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Energy Dependency and Security

The Role of Efficiency and Renewable Energy Sources

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ENERGY DEPENDENCY AND ENERGY SECURITY: THE ROLE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY SOURCES

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Abstract

National and international energy policies have very important role in regional and global power equilibrium and its importance is increasing. In this respect, diversification of energy resources and their transportations routes, efficient use of local resources and the use of existing energy resources with various technological and strategic practices in the most efficient way possible are necessary in order to improve energy security and reduce dependence on foreign energy sources.

Energy efficiency and renewable energy sources stand out as an important issueS especially regarding energy supply security, reducing foreign energy dependency, economic development, maintaining the balance between environment and sustainability as well as making important gains in all these issues. Thus, Improving energy efficiency saves money, reduces carbon emissions and decreases your country's dependence on foreign energy supplies. Energy security – the uninterrupted availability of energy sources at an affordable price – can also profit from improved energy efficiency by decreasing the reliance on imported fossil fuels. Possible improvements in energy efficiency are examined in six main categories: 1) buildings, 2) industry, 3) transportation, 4) electricity generation and distribution, 5) appliances and equipment, and 6) lighting.

According to the Turkish Energy Efficiency Strategy Document (2012-2023), it was observed that with rational policies and technological improvements, a minimum of 20% increase is possible in energy efficiency between 2013 and 2023. In the last year, major energy-consuming countries also have announced new measures: China is targeting a 16% reduction in energy intensity by 2015; the United States has adopted new fuel economy standards; the European Union has committed to a cut of 20% in its 2020 energy demand; and Japan aims to cut 10% from electricity consumption by 2030.

The aim of this paper is to study the importance of energy efficiency and renewable energy sources and their roles on reducing energy dependency and promoting energy security. In addition, the energy efficiency applications of Turkey will be discussed and general energy Outlook of Pakistan and some policy implications to solve the energy crisis in Pakistan will be presented.

Keywords: Energy Efficiency, Energy Dependency, Renewable Energy, Energy Security, Turkey, Pakistan

1. Introduction

National and international energy policies have very important role in regional and global power equilibrium and its importance is increasing. In this respect, diversification of energy resources and their transportations routes, efficient use of local resources and the use of existing energy resources with various technological and strategic practices in the most efficient way possible are necessary in order to improve energy security and reduce dependence on foreign energy sources.

All societies require energy services to meet basic human needs (e.g., lighting, cooking, space comfort, mobility, communication) and to serve productive processes. For development to be sustainable, delivery of energy services needs to be secure and have low environmental impacts. Sustainable social and economic development requires assured and affordable access to the energy resources necessary to provide essential and sustainable energy services. This may mean the application of different strategies at different stages of economic development. To be environmentally benign, energy services must be provided with low environmental impacts and low greenhouse gas (GHG) emissions. However, the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) reported that fossil fuels provided 85%1 of the total primary energy in 2004, which is the same value as in 2008. Furthermore, the combustion of fossil fuels accounted for 56.6% of all anthropogenic GHG emissions (CO2) in 2004. The IPCC is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of knowledge on climate change and its potential environmental and socio-economic impacts.

Climate change is one of the great challenges of the 21st century. Its most severe impacts may still be avoided if efforts are made to transform current energy systems. Renewable energy sources have a large potential to displace emissions of greenhouse gases from the combustion of fossil fuels and thereby to mitigate climate change. If implemented properly, renewable energy sources can contribute to social and economic development, to energy access, to a secure and sustainable energy supply, and to a reduction of negative impacts of energy provision on the environment and human health.

Renewable energy is largely a domestic source of energy. When it displaces imported fuels, it contributes to greater national energy security and directly reduces import bills, which represent a fairly significant percentage of gross domestic product (GDP) in many importing countries and often contribute to a trade deficit. Renewable energy sources (such as wind, solar and biomass) have the potential to reduce these effects significantly. Moreover, greater use of renewables could indirectly put downward pressure on oil and gas prices and reduce price volatility. In the electricity sector, renewables mainly reduce the need to import gas or coal, as oil use is limited in this sector.

While GDP per capita and population growth had the largest effect on emissions growth in earlier decades, decreasing energy intensity significantly slowed emissions growth in the period from 1971 to 2008. In the past, carbon intensity fell because of improvements in energy efficiency and switching from coal to natural gas and the expansion of nuclear energy in the 1970s and 1980s. In recent years (2000 to 2007), increases in carbon intensity have been driven mainly by the expansion of coal use in both developed and developing countries, although coal and petroleum use have fallen slightly since 2007. In 2008 this trend was broken due to the financial crisis. Since the early 2000s, the energy supply has become more carbon intensive, thereby amplifying the increase resulting from growth in GDP per capita.

Baseline projections for the EU indicate that electricity consumption will grow on average by 2%/y to 2030, with a potentially slightly slower pace each year because of energy efficiency improvement measures and higher fossil fuel prices, in particular natural gas,

which will consequently affect electricity pricing. This provides an impetus to improve technologies in coal- and gas-based power generation and more specifically to improving conversion efficiency, as this would result in substantial CO2 and fuel savings. For example, each percentage point efficiency increase is equivalent to about 2.5% reduction of CO2 emitted. Power plant efficiency is therefore a major factor that could be used to reduce global CO2 emissions.

Since 2008, China has become the largest emitter of GHG in the world overtaking the United States. Now China accounts for 25% of_total global CO2 emissions, up from 11% in 1990. The top five coun- tries with the highest energy related CO2 emissions in addition to China, include USA, India, Russia and Japan, which in total represented 58% of global emissions in 2011). Adding the cumulative emissions of the next five countries: Germany, South Korea, Iran, Canada and Saudi Arabia demonstrates that the top ten countries accounted for slightly more than two thirds of world emissions in 2011. The largest increase has taken place in China and India, where emissions per capita in China increased by a factor of three and in India by 2.5 respectively, and the Middle East (+75%), due to the high economic growth.

In 2009, the European Union released the Renewable Energy Directive, which set legally binding targets for the share of renewable energy (covering electricity, heat and biofuels) in gross final energy consumption of each member state by 2020, equating to 20% in total. To ensure that their targets are met, each country is required to prepare an action plan and provide regular progress reports. Renewable energy is expected to continue to be central to EU energy policy beyond 2020. A recent European Commission report indicated that renewable energy could meet 55-75% of final energy consumption by 2050, compared with less than 10% in 2010 (EC, 2011; EU, 2011). According to the Turkish Energy Efficiency Strategy Document (2013-2023), it was observed that with rational policies and technological improvements, a minimum of 20% increase is possible in energy efficiency between 2013 and 2023. In addition, major energy-consuming countries also have announced new measures in 2012: China is targeting a 16% reduction in energy intensity by 2015; the United States has adopted new fuel economy standards; the European Union has committed to a cut of 20% in its 2020 energy demand; and Japan aims to cut 10% from electricity consumption by 2030.

2. Energy Efficiency

Efficient energy use, sometimes simply called "energy efficiency", is the goal of efforts to reduce the amount of energy required to provide products and services. **Energy efficiency** is a way of managing and restraining the growth in energy consumption. For example, insulating a home allows a building to use less heating and cooling energy to achieve and maintain a comfortable temperature. Installing fluorescent lights or natural skylight reduces the amount of energy required to attain the same level of illumination compared to using traditional incandescent light bulbs. Compact fluorescent lights use two-thirds less energy and may last 6 to 10 times longer than incandescent lights.

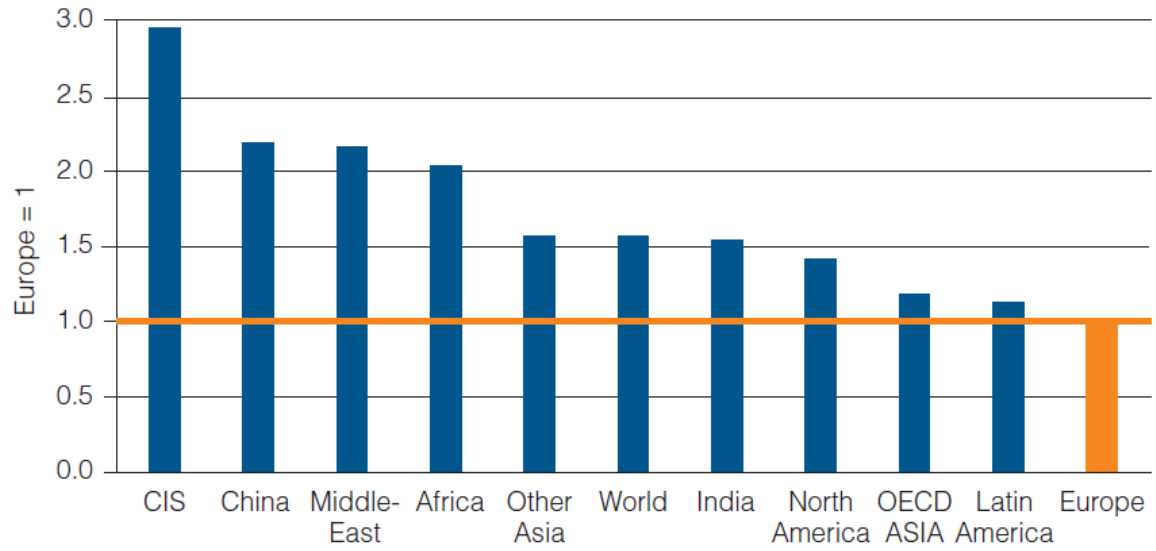
Energy efficiency stands out as an important issue especially regarding supply security, economic development and competitiveness on the one hand, and maintaining the balance between environment and sustainability as well as making important gains in all these issues on the other.

Energy efficiency offers a powerful and cost-effective tool for achieving a sustainable energy future. Improvements in energy efficiency can reduce the need for investment in energy infrastructure, cut energy bills, improve health, increase competitiveness and improve consumer welfare. Environmental benefits can also be achieved by the reduction of greenhouse gases emissions and local air pollution. In addition, energy efficiency reduces your country's dependence on foreign energy supplies.

According to World Energy Council 2013 Report, most countries have significantly reduced their total energy use per unit of GDP over the last three decades. The decline in energy intensity has been driven largely by improved energy efficiency in key end-uses such as vehicles, appliances, space heating and industrial processes. Governments have implemented a wide range of policies and programmes such as energy efficiency standards, educational campaigns, obligations for market participants and financial incentives to accelerate the development and adoption of energy efficiency measures. Western Europe is currently the region with the lowest energy intensity, while among the large consumer countries; CIS uses almost 3 times more energy per unit of GDP than Europe. In China, Africa and the Middle East, the energy intensity is two times higher than the average in Europe. High energy intensities can be attributed to a number of factors, including the structure of the industry, the share of energy intensive sectors, low energy prices and other. Latin America and OECD Asia & Pacific are about 15% above the European level, while India and other Asia are at the same level as the world average with energy intensity 50% higher than in Europe and slightly less than North America.

Primary energy intensity levels by world region (2011)

Source: WEC/ENERDATA

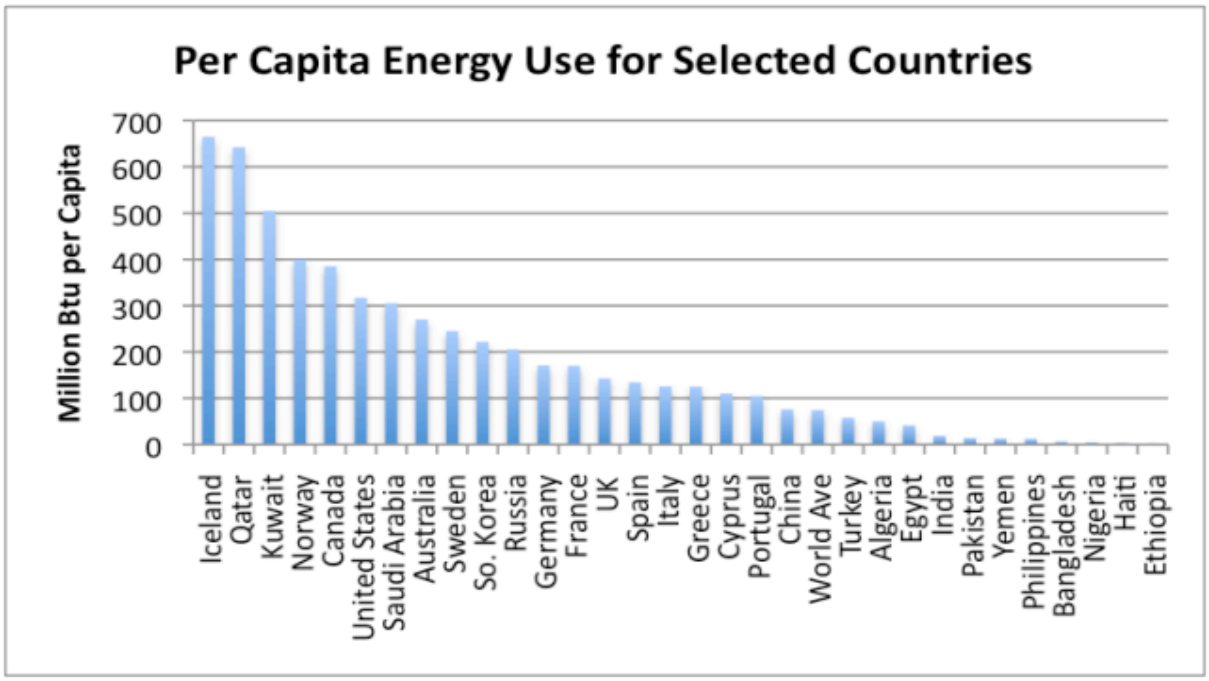


Energy efficiency has proved to be a cost-effective strategy for building economies without necessarily growing energy consumption. For example, the state of California began implementing energy-efficiency measures in the mid-1970s, including building code and appliance standards with strict efficiency requirements. During the following years, California's energy consumption has remained approximately flat on a per capita basis while national U.S. consumption doubled. As part of its strategy, California implemented a "loading order" for new energy resources that puts energy efficiency first, renewable electricity supplies second, and new fossil-fired power plants last.

Energy conservation is broader than energy efficiency in that it encompasses using less energy to achieve a lesser energy service, for example through behavioural change, as well as encompassing energy efficiency. Examples of conservation without efficiency improvements would be heating a room less in winter, driving less, or working in a less brightly lit room. As with other definitions, the boundary between efficient energy use and energy conservation can be fuzzy, but both are important in environmental and economic terms. This is especially the case when actions are directed at the saving of fossil fuels.

Reducing energy use is seen as a key solution to the problem of reducing greenhouse gas emissions. According to the International Energy Agency (IEA), improved energy efficiency in buildings, industrial processes and transportation could reduce the world's energy needs in 2050 by one third, and help control global emissions of greenhouse gases.

America is an "energy hog" and uses twice as much energy per capita as most European countries and perhaps ten times as much as most of Asia and Africa (see following figure).



It is a result to a large extent to a greater degree of industrialization. Much of industry is energy demanding. More industrialized countries in Asia, such as Japan, China and Taiwan, use more energy than the rest of the Asian countries but not as much per capita as the U.S. More of Asia is rapidly industrializing so it is certain that its energy demands will increase and offer more competition for energy supplies to the more energy intensive countries. These changes are inevitable and relate to the increase in the quality of life associated with such industrialization, rising population and income. In any case, the energy needs of much of the rest of the world will increase, and if this is accompanied by the increasing energy use in America that we have experienced, the world's energy requirements are bound to grow. If this occurs in a time of limited resources, problems will arise. There will be increasing strife among competitors for the available resources and increased cost, leading to a limitation of the rate of growth. The burden of this limitation will fall more heavily on the poorer parts of society. To decrease these problems, it appears desirable to reduce the per capita energy use for ourselves and to find ways for others to grow in a less energy intensive way. This can be accomplished through changes in life style, finding ways for using energy more efficiently and using altrnative energy sources such wind, solar and biomass.

In addition to the possibility of diminished sources of fossil fuels, there is a problem in the production of carbon dioxide from burning fossil fuels. The evidence is clear that the carbon dioxide (CO2) concentration in the atmosphere has greatly increased (Weart, 2008). The increase in carbon dioxide has been accompanied by a change in the Earth's climate. The climate change in turn has been ascribed to the greenhouse effect. Human activity, that has increased the amount of the greenhouse gases in the Earth's atmosphere, has led to an increase in climate warming (Physical Geography, 2009).

It is evident that because of the limitations of fossil fuel supply and consideration of the environmental deterioration arising from their use, that other sources of energy should be considered. To secure energy supply and meet the energy demand in future, the importance of renewable energy (such as wind, solar and biomass) becomes even more critical.

Energy security – the uninterrupted availability of energy sources at an affordable price – can also profit from improved energy efficiency by decreasing the reliance on imported fossil fuels. Energy security is very important, especially for energy importing (energy dependent countries, such as Pakistan and Turkey) countries. Because rising in energy prices or decreasing in energy supply will have a negative impact on the growth of these countries.

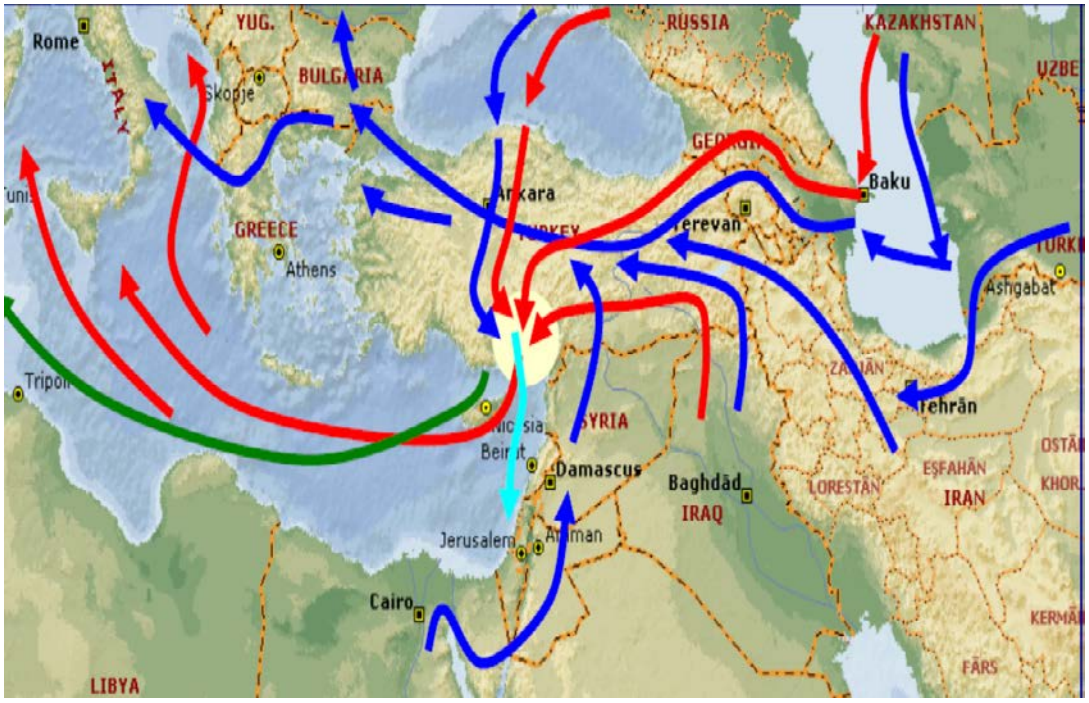
In addition, the question of energy security also is one of the main concerns for the future of Europe because of the growing dependency of the European countries on third parties, namely Russia, for natural gas. The future of European energy security will be shaped by the EU's dependence on Russia and its ability to find alternative sources of energy as well as multiple routes of transport. Turkey's location between the major energy producers in the Caspian and the major energy consumers in Europe has increased Turkey's potential role as the transit country.

To promote energy security of Europe, Nabucco is projected to transport natural gas from the Caspian region through Turkey, Bulgaria, Romania and Hungary to Austria, and the Cooperation Agreement was signed between these five countries in October 2002 (see following figure). The Agreement signed on 13 July 2009 between these five countries enabled the operationalization of these plans. The consortium for the pipeline, the Nabucco Gas Pipeline International, was founded in 2004 with the objective of constructing a new pipeline connecting the Caspian region, the Middle East and possibly Egypt as a new supply route for Europe. The investment for the pipeline, which will be approximately 3,300 kilometres, is estimated to cost around 8 billion Euros. Potential suppliers to the pipeline are the Caspian states, Azerbaijan, Kazakhstan, Turkmenistan, Iran, and, if possible, Egypt and Iraq as well. The major supplier for the initial stage of the Nabucco pipeline is projected to be Shah Deniz fields of Azerbaijan.

3. Turkey Energy Outlook

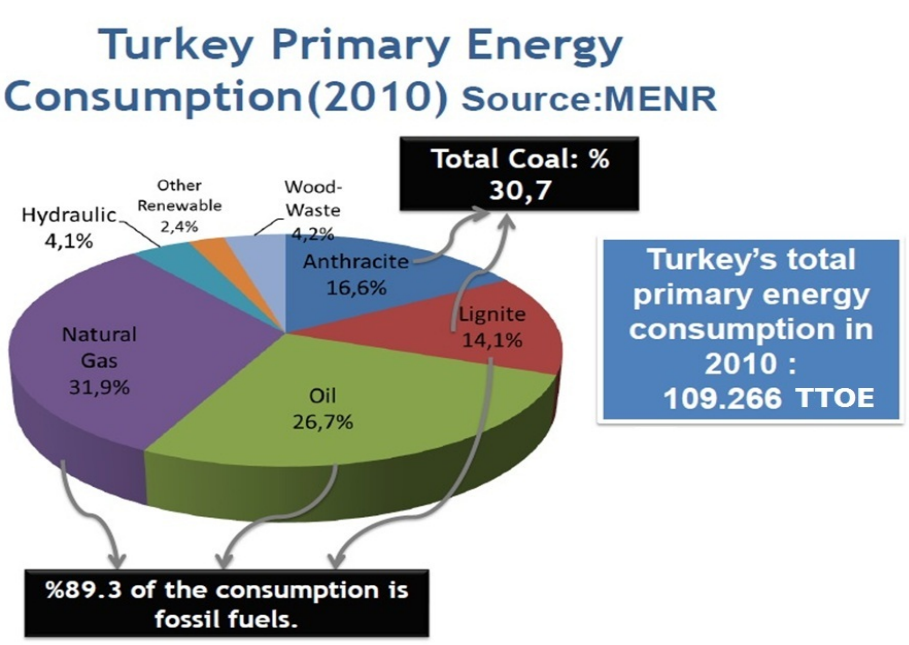
Turkey's importance in the energy markets is growing, both as a regional energy transit hub and as a growing consumer. Turkey's energy demand has increased rapidly over the last few years and likely will continue to grow in the future

Over the last two years, Turkey has seen the fastest growth in energy demand in the OECD, and unlike a number of other OECD countries in Europe, its economy has avoided the prolonged stagnation that has characterized much of the continent for the past few years. The country's energy use is still relatively low, although it is increasing at a very fast pace. According to the International Energy Agency (IEA), energy use in Turkey is expected to double over the next decade, while electricity demand growth is expected to increase at an even faster pace. Meeting this level of growth will require significant investment in the energy sector, much of which will come from the private sector. Large investments in natural gas and electricity infrastructure will be essential. In addition to being a major market for energy supplies, Turkey's role as an energy transit hub is increasingly important. It is key to oil and natural gas supplies movement from Russia, the Caspian region, and the Middle East to Europe. Turkey has been a major transit point for seaborne-traded oil and is becoming more important for pipeline-traded oil and natural gas (see following figüre).

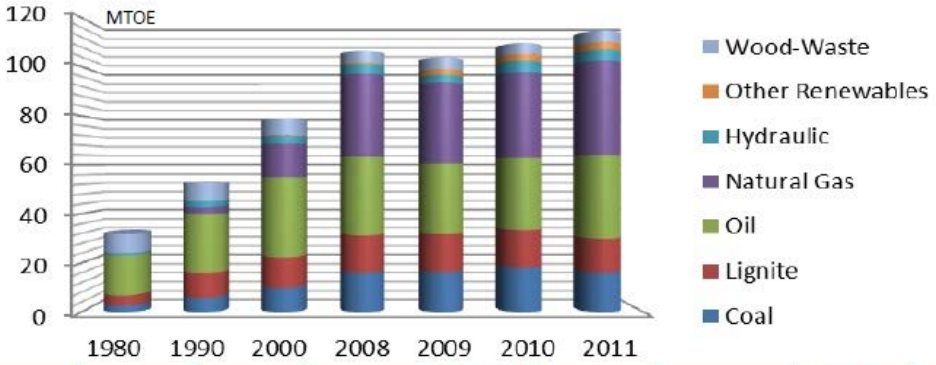


In 2010 and 2011, Turkey's economy was one of the fastest growing economies in the world, at over 8 percent annual growth rates, and with this economic expansion, Turkey's oil consumption grew. In 2011, Turkey imported more than 90 percent of its total liquid fuels consumption. According to the IEA, Turkey's imports are expected to double over the next decade.

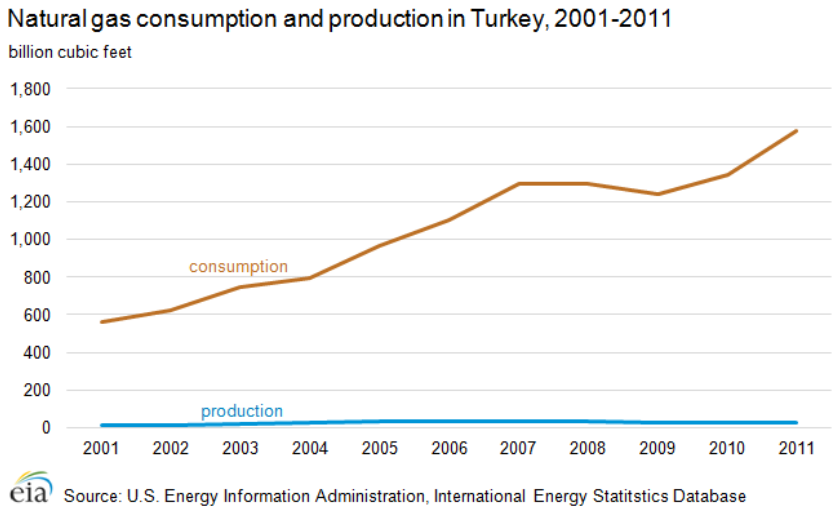
In the following figures, the Developments in the energy demand and energy supply of all types are given.



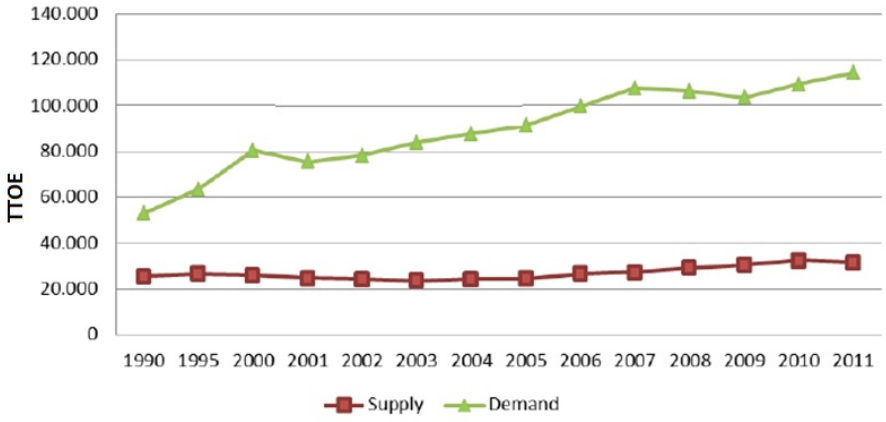
Development of Primary Energy Consumption of Turkey (1980-2011)



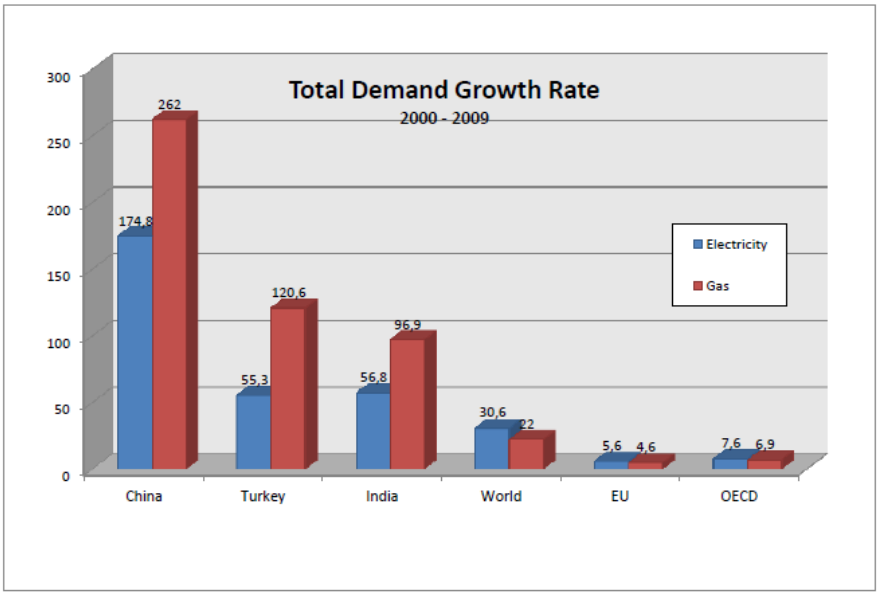
	Coal	Lignite	Oil	Natural gas	Hydraulic	Other Renewables	Wood-Waste	Total
1980	8,9	13,2	50,5	0,1	3,3	0,0	24,1	100,0
1990	11,7	18,8	45,3	5,9	4,6	0,1	13,7	100,0
2000	12,6	15,9	41,1	17,5	4,3	0,3	8,2	100,0
2008	15,2	14,3	29,9	31,8	3,8	0,5	4,5	100,0
2009	15,8	14,8	27,9	31,6	3,0	2,2	4,6	100,0
2010	16,6	14,1	26,7	31,9	4,1	2,4	4,2	100,0
*2011	14,1	12,2	29,7	33,3	4,1	2,5	4,1	100,0

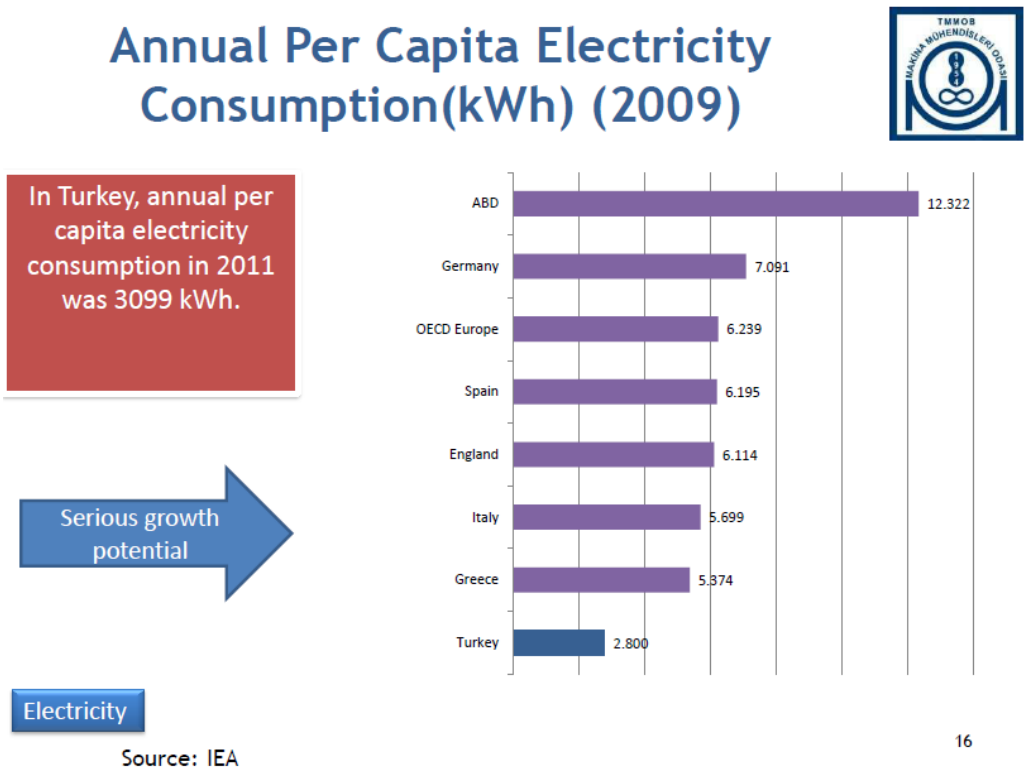


Development of Domestic Energy Supply and Energy Demand (1990-2011)



The rate of increase of aggregate demand between 2000-2009





Annual per capita electricity Consumption for Pakistan was 449 kWh in 2011.

3.1 Energy Efficiency and Applications in Turkey

Turkey, forging ahead with confident and rapid steps to become a pivotal and strong country in her region and the world, should aim for more efficient use of energy resources, development of deliberate policies of energy security, diversification of energy resources (using renewable energy sources), and development of new technologies. Turkey's energy import (mainly crude oil and natural gas) in 2011 was around 54 billion dollars, which equals %69 of the account deficit. Turkey should reduce its dependence on foreign energy sources and become a pioneer rather than a follower in the energy sector, especially among developing economies.

Possible improvements in energy efficiency are examined in four main categories: 1) buildings, 2) industry, 3) transportation, 4) electricity generation and distribution. Data analyses and optimization studies lead to the following conclusions: It is estimated that a saving of 20% to 60% in yearly energy consumption can be made with efficiency implementations in buildings; 10% to 40% increase in efficiency can be obtained with the use of energy management systems in the industry; compared to vehicles with internal combustion engines, electric vehicles provide 70% cost benefit and 65% decrease in CO2 emission; and 16% to 28% improvements in electricity generation and distribution can be achieved with compensation, introduction of SCADA systems, and smart grid implementations in distribution[1].

As a result of the analyses were made by the academicians and government authorities of Turkey made, it was observed that with rational policies and technological improvements, a minimum of 20% increase is possible in energy efficiency between 2012 and 2023. To achieve these objectives, Turkish government announced and applied the following "Turkey Energy Efficiency Strategy Document" in 2010.

[1] http://oip.ku.edu.tr/energy-matters/turkeys-energy-efficiency-assessment-and-targets

Turkey Energy Efficiency Strategy Document (2012- 2023)[2]: It is targeted with this document to decrease at least 20% of amount of energy consumed per GDP of Turkey in the year 2023 (energy intensity).

-To reduce energy intensity and energy losses in industry and services sectors

-To decrease energy demand and carbon emissions of the buildings; to promote sustainable environment friendly buildings using renewable energy sources

-To provide market transformation of energy efficient products

-To increase efficiency in production, transmission and distribution of electricity, to decrease energy losses and harmful environment emissions

-To reduce unit fossil fuel consumption of motorized vehicles, to increase share of public transportation in highway, sea road and railroad and to prevent unnecessary fuel consumption in urban transportation

-To use energy effectively and efficiently in public sector

-To strengthen institutional capacities and collaborations, to increase use of state of the art technology and awareness activities, to develop financial mechanisms except public financial institutions.

-To have at least 3 operating nuclear power plants

Turkey, which continues efforts to construct nuclear power plant, aims to use 36,000 MW hydroelectric, 20,000 MW wind, 3,000 MW solar, 600 MW geothermal, 2,000 MW biomass energy by 2023.

-Turkey's renewable energy resource potential is around 136,600 MW. However, Turkey uses only 13.6 per cent of its domestic renewable energy resources.

-Turkey aims to drop natural gas' share in electricity production to 30 per cent but raise renewable energy resource share to 30 per cent by 2023.

-To increase the share of nuclear power to 5% in the electricity production.

-To increase utilization of local and renewable energy sources to reduce excessive dependence on natural gas (15-20 % of energy)

The envisioned goals can only be achieved with a National Energy Strategy that is future-oriented and holistic; has realistic objectives and measurement mechanisms; is oriented towards local resources, manpower, scientific research and technology development; is open to global opportunities and partnerships; is shaped by active participation of all stakeholders in the guidance of the public sector; and is implemented consistently and adamantly.

Japan, Switzerland, Germany, and Denmark, which are all very successful in energy efficiency, as well as the example of the United States, which continuously puts more and more emphasis on energy efficiency.

3.2. Energy Efficiency and Energy Dependency Relationship in Turkey

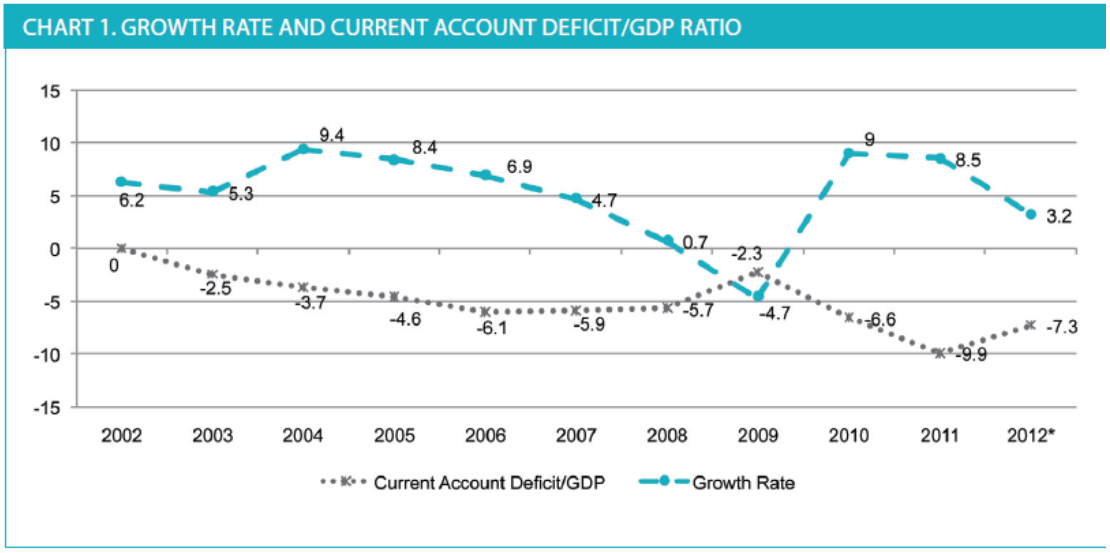
Let me first point at the relationship between import dependency in energy and current account deficit. Turkey is dependent on imported energy. More than 70% of energy consumption is imported. The energy import was 38,5 billion USD (20.8% of total import) in 2010 and 60,1 billion USD (25.1% of total import) in 2012.

As of 2011, Turkey's current account deficit was 10% of its GDP (see Chart 1 and 2). Turkey's dependency on energy imports is the main driver of the current account deficit. Deficit in current account was considered as one of the elements of fragility in Turkish economy. As a result, Turkish economy had to choose between economic growth and current account deficit.

[2] http://www.eie.gov.tr/verimlilik/document/Energy_Efficiency_Strategy_Paper.pdf

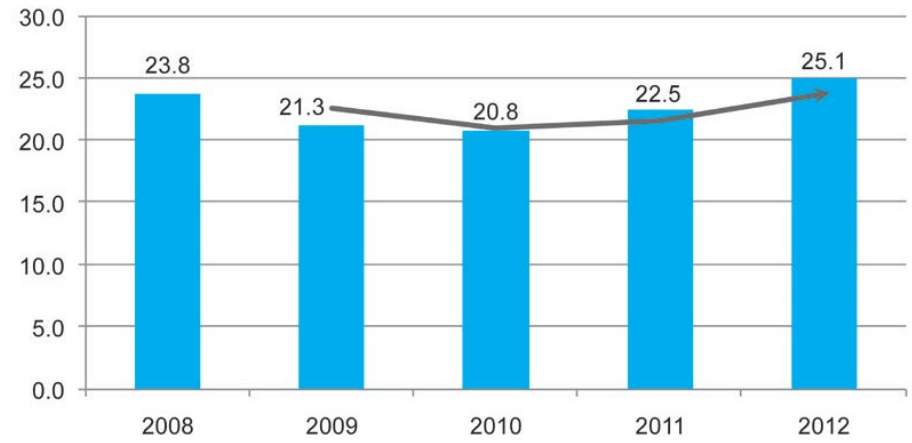
Foreign trade Developments in Turkey

	Annual (Billion $)		Periodic (Billion Dollar)		
	2011	2012	2012 / (JAN - FEB)	2013 / (JAN - FEB)	Change (%) 2012/2013
Export	134.9	152.5	22.1	23.9	8.3
Energy Export	6.5	7.7	1.3	1.1	-14.5
Gold Export	1.5	13.3	0.7	1.0	41.6
Import	240.8	236.5	35.3	38.2	8.3
Energy Import	54.1	60.1	9.5	9.1	-3.6
Gold Import	6.1	7.6	0.4	1.7	307.2
Foreign Trade Volume	375.7	389.0	57.4	62.1	8.3
Foreign Trade Balance	-105.9	-84.1	-13.2	-14.3	8.4
Balance excl. Energy	-58.4	-31.6	-5.0	-6.2	25.2
Export/Import (%)	56.0	64.5	62.7	62.7	*



Source: Turkish Statistical Institute, Middle Term Program (2013-2015)

Chart 2. Rate of Energy Import in the Total Import of Tukey (%)



Because of Turkey's dependence on external sources for energy, it is clear that any problem or crisis in energy supply can negatively affect the economic growth of Turkey. Thus, policies that provide energy supply security should be put into practice, which is critical because of Turkey's geographic and geopolitical location. The expansion of renewable energy

will reduce dependence on foreign energy sources, volatile oil and natural gas prices on international markets, and curtail the long-run environmental degradation associated with carbon emissions. Therefore, Turkey's energy policies should be such that they should diminish the country's dependency for external energy sources by substituting them with renewable energy sources of Turkey and increasing energy efficiency.

Turkey, forging ahead with confident and rapid steps to become a pivotal and strong country in her region and the world, should aim for more efficient use of energy resources, development of deliberate policies of energy security, diversification of energy resources (using renewable energy sources) and development of new technologies. Turkey should reduce its dependence on foreign energy sources and become a pioneer rather than a follower in the energy sector, especially among developing economies.

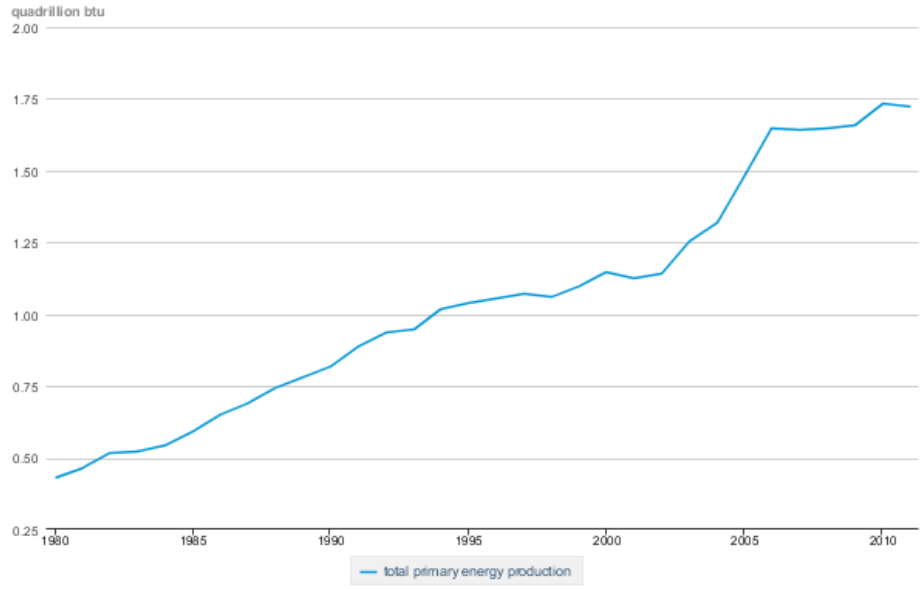
By increasing energy efficieny in Turkey, the energy dependency will be reduced and this will decreases the energy import and finally the current account deficit will be reduced. As a result, with energy efficiency policies current account deficit of Turkey can be decreased at least by 30%. In other words, current account deficit/GDP ratio can be decrased to 4-5% from 8%. Of course energy efficiency is one of the factor that will decrease the current accout deficit. The others are to export high value added products, increasing FDI and tourism revenues.

4. Pakistan Energy Outlook

The economy of Pakistan recovered modestly in 2012 compared to 2011. However, the overall economic outlook continues to be marked by low growth and high inflation imposed by energy shortages, security issues, and macroeconomic imbalances. Pakistan's inability to meet domestic energy demand has resulted in electricity outages, which is a key political and economic issue in the country. Thus, securing energy supply sources of natural gas, oil, hydro, and coal will be critical for Pakistan's economic growth.

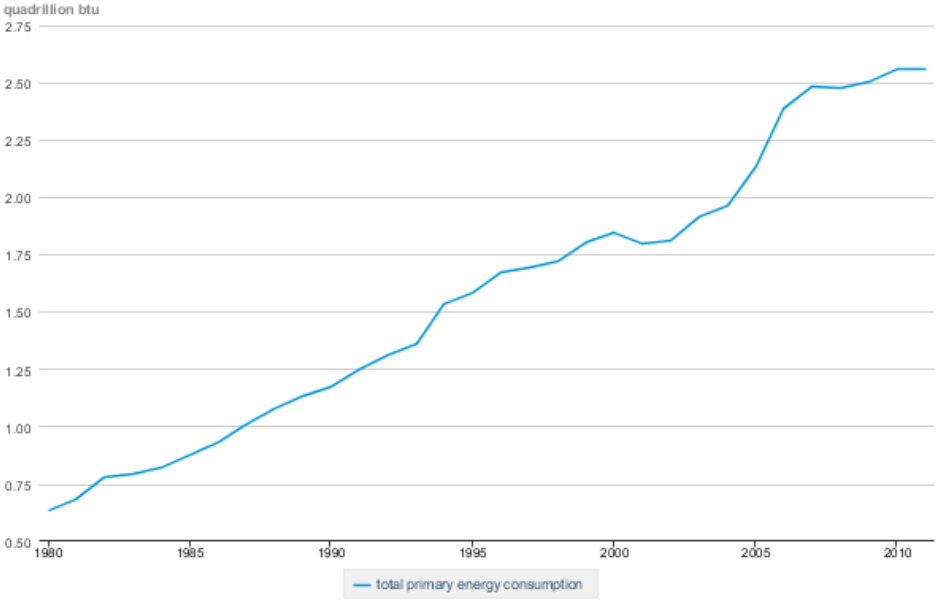
According to International Energy Agency and Asian Development Bank reports, the primary energy demand for Pakistan is projected to increase from 84.6 million tons in 2010 to 145.8 million tons in 2035, growing at an annual rate of 2.2 percent. With this growth, Pakistan's per capita energy demand will reach 0.59 tons per person as compared to that of 0.49 tons in 2010.

Pakistan total primary energy production (1980-2011)

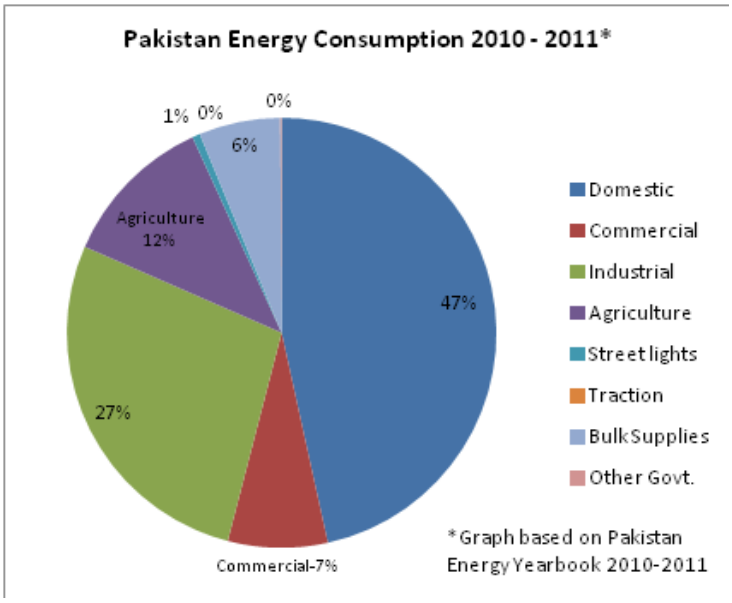


Source: U.S. Energy Information Administration

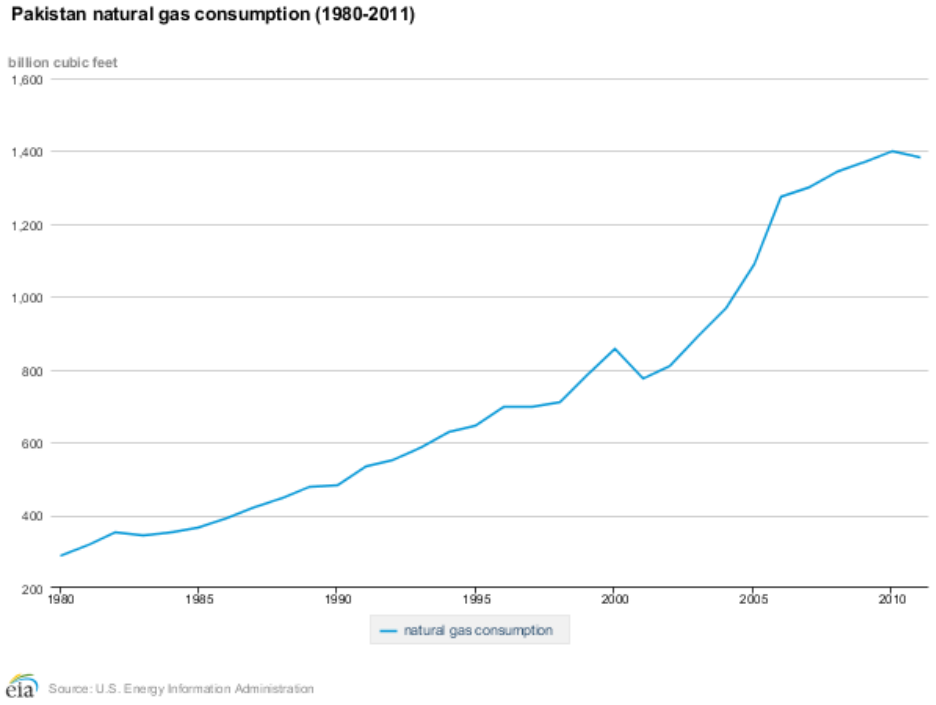
Pakistan total primary energy consumption (1980-2011)



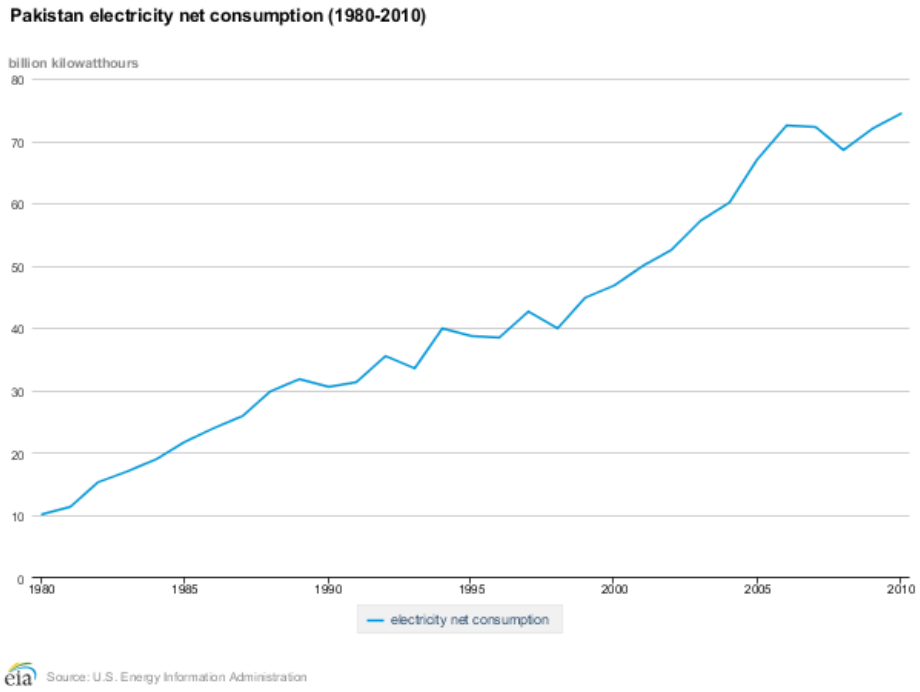
Source: U.S. Energy Information Administration



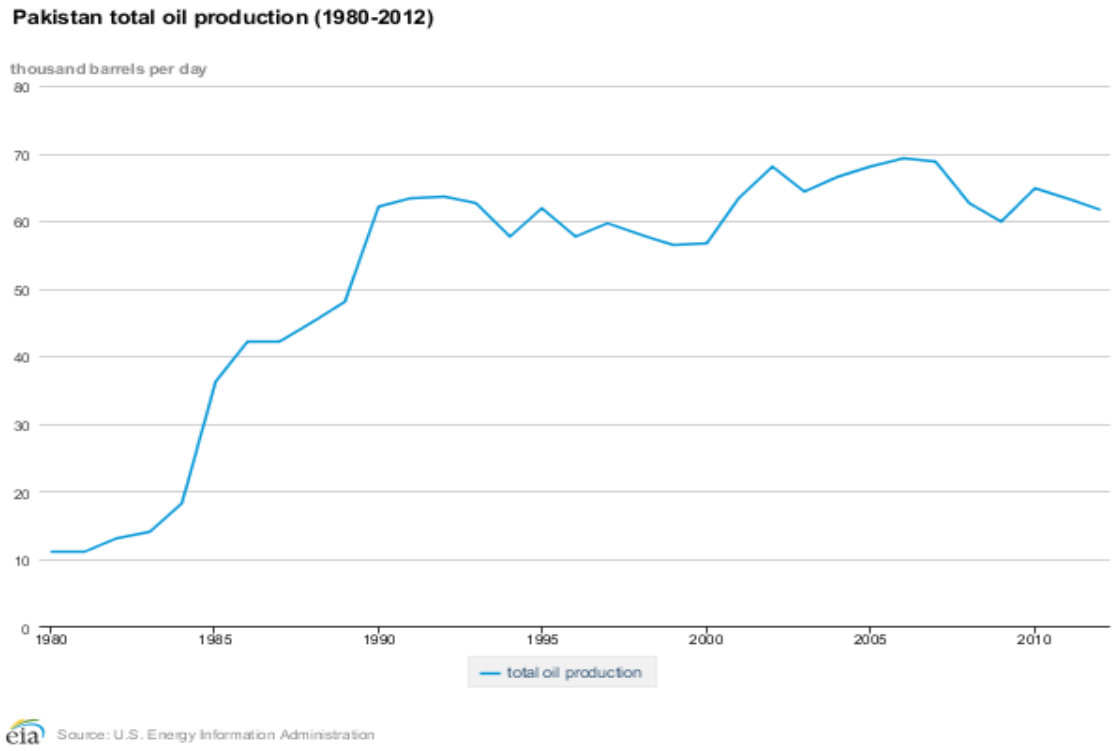
Dry natural gas production has grown by more than 70 percent over the past decade from 809 billion cubic feet (Bcf) in 2002 to 1,383 Bcf in 2011, all of which was domestically consumed. Despite the growth of natural gas production, the country's demand is still constrained. Pakistan currently does not import natural gas because it lacks the infrastructure. Pakistan is self-sufficient in natural gas — the main energy source to meet its primary energy demand — while domestic production will decline from the current 38.4 billion cubic metres (bcm) to 13 bcm in 2035 and Pakistan will have to start importing natural gas sometime after 2015.

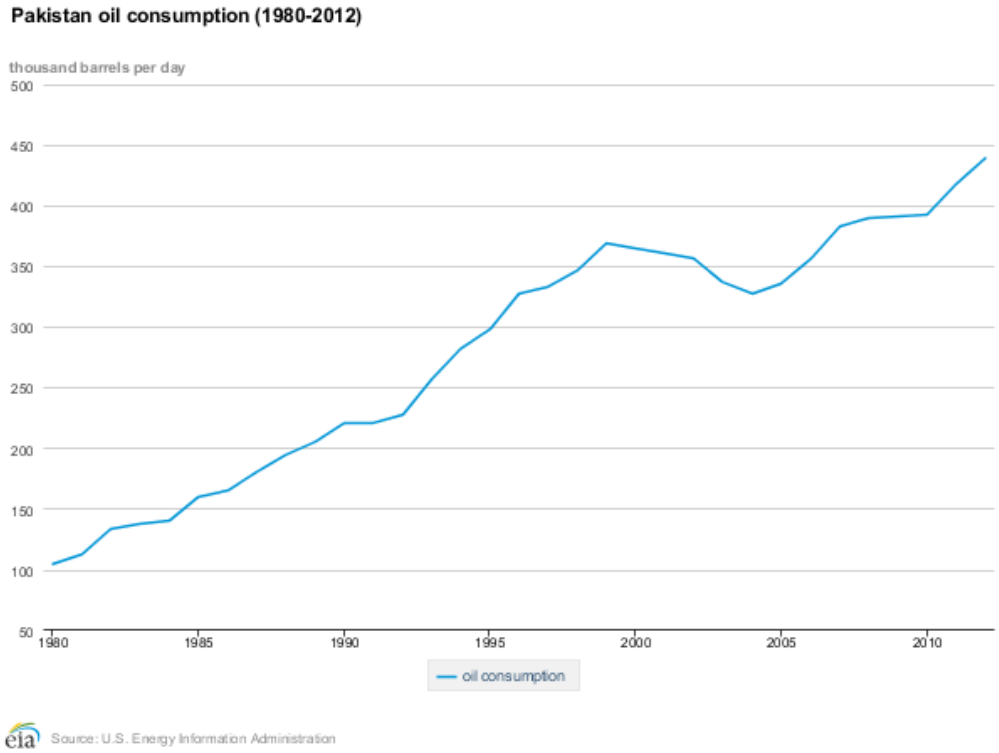


Electricity net consumption has increased from 47 billion kilowatthours (KWh) in 2000 to 74 billion KWh in 2010. According to the latest World Bank estimates, Pakistan had an electrification rate of 67 percent in 2010.

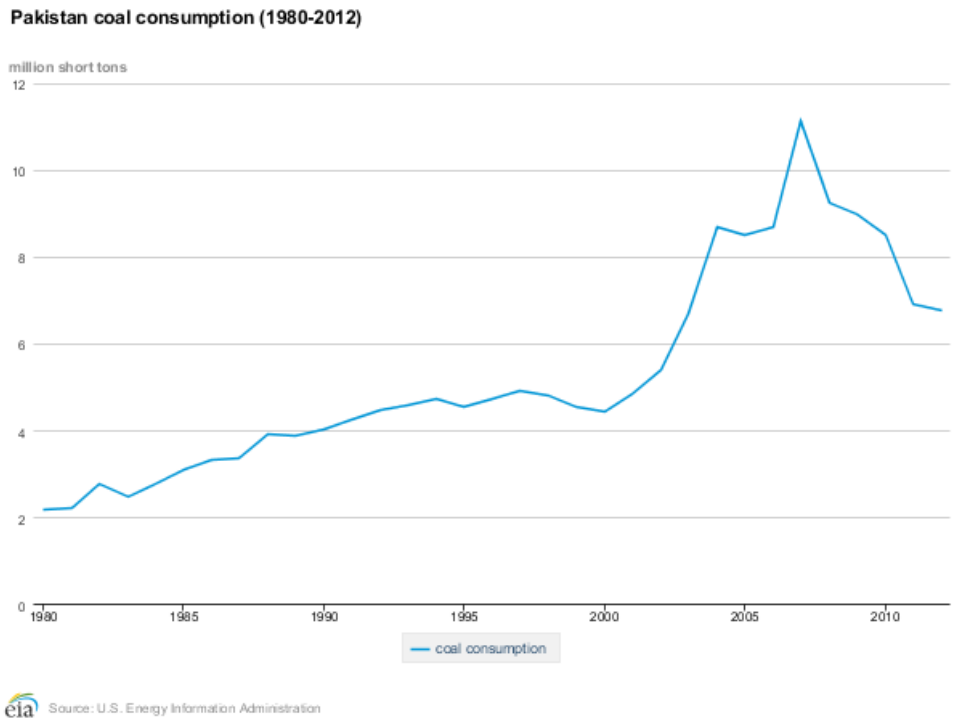


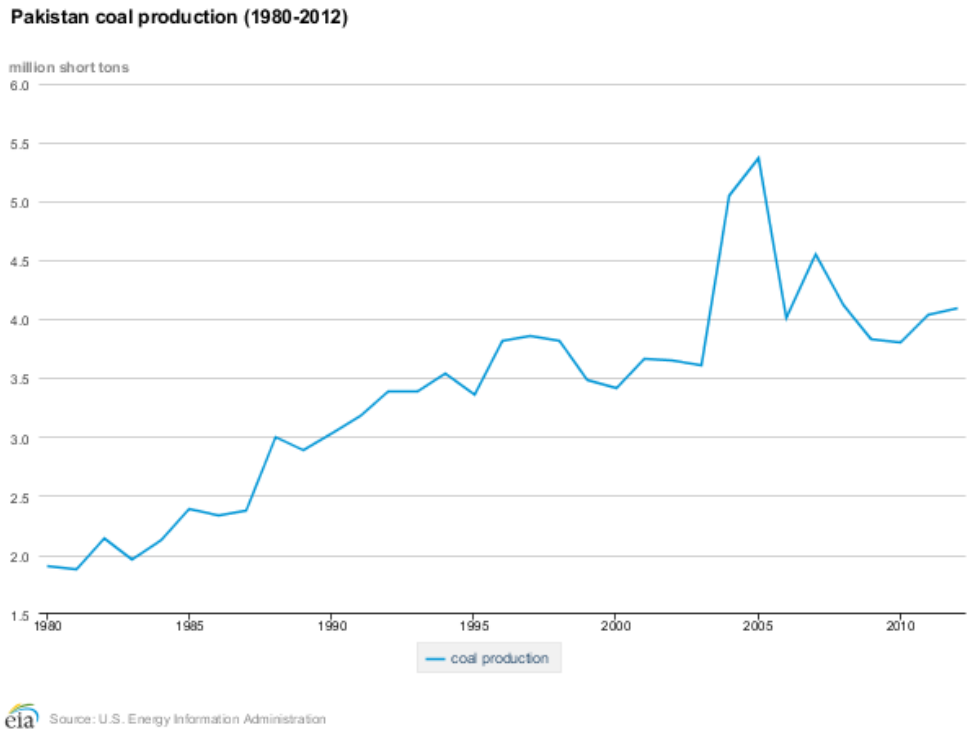
Pakistan is a net importer of crude oil and refined products. Oil production in Pakistan has fluctuated between 55,000 to 70,000 barrels per day (bbl/d) since the 1990s. The country produced 62,000 bbl/d of oil in 2012. Oil consumption has grown over time and averaged 440,000 bbl/d in 2012. Oil import dependency may rise to nearly 90 percent by 2035, if domestic oil production is maintained at a constant level.



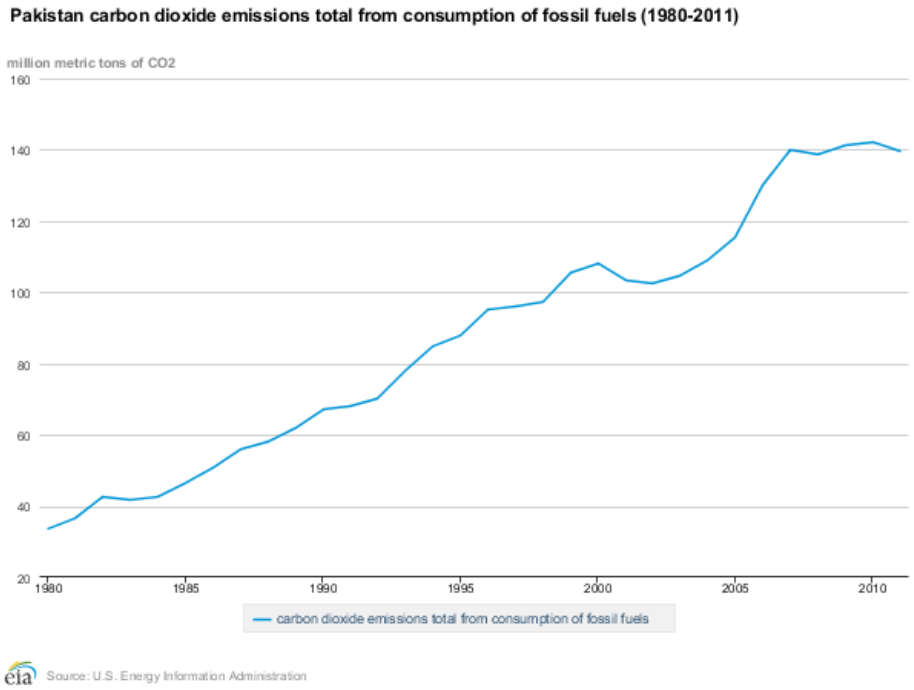


Coal import dependency will decline to 20 percent in 2035 from 67 percent in 2010. Coal production is projected to increase from the current 1.4Mtoe to 9.7Mtoe by 2035, with the expanded production from the Thar coalfield.





Carbon dioxide emissions from consumption of fossil fuels is increasing from last two decade in Pakistan due to inreasing demand in energy.



Pakistan is endowed with potential new and renewable sources such as wind, solar and biomass and their contributions will be important, as well, to diversify the energy sources. To secure energy supply and meet the energy demand in future, the importance of renewable energy becomes even more critical. A rich natural potential of renewable energy resource is already there, the question only lies how to actualize this in practice. Considering

geographical and climatic conditions, Pakistan is well placed for more renewable energy source like **Wind, Solar, Biomass**. Due to more favorable climatic conditions in Pakistan, solar PV possesses almost infinite potential to generate electricity in Pakistan. Wind energy also has a huge capacity to produce electricity in Pakistan. The other potential source of important energy is the Biomass energy.

These rich sources of electricity generation potentially available in the country need special attention and incentives from Government in order to comply with growing energy demands of the country. In this case, Turkey may be a good example for Pakistan to get its experience in this area. Because electricity sector is privatized and all the laws were passed about producing and selling electricity in Turkey. Thus, similar applications can be done wtih private and public sector together by taking economic and social conditions of Pakistan into consideration.

With continued energy demand growth in Pakistan, it will be increasingly difficult to meet demand with domestic sources. Pakistan is faced with constraints in domestic energy supply as well as the need for upgrades and replacement of obsolete energy supply infrastructure, including power plants and transmission and distribution systems.

It is important to note that demand-side efficiency improvements, mainly to reduce electricity demand, will greatly affect Pakistan's overall energy requirements and promote economic growth. As a policy implication, Pakistan government must consider energy efficiency and increasing the share of renewable energy sources (Solar, Wind, Biomass, Hydro…) as a priority items in its energy policy agenda.

4.1. Causes of Electricity Shortages in Pakistan

- Increase in cost of oil
- Number of dams and level of water in rivers
- Power theft (electricity theft)
- Incomplete projects
- Lack of energy conservation program
- Imprudent and reckless energy policies
- Weak grid infrastructure
- High transmission and distribution losses
- Mismanagement
- Corruption
- Growing energy demand and etc.

4.2. Suggestions to Overcome Energy Crisis in Pakistan

- Privatizing distribution is an especially important step.
- the role and share of private sector should be increased.
- There is a need for a strategy to launch a sustainable long-term national energy efficiency program and most importantly, design effective incentive mechanisms.
- Public's awareness of the importance and substantial social benefits of energy efficiency (saving) should be shared with society by using campaigns.
- Pakistan Energy Council should be constituted/created which should include people from public sector, private sector, professionals and academics.
- **Prepare SWOT analysis of energy**

  For policy makers to prepare energy strategy document and give correct decisions on enery policies, Pakistan authorities must prepare a SWOT analysis. It is necessary to see:

  -what we have? (current energy supply, Pakistan energy sources)

  -what we need? (energy demand)

-energy demand > energy supply= Energy deficit
-how and from where we get the difference?
-the cost of financing energy
-the effects of the sources on economy, society and environment.

- **Pakistan needs energy strategy plan**

- To overcome energy crisis, Pakistan needs to take the steps in form of:

-short term plan

-import electricity from your neighbours
-strict regulations by government, such as using smart electricity counters instead of mechanical one to reduce the electricit theft and etc.

-medium term plan

-developing and installing solar and wind projects in small places like villages.
-announce energy efficiency program and apply it.
-using energy saving devices (electrical applicances, lighting etc…)
-announce incentive programs for private sector who build renewable energy investment.

-long term plan

-installing coal based powerhouses
-build nuclear energy plant.
-increasing number of dams
-increasing efficient natural gas stations.

5. Conclusion and Policy Implications

The purpose of this paper is to explore the importance of energy efficiency and renewable energy sources and their roles on reducing energy dependency and promoting energy security. Energy efficiency helps address the "Energy Trilemma" i.e. energy security, environmental sustainability and energy equity. Therefore, improving energy efficiency and using more renewable energy sources will allow energy savings and reduction in the environmental impacts of energy production and use to be achieved, and reduce the energy dependency of that country. Thus, to achieve sustainable development, energy dependent countries must pay attention to energy security and environment, energy efficiency, and renewable energy sources issues for not facing with energy shortages, negative effects on economic growth and climate changes.

As mentined before, both Pakistan and Turkey are energy importing (energy dependent) countries. Turkey is both natural gas and oil importing country while Pakistan is oil importing country. Thus, any problem in energy supply will directly effect the economic growth of these countries.

In this case, the importance of energy efficiency and renewable energy sources become more critical for these countries. Renewable energy sources and energy efficiency should be supported for the following reasons:

-for energy supply security and diversification of energy sources,
-reducing dependence on energy imports,
-to fight against climate change, reducing carbon dioxide emissions, creation of new jobs, contributing to local and regional development (contributing to economic and social cohesion).

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