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Measuring Sustainability of Energy Conservation and Efficiency in Pakistan

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Abstract
Energy conservation & efficiency has become an important field. It not only helps in reducing energy consumption but also have positive impacts on economy and environmental conditions of the country. Pakistan has also taken initiative for energy conservation & efficiency. National and provincial bodies like NEECA and PEECA are working to improve efficiency and increase energy conservation. Pakistan has also made targets of saving 1000MW of electricity by the end of 2018 with the help of energy conservation and efficiency techniques. For this purpose, many policies and utilities are made at national and provincial levels. This paper finds sustainability of energy conservation & efficiency sector of Pakistan by exploring policies and initiatives taken by the government of Pakistan to obtain sustainability in energy conservation & efficiency sector.

Keywords: energy conservation and efficiency; MEPS; energy labelling.

1. INTRODUCTION

Energy has become an essential element in almost all the daily activities. In the recent century energy has become a crucial part of trade, commerce, industry, economy and agriculture. So, as the reliance of human beings on energy is increased, the difficulties in producing affordable and sustainable energy are also increasing. One of the main pillars of sustainable energy is energy conservation & efficiency.

Pakistan is a country facing severe energy shortage [1]. There is a demand and supply gap of around 5000 MW during peak hours [2]. So, a developing and energy intensive country like Pakistan with an annual increase of 5% to 6% of electricity demand needs to take measures to reserve its energy and use it in a very efficient way.

Energy conservation & efficiency in Pakistan started in 1970s as measure for energy security. But as time passed it has developed into an environmental protection measure as it can limit the carbon emissions by limiting the generation. It is predicted by International Energy Agency that up to 70 percent of CO2 emissions will be reduced by energy efficiency [3]. In Pakistan, energy conservation is seen as a measure to reduce the short fall between generation and demand. Energy conservation can be achieved by many means like using energy efficient electronic products, using different energy efficient techniques in generation of power or by changing the behavioral patterns of individuals [4].

In Pakistan NEECA is a government body working on energy efficiency & conservation. Previously it was known as ENERCON. NEECA was started as a USAID project in 1985. In 1986 it became an agency under the ministry of planning and development. In 1993 it was transferred to water and power ministry and then in 1996 it came under the ministry of environment. Recently in 2011 it was again transferred under the ministry of water and power [5]. National Energy Efficiency and Conservation Act, 2015 is recently passed from the parliament.

This paper looks on the potential of energy conservation and efficiency in Pakistan and what factors are important in achieving sustainability in

this sector. Based on these factors Pakistan's energy conservation and efficiency sector is assessed.

2. POTENTIAL OF THE ENERGY CONSERVATION & EFFICIENCY IN PAKISTAN

A lot of work is done to explore the potential of energy conservation in Pakistan. Energy conversation can save up to 17% of the total electricity produced in Pakistan [6]. National Productivity Organization (NPO) has also been doing work related to energy efficiency and environment. Many energy audits are performed by NPO in the industries. NPO did an energy audit of four companies and the total potential of savings in those four companies was found to be 85.7 Rs million against an investment of 37.9 Rs million. So, this study by NPO shows how much energy and money could be saved by employing energy conservation techniques. Payback period is very small, and the savings are comparatively large. So, energy auditing should be taken out of all the industries so that energy losses could be avoided [7].

Resource efficient greening initiative for Pakistan is taken by UNIDO. This green initiative taken by UNIDO focuses on the greening of industry by improving the efficiency of the machinery and using such mechanisms and technology in industry which will reduce the emissions and thus have a positive impact on the environment. It was found out that the total potential of energy efficiency in different industries of Pakistan is around 1983000 TOE and the investment required to achieve this potential is around 2268 US $ million. Interesting thing here is to notice that the payback period is very small and is less than 3 years for all the sectors [8].

3. FACTORS IMPORTANT FOR ENERGY CONSERVATION & EFFICIENCY

Policies and planning, incentives for using energy efficient products, national targets and goals, energy labelling and MEPS are the factors important for achieving sustainability in energy conservation and efficiency sector as shown in Figure 1 [9, 10].

The first and only energy conservation policy in Pakistan was developed in 2005 known as "National Energy Conservation Policy". In the report published by NEECA the main departments on which they are focusing are industry, power, transport, building, agriculture and renewable energy.

After 10 years of the first policy, first act for energy conservation and efficiency was passed in the parliament of Pakistan. This bill is a huge step forward. This Act extends to the whole Pakistan. A board has been set which is required to have at least one meeting per year for conservation and energy efficiency purposes.

There are no incentives present in Pakistan for small and large consumers to conserve energy and adopt energy efficient products. But government do recognize and publicize the measure taken by large consumers to save energy. Government of Pakistan phased out the incandescent bulbs in favor of the energy savors.

Pakistan has set targets for energy saving. In the 11th five-year plan government decided to save a 1000MW of electricity through energy conservation & efficiency measures by the end of 2018. But no sectorial targets are defined in any legislation, policy or planning of Government of Pakistan.

Energy Labelling has just started in Pakistan. Energy labelling for buildings, vehicles and most of household appliances is planned by NEECA. MEPS for vehicles in Pakistan is defined to be Euro-II [11]. But in case of household appliance and buildings MEPS are mostly in planning phase. Industrial sector is the highest energy consumption sector of Pakistan. So, it also has a high potential for conservation and efficiency. Motors & boilers in the industry are its main load. The motors & boilers used in the industries are mostly inefficient and are not according to the defined standards. The use of efficient motors could result in an energy efficient environment which would be helpful to achieve the targeted energy conservation and efficiency [12].

In developing countries like Pakistan energy conservation & efficiency potential studies should be among top priorities at a national level, because their results could help policy makers to make better and calculate decisions [13].

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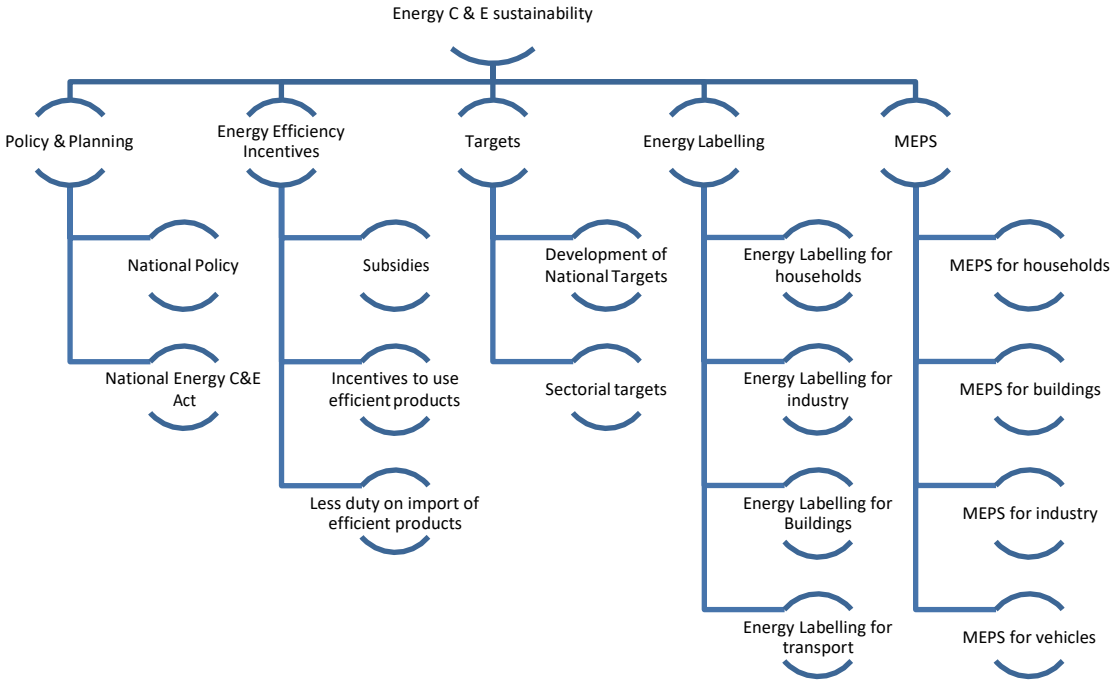

Fig.1. Factors important for factors energy conservation & efficiency

4. RESULTS AND DISCUSSION

Main factors to measure energy conservation & efficiency sustainability are shown in figure 1. These factors are used to measure sustainability of energy conservation & efficiency sector in Pakistan. Table 1 shows which sustainable indicators are present in Pakistan and which does not exist in Pakistan.

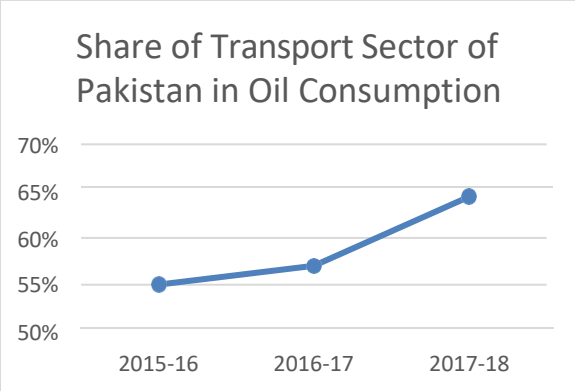

Fig.2. Share of transport sector in oil consumption

Pakistan's energy sector needs to work on many factors like reducing the costs of hybrid and efficient vehicles and increasing taxes on inefficient vehicles. Almost more than half of the oil is consumed by transport sector in Pakistan [14]. Increasing trend in GHG emissions can be seen from that data collected from three inventory years, according to which around 19.848 in 1994, 33.474 in 2008 and 42.572 in 2012 million tonnes of oil equivalent to GHG emissions were caused by transport sector.

In Pakistan road transport is the most dominant because of the poor policies in railway and aeronautical sectors. Almost 96% of the total freight movement and 91% of the total passenger movement is through roads. Due to dominant road transport Pakistan has seen an increase in motor vehicles. One of the main reasons is that the custom duty on hybrid and electric vehicles is same as of other fossil fuel-based vehicles [15]. Figure 2 shows the increasing trend of oil consumption by the transport sector. So, many of such inconsistencies exist in Pakistan's policies.

Pakistan has specified target of energy conservation, but no sectorial targets are defined. Policy makers should also include sectorial targets in policies so that each sector could take part in conserving energy. Another important factor hindering the culture of energy conservation is that no incentives are provided to the customers to use efficient products. Customers should be encouraged to take part in promoting efficient products.

Sustainability Indicator	Present	Not present
National Energy conservation & efficiency policy	+	
National Energy conservation & efficiency Act	+	
Subsidies for energy audits	+	
Subsidies for import of electric & hybrid vehicles		+
Subsidies for import of efficient lamps	+	
Incentives to use efficient products		+
National targets	+	
Energy Efficiency targets for residential sector		+
Energy Efficiency targets for industrial sector		+
Real time pricing		+
Energy efficiency entities	+	
Energy services companies	+	
Information to customers about their electricity usage	+	
Real time information to customers about their electricity usage		+
Financing mechanism for energy efficiency sector		+
Carbon pricing		+
Energy codes for new buildings	+	

Table 1

Energy labelling and MEPS have gained a lot of importance in energy conservation and efficiency target. They provide basic information to public about the efficiency of products. Unfortunately, these are not mandatory in Pakistan. Policies have been made by the government to make labelling and MEPS mandatory for electronic products and buildings in the future. Table 2 shows the products, their labelling and MEPS status in Pakistan.

Energy labelling & MEPS	Mandatory	Voluntary	Planned
Energy labels for households			
Washing machines			+
Air conditioning			+
Lamps		+	
Fans		+	
Solar water heaters			+
Refrigerators			+
Energy labels for commercial & public buildings			
New commercial		+	
New public		+	
Existing commercial		+	
Existing public		+	
MEPS			
Washing machines			+
Air conditioning			+
Solar water heaters			+
Refrigerators			+
Lamps		+	
New commercial & public buildings			+
Electric motors in industry			+

Table 2

Figure 3 shows the overall results of sustainability in the energy conservation and efficiency sector of Pakistan. In Pakistan policy and planning is present to tackle energy conservation but government of Pakistan needs to work on the targets, incentives, energy labelling and MEPS to gain improvement. So,

policy makers should keep these factors in mind while formulating policies for energy conservation and efficiency.

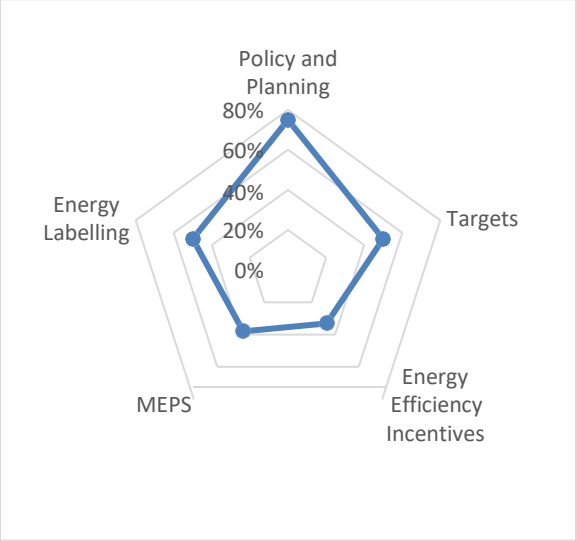

Fig.3. Results

5. CONCLUSIONS

Energy conservation and efficiency has become an integral part of energy sustainability. Developing country like Pakistan which is suffering from energy shortage needs to work on reducing energy intensity and improving energy savings. This paper has provided factors important for energy conservation and efficiency and has identified the sectors which needs improvement so that sustainability could be achieved in energy saving.

NOMENCLATURE

Abbreviations

MW megawatt electric

MEPS minimum energy performance standards

NEECA National Energy Efficiency & Conservation Authority

PEECA Pakistan Energy Efficiency & Conservation Agency

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