Research Report

Title: Energy Saving and Energy Efficiency in Tajikistan: Current State and Problems based on SWOT analysis

by

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DECLARATION

I, **KHALIFAEV Manucher**, (Student ID: 51217606) hereby present my research paper, entitled: “Energy Saving and Energy Efficiency in Tajikistan: current state and problems based on SWOT analysis” and honestly declare that this paper is a result of my own research study.

I, also confirm that this research paper has not been presented for the award of other decrees in the same or similar manner and has not been previously published. All materials and relevant literature used in this study are properly recognized and referenced.

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KHALIFAEV Manuchehr

2019/07/25

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KHALIFAEV Manuchehr

SUMMARY

This study investigates energy efficiency in Tajikistan. After briefly describing status and problems, the study conducts SWOT analysis. Through SWOT analysis, the study will identify and discuss problems and issues on energy saving and efficiency.

The SWOT result shows that the main problems Tajikistan faces include: low electricity price, lack of implementing agency and lack of necessary cooperation between key institutional players in the field of energy efficiency. In addition, there are no instrument/systems in implementing the state energy efficiency policy in Tajikistan.

To increase the energy efficiency, Tajikistan needs to abolish subsidies on electricity. Furthermore, introducing market-based energy prices will provide significant motivation to improve energy efficiency among consumers. In addition, establishment the agency that coordinates and monitors the effectiveness of energy efficiency policies is essential.

This study aims to help policy makers maximizing the potentials and opportunities of energy efficiency and developing strategic plans for achieving the state goals.

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LIST OF ABREVIATIONS

ADB	Asian Development Bank
EC	European Commission
GoT	Government of the Republic of Tajikistan
IEA	International Energy Agency
IPEEC	International Partnership for Energy Efficiency Cooperation
JICA	Japan International Cooperation Agency
JICE	Japan International Cooperation Center
MEWR RT	Ministry of Energy and Water Resources of the Republic of Tajikistan
MFA RT	Ministry Foreign Affairs of the Republic of Tajikistan
NDG	National Development Strategy of the Republic of Tajikistan for the period until 2030
SWOT	Strengths, Weaknesses, Opportunities and Treats
TALCO	State-owned aluminum company
TPSDMP	Tajikistan's Power Sector Development Master Plan
UN	United Nation
WEC	World Energy Council

CHAPTER 1. INTRODUCTION

1.1 Introduction

This paper investigates current problems and opportunities of Tajikistan's energy efficiency issues through conducting SWOT analysis. In addition, the study evaluates effectiveness of implemented energy efficiency policy such as transition to energy-saving lamps in all sectors of national economy of Tajikistan.

This chapter of the study provides clear information on the topic and problems under investigation, including background, research questions, objectives, significant of the study and research implementation process.

1.2 Background

In the 21st century, energy efficiency improvements are becoming one of the priorities of governments and some global international organizations. Many countries around the world indicate energy efficiency improvements in all sector of the national economy as an important component of their national development strategy. To adopt and implement energy efficiency policies and strategies, politicians discuss these issues within international conferences, symposiums and meetings.

To improve existing energy efficiency policies, and planning and implementing more effective and efficient measures, the International Energy Agency provides policy advice and factual analysis through various publications to its member countries (IEA, 2017a).

According to Sharma (2015) design and implantation energy efficiency policies and measures would have positive impact on reducing the expenditures of individuals, business, and governments. Therefore, in the last two decades, several policies and

measures have been implemented to increase the efficiency of energy use or to solve today's energy problems around the world.

Several studies also have been conducted to evaluate the effectiveness of normative and economic policy instruments associated with energy efficiency improvements in various regional context. Furthermore, most existing studies and works focus on improving the mechanisms of state support for energy efficiency improvements and, of course, eliminating the existing barriers and problems in this area. That is why, some countries when developing the energy sector, make accents, not only to create new generation capacities, but to spend more resources to create the conditions for the improvements of energy efficiency and energy saving.

This study suggests an approach to understanding the importance of improving energy efficiency in the Republic of Tajikistan by analyzing the status and problems of energy efficiency and identifying opportunities for developing future energy efficiency plans in Tajikistan.

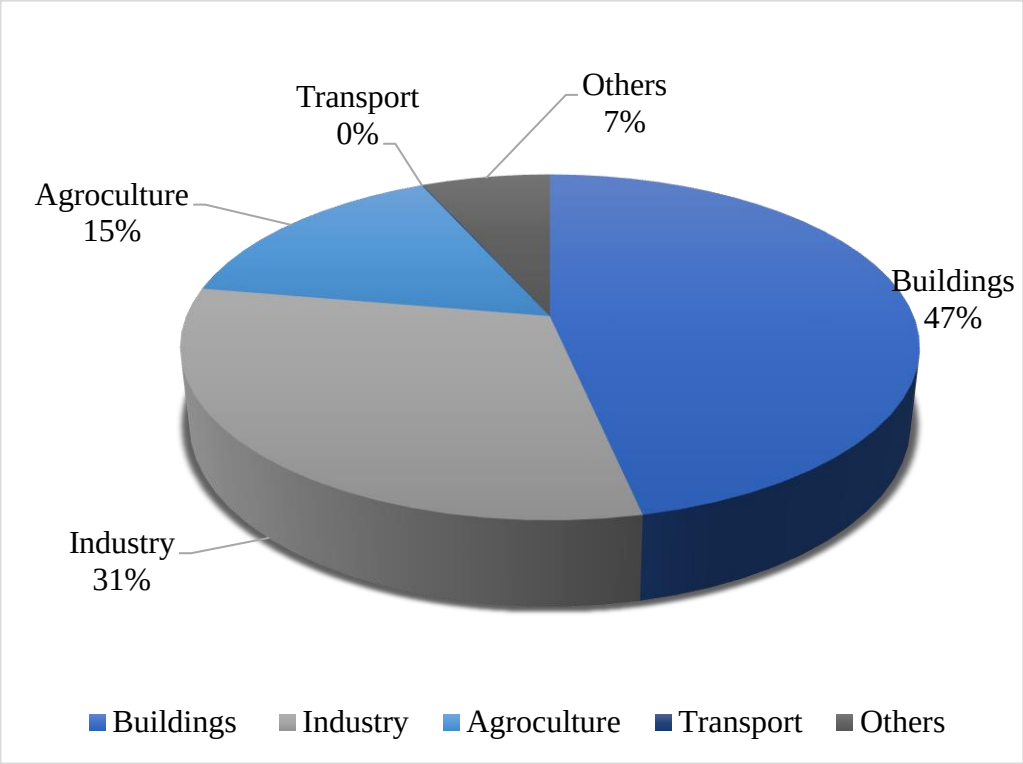
The outcome of the study will show the reality and general understanding for the improving the decision-making process in the future. The analysis result can be used to adopt and improve existing energy policies, and also design new policies associated with energy efficiency improvements in Tajikistan. It includes recommendations to the Ministry of Energy and Water Resources of the Republic of Tajikistan to increase the efficiency of energy use in the country.

1.3 Research Problems

In Tajikistan electricity is mainly produced by hydroelectric power stations - 95%, and the rest of the electricity generated by thermal energy - 5%, that the production

capacity of electricity depends on water and fuel resources[1]. The hydropower stations do not have huge reservoirs to store water to generate electricity during winter period. But, during the winter season, electricity consumption is very high in the country. The latest statistics on electricity consumption in several sectors of the economy of Tajikistan shows that the building sector, industry and agriculture are the main consumers of energy in the country (Figure 1.1).

Figure 1.1 Electricity consumption by sector, 2017



Source: MEWR RT, 2017.

The figure 1.1. presents the main consumers of electricity in Tajikistan is the building sector, which accounts for almost 47% of all electricity. The building sector include all public buildings, private residences including individual residential houses and apartments. Currently a significant number of urban households use electric heating

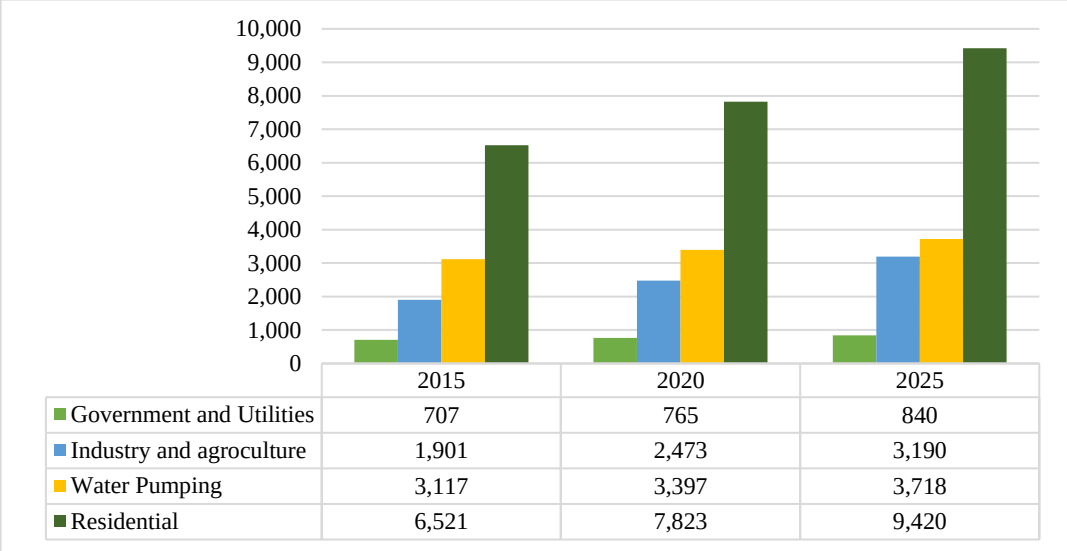
[1] Ministry of Energy and Water Resources of the Republic of Tajikistan.

as a heat source in the country. Natural gas and central heating systems are widely used around the world and offer an alternative method of heating buildings during the winter season. Unfortunately, Tajikistan is not a net gas producer as well as the central heating systems were built during the Soviet Union period, only in a few large cities. The existing district heating system no longer work due to increasing prices for natural gas, and the poor condition of the heating infrastructure (World Bank, 2015).

Due to the difficulties in obtaining natural gas and the cost of rehabilitation of the existing centralized heating system, electricity has become the main resource for space heating needs of the urban population. Therefore, there is a large shortage of electrical energy during the autumn/winter period in Tajikistan. The lack of electricity supply has a strong impact on employment, and influences access to necessary education, health care, income generation, and finally has a significant impact on the economy of the Republic of Tajikistan (United Nations, 2011).

The last 10 years, due to population growth and significant industrial development, the demand for energy in Tajikistan is growing very rapidly. For example, only in 2017 in Tajikistan 150 new industrial enterprises, a residential building with an area of 1.1 million square meters and 64 new education institutions have been constructed (Yodgori, 2018). All these buildings and industrial enterprises are requiring new additional capacity. The figure 1.2. presents electricity consumption forecast by consumer type during 2015 to 2025 in Tajikistan.

Figure 1.2. Electricity consumption forecast by consumer type in Tajikistan (GWh)



	2015	2020	2025
Government and Utilities	707	765	840
Industry and agroculture	1,901	2,473	3,190
Water Pumping	3,117	3,397	3,718
Residential	6,521	7,823	9,420

Source: Tajikistan's Power Sector Development Master Plan.

On the other hand, Bukarica et al (2011) argues that currently in Tajikistan existing energy resources are used inefficiency, and the country loses huge opportunities to increase the efficiency of energy use in all sectors of the national economy. Therefore, reasonable usage of the energy resources and supplying all consumers with high-quality energy has become one of the strategic objectives of the Government of Tajikistan.

1.4 Research purpose and questions

The purpose of this study is to identify current problems of energy efficiency and potential measures for future implementation in Tajikistan and then to provide practical guidance and recommendations on how to design and apply energy policies and measures associated with increased efficiency of energy use in Tajikistan.

The study is planned to find the answer to the following questions:

1. What are strengths, weaknesses, opportunities and threats of Tajikistan's energy saving and energy efficiency?

2. What measures need to be taken to increase the efficiency of energy use in Tajikistan?

1.5 Research Objectives

The research objectives are to find out recommendations for the successful implementation of energy efficiency policies and measures in the future through:

- analyzing current situation and problems of Tajikistan's energy saving and energy efficiency;
- identifying the positive and negative effects of energy efficiency improvements in Tajikistan;
- examining energy efficiency benefits, barriers and measures.

1.6 Significance of the Study

The Government of the Republic of Tajikistan considers energy saving and energy efficiency as a key strategy for achieving its energy strategic goals. To increase the efficiency of energy use in the country, the Government of Tajikistan have emphasized a different target in the National Development Strategy for the period until 2030. As part of Tajikistan energy strategy, the following targets were set for the period until 2030:

- project production capacities 10 GWT;
- electricity losses down by 10 %;
- electricity export 10 billion kW per hours;
- energy saving 500 billion kWh/year (National Development Strategy, 2030).

The overall aim of the Government of Tajikistan is to achieve 500 billion kWh/year energy saving until 2030 through energy efficiency improvement in the

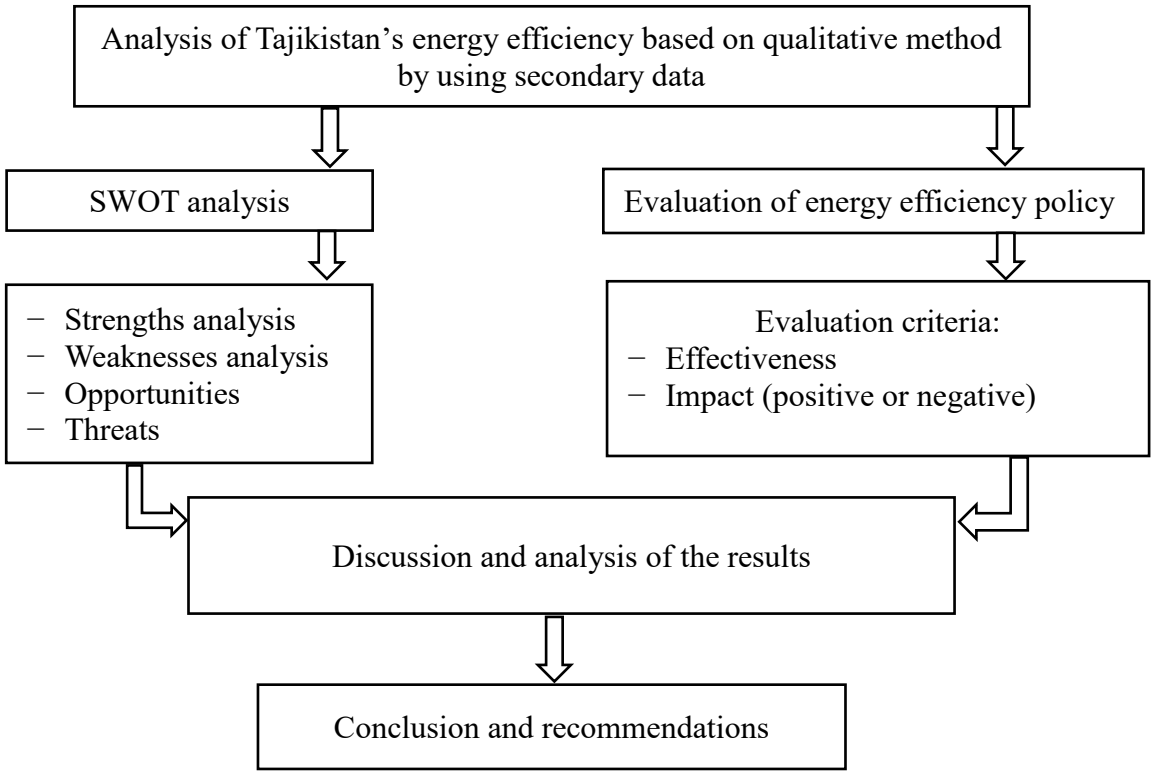
country. This raises such a question: what measures need to be taken to increase the efficiency of energy use in Tajikistan?

Therefore, the search and implementation of solutions, which allow to significantly save existing energy resources is the most urgent task now in accordance with National Development Strategy, Low of the Republic of Tajikistan "On energy saving and energy efficiency" and other relevant strategic documents and programs.

1.7 Research Methodology

The study was conducted based on qualitative methods through using secondary data collections such as official reports of international agencies, textbooks, academic papers and a variety of energy efficiency related literature. Data regarding Tajikistan have been collected throughout oversees research trip to Tajikistan on February 2018.

Figure 1.3 Research implementation process



1.8 Organization of the Study

This study is organized into four chapters as follows: chapter 1 introduces the study through providing clear information on the topic and problems under investigation, including background of the study, research questions, research objectives, research methodology and outline of the chapters.

A brief review of the studies that have been done on energy efficiency measures and policy instruments, definitions and benefits of energy efficiency as well as the current global status of energy efficiency provided in chapter 2.

Methodological aspect of the SWOT analysis, and evaluation approach with its results and also discussion of the finding is provided in chapter 3. Chapter 4 contains conclusions and policy recommendations.

CHAPTER 2. LITERATURE REVIEW

2.1. Introduction

Energy efficiency determines one of the cheapest, cleanest and safest energy resources that every country around the world wants to possess it quickly and cost-effectively to solve energy security issues (IEA, 2017a).

In addition, Bukarica et al., (2011) describes energy saving and energy efficiency as new source of energy supply. Similarly, Hamilton (2013) argues that energy efficiency refers to the use of less electricity to provide the same or better level of service. He indicated that energy efficiency is related to conservation of energy, but they are not the same. One can be more efficient in how energy is used, and one can conserve energy through avoiding its use.

Energy conservation measures are aimed at changing the behavior of individuals, small and medium enterprises and government institutions by encouraging them to decrease power consumption. Examples of energy conservation without energy efficiency improvements includes as simple measures such as turn off the lights when leaving a room, turning off televisions or computers when not in use, heating a room less during the winter period. Examples of improving energy efficiency consist of replacing an appliance, such as a washing machine or refrigerator with a model, which provides the same or better level of service, but uses less electricity.

To adopt and implement energy efficiency policies and strategies, politicians discuss these issues during international conferences, symposiums and meetings. For the improvement of existing energy efficiency policies, planning and implementing more effective and efficient measures, the International Energy Agency provides policy advice and factual analysis through various publications to its member countries (IEA, 2017a).

Several studies also have been conducted to estimate the cost effectiveness of energy policies and to identify specific normative and economic policy instruments assisted with the increase of the efficiency of energy use around the world. Furthermore, most existing studies focus on analyzing of financial, environmental and social impacts of energy efficiency improvements in different regions and countries. Therefore, this chapter would review energy efficiency measures and policy instruments, benefits of energy efficiency and the current global status and trends in energy efficiency.

2.2. The status of energy efficiency around the world

Energy is one of the main resources supporting economic growth, and has a strong impact on employment, income generation, social growth and people's survival (Han, 2010). Since the last century to the present, the main source of power generation has been traditional energy resources, such as oil, gas, coal, nuclear, etc. Unfortunately, traditional energy resources are not endless. On the other hand, using only traditional energy resources is not enough to generate electricity which people desperately needs or for solving today's energy problems associated with a shortage of electricity.

In 2016, the number of people who did not have access to reliable electricity reached 1,1 billion around the world (IEA, 2017b). In connection with these problems, and considering the constant increase in energy prices and the problems associated with the consequences of global warming, in most countries national energy strategies focus on the following elements of energy efficiency policies:

— The reasonable using of energy resources;

— Eliminate the existing barriers and problems in the field of energy efficiency;

— Implement energy saving related activities at national, regional or municipal level;

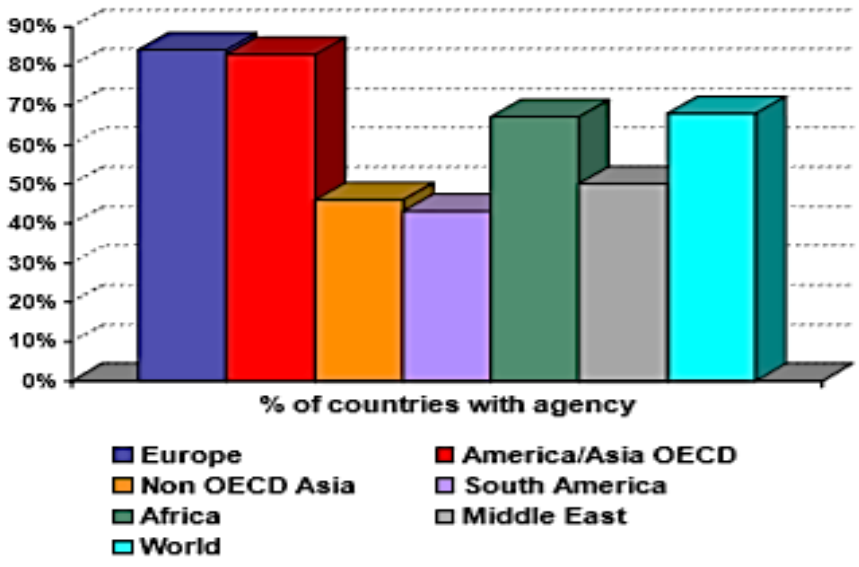
—The development of mechanisms of state support in the field of energy efficiency;

—The promotion of energy saving and energy efficiency measures;

—The development mechanism that can lead to various change in consumers. behavior (for example, purchasing more energy-efficiency technologies, turning off the lights when leaving a room, turning off televisions or computers when not in use, etc.).

In general, implementing such policies includes several aspects of energy saving, as well as the development of energy resources throughout the world. To implement and coordinate energy efficiency policies and measures, many countries around the world have created their own national energy efficiency agency, authorized to develop policies aimed at increasing energy efficiency. The following figure shows how other countries have established energy efficiency agencies at the global level.

Figure 2.1. Countries with an energy efficiency agency



Source: WEC, 2008.

2.4.1 Energy efficiency policy in the European Union

The desire to find a new source of energy supply in Europe has led to the fact that the strategy of access to green energy is gaining more and more priority. In 2016, the

European Council adopted a common energy efficiency strategy for the European Union member states. The action plan targets were to achieve a 20% energy efficiency improvement by 2020 (EC, 2006).

The key point of this action plan is both to reduce carbon dioxide emission and to conserve existing energy resources (Richard, 2017). Implementation of this plan in the first stage focuses on increasing energy efficiency and strengthening the role of consumers and households. Long – term objectives of this plan include requirements for all new buildings to be constructed based on requirement of energy efficiency standards. It is expected that, after implementation of this action plan, the energy costs of each family can be reduced by appreciable amount in European Union countries.

To exchange ideas and experiences as well as to discuss energy efficiency issues with other countries and regions, European Union joined the International Partnership for Energy Efficiency Cooperation. The International Partnership for Energy Efficiency Cooperation (IPEEC) as an autonomous organization was founded in 2009 by a group of countries including Australia, Brazil, Canada, China, India, Mexico, Russia, South Korea, and the United State. The main goal of this organization is to implement energy policy that can lead to enhancing global cooperation on energy efficiency improvements.

2.4.2 Energy efficiency policy in India

Because of population growth and significant economic development, energy demand in India is growing very fast. Primary energy demand in India increased by 51.1% from 2000 to 2010 (Dopazo, 2015) Currently, more than 80 % of the population has access to high quality electricity in India, compared to 43% in 2000 (IEA, 2017b). Over the past 15 years, the Indian government has implemented several energy strategies and made significant progress in this direction.

To reduce the shortage of electricity and to provide its society and economy with reliable and high-quality electricity, the reasonable use of existing energy resources has become an important component of India's energy policy. India not only focused on the development of the new source of energy, but also spent more resources and created the good conditions (personal and institutional capacity) to realize energy efficiency policies. In 2011, the Indian Parliament approved the Energy Conservation Act. The adoption of this document has created a good condition for energy efficiency improvements in India.

In 2002, the Bureau of Energy Efficiency was established as a state body in the field of energy efficiency and facilitating the implementation of the Energy Conservation Act. The Bureau take measures for raising awareness of population on the use of high-efficiency technologies, establishment of mandatory energy efficiency standards for new buildings and labelling system for equipment and home appliances (Government of India, Ministry of Power, 2018). This organization has been very active in conducting analysis of effectiveness of implemented energy efficiency measures and policies.

Finally, the Indian Government created a very good human and institutional capacity for improving existing policies as well as adopting the new energy efficiency policies. As a result of good energy strategies implemented over the past 10 years, India has made substantial progress in the area of energy efficiency. India will achieve universal access in the early 2020s and reach one of the greatest successes in the history of electrification (IEA, 2017b).

2.3. Benefits of Energy Efficiency

The energy efficiency improvements would increase economic development through reduction of power shortages, contributes to environment protection locally and globally – by minimizing pollution and green house emission (WEC, 2010). It would also influence the increasing business competitiveness by decreasing their electricity cost.

Hamilton (2013) emphasize that improving energy efficiency can be achieved by fulfilling a specific task among electricity consumers by more reasonable and efficient use of energy in everyday life. He believes that the adoption and implementation of energy efficiency policies, the use of high-efficiency technologies and the replacement of devices that consume less electricity but provide a better level of services will lead to energy and money savings.

To obtain financial, environmental and social benefits by energy efficiency improvements, many countries and global organizations around the world have adopted and implemented several energy efficiency policies and measures. The closest study on benefits of energy efficiency policies and measures can be found in this report "Energy efficiency: recipe for success-executive summary", (see, WEC, 2016). The study was conducted by using data on energy efficiency indicators and surveys of energy efficiency measures in around 90 countries around the world. The result of the findings shows that, the main strategic benefits of energy efficiency are not only increasing supply security and reducing carbon emissions. But it can also provide another important advantage, which is access to clean and safe energy, creating new jobs, attracting new technologies, which will contribute to higher industrial productivity, and increase the country's export capabilities.

In accordance with International Energy Agency (2014), one of the biggest consequences of energy efficiency is reduction of budget expenditures on unemployment payments, when energy efficiency policies and measures reduce unemployment rate by creating new jobs. Actions to save energy resources also has a significant impact on reducing the expenditures of the individuals, business, governments by reducing electricity cost for lighting, heating and cooling, etc. Reducing household energy costs

by increasing energy efficiency is the easiest, most reasonable and efficient way for families to use energy more reasonable and save money on household expenses.

Governments, industries, businesses, and individuals who can save energy by controlling their energy consumption have lower electricity bills. In turn, lower electricity bills enhance business profitability and improve business competitiveness. Richard (2017) argues that action to minimize our energy consumption leads to the greater availability of energy resources in the future. Therefore, the International Energy Agency (2014) believes that improvements in energy efficiency will reduce public and household spending, improve business competitiveness and energy supply for all consumers only if energy efficiency policies and measures are well developed and properly implemented.

The next advantage of energy saving, and energy efficiency is a reduction in domestic demand. Currently, addressing today's energy issues and providing all consumers with safe and clean energy is becoming one of the main topics of discussion worldwide. Therefore, researchers and experts around the world are conducting several studies in the field of energy saving and energy efficiency. Hawkes (2000) states that as the world population is increasing day by day and more people expect good living standards, the demand for energy is increasing very fast around the world. Therefore, many countries are trying to solve today’s energy problems by constructing new electric power stations, as well as adopting and implementing energy policies and strategies that result in saving existing energy resources.

Yodgori (2018) argues that from the economic point of view, efficiency using of existing energy resources is affordable, simpler and cheaper way for solving the problem of energy shortage than construction of new generation capacity. He says that for new construction of electric power stations we need finance, labor and time. Time is not

profitable for us because a new generation capacity is not built in one or two years. In accordance with Hamilton (2013), improvements in energy efficiency will reduce domestic energy demand. In its turn, reduction in domestic demand leads to less construction of new electric power stations, which saves sufficient capital for the development of other sectors of the national economy. He also notes that, reducing domestic energy demand will result in decreasing the world oil price, so benefiting the countries who import oil products.

Implementing activities to minimize energy consumption will also save energy and money in everyday life. Thus, it has a direct and indirect impact on the economic activity of the country by reducing domestic energy demand and increasing the energy available for export.

In many countries, electricity exports are an important element of economic activity and employments. Design and implementations of energy policies associated with the energy efficiency improvements will solve two main energy problems: first it helps with more reasonable use of existing energy resources, and second it basically produces an additional source of electricity by increasing the efficiency of energy use. Therefore, several countries have implemented policies exactly directed towards improving power generation efficiency, increasing energy exports and finally, generating income from its sale to foreign markets.

Improvements in energy efficiency may also affect in savings in emergency assistance for natural disasters, intensified by climate change as well as reduce in the cost of health effects associated with the use of other traditional fuel resources and technologies (Hamilton, 2013). Kornelis and Joosen (2011) and Hamilton (2013) both argue that the development and proper application of economic and regulatory policy

instruments lead to improved energy efficiency and the use of energy efficiency technologies will reduce climate-related disasters.

For that reason, the proper implementation of economic and regulatory policy tools lead to improved energy efficiency in our lives and make people less susceptible to various health problems through providing a higher level of services. To obtain financial, environmental and social benefits from energy efficiency policies, it is necessary to improve the mechanisms of state support in the field of energy efficiency and, of course, eliminate the existing barriers and problems in this area.

2.4. Energy efficiency measures/policy instruments

According to the literature, there are various kinds of energy efficiency policy instruments and measures including:

- Policy instruments with a normative character (energy efficiency standards for new buildings and energy efficiency requires for appliances and equipment);
- Economic policy instruments (tax dedication and subsidies programs such as grants for the stimulating investments in energy saving measures).

Each energy efficiency policies and measures have its own requirements, indicators and form. Several studies have also contributed to understanding the cost effectiveness of energy efficiency policies and measures. Kornelis Block, Suzzane Joosen and Mirjam Harmelink evaluated the "effectiveness of energy efficiency policies in Dutch service sector" by using *ex post* evaluation approach. While they found that implementation of economic policy instruments (tax dedications and energy efficiency investment subsidies) and normative policy instruments (energy performance standards for new and existing building) effected on improving energy efficiency in the Dutch services sector. They also concluded that, building code regulations are possible

regulatory schemes for future implementation, since it is economically beneficial to the government as the subsidy schemes. They recommended that new buildings should be design, construct and operate based on requirements of building codes and standards.

In addition, investing in energy efficiency technologies and changing an appliance with a model, which provides the same or better level of service, but uses less electricity will also help to achieve a sufficient result of energy saving. In low and middle-income countries many public and residential buildings are in poor condition. Heat losses in this kind of building is very high because of poor conditions of windows, roofs and walls insulations.

Old type windows loss about 30 percent of electricity is used for heating and cooling in residential and public buildings Risser (2011). According to the author, to increase comfort and reduce the amount of energy required for heating and cooling, it must be change traditional windows with new and more efficient types.

To increase the efficiency of energy use in the country, it is needs to adopt and follow all requirements of building codes and standards during the construction of new buildings. In addition, lack of awareness of energy-saving measures among the engineers and practicing architects is one of the main problems, which exist in many countries around the world.

In this regard, Harvey (2010) discuss the energy policies that would promote much greater energy efficiency and result in increasing the efficiency of energy use in all sectors of the economy. He argued that the lack of awareness of energy-saving opportunities among the public and other energy efficiency market participants including group of constructors is one of the main barriers for energy efficiency improvements. He says that in many countries the consumers of electricity do not have enough knowledge and skills on how to save on an electricity bill or how to promote the use of energy-saving

appliances in everyday life. So, there is a significant need to inform all people including electricity consumers about branded energy-efficient products, about energy supply situation and tariff options in the country. Consumers should know that, how they can change their energy usage to help at the national level.

Moreover, Markovska et al. (2009) conducted SWOT analysis of the national energy sector for sustainable energy development in Macedonia. The researchers argue that education, training and raising public awareness of energy-saving opportunities are considered one of the most cost-effective energy efficiency measures. The findings of the study show that many countries would needs to create promoting training programs aim to raise the awareness of the future engineers and architects during study at the universities. Similar programs also need introduce at the technical institutes for training technical specialists as well.

The overall aim of enhancing this kind program is that, the future engineers, architects and technical specialists should know how to design and to build the new buildings with zero energy consummation. Value of such programs would be significantly higher if integrated training programs improves the knowledge and skills of practicing architects, engineers and specialists involved in construction processes. Similarly, Hamilton (2013) says that implementation rising public awareness activities will contribute to energy savings, if in the new construction practicing architects, engineers and designers use their skills and knowledge to develop new and more innovative energy-efficient deviations from previous styles to end-use energy devices.

Generally, all these literatures show that there are many ways exist to use energy resource more efficiently and to solve today's energy problems associated with a shortage of electricity. The best way is changing the behavior of individuals, small and medium enterprises and government institutions by encouraging them to reduce energy

consumption in daily life. To solve today's energy problems, many countries needs to keep close cooperation with all electricity consumers during implementation energy efficiency measures.

To minimize the rate of energy use, education and raising public awareness of energy-saving opportunities is more cost-effective than subsidy schemes for energy conservation. Mostly children should start learning energy saving measures at a very early age. For this reason, there is a significant need, in many countries to organize energy saving measures classes for citizens including engineers, practicing architect, designer and children. During the classes people should learn how to save on an electricity bill, how to promote the use of energy-saving appliances in everyday life and how to change the energy usage to help at the national level.

Finally, all these energy efficiency policy instruments and measures will influence on increasing the efficiency of energy use around the world.

CHAPTER 3. A SWOT ANALYSIS AND EVALUATIONS OF ENERGY EFFICIENCY POLICY IN TAJIKISTAN

3.1.Introduction

This chapter focus on identifying and discussing problems and issues on energy saving and efficiency in Tajikistan. Therefore, this chapter consists of two parts: the first part covers SWOT analysis result and second part include evaluating the effectiveness of implemented energy efficiency policy in Tajikistan.

Part I: SWOT Analysis:

3.2. The SWOT analysis of Tajikistan's energy efficiency

To evaluate current problems and opportunities of Tajikistan's energy efficiency issues we applied SWOT analysis an approach that has been widely applied for investigating current problems and selecting policy priorities. A SWOT analysis is a tool currently used in the planning process created from business management literatures was adopted in the 1980s and has been used in many levels of regional development and national planning (Markovska et al., 2009).

Especially, there were several examples of the successful implementation of SWOT analysis on energy efficiency, energy security, innovation and technology (see for instance, Fertel et al., 2013) and regional energy planning (Terrados et al., 2007). All these studies considered several problems similar to the current research, but in different regions and different countries.

Several European states used this tool for analyzing current problems, selection of policy priorities and formulating national strategies for sustainable development (EC, 2004). For that reason, we applied this method for examining current problems, identifying strength, weaknesses, opportunities and threats of Tajikistan's energy efficiency issues.

Table 3.1 SWOT profile of Tajikistan's energy efficiency

	Internal	External
Positive	**Strength** ▪ Significant government participation in improving energy efficiency by identifying long-term vision; ▪ Substantial energy saving potential in Tajikistan.	**Opportunity** ▪ Access to finance for home improvement and purchasing high-efficiency appliances and technologies; ▪ Worldwide energy cooperation with a focus on energy conservation and efficiency.
Negative	**Weakness/barriers** ▪ Luck of necessary cooperation between key institutional players in the field of energy efficiency; ▪ Lack of implementing body in the field of energy efficiency.	**Threats** ▪ Energy shortage in villages located in a mountain area; ▪ Low electricity price and subsidy across some energy consumers.

We applied this method to examine existing problems, to find recommendations on how to minimize the impacts of weaknesses and threats through maximizing the potential of energy efficiency opportunities and strengths in Tajikistan.

The SWOT table shows the reality of Tajikistan's energy efficiency issues. We hope that it will help policy makers to use the potential of opportunities and strengths of energy efficiency while developing strategic plans for achieving the state goals in the field of energy efficiency in Tajikistan.

On the other hand, analysis results helped us to give some specific recommendations to the Ministry of Energy and Water Resources of the Republic of Tajikistan to minimize the effects of weaknesses and threats through maximizing the potential of energy efficiency opportunities and strengths. A more detailed discussion of strengths and weaknesses, as well as its links to energy efficiency opportunities in Tajikistan, is provided below.

3.2.1 Strengths: *government participation in improving energy efficiency and availability of energy saving potential in the country*

Government participation in improving energy efficiency. The Government of the Republic of Tajikistan consider energy efficiency as a key strategy for achieving its energy policy goals. To improve the efficiency of energy use in the country, the government of Tajikistan, has created the necessary legal framework such as:

- Decree of the President of the RT "On additional measures for the economic use of energy and energy saving", April 24, 2009, #653;
- Law of the Republic of Tajikistan "On Energy Saving and Energy Efficiency", September 19, 2013, #560. Parliament of the RT;
- Energy efficiency strategy (National Development Strategy, 2030).

The overall aim of the government of Tajikistan is to achieve 500 billion KWh/year energy saving until 2030 through increasing the efficiency of energy use in the country (NDS, 2030). Therefore, the government of the Republic of Tajikistan has adopted the necessary legal documents in the field of energy efficiency. To achieve energy efficiency objectives the government of Tajikistan reflected implementation of energy efficiency policies and measures in all existing strategic documents and programs. Adopting these legal and strategic documents shows that the government of Tajikistan is actively involved in the process of realizing initiatives in the field of energy efficiency in the country.

Availability of energy saving potential in the country. Tajikistan also has huge potential of energy saving in the country. There is possibility to save huge capacity of electricity through energy efficiency improvement across some electricity consumers (for example, industrial, residential and agriculture especially, at water pumping stations).

In industrial sector, the state-owned aluminum company (TALCO) is the largest electricity consumer in Tajikistan. TALCO's demand has changed from 5,360 GWh to 7,229 GWh per year (Tajikistan's Power Sector Development Master Plan). The state-owned aluminum company (TALCO) accounts for about 40% of the total net energy consumption (World Bank, 2012).

To improve energy efficiency in the company, the Government of Tajikistan decided to assess the energy saving potential of TALCO and develop new energy efficiency policies for the company. As a development partner, the World Bank supported an Energy Audit of TALCO in 2012. The energy audit evaluated the company's energy-saving capabilities and offers 33 energy efficiency policies and measures for future implementation in the company.

According to Energy Audit recommendation there is possibility to reduce 22 % of TALCO's electricity consumption per year. So, this statistic shows that the energy saving potential is very high in the industry sector. Therefore, it requires that the conservation plan proposed by Energy Audit should be properly implemented in practice.

In agriculture sector electricity mostly uses for the irrigation system. Tajikistan is an agrarian country where more than 70% of its population live in rural areas. It means that the most labor works are in agriculture sector.

In 2015 water pumping consumed 3, 117 GWh electricity and this is expected to increase to close to 20% by 2025 (Tajikistan's Power Sector Development Master Plan). According to the World Bank (2017), it is possible to save 5-15% of electricity consumption by rehabilitation the existing irrigation system in Tajikistan. The following table shows potential of energy saving across some electricity consumers in Tajikistan, especially at the state-owned aluminum company (TALCO) and pumping stations.

Table 3.2. Water pumping stations and the state-owned aluminum company (TALCO) energy saving potential per years

	Consumer type	Electricity consumption in 2014 (KW/h)	Improvement	Possible potential energy saving kWh per year
1.	The state-owned aluminum company (TALCO)	3,073,046.10[2]	22[3]%	676.070.142
2.	Water pumping	2,474,793.80[4]	15[5]%	371.219.07[6]
	Total			**1.047.289.212**

3.2.2 Weakness: *lack of implementing body and necessary cooperation between key institutional players in the field of energy efficiency*

Lack of implementing body in the field of energy efficiency. In 2013, the Tajikistan Parliament passed the *Energy Saving and Energy Efficiency Law*. As part of implementation of this Law, the government of Tajikistan decided to establish the state institution (implementing agency) with strong professional skills, to develop the regulations, programs and policies to increase the efficiency of energy use in the country. Therefore, in 2014 under Ministry of Energy and Water Resources of the Republic of Tajikistan have been established interagency working group.

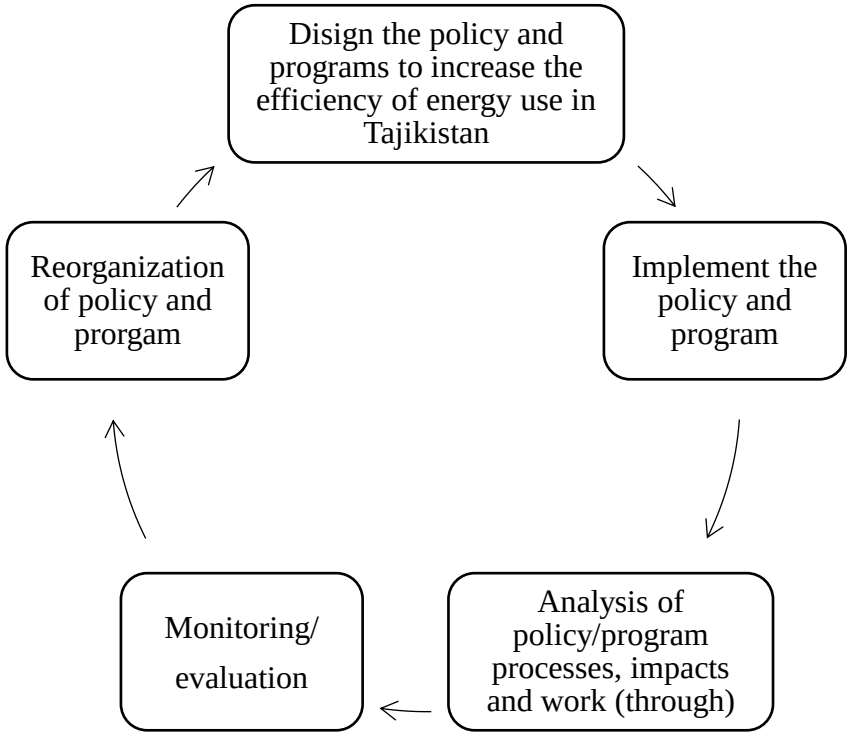
The necessary regulation for the establishment of the agency that coordinates and monitors the effectiveness of energy efficiency policies was prepared and discussed with other ministries and departments. Unfortunately, the Ministry of Finance of the Republic of Tajikistan did not support this document due to the limited financial and macroeconomic status of the country. So, there is no instrument/systems in implementing

[2] Source: MEWR RT.
[3] According to World Bank (2012) estimation there is possibility to save 22% of energy consumption of the TALCO by energy saving improvements.
[4] Source: MEWR RT.
[5] According to the World Bank (2017), it is possible to save 5-15% of electricity consumption by rehabilitation the existing irrigation system in Tajikistan.

the state energy efficiency policy in Tajikistan. This is one of the main problems which Tajikistan faces for energy efficiency improvements in the country.

To increase the efficiency of energy efficiency in the country, establishment of the agency with the mandate to implement the state energy efficiency policy in Tajikistan is essential. The figure 3.1 shows role and responsibilities of the agency that implement the state energy efficiency policy in Tajikistan.

Figure 3.1. Role of the agency that implement the state energy efficiency policy in Tajikistan



Hopefully, establishment national energy efficiency agency in Tajikistan would be a good instrument/system in implementing the state energy efficiency policy in the country. On the other hand, this agency would support and guide electricity consumers by organizing public rising awareness activities, preparing energy efficiency guidelines and marketing of high-efficiency appliances.

Lack of necessary cooperation between key institutional players in the field of energy efficiency. According with the Law of the Republic of Tajikistan several ministries and agencies are responsible for realizing many aspects of the energy efficiency policy in Tajikistan. In accordance to Markovskaya et al (2009) institutional and human capacity to implement energy efficiency policies will influence for the achievement of government energy efficiency goals. Therefore, human development issues for the implementation of the state policy in the field of energy efficiency should be addressed by the Ministry of Energy and Water Resources of the Republic of Tajikistan and the Ministry of Economic Development and Trade of the Republic of Tajikistan.

Evaluating the cost-effectiveness of energy efficiency policies and measures in Tajikistan is a very difficult task, since, usually, very little information is available throughout the country's energy cycle. For that reason, the Statistical Agency under the President of the Republic of Tajikistan as a central statistical agency of the republic is responsible for creating state information data bathe in the field of energy efficiency. The Ministry of Finance and the State Committee on Investment are responsible for financing and stimulating energy efficiency projects in Tajikistan. Issues regarding the establishment of mandatory energy efficiency standards for all energy consumers addresses by the State Agency for Measurements, Standardization and Certification of the Republic of Tajikistan.

Generally, coordination of all the mentioned activities between these ministries and agencies is necessary and should become more and more important in the medium and long-term perspectives.

We can conclude that lack of national energy agency and necessary cooperation between key institutional players are one of the biggest problems that prevent the successful implementation of state energy efficiency policies in Tajikistan.

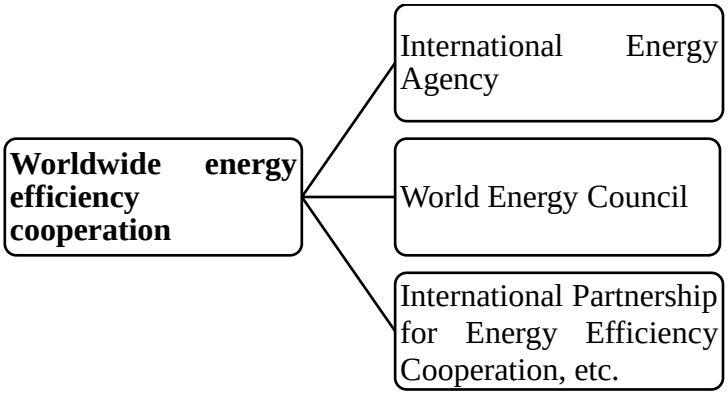
3.2.3 Opportunities: *access to finance and worldwide energy cooperation with a focus on energy conservation and efficiency*

Access to finance. To create financial mechanism that encourages consumers to purchase and use high-efficiency appliances, Asian Development Bank started the implementation Access to Green Finance project in Tajikistan. According to the project ADB is financing a $10 million grant to Tajik families and small businesses for purchasing high-efficiency appliances and technologies (ADB, 2019).

According to the Asia Development Bank (2019), from the beginning of the project about 89 % of loans, were financed through microfinance organizations to Tajik families and small enterprises for purchasing high-efficiency appliances and technologies. Access to energy efficiency loans is a very good opportunity for Tajik households and small businesses to purchase and use high-efficiency appliances and to reduce their electricity bills.

Worldwide energy cooperation with a focus on energy conservation and efficiency. Worldwide energy efficiency cooperation is another opportunity of energy efficiency in Tajikistan. Tajikistan can benefit from this by joining international organizations that increase international cooperation in the field of energy efficiency (Figure 3.2).

Figure 3.2. Favorable international conditions in the field of energy efficiency



Source: *Dunlap, 2017.*

The International Energy Agency provides policy advice and factual analysis through various publications to its member countries (IEA, 2018). The International Partnership for Energy Efficiency Cooperation (IPEEC) enhance worldwide corporation on energy policies that associated on energy efficiency (Dunlap, 2017). These organizations investigate energy efficiency policies, dealing with capacity building and trainings, facilitate its member countries to implement energy efficiency measures, etc.

3.2.4 Threats: *Low electricity price and energy shortage in villages located in a mountain area*

Tajikistan is located in Central Asia, with a territorial area of 143,100 square kilometers, in which 93% of the land area is mountainous (Ministry Foreign Affairs of the Republic of Tajikistan, 2018). The Republic of Tajikistan is currently facing a major problem which is the low level of energy guaranteed rate. Tajikistan's current energy supply mainly is hydropower, accounting for about 98% of the overall energy supply around. Electricity shortages occurred in Tajikistan, more prominent in rural areas, 70% of residents living in rural areas.

According to the Ministry of Energy and Water Resources of the Republic of Tajikistan, there are three main regional power shortages, Murgab Administrative region, Darvaz region and Khatlon Region respectively. Populations in remote areas are mostly low-income families and poor families who usually do not have access to reliable electricity.

Figure. 3.3 Villages that not access to electricity in rural areas of Tajikistan

Source: MEWR RT, 2013.

Lack of electricity supply made citizens of Tajikistan especially in rural areas to use traditional biomass fuel such as firewood and coal for heating and cooking purposes. In such situation, women and children mostly spend their time for collecting fuel resources, because Tajik men migrate to Russia for earning money. As a result, young generation people in rural areas of Tajikistan loose opportunity to get a necessary education.

According to UN (2011) the lack of electricity greatly decreases economic growth, has strongly impact on employment, influences access to necessary education, health care, income generation, and as well as can lead to climate change in Tajikistan. Therefore, Tajik household need reliable and clean energy for their daily life, income generation, improving education system and living conditions, public health, solving gender problems as well as poverty reduction and environment protection.

Low electricity price and subsidizing electricity consumers is also one of the barriers that impede for energy efficiency improvements in Tajikistan. The following table shows electricity tariffs for some energy consumers in Tajikistan.

Table 3.3. Energy Indicators of Tajikistan, 2015-2017

№	Indicators	Electricity consumptions (million kW/h)			Electricity tariffs (diram[7] per 1 kW/h)		
		2015	2016	2017	2015	2016	2017
1	Industry:	4621	4467	4186	30.6	35.65	40.99
-	The state-owned aluminum company (TALCO)	2350	2500	2100	11.8	11.8	11.8
2	Transport	9	7	11	8.2	9.55	16.85
3	Agriculture	2726	2921	2112	8.2	9.55	16.8
4	Population	4914	4845	5424	12.6	14.65	16.85
5	Total consumptions	12817	12805	13513			
6	Electricity tariff growth %				15	16.5	15

Source: MEWR RT,2018.

As we can see from the table in Tajikistan since 2015, electricity tariffs for population have risen more than 70 % from 12.6 diram in 2015 to 16.85 diram somoni 2016. Finally, tariffs for industrial sector and private companies also have risen more than 70 % from 30 diram in 2015 to 40.99 diram in 2016. The current tariffs for electricity for each category of consumers are significantly different from each other. The current tariff policy for electricity is characterized by the presence of cross-subsidization of electricity supply in Tajikistan. It will not provide significant motivation to the efficiency of energy use in Tajikistan among all consumers.

Low electricity price in Tajikistan does not allow for sustainable investments in energy efficiency appliances and technologies, it cannot contribute to the full economic viability of entities, involved in power supply service facility and efficient operation of the energy supply system. Law energy price leading to inefficient using or waste of electricity in the country. Mostly, the goals of consumers who use cheap electricity are to maximize the benefits by saving money, not saving energy by improving energy

[7] 1 Tajik Somoni equal to 100 diram.

efficiency. This is also one of the biggest problems of energy efficiency improvement in Tajikistan.

Part II: Ex-post evaluation:

3.3 The effectiveness of implemented energy efficiency policy in Tajikistan

To evaluate effectiveness of implemented energy efficiency policy and measures in Tajikistan, we selected *exp-post* evaluation as evaluation approach. Ex-post evaluation is widely regarded as a useful tool for analyzing the impact of the implemented policies and for the planning and implementation of more effective and efficiency policies in the future (JICA, 2004). Recently, ex-post evaluation has been applied for the analyzing effectiveness of energy efficiency policies in the Dutch service sector (see for instance Kornelis et al., 2011).

According to JICA the result of ex-post evaluation can be used to make specific recommendations for the improving existing policies and design new policies. In this analysis, we chose impact and effectiveness as evaluation criteria which was adopted by JICA for conducting an evaluation of the policy and project (JICA, 2004) Through using these criteria's we will test effectiveness of implemented energy efficiency policy in Tajikistan.

According to WEC (2016) design and implementation of energy efficiency policy can provide different important advantage, such as access to clean and safe energy, creating new jobs, attracting new technologies, which will contribute to higher industrial productivity, and increasing the country's export capabilities. Therefore, in this analysis, we will show how the implemented energy efficiency policy led to energy saving, creation of new enterprises and new jobs in Tajikistan.

The government of the Republic of Tajikistan considers energy efficiency as a key strategy for reducing internal energy shortage and achieving its energy policy goals.

Within the framework of energy efficiency policy in Tajikistan a decree of the President of the RT "On additional measures for the economic use of energy and energy saving" were introduced in 2009. The overall goal of the government from this decree was to prohibit the use of traditional incandescent lamps and switch to energy-saving lamps in the country. The last 10 years the Government of the Republic of Tajikistan faced problems and difficulties with supplying high quality electricity for its population. This policy was one of the solutions for reasonable using existing energy resources and reducing energy shortage in the country.

The Government of Tajikistan has provided a subsidy for the use of energy-saving lamps and has banned the import and production of traditional incandescent lamps in the country. Under energy efficiency policy, low-income families received support from the Government budget for purchasing energy-efficiency lamps. Government expenditures included subsidies from state budget to support 241,000 low-income families for purchasing energy-saving lamps (GoT, 2009, #653). Total government expenditure was estimated 3,3 million US dollar over the period 2009-2010 (Olimbekov, 2013).

From 2009 till now all public organizations, industrial enterprises and individuals are using energy-saving. In 2010, the total number of energy-saving lamps used in the country was 25472322 lamps (Olimbekov, 2013). According to existing statistics about 1.2 billion kW/h of electricity have been saved during 2009 with the use of energy-saving lamps in Tajikistan (Media Group "Asia-plus", 2010). The total number of energy-saving lamps used in the country amounted to 45063300[8] lamps in 2016, which is 56% more than in 2009.

[8] Data obtained from the Ministry of Energy and Water Resources of the Republic of Tajikistan.

Table 3.4 Comparison of the incandescent lamp to energy-saving lamp

	Incandescent Lamp	Energy Saving Lamp
Watts used	40W[9] 60W 75W 100W 150W	6-7 7-10 12-13W 14-20W 25-28W
Average lifespan	1,200 hours	25,000 hours

*Source:*https://www.viribright.com/lumen-output-comparing-led-vs-cfl-vs-incandescent-wattage/

As table 4.2 shows, the capacity of energy-saving lamps is about five times greater than incandescent lamps, and instead of lamps with a capacity of 100 watts, it is enough to use lamps with a capacity of 20 watts. By doing this, we can save up to 80% energy consumption with the same light intensity. The table 4.3 presents effectiveness of energy-saving lamps based on total number of energy-saving lamps used in Tajikistan.

Table 3.5 The calculation of energy savings with the use of energy-saving lamps

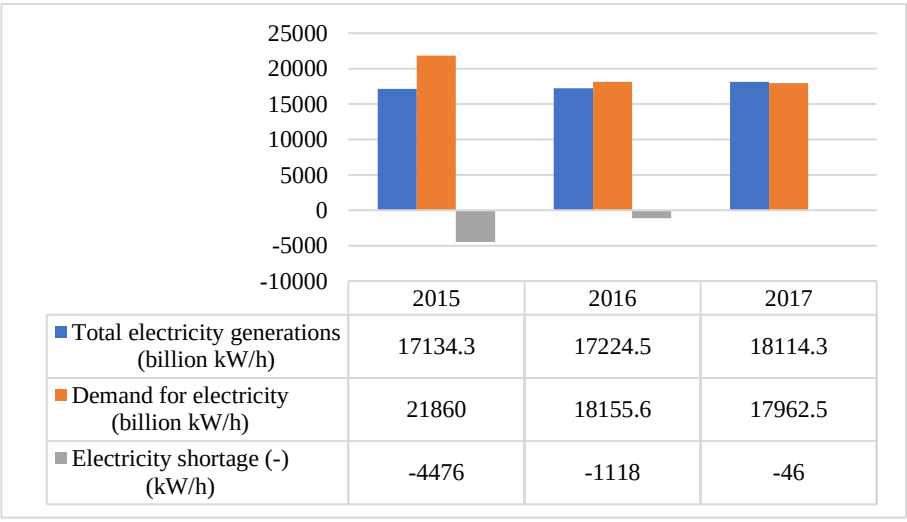
		2013	2016
1.	The total number of lamps used in Tajikistan	25472322	45063300
2.	Energy consumption by using incandescent lamp of 60 watts (9 hours a day)	0,06 kW/h*9h*25472322= 13755053 kW/h*366=5,0 billion kW/h	0,06 kW/h*9h*45063300= 24334182 kW/h*366=8,9 billion kW/h

[9] 100 W= 1 kW

3.	Energy consumption by using energy saving of 20 watts (9 hours a day)	0,02 kW/h*9h*25472322= 4585017 kW/h*366=1,6 billion kW/h	0,02 kW/h*9h*45063300= 8111394 kW/h*366=2,9 billion kW/h
4.	Energy saving	5,0 billion kW/h – 1,6 billion kW/h= 3,4 billion kW/h	8,9 billion kW/h – 2,9 billion kW/h= 6 billion kW/h

It is obvious that the construction of new generating capacity is one of the steps in reducing the shortage of electricity. Another important aspect is increasing the efficiency of energy use in the country. The table 4.3 shows that implemented energy efficiency policy in Tajikistan have led to variety of changes in behavior (for example, buying and using more energy-saving lamps, switching of lights and controlling energy consumption). A surprising result is that transition to energy-saving lamps in Tajikistan has saved 6 billion kWh of electricity in 2016. Finally, implementations of energy saving policy in Tajikistan effected on reducing internal energy shortage in the country (Figure 3.4).

Figure 3.4 Electricity generation, demand and shortage in Tajikistan, during 2015-2017

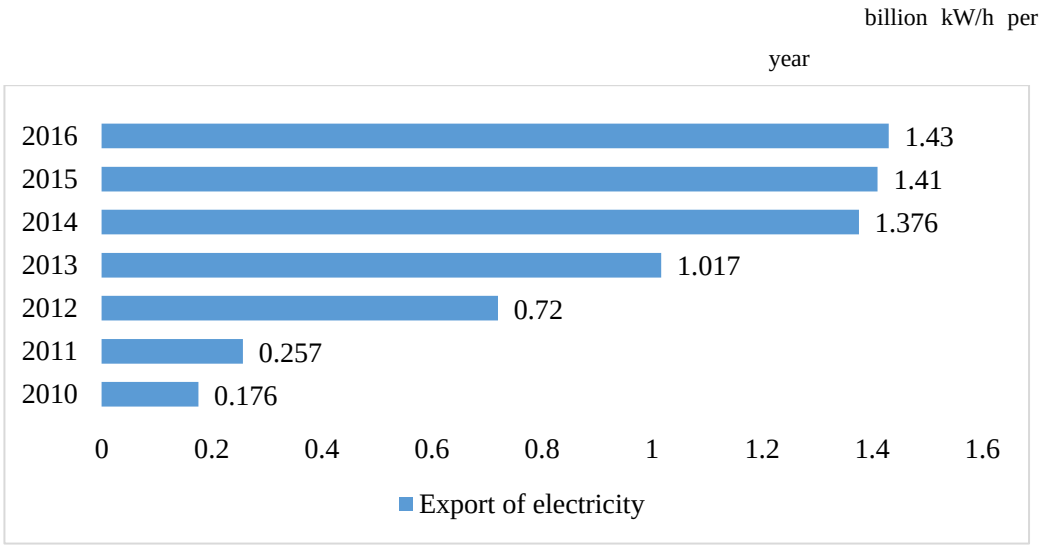


	2015	2016	2017
Total electricity generations (billion kW/h)	17134.3	17224.5	18114.3
Demand for electricity (billion kW/h)	21860	18155.6	17962.5
Electricity shortage (-) (kW/h)	-4476	-1118	-46

Source: MEWR RT, 2018.

As we can see from the (Figure 3.4), energy shortage is decreasing very fast in Tajikistan. It effects on accessibility of all consumers with reliable and sustainable energy and increasing country energy export capability as well. The following figure shows trend of energy export of Tajikistan during 2010-2016.

Figure 3.5 Tajikistan's energy export during 2010-2016



Source: MEWR RT, 2018.

After independence, the Government of the Republic of Tajikistan paid significant attention to supplying all consumers with reliable and sustainable energy and increasing country energy export capability as well. For that purpose, the Government of Tajikistan have implemented policies that associated with improving power generation efficiency, increasing energy exports and finally, generating income from its sale to foreign markets.

Growing demand for energy-saving lamps is another advantage of switching to energy saving lamps in Tajikistan. Growing demand for energy-saving lamps has led to the creation of more than 3 factories for producing energy-saving lamps, recycling facilities and two laboratories to check the quality and safety of energy-saving lamps in Tajikistan[10]. According to official statistics in new factories for producing energy saving

[10] Ministry of Energy and Water Resources of the Republic of Tajikistan.

lamps has created new jobs for 200 residents of Tajikistan (Media Group “Asia-plus”, 2010). Generally, new job creating would increase incomes of citizens, improving living standards and decreasing the unemployment rate. We conclude that implemented energy efficiency policies has been effective in increasing efficiency of energy use in Tajikistan ass well.

CHAPTER 4. CONCLUSION AND POLICY RECOMMENDATIONS

4.1.Introduction

This study has been conducted to identify and discuss problems and issues on energy saving and efficiency in Tajikistan. This chapter aims to present summary of the finding and potential policy recommendations for increasing energy efficiency in Tajikistan.

4.2.Summary of the findings

The analysis presented in this study, focused on investigating current problems and identifying possible solutions to reduce the effects of existing weaknesses and barriers in the field of energy efficiency. Our SWOT analysis of Tajikistan's energy efficiency has shown that there is a lack of necessary cooperation between key institutional players and lack of implementing body in the field of energy efficiency. There is no systems and procedures for implementing, monitoring/evaluating and coordinating the state energy efficiency policy in Tajikistan.

The results of SWOT analysis also have shown that in Tajikistan the greatest advantage in terms of energy efficiency is the state long-term goal in the field of energy efficiency and the availability of energy efficiency potential in the country. Following World Bank (2012) it is possible to save 22% of TALCO electricity consumption per year by implementing energy efficiency measures and to save from 5 to 15% of electricity consumption at water pumping stations by rehabilitation of existing irrigation systems. In our study, we found the possible solutions and potential measures which assist to reduce the effect of existing barriers/weakness and improve the efficiency of energy use in Tajikistan.

It should be noted that, the period covered in this study starting from 2009 and ending in 2019. During this period the government of the Republic of Tajikistan has applied several energy policies with focus on energy efficiency improvements in the country (for example, adopting energy saving law, requires for using energy saving lamps in the country and energy efficiency strategy for the period until 2030).

We conclude that the combinations of some implemented energy efficiency policies have been effective in improving energy efficiency in Tajikistan. The biggest contributions to achieve the state energy efficiency objectives comes from transition to energy-saving lamps in Tajikistan.

In 2009 the government of the Republic of Tajikistan prohibited the use of traditional incandescent lamps and switch to energy-saving lamps in the country. A surprising result is that shifting to energy-saving lamps in Tajikistan has saved from 800 million kW/h to 6 billion kWh of electricity per year. On the other hand, this policy created good conditions for investing in producing energy efficiency appliance, especially energy saving lamps in Tajikistan. As result of this policy in Tajikistan have been created 3 factories for the producing energy-saving lamps, recycling facilities and two laboratories to check the quality and safety of energy-saving lamps (MEWR RT, 2018).

Finally, we can conclude that implementing more energy efficiency policies and measures in Tajikistan will effect on energy savings, increasing investments in energy efficiency technologies, attracting new technologies, which contributed to the creation of new enterprises and new jobs in the country.

4.3.Policy recommendations

To increase the efficiency of energy use in Tajikistan the following recommendations should be implemented:

1) Introduce market-based energy prices;
2) Establishment the agency that coordinates and monitors the effectiveness of energy efficiency policies;
3) Exchange ideas and experiences, discuss energy efficiency issues with other countries, also participate in global cooperation in the field of energy efficiency;
4) Introduce solar photovoltaic off-grid power systems for villages where there is no central power supply.

Introduce market-based energy prices. To attract enough investments in energy efficiency appliances and technologies, Tajikistan should introduce market-based energy prices. This will provide significant motivation to improve energy efficiency among consumers. Increasing the price of electricity will improve the efficiency of energy use by changing consumer behavior and purchasing high-efficiency equipment (Harvey, 2010). On the other hand, this will provide significant motivation to the efficiency of energy use in the country among all consumers.

Establishment the agency that coordinates and monitors the effectiveness of energy efficiency policies. As part of the implementation of the Law on Energy Efficiency, Tajikistan should establish a national energy efficiency agency with a mandate to develop policies aimed at increasing energy efficiency in the country. The implementing agency will be a good instrument for coordinating and monitoring the effectiveness of implemented energy efficiency policies and measures in Tajikistan.

Exchanging ideas and experiences, discuss energy efficiency issues with other countries, also participate in global cooperation in the field of energy efficiency. According to the Law of the RT (2013, article #6), the Ministry of Energy and Water Resources of the Republic of Tajikistan is responsible for discussing energy efficiency issues with other countries, as well as participating in international cooperation in this area. The Ministry of Energy and Water Resources of the Republic of Tajikistan should actively corporate with international community in the field of energy efficiency. By using this king opportunity create professional human capacity and system which coordinate and evaluate the effectiveness of implemented energy efficiency policies and measures in Tajikistan.

Introduce solar photovoltaic off-grid power systems for villages where there is no central power supply. Tajikistan has the highest solar irradiation values; especially solar irradiation is high in the mountainous regions with sunshine duration of 280 to 330 days a year and the annual total irradiation of 1600 kWh/m2[11]. Tajikistan should effectively use available solar radiation resources to solve current energy problems, where there is a serious need for energy among remote communities.

Hopefully, all proposed recommendations will influence on increasing the efficiency of energy use in the Republic of Tajikistan.

[11] Sources: MEWR RT.

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