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The Sustainable Development Strategies for Energy Sector in Iran

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Abstract

Sustainable development at the new field of politics, culture, environment, economy, trade, and the rights of humans, calls to consideration. Sustainable economic means to maintain and promote the current economic situation, without suffering degradation of natural resources. In this regard economic activity should cause the growth of community justice and efficiency. Relying on the definition provided by the WECD, two mainstreams sustainable development in energy consumption is specified: the use of renewable energy resources and energy efficiency improvement. In this study, at first some aspect of sustainability will be discussed and then the energy consumption in different parts of the Iranian economy is reviewed, in order that, the outlook has made it clear that the concepts of sustainable development and energy enables us to diagnose the current state of sustainability in energy use in Iran. In this way, the possibility of providing policy advice on sustainability in energy use has been provided. Finally, by introducing tax on energy consumption, we are going to calculate a tax path to maintain energy consumption on sustainable development pattern.

Keywords: energy consumption taxation; sustainable development; pattern of energy consumption.

Introduction

Having passed hundred years of exploring oil and gas resources and increasing development of using them for producing energy, which has led to their important, strategic and specific role, the logic of their consumption has not changed so much yet.

Total energy production in Iran during the years up to 2009, except in periods of 1974-1981 and 1983-1986, has been increased. Net energy exports are always positive. In contrast, the total final energy consumption that has increasingly trend and is almost uniform.

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In the household and business sector in the years which are considered in this study, petroleum products are accounted for 75 percent of total energy consumption. The biomass solid has been ranked second with 21 percent of energy supply. Electricity with 3 percent and coal with 0.5 percent share in country have not had very important share in the energy supply. Natural gas consumption at all time until 1972 had not any role in home and business consumption. Oil consumption was growing up until year 1976 and then the increased consumption of natural gas intensified, oil consumption with its steep decline began much so that in year 1998 the share of both the resource (oil and gas) was the same so that after this year the share of natural gas surpassed oil.

Solid biomass from the beginning has had a negative growth rate and only increased in the last years. Although the share of total electricity consumption of household and commercial energy sector has always trend upward until 1990 but this trend has been done with high gradients, while later this year has slowed the process and has been less steep. Coal energy is always a little part of this section. So years 1976 and 1990 as a turning point in household and commercial sector for energy consumption is diagnosed. In 1976, natural gas was a serious to replace petroleum products (for 22 years the share of oil products has taken the lead). In the same year that electricity is replaced for solid biomass. In the year 1990, the process of replacing the electricity to the solid biomass has become rather.

This represents that two events has occurred in the energy consumption style in household and commercial sector: replacement of natural gas for oil, which has been very successful, and replacing electricity for biomass power which has been less successful.
In the industrial sector in the early years of sample, gasoline with 87 percent and electricity with 11.5 percent, have the highest share of energy use in industry. Share of natural gas has a low and about 1.5 percent. However, the share of natural gas has been consistently raising since year 1971 so that after this time will further increase the intensity. It seems from this year onwards the trend for the oil intensity of consumption is always descending. So, the year 1976 to be seen as a turning point in the pattern of changes in the energy in industrial sector. From year 1971 onwards substitute natural gas instead of oil starts too seriously and after 22 years the share of natural gas consumption exceeds oil. Although an increasing share of electricity in total energy consumption in industry sector has increased but this has been very slow.

The agriculture section carries no energy diversity. Ever having greater share of oil products to electricity, however contrary to the negative growth of oil products, the process of electricity is increasing.

Petroleum products have been the only resource of energy in transportation sector until year 1998. In 1999, natural gas and electricity were added to this section. However, these two recent resources have shown very small share but growing rate in energy consumption in this sector. This fast growth since 2003 has been occurs, but still 99.22 percent of energy supply in this section is petroleum products.
Refineries, with 74.5 percent of oil and later natural gas, with 24 percent of the largest energy share have had. But only 1.5 percent of electric energy supply to refineries is formed.

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By having this situation for energy consumption pattern in Iran, in the rest of the paper we are going to discuss about sustainable development principles in the next section. In the third section energy consumption efficiency in Iran is measured. Last part of the paper includes some sustainable development strategies for energy consumption.

Sustainable Development

Although we can consider the period of studies of development economics just equal to the period of modern economics science (It means the period that Adam Smith published his "Nations Wealth" book in 1776), but regular study of it concerns to some recent decades. Development economics is a branch of economics science that in many aspects is too different with.

Orthodox economics science is related to the optimum allocation of scarce resources in order to reaches the most needs. In this regard, not only development economics does the duty, but also its effects on the social tasks and an effective part on people lives level.

Keynes plainly introduced two economics sciences, one of them was classic economic. The other is politics prescription system which is however the base for development economics. Development economics has changed too since that time.

But experiences between the decade 1950 and 1960 that brought much economic growth with inequality, poverty, and unemployment, led to appear a new attitude. The development has a multi-dimension meaning and includes the components of society, the economics, and the environment. Even after this new attitude, the meaning of sustainable development got more meaningful, because of the component of "sustainable". The first copy of the sustainable development expressed what we want hold sustainable, that was long-term growth rate of economic. Such a thought related to neoclassical school of thought that growth of population didn't allow the wage rate getting increase more than current level.

On the other hand, because of resource scarcity, general pure product gets increase with dissension rate. So, the gap between profit and low-payment getting decrease to reach situation that this gap arrives zero. In this condition we reach a sustainable situation. In the other word, by the definition of Reppeto (1982) and also Pierce et al (1990), the sustainable development is a kind of development that concentrate on management of all natural, human, and financial resources of a country in order to increase in the wealth and welfare along the time and it could be supposed by the way of vector diagram that society is following to maximize.

Such a copy is presented in two forms: Strong sustainability, that growth change rate must be positive in every interval and Weak sustainability that the general process of growth is enough to be ascending.

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By the way, the first copy of sustainable development had a main fault. Its fault was infinite horizon; however, the politicians are interested in taking policy during the specific period. It's may be true to say that understanding of the sustainable development discussion owe to entering into the environment during the decade 1980 (A.D) and then in 1987 by the report of Brandt Land who was a member from the direction of environment universal commission and development (WECD). This report reached to a condition so that to definite the sustainable development, we rely on in this paper. The sustainable development such on developments that satisfy people needs without jeopardizing the capacity of the future generations to supplying their needs (WECD 1987, Demirbas 2007 and Dincer 1998)

It's that approval copy of sustainable development. After such activities in the field of definition of sustainability in development, the subject of environment and development grow promptly. For example; in 1989, the United Nations issued a resolution that led to forming the unique international summit with the title "the Earth Summit" that had been taken place at Rio-Dujaniro of Brazil in June 1992.

As we know “development” is a multidisciplinary concept and research about it doesn't limit to economic aspect. This issue about “Sustainable development” is the same too. So, sustainable development is very developing issue because of being multidisciplinary. Here, we limit our study and concentrate on sustainable development in energy consumption.

Accessing to energy has two main effects on economic: The first, it’s an important input that effects the people activities and firms that result in improving efficiency level at their works and promptly growing the economic activities. In this case, consuming of the energy lead to increasing the income.

On the other hand, in fact, according to the second rules of thermodynamic, we never could access to kind of energy that consuming of it, being completely useful and without any waste. So, as a second effect, consuming of energy causes to make some waste that is thrower in the environment.

Thus, using the resources may be threatened by two main perils: The first, we use resources of energy in order to more developing of the society and economic, however, some parts of these resources belong to next generations. Also we have no information about the interest of next generations whether they would rather the developing of society and economic or they’ll rather more resources of energy. The second, more using of resources of energy, more throwing of wastes in environment. More using of energy more than the potential of self-repairing of nature more is decreasing the posterity's potential to supply their needs.

So, the sustainable development in energy consumption meaning that using of resources of energy in order to society and economic development so that the posterities’ potential not to jeopardize in supplying their needs. The posterities need to have resources and environment that at least to be as qualities as our current resources and environment to supply their needs.

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So, it's clear using the energy resources with regard to their properties to be reproduced by the nature and their wastes to be thrown in environment by their self-repairing properties.

So, nowadays world strategies for having the sustainable development in energy consumption are: 1) more using of renewable energy resources 2) more increases the efficiency in consuming of energy.

Using the renewable energy is one of an effective way and useful of the sustainable development and clean energy (Bylen & Partners, 2008). There are two main reasons that why using of the renewable energy resources lead to the sustainable development in consuming of energy.

The first, as the name of these resources shows us, these resources are enable to get reproduce, so we could use of them without jeopardizing the needs of posterities.
The second, amount population of their wastes and pollution that leave in environment is little. This matter causes the potential and quality of environment doesn't decrease for posterities' life.

In addition to this main reason, renewable energy resources have other advantages. Substuting of these resources instead of using fossil fuels decrease the economic dependency to fossil fuels in both fossil fuel exporting and importing countries. This results the effect of the fluctuation of price of these kind of energy on economic to be prevented. The other advantage, there is no of geography for the renewable energies.

The renewable energy resources have another positive advantage that consist of variety and low charge of accessing that these kind of energy only need to primary investment and with promoting of technology, the primary investment decreasing too.

Efficiency in Energy Consumption

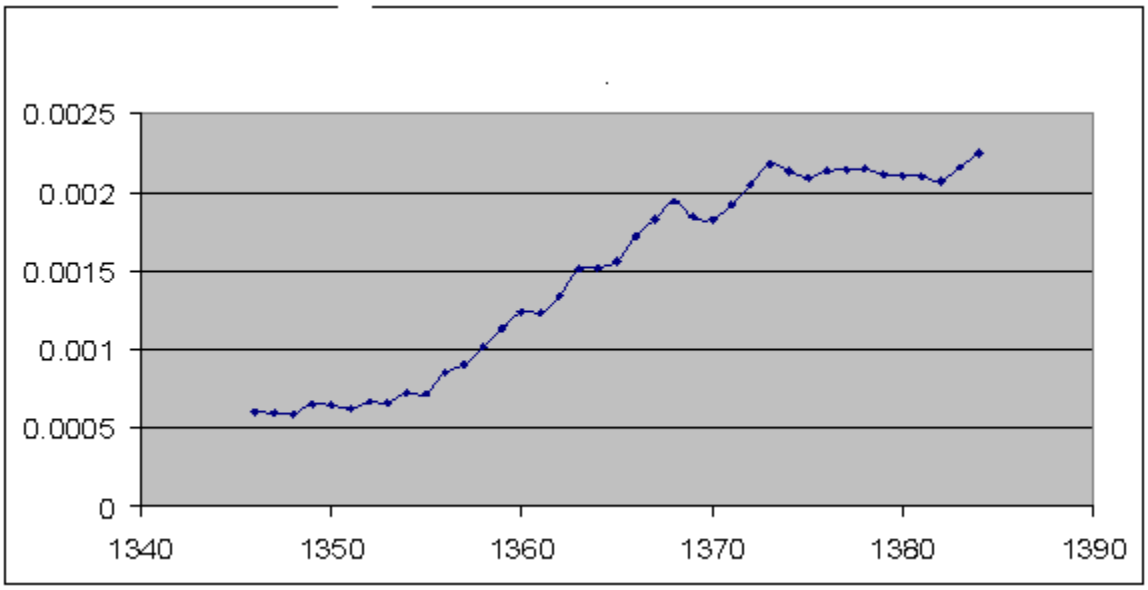
Using of renewable energy resources is not a guaranteed way of the sustainable development in consuming of energy. It is worth to notice that nearby 70% of whole of word's primary energy waste through the process of producing of energy till consuming (developing plan of United Nations in 2000).

So, more efficiency using of energy resources, less needing of population to energy. So, it's getting easy to supply their needs by using of renewable energy resources. Through this way, there is less requiring investing and wasting the money on costly projects. According to Beck F, Martinot E. (2004); efficiency use of the energy projects, which exist now are more economical than wasting money to make new projects.

There are several indicators to measure the efficiency in consuming of energy. Among these indicators, the indicator of energy intensity is more useful because of having charge in structure factors. This kind of indicator is in form of dividing consumption of energy to GDP. As fact, this

indicator expresses; how much energy is waste for each unit of GDP. So how much the amount shown by this indicator is less, it means more efficiency in consuming of energy.

Figure 1: Energy Intensity Trend in Iran



As figure (1) shows, the energy intensity amount in Iran are increasing during the whole sample period of study. This behavior is against with sustainable development principles. To make rational decision on energy consumption style we need to consider some strategies to return on sustainable development path for energy consumption.

Comprehensive Strategies for Energy Consumption

International analysts believe the oil-rich countries or have large reserves of natural gas has failed to state the main source of energy to be of his strategic plan. Some economists and political analysts believe that all governments in Iran, lack to have a comprehensive strategy on oil and gas industries. If we are still thinking to a comprehensive energy strategy it is better that the following priorities to be considered:

To explore the potential resources in the regions that oil and gas reserves confirmed by experts according to resource economics principles.

Gas injection pressure to compensate for or prevent a sharp reduction in wells pressure and increase their productivity.

Promote regional political atmosphere and facilities adjusted to increase oil and gas Swap possibility.

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Feasibility study for increase in gas exports, especially in the form of LNG and GTL projects in the region and the world.

Construction and development of petrochemical projects in order to create value added in crude oil and natural gas and convert them into complex polymers and final petrochemical products and higher production in different circles.

Development of target markets for petrochemical products export.

To promote the construction of modern refineries and refining volume of processed oil wealth at the direction of petroleum imports.

Modernization of pipelines and Telecommunications and petroleum Stations and equipped them with complete satellite systems and smart.

Optimizing the energy use of different parts and taking steps toward establishing a balanced world.

The gradual elimination of subsidies and price adjustment of energy carriers in the regional level so that the economic principle is observed relationship between price and consumption.
Combining local knowledge and efforts with the opportunities and advantages of modern technology.

Adjusted strategy and diplomacy in the country and international levels in order to attract as much investment in oil, gas and petrochemical industries.

Investment Strategy

Strategy for investment in oil and gas industry principles should be observed for at least the following principles:

Laws Terms of international investment in the oil industry should be aligned and coordinated with the principles and concepts of international law. These rules must be transparent with the necessary environment for investment to create catchy.

Stability in Macro Policies, macro policies in the oil and gas field in the country should be clear and may have long lasting.

Clearly define of the Legal Framework of financial contracts, in both the international legal and finance sector.

Political Risk and Social and political crises, revolutions, wars and stressful society, tend to reduce investment. So, decreasing this sort of risk should be a priority.

Options, defining the options to protect benefit of two parts in contracts should somehow feel by investors in the contract.

Tax Rules as a Golden Tool

Regardless of historical arguments among economists about the government intervention in economy, three duties of government are include of:

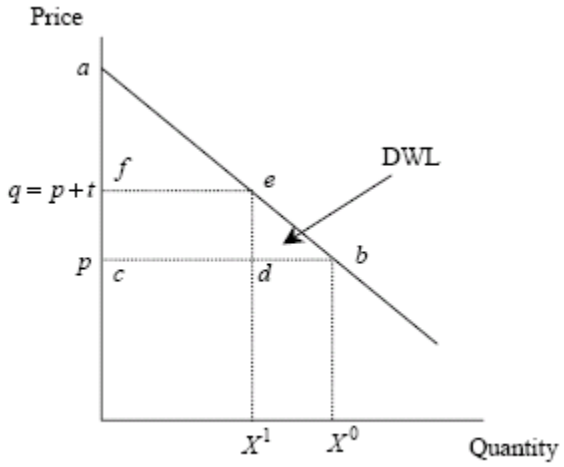
Allocating of resources

Distributing of the income

Economic stability

In each duty "The Tax" is one of the tools of taking policy for government. According to the recent researches in sustainable development, in this paper our focus is on allocating of resources. The most taxes cause to making inefficiency during doing their job. By concentrating on commodity taxation, imagine the specific good which has demand curve in form of show.

Figure 2: Tax Effect on Demand Quantity



Before impose a tax, price of good is P, quantity of demand is X0. In this price, consumer surplus is the same as the area of abc triangle. After impose a tax with the rate of t, price increases to q = P + t and demand of that good decrease to X1.
This amount of demand which decreased causes the consumer surplus to decrease to aef. On the other hand, such a tax effects on government tax revenue to t*X1 (it means the area of cdef).

In fact, the welfare transfers from consumer to government, but a part of consumer welfare reaches to nobody and no specific group. This amount is that area of abd triangle. This amount of loss is called Dead weight loss (DWL).

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In fact, tax imposing causes a gap between have paid price by consumer and have got price by producer. It causes to create the social welfare loss. Scilicet, tax on good causes to change the consumer mind (for example; instead of purchasing goods taken high tax to buy goods taken low-tax). So, this matter disrupts the efficiency.

Calculating this social pure loss is approximately possible. As DWL is equal to area of ebd triangle so for a linear demand curve;

DWL= ½ t* dx (1)
On the other hand, the price elasticity of demand is defined as:
εd = =(dx/dp)*(p/x) , dp=t (2)
By substituting dx from equation (2) into the equation (1) we get;
DWL = = ½ εd * X0/P0 * t2 (3)

So, this amount of Dead Weight Loss depends on the price elasticity of demand, tax rate, and before tax price and demand quantity(X0 and P0).

Now to make use this tool to solve sustainability energy problem, we need to come back to describe the problem. As we discussed in the last parts of the paper, one of the most important questions about sustainability of energy resources is how we could determine the needs and priorities of posterities. In this regards, we are all agreeing in this point that we must hold this recent situation and don't let the consuming energy situation gets any worse. This is least try to hold sustainability in consuming of energy resources by regard to the "Sustainable development".

On the other hand, one of the most important and proper indicator for examine of consuming of energy resources is "Energy Intensity" indicator.

Our theory has started by these questions that how we could hold sustainable the energy intensity? Of course, this matter derivate with general approval that mentioned before. Although it's not as desirable as declined amount of energy intensity, it consider as worthy aim. So, we start with definition of energy intensity:

$$I = \frac{E}{Y} \quad (4)$$

Where, E is energy consumption, Y is gross domestic product, and I is energy intensity. By differentiating from equation (4) and suppose that we have dI = 0 to get constant energy intensity, we get:

$$E_E = \frac{dE}{dY}\frac{Y}{E} = 0.5 \quad (5)$$

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Where E_E is income elasticity of energy demand. Equation (5) expresses that when income elasticity of energy demand is 0.5, the energy intensity will be hold constant. Since energy demand is homogenous of zero degree in prices and income, so according to the Euler theorem:

$$\left(\frac{\partial D_E}{\partial P_E}\right) * P_E + \left(\frac{\partial D_E}{\partial P_X}\right) * P_X + \left(\frac{\partial D_E}{\partial Y}\right) * Y = 0 \quad (6)$$

Where DE is energy demand, PE is energy price; PX is price of the relative goods like X and Y is stand for income. So,

$$E_{EPe} + E_{EPx} + E_E = 0 \quad (7)$$

Equation (7) says that, the sum of price elasticity, cross elasticity and income elasticity of demand for energy is equal to zero. By considering equations (5) and (7) we have:

$$E_{EPe} + E_{EPx} = -0.5 \quad (8)$$

Equation (8) is the center of attention in our discussion. According to this equation, the requirement to achieve sustainable energy consumption is the pair wise of E_{EPe} and E_{EPx} so that satisfy equation (8). As you can find from this relationship, whatever the energy carriers have more substitution (positive and high E_{EPx}), in order to reach sustainability there is need to higher E_{EPe} in absolute value. It explains this matter when there is more substitution for energy in order to have sustainability in energy consumption; we need consumers with high price sensitivity. This case is more near to the real world situation. In this analysis we can consider different combinations for price and cross elasticity to get sustainability in energy consumption. It is possible to talk about substitute and complement goods for energy and changing their prices in different direction to be on sustainable path in energy consumption.

As a conclusion, every combination of E_{EPe} and E_{EPx} which satisfy equation (8) are desirable.

So, imposing a tax on energy or its substitute and complements goods is a tool of changing the price of energy goods and other goods which are corresponsive to it, to reach sustainability in energy consumption. But as is discussed before in this paper, imposing a tax may cause inefficiency and Dead weight loss. So, we need even the tax rates of tE and tX which provide the least DWL and price and cross elasticity that are obvious in equation (8) through changing in price.

Thus, policy maker optimization problem is as follows:

Min (DWLtE +DWLtX) (9)

S.t. $\varepsilon E,PE + \varepsilon E,PX = - 0.5$

According to the approximately amount of DWL which computed in equation (3) we could make a conclusion

Min ½ ($\varepsilon E,PE * t2\ E * E/PE + \varepsilon E,PX * t2\ X * X/PX$) (10)

S.t. $\varepsilon E,PE + \varepsilon E,PX = - 0.5$

By solving this optimization problem, as a result, we get to:

$tE/tX = (X/E * PE/PX)1/2$ (11)

By having the tax rates on energy (E) and other goods (X) in equation (11), we can get to sustainable energy consumption and also minimizing DWL of taxation simultaneously. It is clear that to achieve this important goal, the tax rate ratio for energy and other goods should be proportional to the amount of consumption for these two type goods and their relative prices as well.

Discussion And Conclusion

Sustainable development is a multidisciplinary subject to study. Using efficient and renewable resources are two main alternatives to get on sustainable development path. The pattern of energy consumption has several changed in Iran. We could divide these changes in two main groups: internal group changes and external group changes.

Internal group changes: changing of the pattern of consuming of energy in each of three groups that classified renewable resources, non-renewable resources and electricity. These changes occur among group of energy resources and also group of electricity energy. Internal-group and external group changes are briefly defined in table (1).

Table (1): Internal-group and external group changes

Substituting of natural gas for petroleum productions	Non-renewable energy resources	Internal group	The pattern of energy consumption changes in Iran
	Renewable energy resources		

Using Renewable energy group in producing electricity	Electricity energy		
Substituting of electricity for petroleum productions	Between the renewable and Electricity energy	External group	
Using Renewable energy group instead of non-renewable energy	Between the non-renewable and Renewable energy		

The first changes: Substituting of natural gas for petroleum productions

The second changes: Using Renewable energy group in producing electricity

The third changes: Substituting of electricity for petroleum productions

The final changes: Using Renewable energy group instead of non-renewable energy.

Strangeness and weakness points of these pattern changes in energy use in Iran are shown in table (2).

Table (2): Strangeness and weakness points of energy consumption pattern change

Strangeness points	weakness points
substituting of natural gas for petroleum productions at households and commercial parts, industry, refinery	Late starting substituting of natural gas instead of petroleum productions at transportation and agriculture parts
Using Renewable energy Resources in producing electricity	Lack of attention to use waves energy
	Low-speed of Substituting of electricity for petroleum productions at households and commercial parts, industry, agriculture parts
	Late starting of Substituting of electricity for petroleum productions at transportation parts
	Lack of attention to direct use of Renewable energy group

Although natural gas is cleaner than petroleum productions, success in substituting of natural gas turns to fade. This matter is along with weakness points in using of renewable energy resources and lack of efficiency in consuming of energy in Iran. So, we couldn't have a desirable imagine of our country energy in the future. By considering of issue of efficiency in consuming of energy, this essay presents a model which measures the rate of taxation on goods and other relevant goods to achieve sustainability.

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Through this way, not only puts the energy consumption style on the way of sustainable development but also it has the least amount of Dead weight loss due to posing of tax. This rate of taxation is function of relative prices and relative amounts of energy (relate to relevant goods to energy).

So, in countries which relative price of energy is little, it is possible to posing more tax on relevant goods to energy. In Iran, because of low energy prices it is predictable that the rate of taxation to be enacted that high amount of tax to be on relevant goods to energy (not on energy itself).

Finally, according to the all mentioned matters in this paper, for achieving sustainable development we could express following recommendation as the sustainable development strategies for energy consumption:

- The same attention on both efficiency and substituting of renewable energy resources.
- Imposing optimal tax rates by the way of the presented model in this paper.
- Pay attention to substituting of energy resources in transportation sector.
- Increasing the rate of using of electricity in different economic parts of Iran specific in household and commercial sectors.
- More using of renewable energy resources in producing electricity (indirect way).

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