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THESIS

TARIFFING METHODOLOGY IN ELECTRICITY SUPPLY SECTOR OF KAZAKHSTAN AND ITS IMPLICATIONS FOR EFFECTIVENESS IN ELECTRICITY SUPPLY SECTOR

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LIST OF ACRONYMS

RK	The Republic of Kazakhstan
MERK	Ministry of Energy of the Republic of Kazakhstan
CRNMPC	Committee on Regulation of Natural Monopolies and Protection of Competition under the Ministry of National Economy of the Republic of Kazakhstan
KOREM	Kazakhstan Operator of Electric Power and Capacity Market
KEGOC	Kazakhstan Electricity Grid Operating Company
UPS RK	Unified Power System of the Republic of Kazakhstan
RB	Rate Base
IRR	Internal Rate of Return
GRES	Thermal plants that produce only electricity and referred to as Governmental Regional Electric Station
CHPP	Combined Heat and Power Plants
CPP	Condensing Power Plants
GTPP	Gas Turbine Power Plants
HPP	Hydro Power Plant
RES	Renewable Energy Sources
VIC	Vertically-Integrated Companies
MW	Megawatt
RoR	Rate of Return
FDC	Fully Distributed Cost
PLP	Peak Load Pricing

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ABSTRACT

The background of this research was defined from the current situation in electrical energy supply sector in the Republic of Kazakhstan, where the major problem is a high level of depreciation of existing electric power capacities. According to the latest statistics published by the System Operator of the National power industry of Kazakhstan the depreciation rate of power plants is around 70%. Provided a growing trend in electricity consumption forecast, a significant amount of new power capacities is required to be built in a nearest future to meet an internal power demand.

In order to solve the problem of aging electric power capacities and ensure that in a future there will be sufficient number of generating power plants to meet a growing demand, Kazakhstan needs to attract foreign investors today. Up to the current moment the power supply industry is highly dependent on external resources, since locally there is no sufficient financing, no available technologies and no qualified professionals who might carry out such complex projects as building modern power plants. Since the major factor that defines the attractiveness for foreign investors is a tariff, which will ultimately results in investor's returns, it is very important to design and implement an adequate tariffing methodology in power supply sector to attract external investments.

Currently electricity supply in Kazakhstan is a highly regulated industry where government plays a significant role in defining or limiting tariffs for power producing companies. After the collapse of Soviet Union, the government of Kazakhstan has been looking for the optimal tariffing methodology that will be attractive enough for investors and fair enough for electricity end consumers.

Since 2009 the tariffing methodology in power supply switched from cost-plus approach to "marginal tariffs". The idea behind application of marginal tariffs implied the following: all electricity suppliers have been divided into 13 groups and each group received its own tariff, fixed for the following 7 years and tariff for each group was independent from other groups'. The first seven years of application of marginal tariffs from 2009 to 2016 did not show expected results since no much investments have been made during this period.

However, due to the lack of other alternatives, in 2016 the application of marginal tariffs in Kazakhstan was prolonged until the end of 2025. From 2016 till 2018 power suppliers will charge marginal tariffs for electricity (the same as it was during 2009 – 2015), and starting from 2019 marginal tariffs will be split into two groups, tariff for electricity and tariff for capacity, defined for 15 groups and valid until the end of 2025.

This research is aimed to provide recommendations to the Ministry of Energy of the Republic of Kazakhstan on the most appropriate tariffing methodology to be applied in electricity supply sector of Kazakhstan, which will be high enough to attract investments and at the same time will not become unbearable burden for end-consumers. In addition, this research will elaborate on the conditions and prerequisites to be in place to ensure successful implementation of suggested recommendations.

The theoretical framework of the research will be based on a review of theories describing different tariffing methodologies used in electricity supply. Based on the review results, a comparative analysis of tariffing methodologies found in theory with those applied in Kazakhstan will be performed to elaborate on what the country can learn from theories. For this purposes secondary data will be collected from official websites, empirical studies documentation, legislative documentation and other appropriate literature.

1. INTRODUCTION

1.1. PROJECT CONTEXT

The Republic of Kazakhstan (hereinafter Kazakhstan) is a developing country where economic growth and social security are those of the highest priority. The state has an ambition to become one of the 30 most developed countries in a world by 2050 as stated in the "Address of the President of the Republic of Kazakhstan N. Nazarbayev to the nation" (2014). It is known that one of the most crucial driver of economic growth, especially in developing regions, is a reliable access to electricity at reasonable price. In this perspective *reliability* implies a secured electrical energy system functioning within acceptable level of system breakdowns or power outages, *access to electricity* means that there are no limitations or restrictions to get access to the electrical grid and the *reasonable price* for electricity is a price that fairly represents the costs incurred to produce and transmit electricity providing expected level of return for involved stakeholders. In this context, the cost of electricity supply plays one of the major role in the electrical energy industry and the economy of the country. It is, therefore, utmost important that tariffing methodologies used are adequate, efficient and considered as transparent and fair.

The power system of Kazakshtan takes its roots from the collapse of Soviet Union in early 1990s, when a number of new sovereign states have been established, including the Republic of Kazakhstan. All the new states had to re-establish their power system that was previously a part of an integrated soviet power system and now became isolated from neighboring countries. Like Kazakhstan, most of post-soviet countries faced similar challenges in power supply sector, including establishment of appropriate and efficient tariffing methodology in power supply. Provided a similar nature of power supply sectors among post-soviet countries, the results of this research, focused on Kazakhstan case, might be also relevant to other post-soviet countries adjusted for specific conditions of each state.

1.2. PROBLEM STATEMENT

Currently the electricity industry of Kazakhstan has a deficit in power capacity and internal electricity demand exceeds electricity supply, the country exports electrical energy from Russian Federation and Central Asian region which makes the country dependent on external energy supply. Despite slight efforts made towards energy efficiency and energy conservation in the country, the electricity demand in predicted to continue its growth in the future. On power supply side, in contrast, the trend is the opposite: the existing power capacities are outdating, no sufficient investments and reconstructions of power facilities are made. As of 2014 total depreciation of power generation plants was estimated to be around 70% including 57% of those that have been exploited for more than 30 years (KazEnergy, National Energy Report, 2015).

Provided that electricity supply is a capital intensive industry where significant initial investments are required in a long-term prospective, the country might have a risk of electricity deficit in the long-term perspective If no actions will be implemented in the nearest future, the electricity supply sector of the country might face a situation when power generation capacities will not be sufficient

to cover an increasing demand for electrical energy and there will be no development in energy industry in particular and the economy in general.

From 2009 till 2015 the tariffing methodology of marginal tariffs was applied in power supply sector of Kazakhstan. All power suppliers were divided into 13 groups and each group, independently from each other, received a fixed tariff for seven years, that was a maximum level that power suppliers were allowed to charge. In exchange for marginal tariffs, all power suppliers submitted their planned "investment program", where a detailed plan of investment and reconstruction activities was presented. However, at the end of 2015 the main problem of lack of investment was not resolved. The expected amount of investments in power capacities was not made and there was no new significant power projects made. A number of power sector specialists put the blame on "marginal tariffs" methodology and claimed that such a methodology eliminates competition, transparency and investment incentives. As alternative, the experts suggest to switch to free-market mechanisms with a lowest level of regulation, as currently the case in many developed countries, that will presumably boost incentives for foreign investors to invest in power facilities. However, the open questions are: is Kazakhstan in its current economic and political situation ready to switch from regulation to free-market organizational structure? Are there any ready-to use alternate methodologies that can be applicable for Kazakhstan? Is the applied methodology of 'marginal tariffs' a root cause for lack of investments or there are other factors that should be considered as well? The answers to these questions will help better understand the root causes of the problem and find an optimal solution.

1.3. RESEARCH OBJECTIVE

The goal of this research is to provide recommendations to the Ministry of Energy of the Republic of Kazakhstan (MERK) on better design of tariffing methodology and tariff structure in electricity supply sector in Kazakhstan and the way the country could implement it by making a comparative analysis of tariffing methodologies used in Kazakhstan with those suggested by theories.

1.4. RESEARCH DESIGN

In the following sections, a design of this research is elaborated. The design of this research is based on principles and methods as described by Verschuren and Doorewaard (2010) and includes elaboration of a research framework and a conceptual model, defining research central and sub-questions, defining key concepts, deciding on a research strategy, types and sources of research materials and concluding with planning and time schedule of research implementation.

1.5. RESEARCH FRAMEWORK

According to Verschuren and Doorewaard (2010), research framework is a "schematic presentation of the research objective and includes the appropriate step that need to be taken in order to achieve it". The research framework for this research has been constructed based on seven steps and presented below:

Step 1: Characterize briefly the objective of the research project

The aim of this research is to formulate recommendations to the Ministry of Energy of the Republic of Kazakhstan concerning improvements in tariffing methodology in electricity supply sector of Kazakhstan.

Step 2: Determine the research objects

The research objects in this research are tariffing methodologies currently used in Kazakhstan and tariffing methodologies described in theories.

Step 3: Establish the nature of the research perspective

Provided that this research looks for causes of problems in existing tariffing methodology in Kazakhstan that have to be solved, this is a practice-oriented diagnostic research. Based on a review of different types of tariffing methodologies used in electrical energy supply sector in theory a set of criteria and conditions attributable to effective and appropriate tariffing methodology will be defined. These criteria and conditions will be presented in a form of a conceptual model. The existing tariffing methodology used in Kazakhstan will be then evaluated using this conceptual model.

A Conceptual model

A conceptual model serves several major purposes (Verschuren, P. & Doorewaard, H., 2010):

- Helps in demarcating clearly a research subject
- Helps in formulating correctly the assumed relationship between the core concepts
- Links the research project to an existing theory

A conceptual model for this research is presented on a figure below:

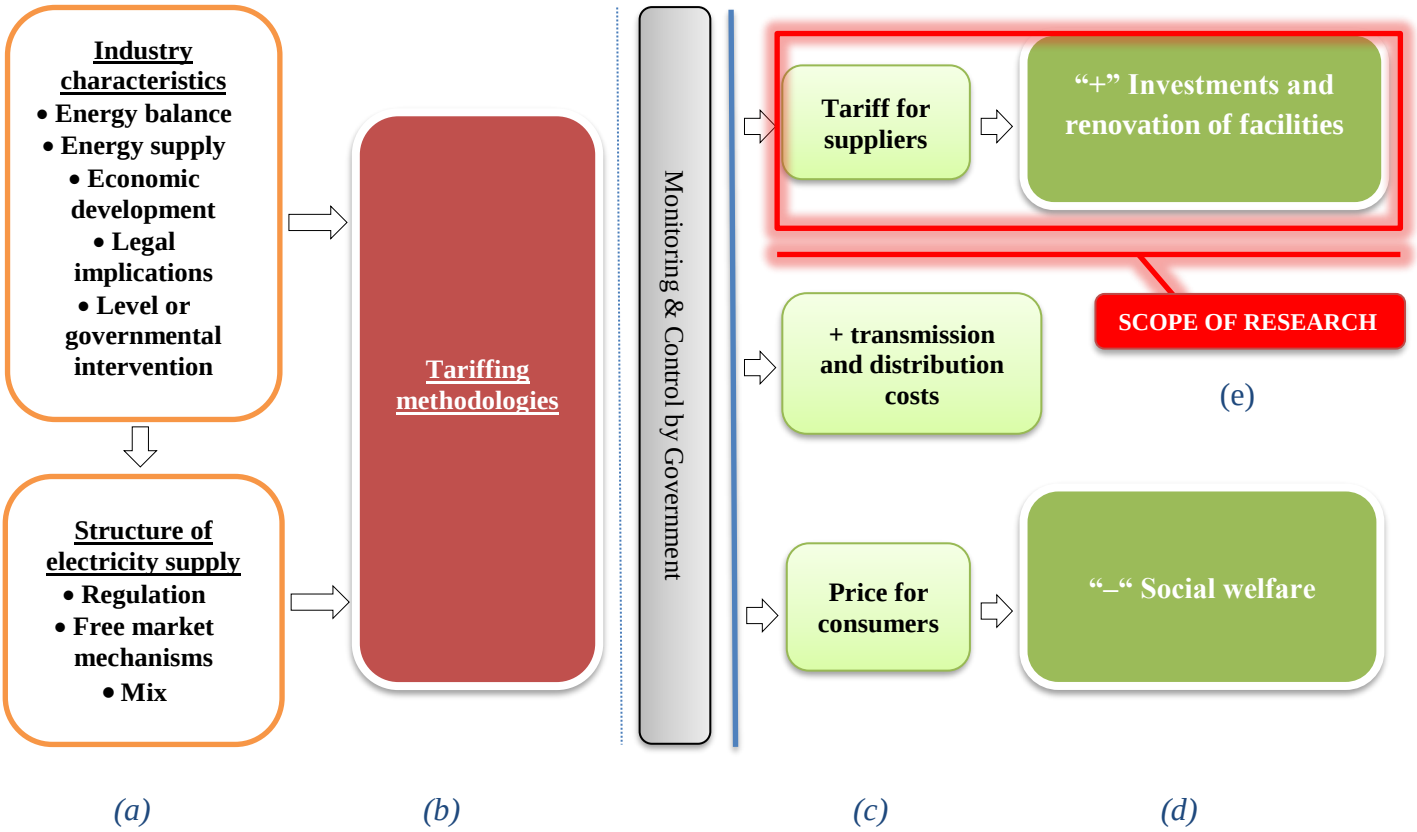


Figure 1.5-1 Conceptual model

The conceptual model reveals core concepts of the research and causal relationship between them. As shown on the conceptual model of the research:

(a) major country's characteristics, such as a level of economic and social development, legislation, electrical energy status define conditions and shape a structure of electricity supply industry;

(b) based on established condition and industry structure an appropriate tariffing methodology is elaborated and implemented;

(c) a tariff for electricity suppliers is estimated on a basis of selected tariffing methodology, oftentimes after it has been approved by authorized monitoring and controlling official bodies (agencies, committees and etc.);

(d) the level of tariff has a dual effect:

- A higher level of supply tariff has a positive effect on power plants' ability to renew their production facilities and also help attract new investments;
- In contrast, when added to the cost of transmission and distribution, a higher tariff will result in higher electricity cost for final consumers. This, in turn, will have a negative effect on economic development and social welfare;

(e) for the purpose of this research tariffing methodologies used in **electricity supply** are studied. Tariffing methodologies used in transmission and distribution sector, as well as end-user tariffs are excluded from the scope of this paper.

Step 4: Determine the sources of the research perspective

Theoretical framework of this research is developed by reviewing scientific literature on tariffing methodologies as well as studying recent documentation and reports specific to electrical energy industry in Kazakhstan.

Step 5: Make a schematic presentation of the research framework

The framework of this research is schematically presented on a figure below:

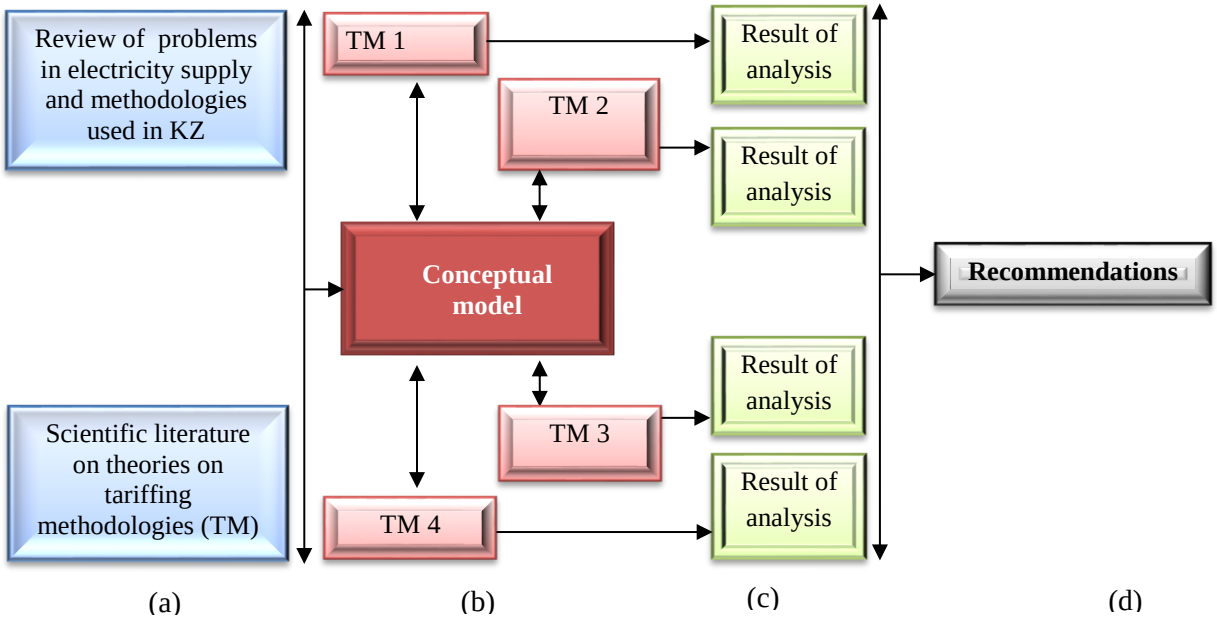


Figure 1.5-2 Schematic presentation of research framework

Step 6: Formulate the research framework in the form of elaborate argument

The course of this research is formulated with the following steps:

a) A review of the current situation in electricity supply sector will identify what are the existing problems in Kazakhstan and how these problems are related to tariffing methodology used;
b) Literature review of theories related to different types of tariffing methodologies in electricity supply will provide insights on what practices can be used in Kazakhstan;
c) A confrontation of the result of analysis concludes with
d) Recommendations for improvements in tariffing methodologies to be used in electrical energy supply sector of Kazakhstan.

Step 7: Check whether the model necessitates any changes

The model does not require any changes.

1.6. RESEARCH QUESTIONS

A method of subdividing the research framework (see 1.5 above) has been used to formulate central questions and sub-questions, respectively. The central questions and sub-questions are presented below:

Central question 1	**What are the problems in electricity supply in Kazakhstan and how are these problems related to the tariffing methodology currently applied in the country?**
Sub-question 1.1	*What are the current problems in electricity supply in Kazakhstan?*
Sub-question 1.2	*How are these problems related to the tariffing methodology currently used?*
Central question 2	**Are the conditions for a free-market organizational structure in place in Kazakhstan?**
Sub-question 2.1	Is free-market organizational structure applicable to the current situation in Kazakhstan?
Sub-question 2.2	What are the conditions to be in place for free-market mechanisms?
Central question 3	**What type of tariffing methodology in electricity supply is the most appropriate in a current situation of Kazakhstan?**
Sub-question 3.1	What types of tariffing methodologies are applied in power supply sector from theoretical perspective and what is the most appropriate tariffing methodology for Kazakhstan power supply sector?
Sub-question 3.2	What conditions or prerequisites are necessary to be in place in Kazakhstan power supply so the applied tariffing methodology brings expected results?

1.7. DEFINING CONCEPTS

For the purpose of this research, the following key concepts and their definitions are used:

Concept	Definition
Electricity supply sector	A sector of a state economy comprising power plants with generation capacity > than 50 MW
Tariffing methodology	"Tariffing methodology" is understood as a prescribed set of rules used to determine the tariff of electrical energy supply that power plants can charge. Tariffing methodology used in transmission and distribution sector are not in the scope of this research
The tariff of electricity supply	A tariff that power plants can charge

Efficiency	"Efficiency" is understood as efficiency of electrical energy generation industry – measured in terms of its reliability and stability parameters (number of cut-offs per day, level of tariffs, share of renewable energy)

Table 1.7.1 Key concepts

1.8. RESEARCH STRATEGY

In this paper, a desk research strategy is used with a combination of a literature survey and a secondary research. The selected strategy is a non-empirical type of research focused on a breadth of a large-scale overview of existing literature and materials by applying a qualitative analysis approach.

Existing literature, secondary data and the most recent official statistical materials will be used as sources of information for this research.

1.8.1. RESEARCH UNIT

For the purpose of this research, two research units have been selected: tariffing methodology used in electricity supply sectors in Kazakhstan and those described in theory. The comparative analysis of these units will result in sufficient information to reach the objectives of this research.

1.8.2. SELECTION OF RESEARCH UNIT

The tariffing methodologies to be studied in this research are selected on the basis of the following criteria:

- the methodology applied in Kazakhstan electricity supply had been enacted by the governmental body;
- the methodology is used in electricity supply sector;
- the methodology is obligatory to be implemented by power plants with capacity more than 50 MW .

1.9. RESEARCH MATERIAL

This section elaborates on the types of materials, information and data required to answer the research questions as well as the sources and accessing methods to be used in the research.

1.9.1. DATA AND INFORMATION REQUIRED, SOURCES AND METHODS OF COLLECTION

The list of data and information, required for the purpose of this research, is based on the set of sub-research questions (see 1.6 above) and shown in table 1.9.1. The sources and collection methods for each type of data and information are defined accordingly.

Central question 1: What are the problems in electricity supply in Kazakhstan and how are these problems related to the tariffing methodology currently applied in the country?

Sub-question 1.1: What are the current problems in electricity supply in Kazakhstan?

Data/information required	*Source of Data*		*Accessing method*
Overview of materials on current situation in electricity supply sector in Kazakhstan	Media	Reliable sources in Internet	Content analysis
	Documents	Industry reports, publications, reviews, legal documents, policies	Content analysis

Sub-question 1.2: How are these problems related to the tariffing methodology currently used?

Data/information required	*Source of Data*		*Accessing method*
Review of the relationship between existing problems and tariffing methodology used	Media	Reliable sources in Internet	Content analysis
	Documents	Industry reports, publications, reviews, legal documents, policies	Content analysis
	Literature	Books, scientific articles	Content analysis

Central question 2: Are the conditions for a free-market organizational structure in place in Kazakhstan?

Sub-question 2.1: Is free-market organizational structure applicable to the current situation in Kazakhstan?

Data/information required	*Source of Data*		*Accessing method*
Overview of types of organizational structures in electricity supply found in theory	Documents	Industry reports, publications, reviews, legal documents, policies	Content analysis
	Literature	Books, scientific articles, specialist journals	Content analysis

Sub-question 2.2: What are the conditions to be in place for free-market mechanisms?

Data/information required	*Source of Data*		*Accessing method*
Overview of conditions necessary to be in place in a free market	Documents	Industry reports, publications, reviews, legal documents, policies	Content analysis
	Literature	Books, scientific articles, specialist journals	Content analysis

Central question 3: What type of tariffing methodology in electricity supply is the most appropriate in a current situation of Kazakhstan?

Sub-question 3.1: What types of tariffing methodologies are applied in power supply sector from theoretical perspective and what is the most appropriate tariffing methodology for Kazakhstan power supply sector?

Data/information required	*Source of Data*	*Accessing method*
Comparative analysis of tariffing methodology in electricity supply applied in Kazakhstan and those found in theory	Information from Central Questions 1 and 2	Content analysis

Sub-question 3.2: What conditions or prerequisites are necessary to be in place in Kazakhstan power supply so the applied tariffing methodology brings expected results?

Data/information required		*Source of Data*	*Accessing method*
Insights from literature and related publications	Media Documents Literature	Related information sources	Content analysis

Table 1.9.1 Data and information, sources and methods of collection

1.9.2. ANALYTICAL FRAMEWORK

The schematic presentation of analytical framework of this research is shown on a figure below:

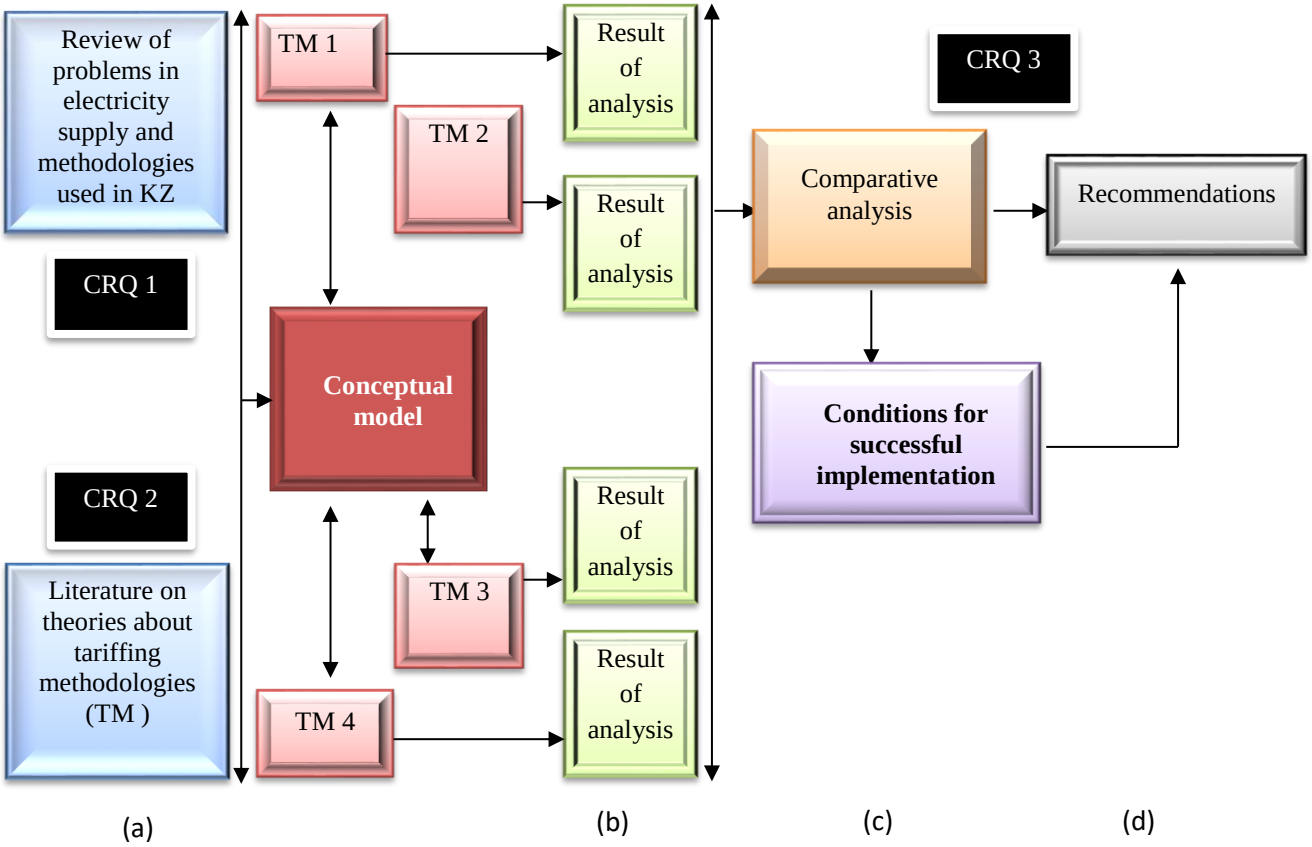


Figure 1.9-1 Analytical framework

The analysis of materials, information and data will be carried out as follows:

(a) To answer the first central question a review of relevant literature and documents will be performed. As a result, the existing problems in electricity supply industry in Kazakhstan will be identified along with how these problems are related to tariffing methodology currently used.

(b) To answer the second central research question a relevant literature, reports and statistics will be reviewed and analyzed to elaborate on what features of tariffing methodologies from theory can be applied to improve tariffing methodology in electricity supply area of Kazakhstan.

(c) A comparative analysis of information obtained in answering central research questions 1 and 2 will allow identify the conditions and requirements that should be established in Kazakhstan in order to successfully implement suggested improvements.

(d) Based or results achieved the set of recommendation will be formulated to the Ministry of Energy of the Republic of Kazakhstan.

1.10. ORGANIZATION OF THE RESEARCH

This research is organized in a following way:

Chapter 1 describes the research context, the problem statement and the research objective.

Chapter 2 elaborates on electricity supply problems of Kazakhstan with a special focus on how these problems are caused by existing tariffing methodology and tariff structure. This chapter will conclude with the answer to a central question 1 and sub-questions 1.1 and 1.2 as described in section 1.6.

Chapter 3 provides a theoretical overview of organizational structure in power supply sector with regards to the level of regulation. A discussion of appropriateness of a certain tariffing methodology in power supply sector is always closely interrelated to the organization of the industry. Some tariffing methodologies might be applied only in free-markets, while others can be used only within a regulated environment. Therefore, it is important first to identify which options in terms of organizational structure of the industry are available in a country. In particular, this chapter will discuss whether government regulation, free-market structure or both can be applied in Kazakhstan in a current situation. This chapter will conclude with the answer to a central question 2 and sub-questions 2.1 and 2.2 as described in section 1.6. The conclusions of this chapter will be considered when performing comparative analysis of tariffing methodologies in chapter 4 and chapter 5.

In **Chapter 4** a comparative analysis of existing tariffing methodology used in Kazakhstan and those found in theories will be carried out. As a result, the conclusion will be made about the types of tariffing methodologies that best fit the current organization structure of the power supply in the country and that can result in boosting incentives for external investors to invest in construction new power capacities. Chapter 4 will also conclude on the type of tariffing methodology found as the most appropriate for power supply sector in Kazakhstan to solve the existing problem of outdating power capacities and what conditions should be in place to guarantee the selected tariffing methodology will bring expected results. Chapters 4 will conclude with the answer to sub-questions 3.1 and 3.2 as described in section 1.6.

Chapter 5 and **Chapter 6** will conclude on the results of the research and provide recommendation on what types of tariffing methodologies can be considered in power supply industry of Kazakhstan and what conditions should be settled by the regulator to make the selected methodology bring expected results.

2. ELECTRICITY SUPPLY PROBLEMS IN KAZAKHSTAN WITH A SPECIAL FOCUS ON HOW THESE PROBLEMS ARE CAUSED BY EXISTING TARIFFING METHODOLOGY

2.1. STRUCTURE OF KAZAKHSTAN ELECTRIC POWER SYSTEM

The Electric Power system of Kazakhstan is represented by a Unified Power System of the Republic of Kazakhstan (UPS RK) that includes a combination of different types of power plants, transmission and distribution lines and substations that are designed to provide a reliable power supply to consumers. An overview of Unified Power System of the Republic of Kazakhstan below is based the last updated information announced by the System Operator of electric power system of Kazakhstan (KEGOC, 2016).

Regulation, monitoring and control and system operator of Unified Power System of the Republic of Kazakhstan

The industry can be characterized as highly regulated by government, represented by the Ministry of Energy of the Republic of Kazakhstan (MERK), that carries out regulatory functions in order to meet the consumers demand for energy and protect the rights of electricity market participants. The main tasks and functions of the Ministry of Energy of the Republic of Kazakhstan, among others, are:

- to implement the state policy in the electric power industry;
- to draw up development programs for the electric power industry and monitor their fulfillment;
- within the bounds of its competence to elaborate and approve regulatory legal acts of Kazakhstan in production, transmission and use of electricity and heat with the exception of technical regulations;
- to enter into agreements and investment contracts with energy producing organizations.

The major functions over monitoring and control of energy industry are carried out by the Committee for State Energy Supervision that supervises the following areas:

- the fulfillment of technical requirements in the electric power industry under regulatory legal acts of the Republic of Kazakhstan;
- rational and economical use, optimization of electricity and heat production, transmission and consumption modes;
- readiness of power stations, electric and heat networks for operation in the autumn and winter conditions.

Committee for Regulation of Natural Monopolies and Protection of Competition of the Ministry of National Economy of the Republic of Kazakhstan (CRNMPC) is the state body performing the management of natural monopolies and regulated markets (including those in the electric power industry) pursuant to the procedure established by the legislation of the Republic of Kazakhstan.

In June 2014 Kazakhstan Electricity Grid Operating Company (JSC "KEGOC") was defined as a System Operator of electric power industry of Kazakhstan and performs the following functions, among others:

- ensures the operational availability of the Unified Power System of the Republic of Kazakhstan;
- determines the amount, structure and allocation of the capacity reserves for the energy producing organizations and engage the capacity reserves in the Unified Power System of the Republic of Kazakhstan;
- provides equal access to the national grid for the wholesale electricity market participants;
- develops electricity and capacity balance forecasts.

An organizational structure of Kazakhstan's power sector is presented on figure below:

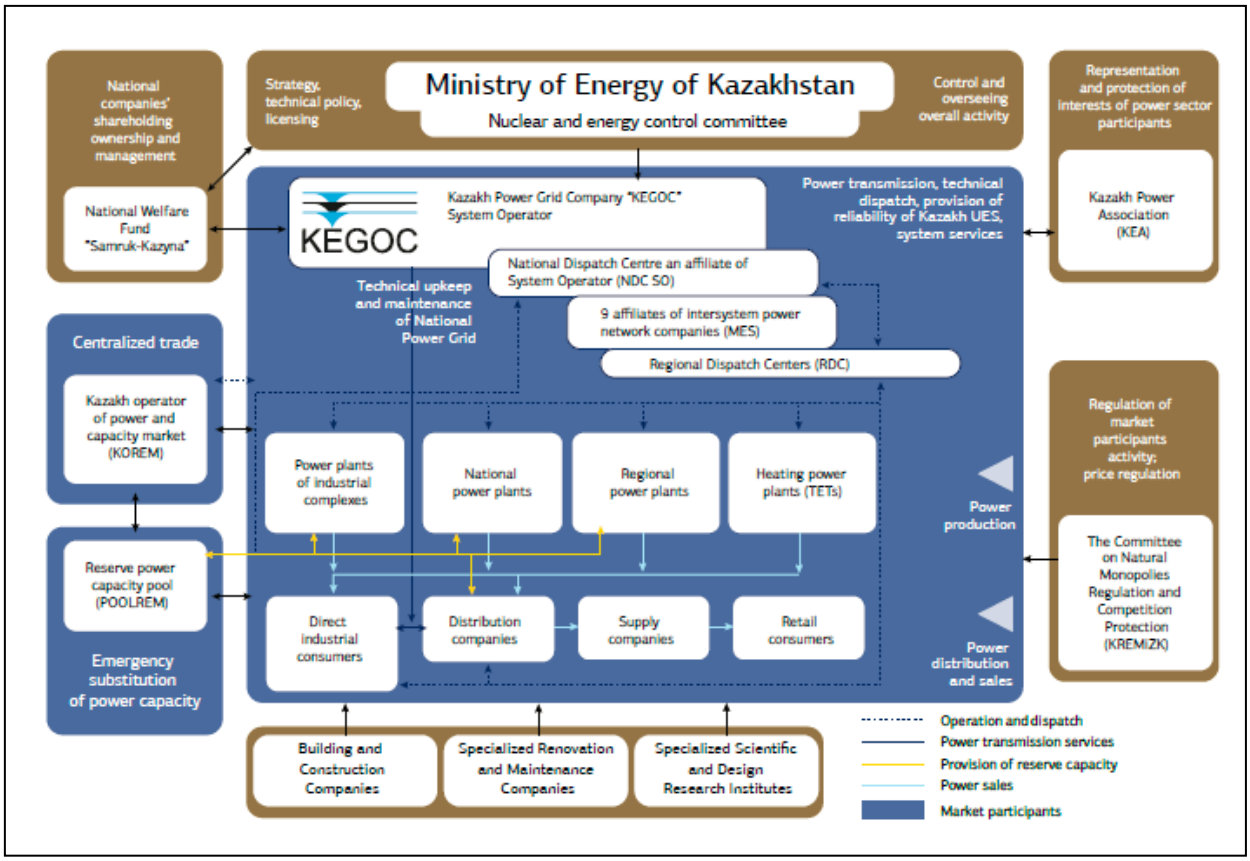


Figure 2.1-1. Organizational structure of Kazakhstan's power and heat sector (National Energy Report, 2015)

The major legislative and regulatory acts and documents effective in electric power industry of Kazakhstan are:

- The Law of the Republic of Kazakhstan "On Electric Power Industry" dated 9 July 2004;
- The Law of the Republic of Kazakhstan "On Energy Saving" dated 13 January 2012;
- The Law of the Republic of Kazakhstan "On Renewable Energy Support" dated 4 July 2009;

- The Rules for organization and operation of the wholesale electric energy market of the Republic of Kazakhstan enacted on 20 February 2015;
- The Rules for rendering services by the System Operator, organization and operation of the system and ancillary services market enacted on 3 December 2015;
- The Rules for operation of the balancing electric energy market enacted on 20 February 2015;
- The Rules for organization and operation of the retail electric energy market, as well as access and provision of services on this market enacted on 20 February 2015.

2.2. OVERVIEW OF ELECTRICITY SUPPLY IN KAZAKHSTAN

According to the National System Operator KEGOC (KEGOC, 2016), electricity generation capacity is presented by both private and state-owned companies. Electricity in Kazakhstan is generated by 111 power plants of various form of ownership. The total installed capacity of power plants in Kazakhstan is 21307.2 MW and available capacity is 17503.5 MW. The power plants are branched into power plants of national importance, power plants of industrial importance and those of regional importance.

The power plants of national importance are the large thermal power plants generating and selling electricity to consumers at the electricity wholesale market of Kazakhstan:

- Ekibastuz Governmental Regional Electric Station -1 LLP named after B.G. Nurzhanov;
- Station of Ekibastuz Governmental Regional Electric Station -2 JSC;
- Power plant of EEC JSC;
- Governmental Regional Electric Station of Kazakhmys Energy LLP
- Zhambyl Governmental Regional Electric Station JSC named after T.I. Baturov.

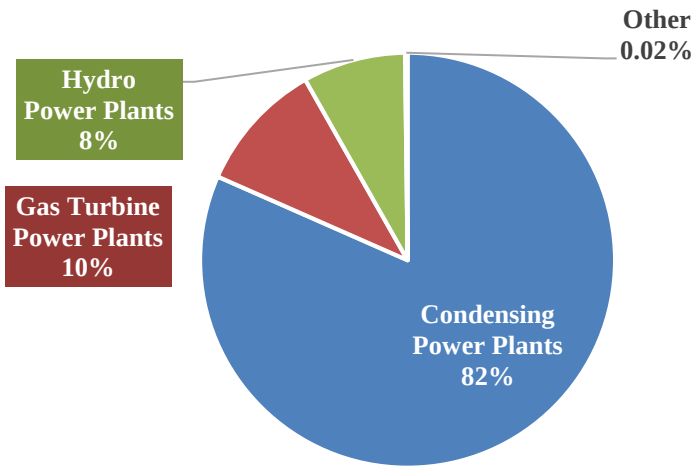
Large hydro power plants are used as auxiliary units and to control load schedule profile of Unified Power System of the Republic of Kazakhstan. The major plants are:

- Bukhtarma Hydro Power Complex of Kazzinc LLP
- AES Ust-Kamenogorsk Hydro Power Plant LLP
- AES Shulbinsk Hydro Power Plant LLP
- Moinak Hydro Power Plant JSC

The power plants of industrial importance are the Combined Heat and Power Plants (CHPP) which supply heat and electric power to large industrial enterprises and nearby populated areas:

- Combined Heat and Power Plant-3 Karaganda Energocenter LLP;
- Combined Heat and Power Plant-PVS, CHPP-2 of Arcelor Mittal Temirtau JSC;
- Combined Heat and Power Plant of SSGPO JSC, ERG, Eurasian Group;
- Balkhash Combined Heat and Power Plant, Zhezkazgan Combined Heat and Power Plant of Kazakhmys Energy LLP;
- Combined Heat and Power Plant-1 of Aluminium of Kazakhstan JSC, ERG, Eurasian Group and others.

According to the last statistics from the National Operator of Unified Power System of the Republic of Kazakhstan, in 2015 total 90796,6 mln. kWh of electricity has been generated. The structure of generation capacity by technology is presented on a graph below:



Graph 2.2-1 Electricity generation by technology, 2015
(KEGOC, 2016)

The map of power sector of Kazakhstan with major power plants is presented on a figure below:

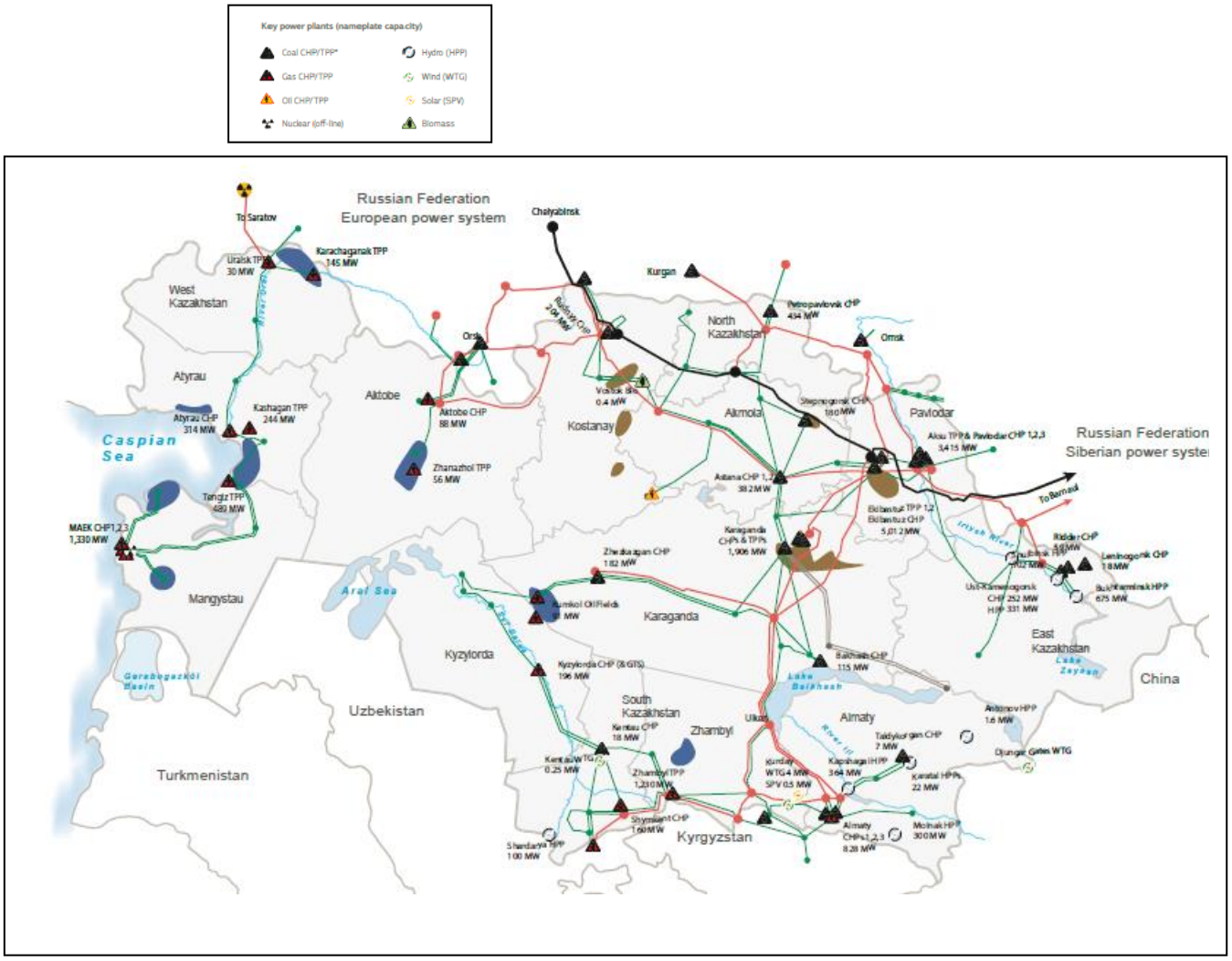


Figure 2.2-2 Map of Kazakhstan Power sector **(National Energy Report, 2015)**.

New projects currently under discussion

Renewable energy. Development of renewable energy sector in Kazakhstan has received greater attention in recent decades and many efforts and improvement have been made in this domain. Two major documents that define future development goals for renewable energy sector are: a "Concept of Transition towards Green Economy" enacted in May 2013 (Concept Transition to Green economy) and a "Concept of Fuel and Energy Sector Development of the Republic of Kazakhstan to 2030" enacted in June 2014 (Concept of Fuel and Energy Sector Development of the Republic of Kazakhstan to 2030). According to these two strategic documents, Kazakhstan defined a goal to achieve a share of renewable energy produced to be 3% by 2020 and 10% by 2030. Since 2013, a number of corresponding legislative and regulatory acts and documents have been elaborated and enacted, such as Decree about feed-in tariffs for renewables, Decree on rules to estimate tariffs for renewables, Law "On support of renewable energy producers" and others.

Nuclear power generation. Kazakhstan is well-known for its substantial reserves of uranium. Currently the country is one of the world's leading supplier of uranium along with Canada, Australia, Russia and Niger. However, Kazakhstan only exports extracted uranium to other countries but does not process it or use it for internal use. One of the main prospective use of extracted uranium might be utilizing it as a fuel for nuclear energy generation. Using nuclear power plant would be launched in Kazakhstan; it might well resolve a number of existing challenges:

- due to a great capacity, nuclear power could be used to cover a growing demand/deficit of electricity, especially in south zone of the energy system
- the country might receive greater pay-off from uranium reserves if used as a fuel for power plant instead of being exported abroad immediately
- the country will increase its "green" credentials

On the other hand, nuclear power generation brings significant risks of possible accidents (such as Chernobyl, Fukusima) and nuclear waste disposal. Provided that Kazakhstan is located in a highly seismic zone, the debates about rationale to build or to ban a construction of nuclear power plant are very challenging and so far did not succeed.

New power plant. In 2012, the government of Kazakhstan signed an agreement with investors from South Korea (Samsung engineering company ltd.) about construction a new thermal power plant "Balhash thermal power plant" of installed capacity 1320 MW (first module). The construction of the power plant in a deficit South zone was expected to cover the existing demand and also become a significant source of new power capacity within Unified Power System of the Republic of Kazakhstan. The construction of the first module was planned to be finalized by 2017, but it is most probable that this finalization of the project will be postponed for later periods.

2.3. ELECTRICITY MARKET ARRANGEMENTS IN KAZAKHSTAN

Electricity market of Kazakhstan has two levels: wholesale and retail electricity markets. The wholesale electricity market is a system of free relationships in purchase-sale and transfer of electricity on a contractual basis between its participants represented by power generation

organizations, national transmission system, regional transmission and distribution electric networks, wholesale consumers and other centralized operational dispatch management organizations, which provides all participants with equal access to proposed goods and services. Retail electricity market includes aall electricity consumers with the connected capacity of less than 1 MW are the players of the retail electricity market as well as power supplying companies selling electricity to them on the competitive market. In this research will be based on power suppliers that operate in wholesale market (KEGOC, 2016).

The functional design of the wholesale electricity market in Kazakhstan, comprises:

- Market of decentralized purchase and sale of electricity (bilateral contracts of electricity purchase and sale). According to Kazakhstan Operator of Electric Power and Capacity Market (KOREM. Annual report), 97% of electricity is traded via bilateral contracts. The major terms of bilateral contracts are confidential and, therefore, not available for analysis or comparison for general public. Power generating companies generate and sell electricity at the wholesale market of Kazakhstan if they meet the following conditions:
  - ✓ they have licenses as required by the laws of Kazakhstan;
  - ✓ they have access to the national and(or) regional electric network;
  - ✓ they supply at least 1 megawatt (further MW) of electricity of daily average (base) capacity to the wholesale market and have commercial metering systems, telecommunications harmonized with the System Operator's systems.
- Centralized electricity market, which is based on purchase and sale of electricity for short-term (spot-trade), mid-term (week, month) and long-term (quarter, year) period. Centralized trade markets ensure open non-discriminatory access of all participants to the electricity market and generate fair index of the current market electricity price. Kazakhstan Operator of Electric Power and Capacity Market (KOREM) is responsible for operation of the centralized trade market. Kazakhstan Operator of Electric Power and Capacity Market reported that less only 3% of power trading was carried out via centralized market in 2015 (7% in 2014) (KOREM. Annual report). Such a low per cent of centralized trading is due to the fact the key players in electricity markets are so-called “vertically-integrated companies” (VICs) that produce electricity and consume it internally within own group. In other words, a vertically-integrated company possesses its own generation facilities and consumes internally all electricity produced without selling it on a wholesale market. Vertically-integrated companies are not considered to be monopolies, since they do not have influence on other electricity suppliers or consumers, but rather generate and consume own electricity in isolation from other electricity suppliers and consumers. As a result, there are no incentives for vertically-integrated companies to make any voluntary trades via centralized auction, which requires disclosure of internal information as well as imposes additional service charges.

Relations arising between the participants of the wholesale electricity market of Kazakhstan are regulated by the civil laws of Kazakhstan, the Rules of organization and functioning of the wholesale electricity market of Kazakhstan, other regulatory legal acts and contracts between the participants of the wholesale electricity market.

In May 2014 a legal agreement has been signed by Kazakhstan, Russia, Belarus, Kyrgyz Republic and Armenia to establish the Eurasian Economic Union (EEU). One of the key goal of Eurasian Economic Union is to establish a single market for electricity by 2019. The participating countries agreed to align legislative framework so all members receive a non-discriminatory access to common Eurasian Economic Union infrastructure. In 2015 a concept of a common electricity market for Eurasian Economic Union members has been also adopted (National Energy Report, 2015).

2.4. OVERVIEW OF ELECTRICITY TARIFF STRUCTURE AND TARIFFING METHODOLOGY IN POWER SUPPLY

Existing electricity tariff structure in Kazakhstan

End consumers of electricity are represented by two major groups: industrial and household consumers. Industrial consumers that consume significant amount of electric energy in production process are, as a rule, wholesale buyers that acquire electricity via bilateral agreement with electricity suppliers at wholesale electricity market. For industrial consumers the price of electricity includes the tariff of electricity suppliers and the cost of transportation via electricity grid. Household consumers, as well as small and medium enterprises, that consume relatively small amount of electricity, do not have access to the wholesale electricity market. Therefore, household consumers and small and medium enterprises purchase electricity from service companies. These service companies have access to the wholesale electricity market, they buy electricity via bilateral agreements with power suppliers and then distribute electricity to household consumers and small and medium enterprises.

Household consumers and small and medium enterprises are charged by one bill, issued and managed by service companies. The structure of end-user tariff for these group of consumers consists of the following components:

- Costs of purchase price from suppliers (generators): tariff of power suppliers
- Transportation costs: tariff of via high and medium voltage transmission lines
- Service costs: dispatch and distribution fee

As an example, a structure of one of the major retail supplier of electricity that operates in the capital of Kazakhstan, LLP “Almaty Energo Sbyt” as of 1 January 2016 is provided in a table below:

Description	Kazakh tenge/kwt.h (excl. VAT)	Share in end-user tariff, %	Share of supplier, %
Cost of purchase price from suppliers (generators)			

JSC "Almatynskie Electricheskie stantsii"	8,6	53%	44%
JSC "Jambyl GRES"	8,7		8%
JSC "Moinak HPP"	9,5		12%
LLP "Ekibastus GRES-1"	7,49		22%
JSC "Ekibastus GRES-2"	8,65		14%
Average tariff of suppliers	8,48		100%
Transportation costs			
JSC "KEGOC"	2,080	40%	
JSC "AJK"	5,35		
JSC "KTJ"	1,64		
Average cost of transportation	6,52		
Service costs			
LLP "Almaty Energo Sbyt"	1,1	7%	
End-user tariff	16,10		

Table 2.4.1 Structure of end-user tariffs on electricity on the example of LLP "Almaty Energo Sbyt"
(LLP "Almaty Energo Sbyt", 2016)

The tariff structure as presented above is typical for most of retail suppliers, where more than 50% of total end-user tariff represents production costs expressed via electricity supply tariffs.

A special group of electricity suppliers include generators that use renewable power resources, such as wind, solar and bio-fuel. According to the Government Act #645 (Feed-in-tariffs for electricity generated by using renewable energy sources, 2014), qualified generating companies that use renewable power resources are entitled to charge so-called "feed-in-tariffs" that has been defined by the government and presented below:

#	Technology	Tariff, tenge/kw.h (exc. VAT)
1	Wind power plants (except for "Astana EXPO-2017" wind power plant)	22,68
1-1	"Astana EXPO-2017" wind power plant	59,7
2	Solar power plants (except those that use photoelectrical modules produced based on Kaz PV)	34,61
3	Small HPPs	16,71
4	Biogas technology	32,32

Table 2.4.2 Feed-in-tariffs for renewable energy sources

Feed-in-tariffs are approved for the 15 years after the start of exploitation and they are indexed each year after approval for official inflation rate (Rules on defining feed-in-tariffs for renewable energy sources, 2014). Though significant improvements have been made towards development of renewable energy in Kazakhstan, such as enacting a "Concept of Transition to Green Economy", introducing feed-in-tariff policy for renewables and other legal and technical support from government, the current share of renewable energy in electricity supply is still negligible and comprise less than 0.2 % of total electricity generation (KOREM. Annual report, p. 144).

On a global scale, the renewable energy has attracted significant attention due to its impact on environment and climate change caused by burning fossil fuels. However, even electricity structure in most advance in renewable energy countries has been changed recently, electricity pricing and investment models had relatively little progress (Chao, 2011).

For the purpose of this research, the focal point for the analysis is electricity supply component of end-user tariffs. Transportation and service costs are out of the studying scope, as well as tariffing schemes for combined heat and power plants and generation that uses renewable resources.

Existing tariffing methodology in power supply

Before 2009 the traditional cost-plus approach has been used when defining tariffs for power suppliers in Kazakhstan. In 2009 a new methodology of "marginal tariffs" has been enacted for the following 7 years until 2015.

In 2009 all power plants, that complied with conditions outlined in 2.3 above, have been divided into 13 groups and for each group a fixed marginal tariff was defined for each year from 2009 till 2015. These tariffs were assigned individually for each group without any element of competition integrated. The level of marginal tariffs were ranging from 2,79 to 11,62 kazakh tenge/kw.h or 0,8 to 3,13 euro cents/kw.h (at exchange rate 371,31 kazakh tenge/EUR as of 31 December 2016). (Government Act #392 as of 25/03/2009, 2009).

According to the rules on determination of marginal tariffs (Rules on defining marginal tariffs, 2015), power-generating plants are formed into groups based on the following criteria:

- Type of power plant: condensing (producing only electricity), Gas Turbine Power Plant (GTPP), Combined Heat and Power Plant (CHPP), Hydro Power Plant (HPP)
- Installed capacity: up to 100 MW, from 100 MW up to 300 MW and more than 300 MW
- Type of fuel used: coal, local gas, exported gas, oil
- Distance of power plant from fuel source: up to 500 km, from 500 up to 1000 km, more than 1000 km

According to the Rules, marginal tariffs are estimated at first on a maximum level of tariff of the previous year for each group of power-generating plants. Established marginal tariffs are then indexed for official inflation rate for further years.

In 2015 regardless of existing critics of marginal tariffs efficiency and provided that no other alternative pricing methodology has yet been suggested, in 2016 the Ministry of Energy of the Republic of Kazakhstan officially prolonged the marginal tariff policy. According to new release, qualifying power plants have been divided into 16 groups. From 2016 until 2018 power plants will charge a single marginal tariff for electrical energy and from 2019 until 2025 the full tariff will consist of a marginal tariff for electrical energy and a marginal tariff for power capacity. The amounts of marginal tariffs are presented in a table below:

Group	Marginal tariff for electrical energy for 2016-2018 (tenge/kw.h) *	Marginal tariff for electrical energy for 2019-2025 (tenge/kw.h)**	Marginal tariff for power capacity for 2019-2025 (tenge/kw.h) **
Group 1	8,8	4,50	1,3685
Group 2	8,7	8,55	0,0381
Group 3	7,5	5,16	2,2034
Group 4	6,0	4,71	1,0912
Group 5	8,05	5,48	1,8815
Group 6	8,3	7,41	0,5454
Group 7	7,3	6,36	1,8011
Group 8	7,5	7,07	0,4421
Group 9	7,6	7,02	1,2191
Group 10	8,6	6,80	2,3537
Group 11	13,63	9,68	0,2561
Group 12	12,68	6,75	3,0605
Group 13	4,5	2,06	1,1878
Group 14	10,64	6,44	4,1070

Group 15	8,3	7,97	0,4430
Group 16	13,48	3,58	1,3598

Table 2.4.3. Marginal tariffs from 2016 until 2025

* (Order of the Minister of Energy of Kazakhstan #160 as of 27 February 2015)

** (Order of the Minister of Energy of Kazakhstan #465 as of 3 July 2015)

As during 2009-2015, the level of marginal tariffs in not dependent on the results or efficiencies demonstrated by other power suppliers, and therefore there is no element of competition involved. Also, to get a right to charge a marginal tariff, power suppliers must submit an investment program with a detailed description of the nature and amount of investments they plan to make.

When first implemented, marginal tariff approach was considered to prevent unjustified tariff growth above levels set by regulatory bodies. Marginal tariffs are also referred to as "tariff in exchange for investment" that were initially designed to stimulated investments in generating sector.

2.5. PROBLEMS OF KAZAKHSTAN WITH A SPECIAL FOCUS ON HOW THESE PROBLEMS ARE CAUSED BY EXISTING TARIFFING METHODOLOGY APPLIED

As outlined above, the major urgent problem in power supply industry is a high level of depreciation of capital assets. As estimated in the Concept of Fuel and Energy sector Development to 2030, the depreciation of generating capacity is around 70%. Around 57% of power plants have been operating for more than 30 years. According to National energy report, (KazEnergy, 2013) the power sector of Kazakhstan is experiencing "a substantial technological 20-years lag relative to the best international practices". The plants are old, inefficient and environmentally unfriendly. Provided that power sector is a highly capital intensive industry, significant investments into power supply sector should be infused today in order to meet a growing electric power demand in the future. Otherwise, the country might face a risk of insufficiency of internal power capacities and will be vulnerable and dependent on external power sources.

In order to prevent this problem, a substantial amount of capital investments is needed to be insulated into power supply industry. Kazakhstan at this moment, however, does not have its own financial, technological and human resources to be able to construct new power facilities using internal resources. Therefore, the future of power supply industry is highly dependent on foreign investments and one of the major goal of power sector governors is to provide incentives and attract external investors.

One of the key factor that defines attractiveness for investors is a tariff that will guarantee adequate return on investments and expected profits. However, currently existing tariffing methodology of applying marginal tariffs is being widely criticized for many drawbacks that decrease the attractiveness of the industry for potential investors.

1. One of the critics relates to the principles of defining marginal tariffs, which are considered to be very general and do not account numerous specifications of each particular power plant. Power suppliers had to take marginal tariffs as given and perceive the approach of defining power plants into specific groups as unfair and not transparent. For example, group 4 include three Combined Heat and Power Plants (Balkhash, Zhezkazgan and

Pavlodar) and one Governmental Regional Electric Station of Kazakhmys Energy LLP, group 10 includes Combined Heat and Power Plants along with Hydro Power Plants, group 12 combines Gas Turbine Power Plants and Combined Heat and Power Plants (Order of the Minister of Energy of Kazakhstan #153, 2015). The combination of different types of technologies of production in one group and under the same tariff makes power producers doubtful about the accuracy of grouping and, accordingly, assigning fair tariffs. As a result, some electricity producers may perceive that such an allocation of tariffs in unfair, and therefore, are not keen to make investments in producing capacities.

2. Another argument against marginal tariffs is that they distort the economic performance of generating capacities: while trying to attract sufficient investments, the government is striving to suppress tariffs for end-users of electricity and, thus, secure social welfare of population at the expense of economic efficiency. In other words, initially the government is keen to keep the compensation for producers as low as possible and find ways to stimulate producers to gain profits through increasing production efficiency and optimizing operating costs, rather than claiming higher tariffs from consumers. As a result, the final price for consumers is not determined based on demand-supply equilibrium, but rather on the tariff level that the government considers to be achievable for electricity producers.

3. Another important critics of "tariff in exchange for investment" implementations deals with the lack of control mechanisms over generators' obligations to invest in new or refurbish existing power capacities. According to Kazakhstan Operator of Electric Power and Capacity Market, introduction of "tariffs in exchange for investment" in 2009 raised electricity prices for end-consumers by 30-50%, while increase in investments was only around 20% (KazEnergy, National Energy Report). This means that after implementation of marginal tariffs, the producers received better prices from customers and received greater profits. These surplus profits were supposed to be used for new investments or refurbishment of existing capacities as prescribed by investment program that each producer submitted to get a right to charge marginal tariffs. But instead of making investments, the producers distributed the surplus profits and did not comply with their investment obligations.

4. One recent factor that influenced the attractiveness of marginal tariffs for investors was related to the fact that marginal tariffs are all denominated in local currency, which is not the strongest one. Since the approval of marginal tariffs in February 2015, for example, the local currency devaluated by 200% compared to U.S. dollar or euro. Having that most of capital asset and technology are not produced within Kazakhstan, but acquired from abroad at U.S. dollars or euros, there is a high risk that investors might not be able to return their investments in such a volatile economic environment with a weak currency.

5. The last critics, that is also related to application of appropriate tariffing methodology, is related to environmental pollution. Power suppliers, not having enough returns, are trying to save as much costs as possible and reduce investments into clean technology. Thus, old

inefficient equipment is used which produce much more environmental pollution. Most of environmental problems of Kazakhstan, such as air and water pollution, radioactive contamination, desertification and others, have been inherited from the Soviet Union. However, since the collapse of the Soviet Union, the environmental situation did not improve much and even became worse (Dahl C., Kuralbayeva K., 2001). Ineffective tariffing policy also contribute in this worsening situation.

In order to address the described problems, a high level strategic decisions should be made. One of such decision was made by the President of Kazakhstan in his "100 Specific steps" in which he defined the future directions of the country.. Specifically related to energy sector, step 50 describes the need to reorganize electric power industry and introduce a model of a "single buyer" that will help smooth differences in electricity tariffs among regions. However, the model of a "single buyer" can be implemented under free-market conditions, where a "singe buyer" will represent a form of monopoly and electricity producers will strive to compete with each other to provide lower selling price and better quality. This model will not give any results while marginal tariffs are applied and therefore should be considered to be implemented after 2025.

Step 52 declares the need to introduce a new tariffing policy in electric power industry that will stimulate investments in the sector. According to this step, it is planned to split a tariff into two components: a fixed part to cover capital expense and a fee for consumed power to cover variable costs. This strategy will replace the existing "cost-plus" methodology (National newspaper "Kazakhstan Truth", 2015). This step is more applicable within marginal tariffing strategy since it can boost incentives for investors. The difference between a two components tariffs and "cost-plus" methodology is that when applying two component tariffs, the producers will be compensated for investments made even though no electric energy will be sold. In other words, if an investor builds a new power plant or capacity, however cannot sell produced electric energy, then the producer will still get remuneration for built capacity, and therefore, will guarantee the remuneration for capital costs. In contrast, when a "cost-plus" methodology is used, the producers can charge only one tariff, that includes both capital and operational costs. In this case, if the producer cannot find a customer to sell electric energy, then the producer will not be able to cover its capital as well as operational costs. Therefore, a two component tariffs will contribute into solving the problem of insufficient investments in power supply sector.

From this perspective, tariffs on electric power should be sufficiently high to generate an acceptable of return for electricity producers. A too rapid tariff growth may undermine an economic growth, but in a longer term, tariff need to be approximated to world market level. Long-term tariff policy should result in less wasteful energy consumption and enhance incentives for energy efficiency (National Energy Report, 2015).

Provided the existing situation the primary goal for governors of power supply industry is to develop own tariff-setting model to find an optimal solution. Researchers state that managing electricity prices might be a low-cost tool to improve electricity efficiency for countries where government has control over electricity tariffs (Kwon S. et al., 2016).

It is also admitted by the government, that high tariffs alone will not be able to attract enough investments to cover the anticipated consumption growth. Therefore, additional efforts and establishment should be put in place to attract new investors and retain existing ones. One of such establishment might be introduction of new market models for wholesale power trading and capacity market. Capacity market, that was initially planned to be introduced in 2016, is now a goal for 2019. Experts believe that such a mechanism will significantly increase attractiveness for investors in power sector (National Energy Report, 2015).

Chapter summary

Referring back to research questions from section 1.6 the following can be concluded:

Central question 1. What are the problems in electricity supply in Kazakhstan and how are these problems related to the tariffing methodology currently applied in the country?

Research sub-question 1.1. What are the current problems in electricity supply in Kazakhstan?

The major problem of power supply is old and outdating power facilities. Currently the country does not possess own sufficient financial, technological and human resources and depends on external investments. There is a lack of incentives to attract foreign investors that, consequently, causes the risk of inability to satisfy a growing power demand with insufficient power supply in the future, if no actions will be made in the present.

Research sub-question 1.2 How are these problems related to the tariffing methodology currently used?

The key factor that defines the attractiveness for foreign investors to invest in long-term power supply projects in Kazakhstan is a tariff, sufficient enough to guarantee expected return on investments. The tariff is defined based on enacted tariffing methodology.

3. ORGANIZATIONAL ASPECTS OF ELECTIRICITY SUPPLY INDUSTRY

In recent years electricity industry experts in Kazakhstan have started searching for inspiration from the developed western countries where liberalized market mechanisms have been implemented in electrical systems in order to find a benchmark tariffing methodology that might be successfully adapted into Kazakhstan energy supply sector. A number of power sector experts believe that adaptation of liberalized market mechanisms into electricity supply and free competition principles will resolve most of the problems in power supply sector: the supply price will go down because of a competition among generating companies, tariffing methodology will be clear and transparent and will therefore attract investors. However, these believes are still based only on ungrounded thinking of some individuals, not backed up by elaborated action plans or development programs. Even though a free-market approach has been successfully implemented in developed country, it does not mean that such an approach is guaranteed to be success in other economies, since a number of other factors and conditions should be taken into account. Still, the question is whether the principles of liberalized market mechanisms can be easily and instantly implemented in existing electricity supply sector of Kazakhstan and whether the tariffs calculated on a free competition principles will be accepted by all stakeholders?

In this chapter a theoretical framework is elaborated on the basis of review of relevant literature and documents about the types of organization in power supply sector. The first part of the chapter elaborates on theoretical overview of definitions and characteristics of electricity as a commodity, since electricity is a specific type of goods and its uniqueness can well define the organizational structure of power supply. The second part of the chapter will focus on different types of organizational structure in power supply. The last part of the chapter analyses what types of organizational structure can be applicable in Kazakhstan and what effect this might have on the appropriateness of different tariffing methodologies.

3.1. ELECTRICITY AS A TYPE OF COMMODITY

Electricity as a type of commodity

There are several attributes of electricity that make it a specific type of commodity. Arentsen & Kunneke define two types of such attributes: economic and technical from one side and political from the other (1996). The economic and technical attributes are defined as follows:

- Electricity represents a type of a basic-need good, it cannot be substituted by other types of energy, it has a relatively low elasticity of price;
- Production, transport and distribution of electricity are assumed to be monopolies characterized by economy of scale operations;
- Electricity industry requires significant initial investments in infrastructure;
- Electricity cannot be easily stored in significant volumes, so electricity generation and consumption should be constantly balanced within one integral system.

From economic perspective, electricity is generally perceived as a type of collective good that cannot be allocated by using competition and free-market allocation (Kunneke, 2008). It was considered as an "anti-market" product and for that reason a state-owned monopoly was considered a more appropriate form (Glachant, J.M & Ruester, S, 2014).

Political attributes are related to the fact that most countries have a strong interest in becoming energy independent from other countries or regions striving to establish a safe and reliable electricity supply within own borders and own capacities.

The listed economical, technical and political attributes of electricity results in a high degree of public involvement and governmental regulation of the industry and, in fact, determine the theoretical potential for liberalization of the industry (Arentsen M.J. & Kunneke R.W., 1996).

As stated by Hage and Rufin (2016), government intervention is accepted to address market failures such as natural monopolies as well as environmental and social responsibility.

Moreover, regulation in electricity pricing play an important social role, especially in developing countries, where vulnerable social groups need to be protected and supported by government.

Electricity industry and its structure

Traditionally electricity industry was associated with significant economies of scale and represented activities of a natural monopoly. Liberalization, in turn, was understood as a restructuring change from centralized activities towards competition. It is generally expected that liberalization of the industry will result in market-based incentives and higher efficiencies. Vertical integration (oftentimes used in electricity industry) is a type of organizational structure in which one single organization governs the whole electricity production and trading chain (Kunneke, 2008).

Nowadays the greatest portion of electricity is produced, transmitted, distributed and consumed via a central system, providing only a limited share for distributed generation. In most cases, the producers of electricity trade it on a wholesale market and transport it via centralized transmission and distribution grids. During transportation, total amount of physical flow of electricity entering and leaving the grid is metered and registered. Final consumers receive electricity via contracts with trading supplying companies. As a result, from technical perspective electricity industry is one single integrated system that requires a regulation and balancing at each moment of time.

Generation sector is presented by all types of production units (power plants) that are able to generate electricity, transmission sector represents transportation of generated electricity from production units via high-voltage transmission wires and distribution sector includes distribution services to final consumers via low-voltage distribution wires and procedures related to contracting and billing consumers. In electricity industry one company might operate either in one sector, for example only generation or distribution, or might integrate two or more functions, for example possess its own generation facilities as well as transport generated electricity via own transmission wires. In the latter case, such a form of organization is called vertically integrated company (VIC). Vertically integrated company, as well as vertically integrated monopoly (VIM), have been widely

spread in highly regulated electricity industry since it was perceived that such an integration would provide greater economies of scale. In this research, the study focus is on electricity generation sector only.

Electricity consumption varies throughout the day and the years. Daily peaks tend to occur early in the morning and late in the evening, off-peak during the night. Dependent on climate conditions, electricity consumption is greater during cold temperatures (heating) or hot temperatures (cooling).

There are also two supply types: base load and peak-load supply. Usually, power plants using coal, nuclear and gas are used to cover a base load supply, when they run all the time with little flexibility to adjust in short time period. Gas and hydro fueled plant are usually utilized to cover peak-loads since they have a high maneuver capacities.

Economists agree that in electricity industry there is a room for government regulation, which can be expressed in two major ways: ownership or regulation (Dahl, 2004).

3.2. TYPES OF ORGANIZATIONAL STRUCTURE IN POWER SUPPLY

For the purpose of this research, when considering electricity power supply, two extreme types of organizational structure will be discussed: regulation and liberalized or free markets. Under regulation structure a high level of governmental involvement is implied, where the government plays a key role in establishing tariffs and imposes a high level of control. Liberalized markets, in contrast, are regarded as organizational structure in power supply, where free-market mechanisms and free competition principles are applied with no or minimum level of governmental interventions. Under this structure, tariffs for electricity are based on demand-supply equation, where power suppliers negotiate prices with power consumers. In this section a theoretical prospective of organizational structures in power supply sector is provided.

Regulation vs. Liberalized of markets

Arentsen and Kunneke (1996) argue that the type of governmental regulation is determined by the type of industrial organization. And the regulation, in turn, can be presented by three major types:

a) A facilitating style: the government only establish rules and conditions within the industry;
b) An initiating style: the government encourages certain direction;
c) An enforcing style: the government enforces a certain direction.

A selected type of regulation has effect on different types of regulation objects, including tariffs.

Basic models of organization in the electricity industry are described according to Arentsen & Kunneke (1996). Three types of economic activities are distinguished:

- Market
- Network
- Hierarchy

All three types of activities can be differentiated in three major categories: the mechanism of economic decision making, the mechanism of allocation and the goals of economic activities.

In markets system decisions are highly individualized with neoclassical price theory implemented. Price for electricity is established based on markets mechanisms through open competition of market participants.

In network system a group decision prevails where individual members cannot change rules without a consent of other group members. Instead of competition, the groups are striving to achieve consensus to increase collective profitability and continuity.

Hierarchies represent a system where the decisions are made by authorized public authority which follows certain established directives and rules. The public interest is of highest priority with less accountability of individual or group interests.

A clear distinction among three types of activities discussed can be done from theoretical perspective. In practice, however, all three mechanisms can be presented in a mix with one mechanism dominating or prevailing. Arentsen & Kunneke (1996) define 9 major systems for coordinating economic activities from extreme Full free market at one side and Full hierarchy from the other.

Deregulation of electricity supply

Because of numerous problems and inefficiencies associated with industry regulation, a concept of deregulation of electricity generation sector emerged in western developed countries. The main idea is to shift gradually an electricity generation sector from a regulation to a liberalized free-market with high level of competition and minimized governmental involvement and control.

Dahl (2004) presents three types of models in electricity supply that are distinguished by the level of competition involved. These are:

- A Single buyer model where one assigned buyer (e.g. a distribution company) buys all electricity to satisfy the demand from electricity suppliers that compete with each other. In this case, a regulator first should define the rules for a Single buyer so all the parties understand and agree with them.
- Wholesale market model in which all wholesale electricity suppliers and buyers that are connected to the common electricity transmission grid trade with each other. The trading transaction is made either via a bilateral agreement or via an open market platform.
- Retail model is a form of competitive market where retail consumers can choose their suppliers and there is an open access to transmission and distribution facilities.

According to Hunt and Shuttleworth (1996) the retail model is the most efficient, however when the following is provided:

- A well-established electricity retailing system;
- A mature market institutions;
- A constant vigilance against market power;
- An appropriate methods of dispatch, which is when electricity is provided to consumers when they need it.

In addition, it is important that efficiency in electricity supply market is also contingent upon free entry for new participants and ensuring sufficient level of competition, which might be measured by, among others, a Herfindahl's index (Dahl, 2004).

The concept of liberalization is defined as follows (Arentsen M.J. & Kunneke R.W., 1996):

a) a change in the dominant coordination system from hierarchy to network or from network to price mechanism and/or
b) a change in the additional coordination system from hierarchy to network, or from network to price mechanism

A list of factors that might influence a successful and quick implementation of market liberalization was defined by Glachant and Ruester (2014):

- A level of power of national monopolies holding generation facilities and infrastructure.
- Availability of technology invented, like in telecom sector that will allow free competition with established giant state companies.
- Nature of electricity being itself is a specific type of commodity.
- A level of renewable energy penetration: from wholesale market perspective, a great amount of renewable energy produced and traded in a free market can easily decrease the average market price for conventional generators. The reason for this is that the market price is based on variable costs of electricity generation, which are much lower for renewables than for those using traditional resources. As a result, competitive wholesale market arrangements might be implemented in industry where conventional generators are able to survive under price pressure imposed by renewables.
- Smart grids. Within EU recent invention of information communications technologies (ICT) made it possible to introduce market arrangements in electricity sector that allows electricity suppliers and customers to trade within one unified platform under common transparent rules by exchanging both physical electricity and financial flows.
- Transparency. The lack of transparency puts barriers for new entrants and undermines the entire mechanism of competition.

In addition, external factors may play a significant role in determining energy sector structure, such as oil prices, natural disaster (Fukusima accident) or economic crisis.

According to Glachan & Perez (2011) the creation of electricity market is a complicated diversified process that comprises a combination of industrial, technological and institutional constraints that ultimately shape a policy-making process. Moreover, there is no one unified formula to create a universal market that would fit all and transition towards liberalization of existing electricity structure is a continuous multi-disciplinary process that requires involvement of numerous stakeholders.

In their work "The liberalization of electricity markets" (Glachant J.M. & Perez Y., 2011) the authors provide additional elements which are required to make a successful reform towards liberalization in electricity industry. These are:

- The vertical separation of competing segments;
- The horizontal dismantling of competing segments;
- The creation of an independent management of the transmission grid;
- The creation of electricity markets in real time;
- Setting rules for third-party access, transmission allowance and signals of localization and connection for new entrants;
- The identification and separation of costs of electricity supply – a crucial point of reform;
- The creation of an independent regulator;
- Mechanisms of transitions and ex-post amendments;
- Coherence of decisions over time.

Barriers for liberalization

One of the barrier for liberalization of electricity sector is unwillingness of key players to invest in the industry under market-based rules since the expenditures required are significant, the payback period is longer than average and there are no guarantees for return on investments made (Kunneke, 2008).

In addition, it has been concluded that successful implementation of liberalization process is possible when certain technologies are stimulated for development (Kunneke, 2008). Such a stimulation is very dependent on a political will, which, however, is not always the case especially with authoritative political environmental.

Ownership

When deregulating the industry it is also important to define ownership status. There are two major types of ownership: public ownership that includes direct government ownership or government owned corporation and private ownership.

Dahl (2004) lists several reasons why private ownership might be more efficient than public:

- ✓ The company cannot be easily removed from the industry even being inefficient since its activities are guaranteed by the government;
- ✓ Combination of ownership and regulation can create a risk of conflict of interest;
- ✓ Application of public rates of return instead of private ones can distort decisions;
- ✓ Procurement and hiring procedures are more stringent;
- ✓ Political goals might be imposed;
- ✓ Less incentives cost minimization and profit maximization.

3.3. COMPARATIVE ANALYSIS: WHAT LEVEL OF REGULATION IN ELECTRICITY SUPPLY IS APPROPRIATE FOR KAZAKHSTAN

Based on description of a tariffing methodology of “marginal tariffs” currently implemented in Kazakhstan, it can be concluded that at present moment the power supply sector operates in a highly regulated environment. Indeed, the government first decides on grouping all power suppliers based on specific factors. Then the government defines for each group of power plants

what maximum tariff the suppliers of this group can charge during a seven year period. The marginal tariffs are set for each group of power suppliers independently, so the efficiency results of one group do not have effect on any other groups.

The purpose of this section is to determine if Kazakhstan can switch from regulatory approach to free-market mechanisms in its current economic situation.

Based on a theoretical overview made in a previous section, a number of conditions have been identified that need to be in place for a successful switch to a free-market structure. The most important and critical conditions have been selected and analyzed in terms of their applicability to the current situation in Kazakhstan. The results of the analysis are summarized in a table below:

Condition necessary for free-market structure	Applicable to Kazakhstan	Reasoning
An appropriate methods of dispatch	Yes	Electricity is provided to consumers constantly, so consumers have access to electricity when they need it
A mature market institutions	No	In Kazakhstan power industry market institutions represent a relatively new structure. As of today there is only one official market platform where power suppliers and wholesale customers can trade electricity - Kazakhstan Operator of Electric Power and Capacity Market. This company was established in 2000 and fully owned by the government of Kazakhstan. In other power sectors, transmission and distribution, market institutions are not developed as well.
A well-established electricity retailing system	No	At present moment retail consumers (households and small and medium enterprises) do not have access to wholesale markets. For these customers there are special service companies that have access to wholesale markets. These service companies buy electricity from power suppliers on wholesale market and then sell the electricity further to end consumers. This, however, means that end-users are not experienced in electricity trading and fully dependent on service companies. In case free-market

		mechanisms will be implemented, households and small and medium enterprises might not be willing to take direct participation in trading, but would rather deliver this function to service companies.
Free entry for new participants and ensuring sufficient level of competition	Yes	All participants have a right to enter the market, if complied with specified technical and legal requirements.
A level of power of national monopolies holding generation facilities and infrastructure	High	Currently around 40% of total power supply is owned and controlled by the government executed via national company "Samruk-Energo". As a result, these power generators will be always be or perceived as favorites and therefore, no competition principles will be possible. The government should first make this power capacity operated by independent companies to establish free-market conditions.
Availability of technology invented	No	Internally Kazakhstan does not invent/produce any technologies for power supply industry. Kazakhstan as any other country can buy such technologies from abroad, which however will bring significant costs and will result in higher prices for end consumers.
A level of renewable energy penetration	No	The level of renewable penetration is less than 0.2%
Smart grids	No	The discussions about implementing smart grids in power sector of Kazakhstan are in their very initial stage. It is not even known yet when smart grids might be implemented
Transparency	No	At present moment power supply industry is far away from being characterized as transparent. A number of allegation and disputes are known publicly that indicate the level of transparency is very low and much

		efforts should be put to improve the existing state of affairs.
The vertical separation of competing segments	No	Around 30% of total electricity supply is generated by vertically-integrated companies, that are mainly oil and gas companies with external capital involved. Currently, vertically-integrated companies are not participating actively in market trading since vertically-integrated companies do not have such an obligation to trade electricity on a wholesale market and decide on their own what to do with electricity produced. In most cases, vertically-integrated companies produce and consume power within own operations. Under existing terms, the government will not be able to force vertically-integrated companies participate in a free-market trading with other market participants.
The creation of an independent management of the transmission grid	Yes	The transmission grid is operated by the Kazakhstan Electricity Grid Operating Company, which also functions as a National Operator of Electric power industry of Kazakhstan. The company is owned by the government of Kazakhstan. This, however, does not undermine the applicability of free-market mechanisms, since all power producers have a right to access the national transmission grid.
The creation of electricity markets in real time	No	Currently there is a platform for a-day-ahead markets, however the volume of trading is less than 5% of total transactions
The creation of an independent regulator	No	The regulation functions over tariffs in power supply are executed by the Ministry of Energy, which is a fully governmental body.
Coherence of decisions over time	Yes	In most cases there is cohesion over regulator's decisions over time.

Table 3.3.1. Key factors of free-market mechanisms and their applicability to Kazakhstan

In addition to the analysis in a table above, it is worthy to add a note about the economic situation in a country. Kazakhstan is still referred to as a "developing country", which, in fact means that the average level of living in Kazakhstan is below average for ordinary citizens. Also, it means that for general public, payment for electricity bills is not a negligible part of monthly expenses, but might represent a relatively significant part of one's living costs. According to Arblaster and Hooper (2015), general environment of developing economies has the following attributes:

a. Limited financial resources for economic development
b. High priority to other needs: poverty, social security
c. Equipment is costly to acquire, limited amount of sources of capital
d. Difficulties to recruit and retain sufficient amount of qualified professionals
e. Poor infrastructure

Electricity, therefore, is a very important collective type of good, that cannot be left for economic mechanisms that ultimately pursue the goal of profit maximization and not of social justice. The general population of the country perceives the government as the only institution that can protect the rights of those who are not able to pay "fair" market prices, but still need access to electricity. This situation is very different from what we see now in rich developed countries, where electricity is perceived as given, cheap and reliable and electricity access and costs are not issues at all. Therefore, free-market mechanisms that Kazakhstan is taking from the West and applies in other areas, e.g. food, bank services and many others, are not that easily adoptable when it deals with electricity as a specific type of good.

It is worthy to notice that the above analysis was based on conditions selected specifically for Kazakhstan case. If applied to another post-soviet country, other conditions might be selected as important that could result in different conclusion.

Chapter summary

Referring back to research questions from section 1.6 the following can be concluded:

Central question 2. Are the conditions for a free-market organizational structure in place in Kazakhstan?

Sub-question 2.1: Is free-market organizational structure applicable to the current situation in Kazakhstan?

Based on the analysis performed in this chapter, the conclusion is that currently and in the nearest future, Kazakhstan is not ready to switch from regulation to free-market mechanisms in electric power supply sector since most of the conditions for successful transition to free-market mechanisms, as described by theory, are not yet settled in Kazakhstan. Market reforms that showed to be success in European Union are not yet an alternative solution for the current economic situation and electricity system of the country.

Sub-question 2.2: What are the conditions to be in place for free-market mechanisms?

Unless the conditions outlined in table 3.3.1 are established, the regulation will remain a more appropriate organizational structure for electricity supply. The results of this conclusion will be referred to when analyzing appropriateness of specific tariffing methodologies described in the following chapter. Tariffing methodologies that are considered to be more appropriate in a regulatory environment will weight more than those applicable mostly in a liberalized markets in terms of their applicability to Kazakhstan power supply sector.

4. TARIFFING METHODOLOGIES: THEORIES AND APPLICABILITY TO ELECTRICITY SUPPLY OF KAZAKHSTAN

This chapter describes a theoretical perspective of tariffing methodologies used in electricity power supply sector. The first part of the chapter provides an overview of each tariffing methodology as described in academic literature and a comparative analysis of all methodologies is performed. The second part of the chapter discusses the applicability of each tariffing methodology to existing conditions in power supply industry of Kazakhstan.

4.1. OVERVIEW OF THEORIES ON TARIFFING METHODOLOGIES APPLIED IN POWER SUPPLY

An overview of theories on tariffing methodologies is given in this section.

The first five methodologies have been described by Dahl in his work "Energy Economics and International Energy Markets: Understanding Pricing, Policies, and Profits (2004) and presented below.

- **Rate of return regulation**. In this type of regulation, the generation company is allowed to earn a normal rate of return on capital stock or their rate base. Rate base is the base of the regulated firms' investment. In this case, the generation company is allowed to charge a price, which will cover non-capital expenses and earn a normal rate of return. The regulator decides on what is level of rate of return is considered to be a "normal rate of return". Like for other incentive regulation, such as price cap, rate of return is set before the actual demand is known. According to Tahavaien et al. (2012) rate of return regulation is mainly considered to be appropriate of start-up regulation model, in which the effectiveness of the model depends much on the information available for the regulator. Under rate of return regulation the established rates are usually revised on an annual basis, so the forecast errors are not that harmful as for other regulatory pricing where rates are reviewed less frequently, e.g. in a case of price cap regulation (Glas V. et al., 2013). Also, unlike incentive regulation, such as price caps, rate of return regulation does not raise the question of deteriorating quality of services provided by companies (Tahvanaien K. et al., 2012).

  However, according do Dahl (2004) this pricing regulation is associated with several problems, such as:

  - ✓ **Transfer pricing.** Difficulty in estimating transfer prices when two or more companies within a group trade with each other but not using market prices;
  - ✓ **A controversy over a normal rate of return**. A level of normal rate of return should be sufficient to attract investments to the industry. However, a calculation of a normal rate of return is a complicated process itself, which might include numerous uncertainties and assumptions. Moreover, to be attractive for investors the normal rate of return should be not less than the Internal rate of return (IRR),

which, however, is also a complex process due to the difficulty in forecasting future cash flows;

- ✓ **A controversy over a rate base**. As a rule, a rate base represents a book value of capital cost, which is initial cost minus accumulated depreciation. However, the book value does not reflect the actual market value of the capital. The market value is obtained through annual asset valuation process, which is an alternative to a depreciation method, but it is much more expensive and not widely used by companies;
- ✓ **Time lag**. Since the regulator needs time to review and approve the final price there is always a time gap between the point when the utility company submits costs and when these costs are approved or adjusted by the regulator. Moreover, according to Tahvanaien et al. (2012) there is a time lack between the period of rate of return established by the regulator and useful life of investments. Power generation industry is capital intensive and investments return period can range from 20 till 50 years. However, rate of returns are usually guaranteed by regulators by shorter periods from one to 5 years on average.
- ✓ **Excessive investments.** Traditional rate of return was criticized for excessively encouraging investments if the rate of return exceeds cost of capital and if excessive investments do not hold under uncertainty. The uncertainty is mainly related to the tendency of expropriation of investment from the asset base in a regulator's ex post evaluation. As a result, the companies might intentionally delay investment plans if there is a risk related to regulator's commitments regarding future policies on rate of return (Tahvanaien K. et al., 2012).
- ✓ **Lack of incentives for cost efficiency.** One of the major drawback of rate of return regulation is the lack of incentives for cost efficiencies. When such a regulation is applied, the companies tend to cut operational costs instead of capital costs.

- **Sliding Plan**. Sliding plan is a modification of a rate of return regulation where the new rate of return is calculated as an old rate of return plus or minus percent of deviation from a target rate of return (Dahl, 2004).
- **Fully distributed cost**. A Fully Distributed Cost (FDC) is used when the company's fixed costs are allocated on more than one product or consumer class. One way is to distribute fixed costs within a price across all consumers, another method is to allocate fixed costs as a fixed charge to each class of customers, and the last alternative is to charge each consumer the marginal cost and then add a fixed amount.

  The major issue with this pricing is to define on what portion of fixed costs will be allocated to each class of consumers so all consumers are treated fair. Also it is important to avoid a distribution of fixed costs when one class of consumers is subsidized by the other one.

- **Peak Load Pricing**. Peak Load Pricing, also known as dynamic pricing, occurs when prices are settled on the basis of a load factor. This type of regulation is used to smooth the difference between peak and off-peak hours. By setting higher prices for electricity consumed during peak hours, the regulator aims to decrease the load and instead foster consumption during off-peak hours when lower prices are charged.

  There are three major types of dynamic pricing. First type is Time of Use (TOU) is when there are two types of rates: peak and off-peak. The second type is Critical Peak Pricing (CPP) where a high price is set during load increases or there is a threat for the whole system. And the last type is Real Time Pricing where actual usage of electricity by customers is displayed in a real time.

  The major benefit of Peak Load Pricing is that it influences the customers' behavior, the demand, which has a direct effect on the power supply (Wahyuda, Santosa B., 2015). According to Hobman E. et al. (2016), a commonly-held assumption that greater information, knowledge and awareness will induce behavior change of electricity consumers is inconsistent with basic principles of human decision making and behavior. The authors state that additional behavioral principles should be accounted for when introducing pick load pricing. These are simplicity, consumers' trust, encouragement of customers' considerations, reducing all costs and risks associated with shifting to new pricing, perceived fairness and others. For areas where such a peak load pricing is implemented, researches show that residential energy use and energy costs were reduced, while for commercial and industrial consumers the reduction was not that significant (Yalcintas M., Hagen W.T., Kaya A., 2015).

  The major problem with this regulation is that it requires that all consumers are equipped with appropriate metering devices to make it possible for fixate the amount of electricity consumed during peak and off-peak hours.

- **Price Cap**. This is a type of regulation first used in USA and UK for privatized industries, such as gas, water and telephone. In this pricing type, the regulator can raise or lower prices at the inflation rate adjusted for expected productivity. According to empirical studies this method was considered superior to rate of return regulation (Dahl, 2004). Price cap is a form of regulation where the company is not allowed to charge price that exceeds the value set in a base period, adjusted for inflation and economy-wide gains minus productivity givebacks (Glas V. et al., 2013). Regulatory price caps are known for creating disincentives for utilities to energy efficiency and conservation (Hage F., Rufin C., 2016).
  According to Arblaster and Hopper (2015), this regulation type requires strong institutions with educated staff with technical expertise and access to information about entities they supervise, as well as significant administrative costs.
  According to Sappington and Weisman (2016), price cap regulation is considered to be superior to rate of return when seeking competitive market outcomes since rate of return induces excessive investments, limits innovations and encourages inefficient technologies.

Price cap regulation, on the other hand, is perceived to provide strong incentives to innovate and reduce operational costs.

Additional tariffing methodologies found in literature are described below:

- **"Light handed"**. A type of regulation when a government does not intervene into the industry unless there is a monopoly pricing implemented. This type of regulation has been first implemented in New Zealand. According to Arblaster and Hopper (2015), "light handed" is a form of regulation where there is less intervention into the affairs of regulated entities, there is a potential to develop competitive influence and there are less administrative costs. This approach, in addition, requires a good quality of information, reported by regulated companies, so regulators receive sufficient and reliable overview of the entities' performance.
- **Yardstick comparison**. As a name implies, also called as benchmarking, this regulation is based on comparison of all participating parties with a best performing units, which is set as a benchmark. Those parties who did not perform well comparing to the benchmark are pressured to do better. Such an approach was first implemented in Scandinavian Norway and Sweden. Yardstick comparison is mainly used to regulated comparable regional monopolies. This mechanism creates an artificial competition by rewarding firms on their relative performance: so the firm's payoff depends on the firm's own costs and on the costs of other firms within benchmarking analysis (Lefouili, 2015). The main types of benchmarking techniques commonly applied by regulators are non-parametric approach (Data Envelopment Analysis or DEA) and parametric approach (regression). Data Envelopment Analysis approach compares inefficient companies with the structurally most comparable peer companies, while regression technique compare each firm to all other firms (Burns P. et al., 2005). One of the feature of yardstick competition, is that regulated companies are operating in closed markets (Varmaz A. et al., 2013).

  Several concerns have been raised in relation to application of yardstick comparison. The main of these concerns were studied by Burns et al. ((2005) and discussed by the authors as below:

  - "As there is no singe model or methodology which can be justified, it is inappropriate to choose one for regulatory purposes". The authors state that different models can be chosen to address different goals.
  - High level of uncertainty about which cost drivers to include for benchmarking purposes. Burns et al. claim the a proper selection of cost drivers is plausible in each particular model, where the cost drivers are well understood.
  - It is difficult to compare capital costs to execute proper benchmarking analysis. For this concern the researchers argue that consistent approaches for measuring capital costs have been developed and already deployed in regulatory practices.
  - Companies cannot earn a market based return if benchmarking principle is applied. According to the authors, regulators may adjust the allowed rate of return so on average the companies will be able to earn market rates of return.

- The last concern relates to the notion that yardstick comparison might be undermined by collusion of firms that will distort the results of benchmark analysis. However, the authors state that this factor is not relevant as long as a large number of companies are included in benchmark analysis.

The analysis performed by Lefouili (2015) showed that the increase of intensity of yardstick competition leads to an increase in firms incentives to invest in cost-reduction innovations. However, on the other hand, firms might be willing to decrease other investments, for example, in quality-improving innovations, if quality is not regulated.

Energy price floor option. Another form of pricing in electricity supply is a national "Energy price floor option" which implies favoring a particular type of generators. This type of pricing is an absolute contrast to the market based and is able to destroy any wholesale competition between electricity generators (Glachant, J.M & Ruester, S, 2014).

Feed-in tariffs

A special type of tariff that appeared along with development of the renewables in recent decades that represent a form of deployment subsidies from governments exercised via feed-in-tariffs. Besides a fixed level of return on their investments, in most European Union countries, the renewables also enjoy a guaranteed consumption of electricity produces, no barriers to enter the market and no barriers to connect to the main grids (Glachant, J.M & Ruester, S, 2014).

One popular alternative to feed-in-tariffs are renewable portfolio standards—government requirements (e.g., in the US) that existing major power suppliers deliver to customers a certain percentage of their electricity that has been generated by renewable sources. Because these suppliers may opt to meet these requirements either from building their own renewable capacity or purchasing the power from independent renewable energy providers, the price is not set by an administrative procedure but by the market, although the demand for green electricity is derived from the original government directive. Another popular mechanism is the tender (or demand auction), whereby a government or large utility solicits bids for the installation of a certain amount of renewable capacity from a particular renewable source or from a group of eligible technologies. An element of competition is involved, in that the government evaluates the bids on the basis of price or other desirable criteria (e.g., local content). Both tenders and renewable portfolio standards reduce the risks of conveying windfall profits to producers when administrative pricing schemes (e.g., feed-in- tariffs) overestimate generation costs (KazEnergy, National Energy Report, 2015).

In this section an overview of literature about the types of tariffing methodologies applied in electricity supply is given. Based on this overview, an analysis of applicability of each methodology to the current situation in Kazakhstan is given in the following section.

4.2. COMPARATIVE ANALYSIS OF TARIFFING METHODOLOGIES USED IN ELECTRICITY SUPPLY IN KAZAKHSTAN WITH THOSE SUGGESTED BY THEORIES. APPLICABILITY OF EACH TARIFFING METHODOLOGY TO EXISTING CONDITIONS IN POWER SUPPLY INDUSTRY OF KAZAKHSTAN

In order to compare the tariffing methodologies in power supply from theory with tariffing approach currently used in Kazakhstan, at first the main characteristics of each tariffing methodology described in section 4.1 are summarized in a table below:

Tariffing methodology	Applicable organizational structure (regulation or free-market)	Level of competition (L/M/H)	Tariff is fixed/flexible/dependent on other suppliers' performance	Based on actual demand	Requires skilled staff or advanced technologies	Frequency of revision	Boosts investments
Rate of return	Regulation	Low	Depends on own investments, not others' performance	No. Established before demand is known	Skilled staff	Yearly	Yes
Sliding plan	Regulation	Low	Depends on own investments, not others' performance / Depends on results of previous period	No. Established before demand is known	Skilled staff	Yearly	Yes
Fully distributed cost	Both	From Low to High	Depends on own costs and distribution method, not on others' performance	Yes	Skilled staff	Yearly	No
Peak-load pricing	Both	From Low to High	Depends on load, not on others' performance	Yes	Skilled staff and advanced technology	Real time pricing	No, rather effects consumption
Price cap	Regulation	Low	Fixed, does not depend on others' performance	No. Established before demand is known	Skilled staff	Long-term (>1 year)	Yes
Light handed	Free-market	High	Flexible, depends on competition	Yes	Skilled staff and advanced technology	Real time pricing	Yes, if investments improve competitive advantage
Yardstick comparison	A mix of both	Med	Flexible, depends on other suppliers' performance	No. Established before demand is known	Skilled staff	Yearly	Yes, if investments improve competitive advantage
Energy price floor option	Regulation	Low	Fixed, does not depend on others' performance	No. Established before demand is known	None	On a need basis	No
Feed-in tariffs	Regulation	Low	Fixed, does not depend on others' performance	No. Established before demand is known	Skilled staff and advanced technology	Long-term (>1 year)	Yes

Table 4.2.1. Main characteristics of tariffing methodologies described in theory

Further in this section each of tariffing methodology will be considered in terms of its applicability to the current situation of Kazakhstan. For each tariffing methodology SWOT analysis technique will be used to outline the major positive and negative sides of each methodology, after that a discussion about why the analyzed methodology can or cannot be applied to the power supply sector of Kazakhstan will be given and at the end a summary of results will be given. The analysis will be performed for each methodology in the same order as presented in section 4.1.

Rate of return

Strengths/Opportunities:	**Weaknesses/Threats:**
Rates are revised more frequently compared to other regulations (e.g. price cap)	Rate of return is set before the actual demand is known
Does not harm the quality of services provided	No stimuli for cost efficiency
Encourages investments when rate of return exceeds cost of capital and if investments do not hold under uncertainty	Effectiveness depends significantly on the quality of regulatory function, such as determination of rate of return and rate base
	Time lag

Applicability for Kazakhstan

Kazakhstan is a country with a relatively new economy and the rate of return methodology is one of the most widely used in country in many sectors. And power supply sector is not an exception. After the collapse of Soviet Union, a rate of return methodology was used to determine the tariffs for power suppliers. This approach was applied up to 2009 when it was replaced by “marginal tariff'' methodology, which is a form of a price cap method.

The reason why the country rejected rate of return approach was mainly related to the fact, that up to 2009 there was no any significant investments made in power supply capacity and the problem of a lack of generating units became more appealing. Even though there was a number of different factors, such as poor economic conditions, low level of professionals involved, lack of trenchancy and the like, most of the blame was put on a tariffing methodology itself and it was decided to switch to a more appropriate method. Thus, in 2009 the government officially enacted a “marginal tariffs” policy that seemed more promising and appropriate to achieve better investments inflows.

However, if compared to major characteristics of rate of return methodology as outlined in a table 4.2.1, it can be concluded that this methodology might well fit the current situation in Kazakhstan: it can be applied in a regulatory environment, it does not require specific advanced technologies, it is revised quite frequently and, the most important factor, it provides strong incentives to investors to increase the investment base to get higher profits. The last factor would eventually result in solving the major problem of old power capacities outlined in this research.

The question that comes up is why then the rate of return did not ultimately worked out if all conditions are in place and this methodology is presumed to boost investment? To answer this question it is worthy to refer to the literature review made in section 4.1. and the table above, which

describes that this type of regulation can bring incentives to invest, **only if future investments do not hold high uncertainty**. In this context, the level of uncertainty about future investments implies that investors need to have a relatively high level of assurance that the investments they we make under current conditions (ownership, legal aspects, economic indicators, government's commitments) will hold the same or not deteriorate in a future. The time factor is important in the case of power supply industry since the industry is highly capital intensive and investments have a long-term, rather than a short-term nature. The high level of uncertainty about investments is still an issue in Kazakhstan and till nowadays potential investors have no solid security and guarantees from the government that their investments will be held on the same status in future periods.

Additional factor is the lack of transparency and fairness. It was observed and publicly discussed that there was no consistency in defining the rate bases. Thus, one power supplier could receive higher rate base than another supplier with similar parameters.

Finally, under the rate of return methodology, each of power suppler is approached individually, which means that a significant number of qualified personnel needs to be involved in regulation process to provided adequate and timely review and approval of rate base. This, however, not yet the case in Kazakhstan power sector.

Summary

Based on the analysis above, the following can be summarized on the applicability of rate of return methodology to the current situation in Kazakhstan:

Is the methodology applicable to power supply sector in Kazakhstan based on conditions outlined in theory	Yes
What are the critical conditions for the methodology to be a success?	Certainty about future investments, transparency and fair treatment of all suppliers, availability of qualified staff involved in regulation processes

Sliding plan

Sliding plan, as a modification of rate of return regulation, has the same problem with investment future uncertainty, though will help minimize time lags and better response to demand.

Is the methodology applicable to power supply sector in Kazakhstan based on conditions outlined in theory	Yes

What are the critical conditions for the methodology to be a success?	Certainty about future investments, transparency and fair treatment of all suppliers, availability of qualified staff involved in regulation processes

Fully distributed costs

Strengths/Opportunities:	**Weaknesses/Threats:**
Power suppliers are guaranteed to cover all costs	Difficulties to allocate costs in a way so allocation is perceived fair by all customers
	Complicated when subsidies between groups take place

Applicability for Kazakhstan

The methodology of fully distributed costs is very similar to the rate of return in terms that it covers all supplier's costs. The major difference, however, is that the major accent in fully distributed costs is put on the allocation of costs. If referring to the major characteristics of this approach as outlined in a table 4.2.1 it can be concluded that in theory such a methodology can be applied to Kazakhstan, however, it will not bring any help to resolve the main problem since this type of tariffing does not bring any additional incentives for existing and new investors to invest in power supply capacities.

Summary

Based on the analysis above, the following can be summarized on the applicability of fully distributed cost methodology to the current situation in Kazakhstan:

Is the methodology applicable to power supply sector in Kazakhstan based on conditions outlined in theory	No
Major barriers	Inability to boost investments

Peak Load Pricing

Strengths/Opportunities:	**Weaknesses/Threats:**
If demand for electricity becomes more evenly distributed, there might be less need to build new power capacities	Aimed to regulate demand, not investments or asset renovations
Increased reliability of electrical system	Requires high level of adoption by customers

Higher level of customers involvement into regulation of the electricity supply sector	Requires significant investments in metering equipment to fixate consumption time during a day

Applicability for Kazakhstan

Peak-load pricing is very different type of methodology compared to others. The main focus under this approach is on a demand side, not supply. The main purpose of this method is to optimize consumption through charging higher rates during peak loads.

Peak load pricing might be of great help to regulate the electricity industry through minimizing difference between peak and off-peak consumption. So there will be no need to build additional power capacities to cover peak loads and during off-peak periods power capacities will not be idle.

However, in case of Kazakhstan, this option is not feasible in the nearest future. If referring to the main characteristics of the methodology, one of the necessary conditions is availability of technologies. In particular each end consumer will need to install a metering device to be able to register the volume of consumed electricity in specific time periods. Currently, such metering devices are available and can be acquired, however at the price which is much higher than an average consumer in Kazakhstan may allow. Moreover, maintenance and service costs of such advanced devices is greater due to higher complexity of new devices and requires special skills. In case the government will decide to enforce peak-load pricing, it will need to finance acquisition of new metering devices which will bring substantial costs to the state budget. Or alternatively, the government may include the cost of metering device into the tariffs (power supply, transmission or service tariffs) which will ultimately become an additional burden for the end users.

Summary

Based on the analysis above, the following can be summarized on the applicability of peak-load pricing methodology to the current situation in Kazakhstan:

Is the methodology applicable to power supply sector in Kazakhstan based on conditions outlined in theory	No
Major barriers	High cost of required technology and metering devices. Does not bring incentives for investments

Price Cap

Strengths/Opportunities:	**Weaknesses/Threats:**
Considered superior to rate of return	No incentives for energy efficiency and conservation
Limitation of maximum tariff charged by suppliers	High administrative costs
Incentives to reduce operational costs	

Incentives to innovate	Effectiveness depends significantly on the quality of regulatory entities and personnel

Applicability for Kazakhstan

As described in details in section 2.4 above, currently the marginal tariffs methodology is applied in power sector of Kazakhstan. If compared with characteristics of tariffing methodologies described in theories and summarized in table 4.2.1 it appears that the marginal tariffs approach represent a form of price cap regulation. To prove this a detailed analysis of each characteristic of price cap regulation is performed in terms of its application to Kazakhstan. In a table below the analysis of a currently applied tariffing methodology in power supply sector of Kazakhstan is performed using the same factors, as in a table 4.2.1 above.

Key characteristics	**Tariffing methodology in Kazakhstan**	**Reasoning**
Tariffing methodology applied in power supply sector in Kazakhstan	Marginal tariffs	Enacted since 2009. Prolonged until 2025.
Organizational structure of the industry	Regulation	As concluded in chapter 3, currently Kazakhstan is operating in a regulatory environment and the country is not yet ready to switch to liberalized market structure. A number of conditions should first be put in place to make a such a switch a success. The fact that liberalized markets have been successfully implemented in EU does not automatically mean that free-market mechanisms can be applied in any other economies.
Level of competition	Low	The mechanism of marginal tariffs imply that firstly the government divides all power suppliers into groups. Then a marginal tariff for each group is determined. The marginal tariff for each group is fixed (adjusted only for official inflation rate) and is not dependent on other group's performance results. Therefore, the power producers have no any competition

		challenge towards other power suppliers of electricity.
Type of tariff	Fixed for each group of power suppliers	Tariffs are assigned for a group of suppliers and do not depend on other groups' performance. Tariffs are expressed in a local currency tenge for a kw.h. of electricity sold. Tariffs are determined for a first year, and are adjusted for an official inflation rate on an annual basis.
Based on actual demand	No	Tariffs are set ahead of actual trading and do not depend on the level of demand on electricity
Requires skilled staff or advanced technologies	Requires skilled labor	Skilled labor is needed from the government side to properly estimate and justify marginal tariffs and also to provide an adequate level of monitoring and control
Frequency of revision	2016 - 2025	Marginal tariffs in Kazakhstan are set for a long-term (7-10 years) period
Boosts investments	Yes	There is a requirement for power supply companies that are willing to charge marginal tariffs: the company should submit a detailed investment program with a comprehensive description of planned investments and time frames. It is assumed that marginal tariffs are high enough so investors are guaranteed high returns, and therefore need to prove their commitments to invest, rather than to distribute earnings among shareholders.

Table 4.2.2. Major characteristics of tariffing methodology applied in power supply sector in Kazakhstan

Based on comparative analysis of key characteristics of existing tariffing methodology applied in power supply sector of Kazakhstan (Table 4.2.2) and tariffing methodologies found in theory (Table 4.2.1) it can be seen that marginal tariffs methodology applied in Kazakhstan has the same characteristics as a price cap methodology. Therefore, the conclusion is that the marginal tariffs methodology currently applied in Kazakhstan is a form of price cap methodology where power suppliers are given a fixed maximum level of tariffs they can charge, these tariffs are not dependent

on other suppliers' performance and each supplier has to submit an investment program in exchange of getting a marginal tariff.

One of the key factor that needs to be considered about price caps methodology is its ability to attract investors into power supply sector. Like in a rate of return case, a level of certainty in future investments will play a significant role and will define the level of attractiveness for external investors. In a price cap situation, one of the utmost important parameter is the stability of a local currency – kazakh tenge – in a long-run. As mentioned in section 2.4, the marginal tariffs are fixed and defined until 2025. This will give a certain level of assurance to investors of the guaranteed level of their returns. However, the marginal tariffs are all denominated in a local currency without any adjustments to the possible foreign exchange risk. However, most of capital investments are made in a foreign currency (normally USD or EUR) since no power generating equipment is produced in Kazakhstan and needs to be exported from abroad. Thus, investors make their capital expenses in foreign currency, but will receive revenues in local currency. In case of default or devaluation of a local currency, the investor will bring substantial foreign exchange losses, that will not be covered by fixed marginal tariffs or governmental subsidies. To illustrate more, after marginal tariffs, denominated in local currency, for 2019 – 2025 have been approved by the government in February 2015, the local currency devaluated by around 200% compared to USD and EUR since the National Bank of Kazakhstan made a decision to stop regulating local currency level. After such a devaluation, a number of investors had to revise their plans to invest into long-term power supply facilities since marginal tariffs, denominated in a local currency, became not that attractive to cover investments made in foreign currencies.

Furthermore, once investors are attracted, they have an obligation to invest a certain amount of funds in reconstruction of existing or construction of new power capacities. Though several kazakh analytical agencies report that significant investments have been made during application of marginal tariffs, around 14bln USD (National newspaper "Kazakhstan Truth", 2015), other industry specialists claim this level is much lower than originally expected. The major critics of price cap regulation in Kazakhstan is related to the lack of control over fulfillment of investment obligations by power companies. No yet official audited reports have been yet provided by the regulatory authorities to conclude how effective price cap regulation was during 2009-2015.

Summary

Based on the analysis above, the following can be summarized on the applicability of price cap regulation to the current situation in Kazakhstan:

Is the methodology applicable to power supply sector in Kazakhstan based on conditions outlined in theory	Yes (currently applied)
What are the critical conditions for the methodology to be a success?	Control over fulfillment of investment programs by power suppliers and certainty

	about economic stability in the country (foreign exchange rates)

Yardstick comparison

Strengths/Opportunities:	**Weaknesses/Threats:**
Creates stimulus for competition	Not appropriate for incomparable entities
	Can be applied in closed markets only
	Requires transparency of comparison process
	Involves complex calculation, e.g. regression

Applicability for Kazakhstan

Yardstick comparison methodology represents a mix of regulation and competition. Kazakhstan has already experience of implementing yardstick comparison, which has been introduced in 2013 as a regulation model for electricity distribution companies. This regulation was applied for 20 distribution companies that provide comparable services under similar conditions: distribution companies provide only one major service – transport of electricity via 220kV transmission lines within specific location. The comparison of distribution markets is based on 8 parameters, such as a number of connected consumers, a length of transmission lines, a number of compensators and others. On a yearly basis each distribution company submits to a regulator a standard report where all 8 parameters are provided. Additionally, the company submits a list of all costs that are expected to be covered via the tariff that the regulator should approve. When the regulator collects information about 8 parameters from all 20 distribution companies, it estimates a so-called "x-factor" for each company. The x-factor is estimated on the basis of the governmentally approved methodology by using a regression analysis tool. The x-factor is an estimated parameter that shows how good or bad did the company perform during the period comparing to other 19 companies that are included in yardstick comparison. When estimated, the x-factor is then applied to the total costs of the company, which already incorporate an internal rate of return. If the x-factor is more than 1, it means that the company performed better than the average of others, if the x-factor is less than 1 – the company performed worse than others and needs to improve in future periods. When total estimated costs, adjusted by the x-factor, are divided by the expected volume of electricity to be transmitted, and the final amount will represent a tariff.

For example, the company's estimated factor is 1.2, total costs are EUR 1 mln and total expected volume of transmitted electricity is 500,000 kw.h. In this case the tariff for this distribution company will be estimated as follows:

Total costs [EUR 1,000,000] x X-factor [1.2]) / Sales volume [500,000 kw.h] = EUR 2.4/kw.h

In this example, the x-factor exceeds 1, which means that the company had better performance results for the reported period and, as a result, will be given a higher tariff. Those companies whose

x-factor is less than 1, will receive lowered tariffs which will motivate them to perform better in the future compared to other distribution companies.

Since its implementation, a number of critics of the yardstick comparison approach have been identified and the major one relates to the lack of transparency when yardstick comparison is performed by the regulator. The companies, as a rule, do not have access to review or to investigate whether the comparison was made properly and fairly. The company submits its own results, but does not have access to other companies' results that are used in comparison. Therefore, companies should fully trust on integrity, professionalism and accuracy of staff performing yardstick comparison. As a result, distribution companies are not motivated, feel unfair treatment and claim that yardstick comparison is a root of all existing problems in their domain.

When it comes to power supply, the situation is even more complicated. First of all, unlike distribution companies, power suppliers have different technologies – coal, gas, hydro, combined heat and power, renewables and others. All of these technologies are different in terms of production process, capital costs, operations and management. Therefore, it is hardly possible to apply yardstick comparison for incomparable operations. In addition, the experience with distribution companies showed there are also other issues with transparency and fairness. As a result, it may be concluded that even yardstick regulation is a good instrument to promote competition among participants, this can hardly be applicable in Kazakhstan power supply.

Summary

Based on the analysis above, the following can be summarized on the applicability of a yardstick comparison approach to the current situation in Kazakhstan:

Is the methodology applicable to power supply sector in Kazakhstan based on conditions outlined in theory	No
Major barriers	Power suppliers operate in incomparable conditions

Energy price floor option

Applicability for Kazakhstan. Even though the energy price floor option is considered to be against competition and harmful to market mechanisms, it has been applied seldom in Kazakhstan. One of the recent case relates to the agreement between the government of Kazakhstan and Korean electrical company. Under the agreement the Korean companies was assigned to construct a power plant of 1320MW in Balhash area and where the government guaranteed a fixed amount of payment denominated in USD for each MW of installed capacity for the period of 20 years starting from the first year of exploitation that was planned for 2019. The launch of the Balhash power plant was planned as a starting point of creation a capacity market, though market principles were

initially broken when Korean subcontractor received favorable tariffs. This case is, fortunately, is a unique one and does not take place on a regular basis. It is obvious, that this type of regulation cannot be considered as an appropriate tariffing methodology for electricity supply of Kazakhstan and can be applied only in special circumstances.

Summary

Based on the analysis above, the following can be summarized on the applicability of an energy price floor option to the current situation in Kazakhstan:

Is the methodology applicable to power supply sector in Kazakhstan based on conditions outlined in theory	No
Major barriers	Can be used only in special circumstances. Eliminates fairness principle when one supplier receives more favorable conditions than others.

The results of the analysis in this chapter about the applicability of different types of tariffing methodologies are summarized in a table below:

Tariffing Methodology	**Applicable to power supply sector of Kazakhstan**	**If "YES", necessary conditions for successful implementation** **If "NO" – major barriers**
Rate of return / Sliding plan	YES	Certainty about future investments, transparency and fair treatment of all suppliers, availability of qualified staff involved in regulation processes
Fully distributed costs	NO	Inability to boost investments
Peak load pricing	NO	High cost of required technology and metering devices. Does not bring incentives for investments
Price cap	YES	Control over fulfillment of investment programs by power suppliers and certainty about economic stability in the country (foreign exchange rates)

Yardstick comparison	NO	Power suppliers operate in incomparable conditions
Energy price floor option	NO	Can be used only in special circumstances. Eliminates fairness principle when one supplier receives more favorable conditions than others.

Table 4.2.3. Summarized results on applicability of tariffing methodologies to Kazakhstan

Chapter summary

Referring back to research questions from section 1.6 the following can be concluded:

Central question 3. What type of tariffing methodology in electricity supply is the most appropriate in a current situation of Kazakhstan?

Sub-question 3.1: What types of tariffing methodologies are applied in power supply sector from theoretical perspective? What is the most appropriate tariffing methodology for Kazakhstan power supply sector?

The following tariffing methodologies, which are applied in power supply industry, have been found in a literature: rate of return, sliding plan, fully distributed costs, peak load pricing, price cap, yardstick comparison and energy price floor option. A comparative analysis showed that rate of return and price cap are the most applicable types of tariffing methodologies for the current situation in Kazakhstan.

Sub-question 3.2: What conditions or prerequisites are necessary to be in place in Kazakhstan power supply so the applied tariffing methodology brings expected results?

The major factors that influences the effectiveness of application of rate of return and price cap methodologies in Kazakhstan are: certainty about future investments, appropriate level of monitoring and control, transparency and fair treatment of all power suppliers and availability of educated professional staff in regulatory agencies.

5. CONCLUSION

According to Satchwell and Cappers (Satchwell A., Cappers P., 2015), it takes years of testimony and deliberation, experimentation and refining to address changes in regulatory regime and business models through policies and rulemaking by regulatory commissions and legislation.

Kazakhstan is a country with a relatively young economy and power supply industry. United power system of Kazakhstan has been inherited from former Soviet Union with a number of challenges and problems. And nowadays, the country needs to address a number of challenges, including those in electricity power supply sector.

One of the major challenge the power supply governors are facing is related to outdated power capacities and lack of investments into renovation and construction of power generating assets. One of the key aspect to solve the problem is to find an optimal tariffing methodology that will attract foreign investors, boost investments in power generating capacities and secure acceptable tariff level for consumers.

The analysis of theoretical perspective of regulatory tariffing methodologies showed that rate of return and price cap regulation are the most suitable to resolve the main challenges in power supply sector of Kazakhstan. However, both of these approaches require higher level of transparency, certainty about future investment and higher monitoring and control function from regulator's perspective. Only under these circumstances, rate of return or price cap tariffing methodologies will bring expected results.

The same conclusion might be also relevant to other post soviet countries. Most of them, excluding those that joined European Union, are facing similar challenges in power supply as Kazakhstan: weak economies, absence of financial and technological resources, the need to attract foreign investors via high tariffs and returns. In most of these states a power supply sector is still highly regulated by the governments, like in Kazakhstan, and rate of return and price cap regulations are the most commonly used. However, further research is needed that will elaborate on the most appropriate tariffing methodology and necessary conditions that should be implemented in other post soviet countries, since each country might have its own specific conditions and circumstances both on a country level, as well as on a power supply industry level.

Based on the results of this research, three recommendations have been formulated about the tariffing methodologies that might be applied in a power supply sector of Kazakhstan and about the conditions that should be met in order these methodologies might bring expected results.

6. RECOMMENDATIONS ON A TARIFFING METHODOLOGY IN ELECTRICITY SUPPLY IN KAZAKHSTAN AND THE WAY THE COUNTRY COULD SUCCESSFULLY IMPLEMENT IT

Currently electricity power supply sector of Kazakhstan faces a number of challenges. One of the major challenge is to find an optimal tariffing methodology that will fit current economic situation of the country and will boost investments into power supply, while keeping the cost of electricity as low as possible for end consumers. If no actions will be implemented today, the country might have risk that in a future power generating capacitates will not be sufficient enough to cover a growing electricity demand.

Based on a literature review about the types of organizational structure and tariffing methodologies applied in power supply sector and the analysis of applicability of tariffing methodologies to the current situation of Kazakhstan a number of conclusions have been made. Based on these conclusions, recommendations on the most appropriate tariffing methodologies in electricity supply in Kazakhstan have been formulated and presented below:

- In Chapter 3 the types organizational structure of electricity power supply has been discussed. The purpose of this discussion was to determine which type of organizational structure can be applicable to Kazakhstan in its current situation: regulation, free-market mechanisms or both. The type of organization is very important when tariffing methodologies are considered, since some of tariffing structures can be applied only in regulatory environment, others can be used only when free-market mechanisms are established and the rest can be applied in both structures.

  The conclusion made in this chapter was that currently power supply sector of Kazakhstan is not yet ready to switch to a liberalized market structure, since a number of pre-conditions for a free-market operations are not yet established. Therefore, in the nearest future the only available organizational structure for a power supply sector is regulation.

  Recommendation 1

  The first recommendation is to consider only those tariffing methodologies that can be applied in regulatory environment.

- In Chapter 4 a thorough analysis of tariffing methodologies applied in power supply sector has been performed. Each methodology has been assessed in terms of its applicability to the current conditions in Kazakhstan and ability to boost investments into the industry and prevent the problem of lack of power generating capacities.

  The results of the analysis showed that rate of return and price cap regulation are two types of tariffing methodologies that can be applied in power supply of Kazakhstan and bring substantial investments from abroad.

  Recommendation 2

The second recommendation is to keep applying a price cap regulation (as it is now) or switch to rate of return regulation

- Additionally, as the analysis in chapter 4 showed, the application of a suitable tariffing methodology itself might not results in expected increase in investments unless certain criteria are met.

Recommendation 3

<u>If price cap regulation is applied:</u>

1. *to provide guarantees to investors to increase their certainty about stability of local currency. One of the solution might be to guarantee to suppliers, who invest in foreign currency, that foreign exchange rate for a specified period will be held within a particular range. And if the foreign exchange rate will fall outside this range and the investor will suffer significant foreign exchange losses, then the government will cover these losses via additional subsidies or tax relieves up to a certain threshold. Such an arrangement might decrease the financial risk for investors and attracts more external funds,*
2. *to improve monitoring and control over power suppliers' fulfillment of their investment programs via hiring educated professionals and carrying out external audits. If investors will be guaranteed high price caps and foreign exchange rate stability, but will not comply with their investment programs, then power companies will enjoy higher returns, but the power supply industry will not be supplied with sufficient investments. As a result, the ultimate goal of increasing power generating capacities will not be achieved.*

<u>If rate of return regulation is applied:</u>

1. *provide higher level of certainty about future investments via establishing giving long-term guarantees to investors, where the major indicators will be clearly defined, such as rate of return, rate base, foreign exchange rate and legal framework.*
2. *to attract educated professionals to carry out regulatory functions*
3. *to improve transparency of a regulatory activities and establish better communication between a regulator and power suppliers.*

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