (Asian Development Bank, 2015).

Moreover, the small scale projects of decentralized electrification of rural areas of Uzbekistan using solar power panels began implementation in 2009 by Uzbekistan technology transfer agency, which is one step forward for renewable energies (Uzreport, 2009). This projects reflect how Uzbek government strategy and vision to develop the electricity sector is targeted to achieve sustainable development and improvement of quality of life of the population.

3.2. Does institutional structure matter?

Privatization is one of the pivotal goals of former Soviet Union Republics, including Uzbekistan. Generally speaking, the government can attract foreign capital investment, boost economic efficiency through competitive market and allocate resources rationally with a help of privatization. By financial improvement, organizational, and technological restructuring will lead to the development of competitiveness in the markets, and plus enhancement of private investment. This policy actions encourage the privatization as a result. After the

collapse of the Soviet Union most former republics prompted to reform their electricity sector, because of it is one of the most valuable assets to the economy (Anex, 2002).

Uzbekistan's electricity sector demonstrates gradual transition from centrally planned to a market based economy. As it is said earlier, electricity system is managed and operated by Uzbekenergo which was formed to replace the Ministry of Energy and Electrification in 2001. The price of electricity is set by the Pricing Department of Ministry of Finance of Uzbekistan and thus the major regulatory institution (Asian Development Bank, 2005). Moreover, Asian Development Bank (2012) considers Uzbekenergo as a vertically integrated and publicly owned monopoly.

However, the government has focused on commercializing its several business lines and bring competition to the power market. Thus, to become a model power utility in the region, Uzbekenergo purposes to change its organization and procedures. This will include introducing new services, business practices, and technology.

Mehta et al (2007) claims that subsidiaries of Uzbekenergo (Forward to Appendix 1.) are officially separate legal entities, however, each of them report to the Company Council. In addition to that, the electricity tariffs are not unbundled, and even calculation of the bulk power between subsidiaries are not available, and neither discrete account books for them. The Company Council controls all regulators of the entities and communicate with them directly which means it is not visible to the public and vertically integrated. Such a situation increase disputes. For instance, there is a misreport of electricity flow from the high voltage transmission lines into the low voltage distribution system. It might be caused by theft of electricity from distribution lines, bribery cases or employees negligence.

In the Korean case, the electric power sector was managed by three corporations (Chosun Electric, Kyung Sung Electric, and Namsun Electric) before 1960s and on July 3,

1961 KEPCO was established by consolidating them. However, KEPCO was nationalized purchasing 100% of stocks by the government and it became a national public corporation. Hence, the government was responsible for the development, generation, transmission, supply, and all other aspects of electricity sector. Nevertheless, nationalized KEPCO was blamed for incomplete management efficiency as a monopoly corporation that had exceeded the economy of scale. In order to solve this issue, it sold 21% of the stock to a private corporation in October 1989. Additionally, more government stocks were sold after the IMF crisis in 1997 to improve KEPCO efficiency. The next step of institutional change was targeted to split the generation industry into six subsidiaries by the government policy on April 2, 2001. The list of six subsidiaries is as follows:

- Korea Hydro & Nuclear Power Co., Ltd.;
- Korea South-East Power Co., Ltd.;
- Korea Midland Power Co., Ltd.;
- Korea Western Power Co., Ltd.;
- Korea Southern Power Co., Ltd.;
- Korea East-West Power Co., Ltd.

Table 3 shows a comparison of the Uzbekistan and Korean electric power sector structures, where Korean institutions outnumber Uzbekistan's electric sector institutions. For instance, Korean Power Exchange established on March 29, 2001 as a new institution of power market was a new mechanism of management of electricity (Won, 2007). According to article 31 of Electricity Act, all generators and retailers can only trade through this market (KEPCO, 2015) While in Uzbekistan electricity structure Ministry of Finance is responsible for setting price power. Moreover, there are couple of different research institutions related to energy sector in Korean electricity structure which makes market research not only domestically, internationally as well. For example, Korea Energy Economics Institute

conducted research on national energy and resource policy, forecasting supply and demand of energy and resources and research on rationalization of energy utilization, and providing research on green growth related policies (Korean Energy Economics Institute, 2015). This type of institutional structure and reforms made Korean electricity market more economically efficient and feasible for generators and consumers as well.

Moreover, reinforced metering management and prevention of illegitimate power usage methods implemented in the framework of the National Power Grid Development project. These methods included double inspection of effective meters and quick replacement of defective meters, inspection of massive power consumers, and inspection of improper connection to lines. In addition, illegitimate power usage prevention box which is properly sealed made impossible to use power lines illegally and special illegitimate power detection teams were established. These teams dedicated to find corrupted field workers of KEPCO. Such methods were implemented aggressively and quick. During 50 years of development history, Korea has dramatically reduced illegal electricity consumption with said methods (Ministry of Knowledge Economy, 2012).

Table 3. Comparison of Korean and Uzbekistan’s institutions related to the electricity sector.

South Korean energy sector structure	Uzbekistan energy sector structure
Prime Minister	Cabinet of Ministers
Ministry of Trade and Energy	Ministry of Finance
Korea Power Exchange	“Uzbekenergo”
	Ministry of Agriculture and Water Resources
Korea Electricity Commission	Subsidiaries of “Uzbekenergo”
Korea Institute of Energy Research	Subsidiaries of “Uzbekenergo”

Korea Energy Agency (reformed name of “Korea Energy Management Corporation”)	Subsidiaries of “Uzbekenergo”
Korea Energy Economics Institute	Subsidiaries of “Uzbekenergo”
KEPCO	Subsidiaries of “Uzbekenergo”

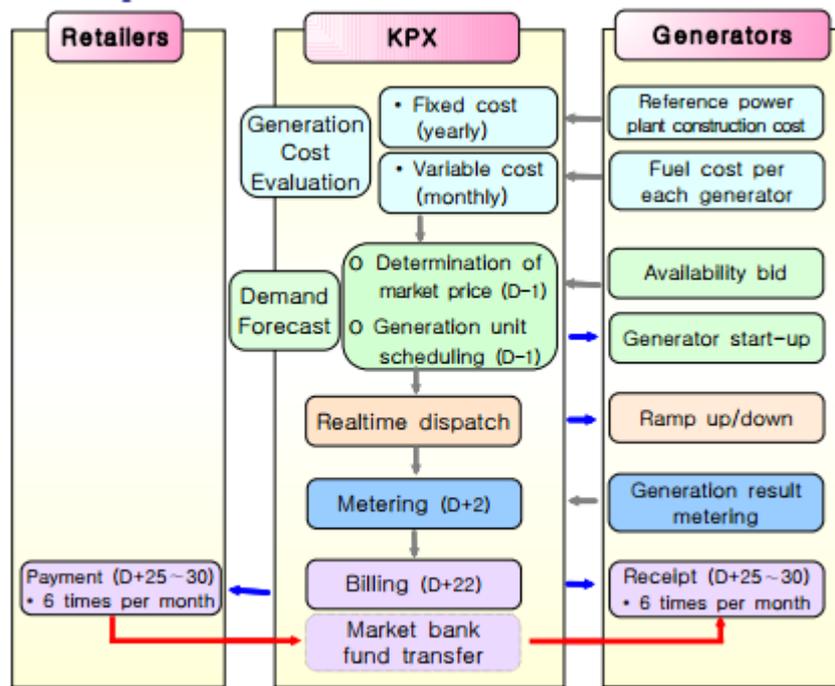
Source: the data compiled from the following websites- www.gov.uz, www.uzbekenergo.uz, english.motie.go.kr, www.kepco.co.kr, www.keei.re.kr, 2015

3.3. Findings:

During the research I aimed to find what the keys to the success of policy makers of Korea were after the Korean War to rebuild their economy. For example, after the Korean War, the country was totally devastated and major power plants were on the territory of the North, and the basic source of fuel for South Koreans was firewood. Then President Lee Seung-Man established a coal-based development strategy to develop the economy step-by-step which should become the main source of energy generation and production. It is one example where we can see the strategy of the Korean government, to rapidly replace old technology with new, and consider not only the needs of industry but residents as well. The essence of this strategy was kept during the next decades of the Korean energy sector in general. For example, as Korean economy was expanding the government started to shift from coal to oil based electricity generation. The oil was till 1970s and 1980s main source of energy generation till the oil shock happened. After the oil shock the Korean government energy policy changed towards reducing reliance on oil for energy generation. Similarly, Uzbekistan also generates power mainly by one type of fuel, which is natural gas.

In addition to that, I have looked at the International Energy Agency Statistics to compare figures on electricity and here what I have found (Table 4.)

Figure 4. Korean Power Market Operation Procedure



Source: Korea's Power Market, KEPCO, 2015

Table 4. Uzbekistan and South Korea's Electricity Statistics for 2012

	Uzbekistan	South Korea
<i>Production from:</i>	<i>Unit GWh:</i>	
-coal	2,145	239,347
-oil	383	21,168
-gas	38,762	111,937
-biofuels	0	964
-waste	0	700
-nuclear	0	150,327

-hydro	11,210	7,652
-geothermal	0	0
- solar PV	0	1103
- solar thermal	0	0
-wind	0	917
-tide	0	0
-other sources	0	503
Total production	52,500	534,618
Imports	12,183	0
Exports	-12,272	0
Domestic Supply	52,411	534,618
Losses	4,613	17,292
Final Consumption	43,312	481,405

Source: International Energy Agency, 2015

As Table 1 above illustrates, it is clear that Korea's electricity capacity is ten times higher than Uzbekistan. Surprisingly, the imports and exports of electricity of both countries are interesting. Uzbekistan imports 12,183 GWh of electricity 12,272 GWh whereas Korea does not import any GWh of electricity and even exports which shows their self-sufficiency in terms of power supply. Moreover, Uzbekistan power losses are higher than Korea, at 8.7% and 3.2% of total production respectively. It means Uzbekistan has significantly high levels of power losses which harms the supply side of the electricity sector. And Uzbekistan should make investments to national power grid system to make power supply reliable.

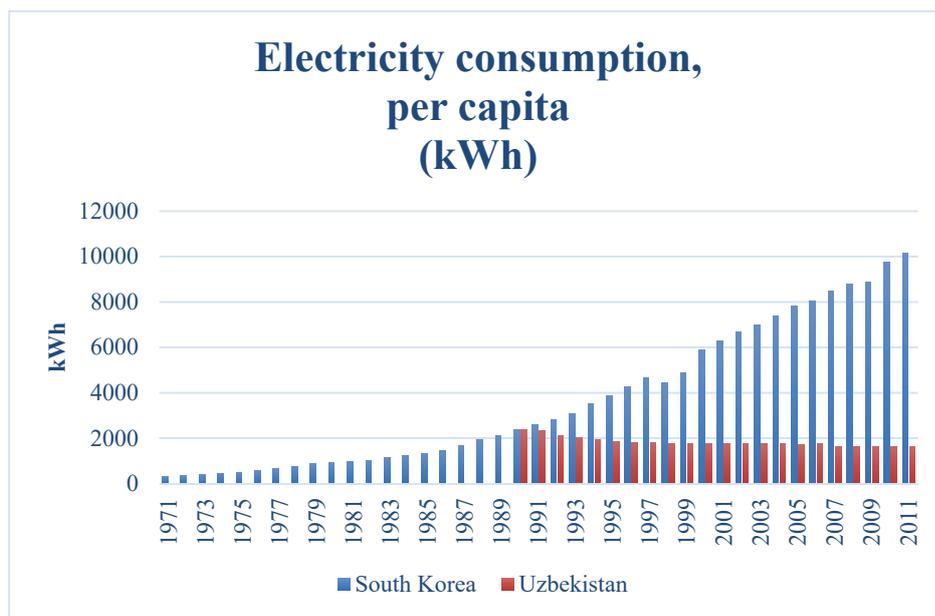
Another interesting fact that I have found is that, after the Five Year Development plans and Rural Electrification Projects the electricity consumption per capita of Korea

started growing. For example, electricity consumption was 298.1 kWh in 1971 while it grew to 913.6 kWh in 1979 respectively. In this decade, Korean population per capita electricity consumption grew three times. Furthermore, the trend continued to grow where it showed ten times much higher electricity consumption per capita with 10162 kWh in 2011.

On the contrary, in Uzbekistan’s case it showed downward trend where the consumption of electricity fell from 2325 kWh in 1991 to 1752.52 kWh in 2001. In ten years of development, Uzbekistan population were consuming almost 600 kWh less electricity than in 1991. Consequently, the electricity consumption per capita continued showing gradual downward trend again where it decreased to 1625 kWh in 2011 respectively (Figure 5).

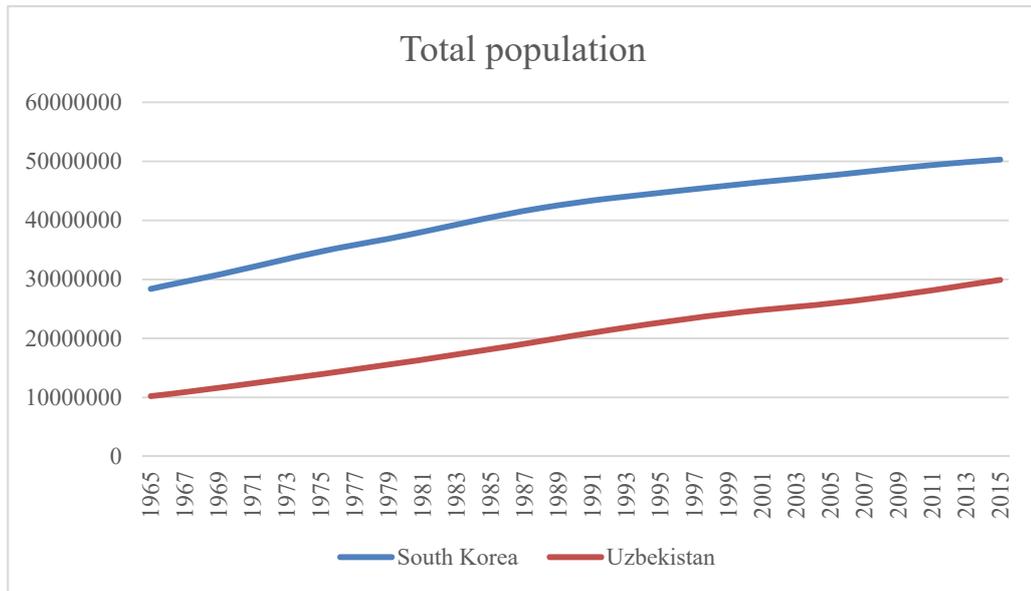
Additionally, the population grew from 20.9 million to 24.8 million in Uzbekistan from 1991 to 2001 respectively. By analyzing the Figure 5 and Figure 6 we can see that the population grew whereas the electricity consumption per capita was decreasing. It means that most of residents are not connected to the national power grid and power sector development was very slow.

Figure 5. Electricity consumption per capita of Korea and Uzbekistan in kWh from 1971 to 2011



Source: Data from www.gapminder.org, accessed 10.10.2015

Figure 6. Total population growth trend of Korea and Uzbekistan from 1965 to 2015



Source: Data from www.gapminder.org, accessed 10.10.2015

Chapter IV. Conclusion and Recommendations

From the above discussion of scholars and analysis of past and current policies of Korea, some conclusions and policy recommendations could be made for Uzbekistan's electricity sector development. Based on the comparison, there are solutions for above mentioned issues in Uzbekistan electricity sector could be found in the development of Korea which had similar type of issues throughout its history.

The first recommendation for the electricity sector development of Uzbekistan is to widen the government infrastructure projects more for rural areas. As analysis shows from above, Korea did in early 1970s and 1980s to develop rural electricity infrastructure a lot of efforts and used new methods of Saemaul Undong to encourage rural people to change their quality of life. According to World Bank Indicators (2015), 64% of the population of Uzbekistan lives in rural areas. By making a similar model of development will help to foster urbanization, expand access to the technology and increase the economy of Uzbekistan.

The second is to create illegitimate power usage prevention programs in the framework of Uzbekenergo management and operation system to make proper metering of electricity between subsidiaries. The Uzbek government should establish new regulations and enforce these types of methods and provide hidden monthly field inspections on distribution lines to find in which areas there are illegal power connections to the electricity lines. Such methods helped to Korea decrease power losses and increase transparency in the electricity sector.

The third important step is to make institutional reforms in electricity sector of Uzbekistan. The privatization of stocks of Uzbekenergo and its subsidiaries will create competitive market for electricity sector. Moreover, Korea divided the generation industry into six subsidiaries from KEPCO in 2001, creating competitiveness in the market and a sustainable supply of electricity to the population and the industry. The development of such

a new type of industry will help to the government of Uzbekistan cut the expenses on investment to the electricity generation infrastructure by allowing private investors to enter the industry do it in order to increase their profit.

The last of recommendation is to establish energy economy institutes to research and create a knowledge database on the demand and supply of energy. Such institutes will help to remove organizational barriers for innovations in the energy sector and to choose appropriate development strategies for related industries as well. Moreover, such research institutions will create links between universities and institutes which study energy related issues. That would generate applicable and up-to-date knowledge for prospective students.

Bibliography

- Anex, R.P. 2002. Restructuring and privatizing electricity industries in the commonwealth of independent states. *Energy Policy*. 30 (2002): pp. 397–408.
- Asian Development Bank. 2012. *Country Partnership Strategy: Uzbekistan 2012–2016*. Asian Development Bank. Available from: <http://www.adb.org/documents/uzbekistan-country-partnership-strategy-2012-2016> (accessed: October 10, 2015).
- Asian Development Bank. 2005. *Electricity Sectors in CAREC Countries: A Diagnostic Review of Regulatory Approaches and Challenges*. Asian Development Bank. Available from: www.adb.org/sites/default/files/pub/2005/electricity-sectors-carec-countries.pdf (accessed: October 10, 2015).
- Asian Development Bank. ADB to Help Uzbekistan Build Central Asia's First Solar Power Plant. *Asian Development Bank News Release*, November 22, 2013. Available from: <http://www.adb.org/news/adb-help-uzbekistan-build-central-asias-first-solar-power-plant>.
- Centre for Economic Research. 2012. *Green Energy for Structural Transformation*. Republic of Uzbekistan: Centre for Economic Research.
- Eschanov, B. 2006. How to meet the future energy needs of Uzbekistan. M.Sc. diss., Royal Institute of Technology.
- Gevelt, T. 2014. Rural electrification and development in South Korea. *Energy for Sustainable Development*. 23 (2014): pp. 179-187.
- John, B., Leigh, G., Hoesung, L., Young-Doo, W., and Jung-Min, Y. 2004. Electricity Reform at a Crossroads: Problems in South Korea's Power Liberalization Strategy.

Pacific Affairs. 77 (3). The Political Economy of Electricity Reform in Asia (fall, 2004): pp. 493-516.

Kochnakyan, A., Khosla, S. K., Buranov, I., Hofer, K., Hankinson, D., and Finn, J. 2013. *Uzbekistan - Energy and power sector issues note*. Washington, D.C. World Bank Group. Available from:
<http://documents.worldbank.org/curated/en/2013/06/18882686/uzbekistan-energy-power-sector-issues-note> (accessed: July 24rd, 2015).

Korea Electric Power Corporation. 2015. *Korea's Power Market*. Republic of Korea: Korea Electric Power Corporation.

Korea Energy Economics Institute. 2015. Major functions of Korea Energy Economics Institute, last modified in 2015,
http://www.keei.re.kr/main.nsf/index_en.html?open&p=%2Fmain.nsf%2Fmain_en.html&s= .

Mehta, A., Rao, S.H., Terway, A. 2007. Power sector reform in Central Asia: observations on the diverse experiences of some formerly Soviet Republics and Mongolia. *Journal of Cleaner Production*. 15 (2007). pp. 218-234

Ministry of Knowledge Economy. 2012. *2011 Modularization of Korea's Development Experience: Rural Electrification Project for Expansion of Power Supply*. Republic of Korea: Ministry of Knowledge Economy.

Ministry of Knowledge Economy. 2012. *2011 Modularization of Korea's Development Experience: National Power Grid Development Project For Stable Power Supply..* Republic of Korea: Ministry of Knowledge Economy.

Ministry of Trade, Industry and Energy and Korea Resources Economics Association. 2013. *2012 Modularization of Korea's Development Experience: Energy Policies*. Republic

of Korea: Ministry of Trade, Industry and Energy and Korea Resources Economics Association.

Mukhamedkhanova, K. 2012. *Energy policy of Uzbekistan: opportunities, problems and prospects*. Paper presented at the JICA Group Training Program in Energy Policy at the Institute of Energy Economics of Japan, May 7 - 25, 2012.

Niez, A. 2010. Comparative study on rural electrification Policies in emerging economies. *International Energy Agency*. Paris. International Energy Agency.

Available from:

http://www.iea.org/publications/freepublications/publication/rural_elect.pdf

(Accessed: October 10, 2015)

Pak, K.H., Gamble, S.D. 1975. *The Changing Korean village*. Seoul: Shin-Hung Press.

Pomfret, R. 2012. *The Central Asian Economies Since Independence*. Princeton and Oxford: Princeton University Press.

Sagdullaev, J. 2005. Energy policy, economic cooperation, and sustainable development in Central Asia: the case of Uzbekistan. Master's degree diss., Justus-Liebig-Universität Gießen.

Salikhov, T.P. 2006. Uzbekistan Energy Strategy. *Power Engineering Society General Meeting. IEEE*. pp.4.

Han, S.Y., Yoo, S.H., Kwak, S.J. 2004. The role of the four electric power sectors in the Korean national economy: an input–output analysis. *Energy Policy*. 32 (2004): pp. 1531–1543.

Stern, D. I. 2011. The role of energy in economic growth. *Ecological Economics Reviews*. Robert Costanza, Karin Limburg & Ida Kubiszewski, Eds. Ann. N.Y. Acad. Sci. 1219:

26–51.

Uzreport. Rural electrification with solar power begins in Uzbekistan. *Uzreport Information agency*, July 13, 2009. Available from: http://news.uzreport.uz/news_4_e_63616.html (accessed: August 10th, 2015).

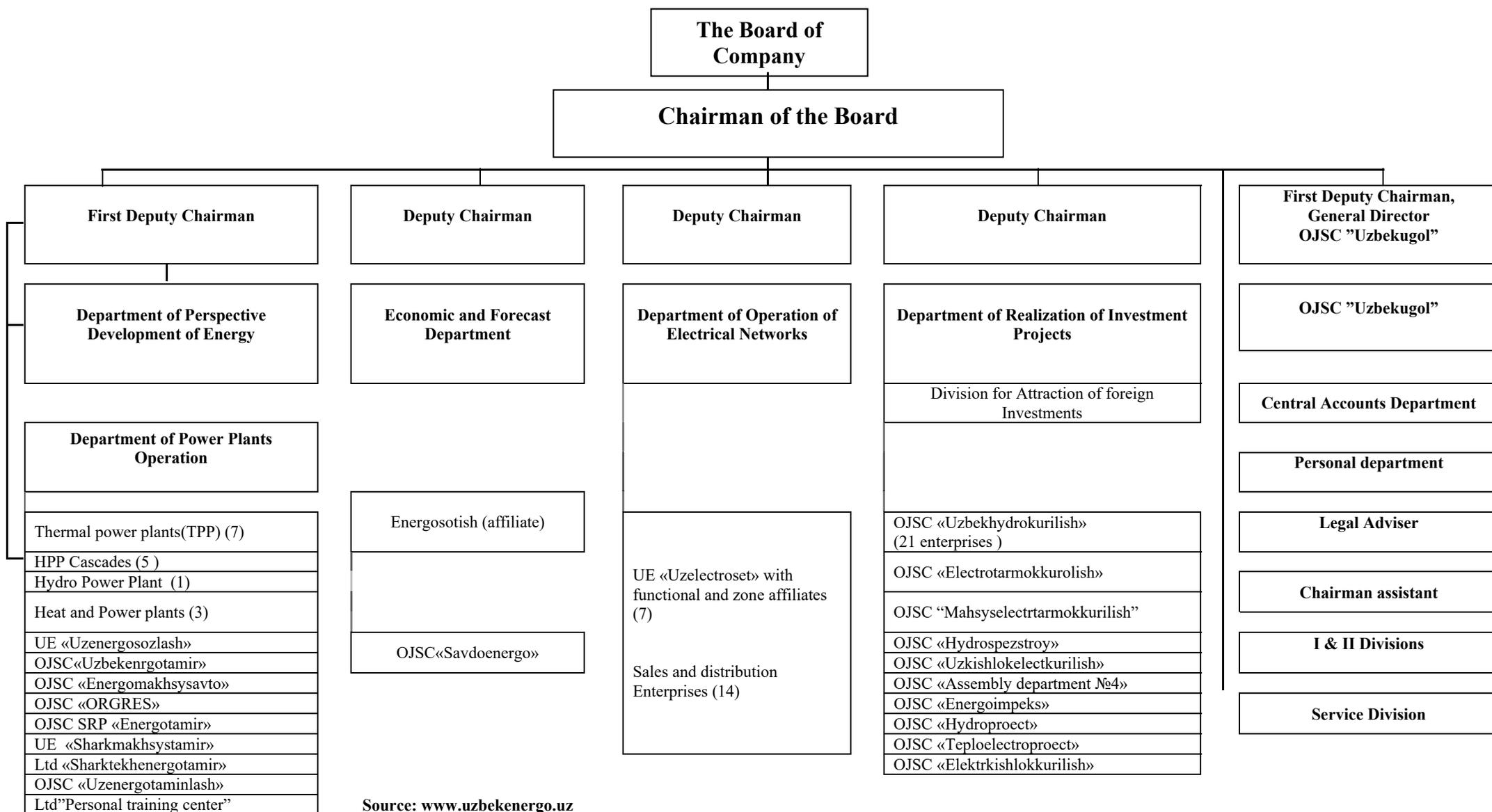
Woo, J. C. Update on Korea Energy Sector and Energy Policies. *NAPSNet Special Reports*, July 21, 2014. Available from: <http://nautilus.org/napsnet/napsnet-special-reports/update-on-Korea-energy-sector-and-energy-policies/> (accessed: July 24rd, 2015).

Won, G.H. 2007. Electric power industry restructuring and ROE: The case of Korea Electric Power Corporation. *Energy Policy*. 35 (2007): pp. 5080–5090.

World Bank. 2014. *Doing Business 2015: Going Beyond Efficiency*. Washington, DC: World Bank Group.

APPENDICES

Appendix 1. Organizational Structure of Uzbekenergo



Source: www.uzbekenergo.uz

