

World Energy Scenario – Current and Future Status: An Overview

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Abstract:

In this paper, the current global energy consumption is presented and the issue of security of electrical energy supply is discussed. The power sector has been looked from variety of aspects such as, demand and supply gap, diminishing energy sources, energy security, and increasing energy costs. Furthermore, the status of energy and potential of renewable sources of energy has been discussed as sustainable alternative. Energy demand is increasing globally and in consequence greenhouse gas (GHG) emissions from this sector are on the rise as well. Nonrenewable energy generation and consumption is one of the most important sources of CO₂ emissions, which cause climate changes. Solutions in this area go hand in hand with the worldwide deployment of policies that look forward a better management and usage of energy in both domestic and industrial scopes. Energy source like natural gas, oil, coal, nuclear, hydro and other renewable sources consumption growths till 2040 are also discussed to investigate the alternative energy system for integrating renewable energies. This vast potential of renewable sources of energy could be utilized to overcome the energy shortage which has not been utilized properly due to lack of policies and infrastructure. The diversification of existing energy resources and exploration of new sources is an important aspect to be considered in order to have a sustainable power development and its implementation in the countries.

Introduction:

Defined as the ability to do work, Energy is one of the major inputs for the economic development of any country. The consumption of energy is increasing at fast pace while available resources limited. Global need for energy is increasing on an average by about 1.5% every year. Out of total amount of primary energy, around 80% comes from fossil fuels. The current consumption of fossil fuels, particularly oil, is not sustainable in long term. Energy consumption has a significant impact on our natural environment. This is clear evidence that climate change is caused by human activity, mostly related to the use of energy. Developing renewable energy is its inevitable choice for sustainable economic growth. Renewable energy has been categorized as traditional and new. The former includes large hydropower, biomass burnt directly etc; the latter includes small hydropower, solar energy, wind energy, biomass energy, and geothermal energy etc.

Classification of Energy

- Primary Energy & Secondary Energy.
- Commercial & Non Commercial Energy

1. Primary Energy & Secondary Energy

Primary energy refers to all type of energy extracted or captured directly from natural resources.

It is further sub divided into two groups.

Renewable (Solar, Wind, Geothermal, Tidal, Biomass)

Obtained from natural sources, which are in exhaustible, e.g: Solar, wind power, geothermal, tidal power & hydro electric power – No pollutant in this case.

Non-Renewable (Fossil Fuels, Crude oil, Coal, Natural Gas, Nuclear Etc.)

Natural resources such as coal, oil & natural gas are example of non-renewable energy.

b. Secondary Energy

Primary Energy sources are mostly converted in industrial utilities into secondary energy sources e.g. Coal, oil or gas converts to steam & electricity.

2. Commercial & Non Commercial Energy

a. Commercial: Energy available in market e.g., electricity, lignite, coal, oil, natural gas etc.

b. Non Commercial

Fuels such as firewood, cattle dung, and agricultural waste;

Primary Energy Resources and Current Scenario

Coal

World wide-826 billion tones of proven coal reserves. The coal reserves will lost in 122 years the current rate of production.

Coal reserve

1. USA-29%
2. Russia -19%
3. China – 14%
4. Australia -9%
5. India-7%
6. Rest part of world-22%

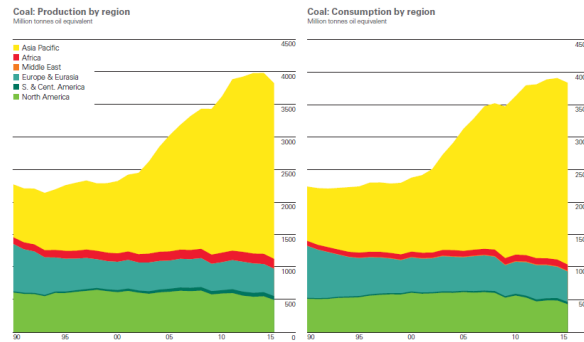


Fig: Coal Production and Consumption by Region (2015)

Oil

Oil worldwide (Conventional Crude oil reserve-1258 Billion barrels.)

60% of the oil reserves are in Middle East, 21% in Saudi Arabia. At current R/P ratio, world oil reserve is estimated at just 42 years. India oil reserve 5.8 billion barrels (800 million tons).

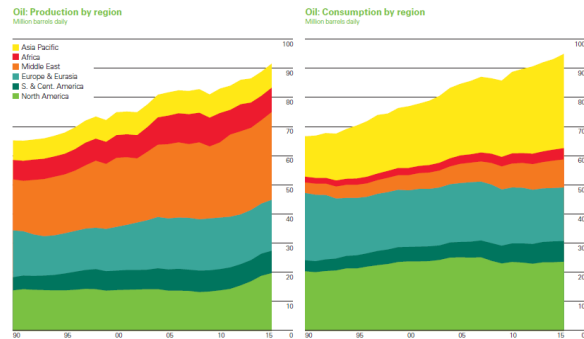


Fig: Oil Production and Consumption by Region (2015)

Natural Gas

Natural gas is a gaseous fossil fuel consisting primarily of methane. Global proven gas reserve is estimated to be 185 trillion cubic meters. The reserves are estimated for 60 years worldwide.

- | | |
|--------------|--------------------|
| Russia – 23% | Saudi Arabia% --4% |
| Iran – 16% | UAE-4% |
| Qatar-14% | Rest of World-35% |

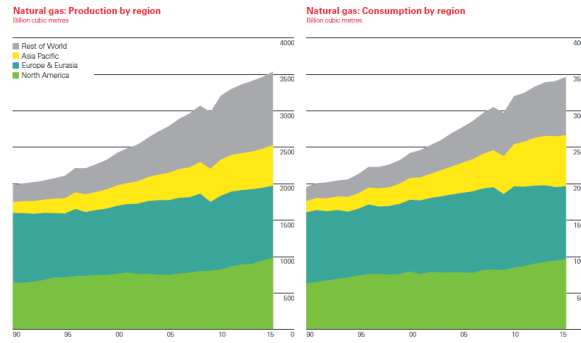


Fig: Natural Gas Production and Consumption by Region (2015)

Nuclear Energy: Nuclear technology uses the energy released by splitting the atoms of certain elements. Today, the world produces as much electricity from nuclear energy as it did from all sources combined in the early years of nuclear power. Civil nuclear power can now boast 17,000 reactor years of experience and supplies almost 11.5% of global electricity needs, from reactors in 31 countries. In fact, through regional transmission grids, many more than those countries depend on nuclear-generated power. Now 31 countries host some 447 commercial nuclear power reactors with a total installed capacity of over 390,000 MWe. The power from nuclear plants is dispatchable on demand, it can be fairly quickly ramped-up, it contributes to clean air and low-CO₂ objectives, it gives good voltage support for grid stability. Reactors can be made to load-follow. These attributes are mostly not monetized in merchant markets, but have great value which is increasingly recognized where dependence on relatively unpredictable intermittent sources has grown.

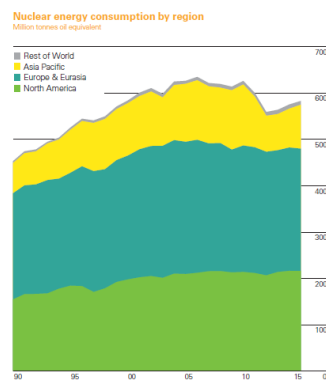


Fig: Nuclear Energy Consumption by Region(2015)

Hydroelectricity: Flowing water creates energy that can be captured and turned into electricity. This is called hydroelectric power or hydropower. The most common type of hydroelectric power plant uses a dam on a river to store water in a reservoir. Water released from the reservoir flows through a turbine, spinning it, which in turn activates a generator to produce electricity. But hydroelectric power doesn't necessarily require a large dam. Some hydroelectric power plants just use a small canal to channel the river water through a turbine. Another type of hydroelectric power plant - called a pumped storage plant - can even store power. The power is sent from a power grid into the electric generators. The generators then spin the turbines backward, which causes the turbines to pump water from a river or lower reservoir to an upper reservoir, where the power is stored. Hydropower is the leading renewable source for electricity generation globally, supplying 71% of all renewable electricity. Reaching 1,064 GW of installed capacity in 2016, it generated 16.4% of the world's electricity from all sources. At the end of 2015, the leading hydropower generating countries were China, the US, Brazil, Canada, India and Russia.

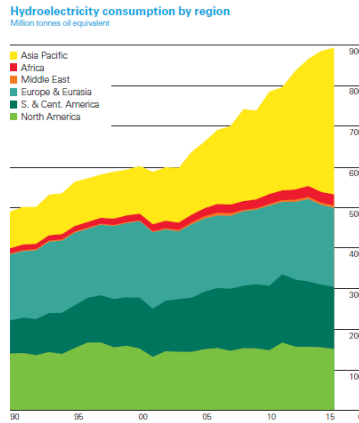


Fig: Hydroelectricity Consumption by Region(2015)

Total global energy consumption is given in the following figure.

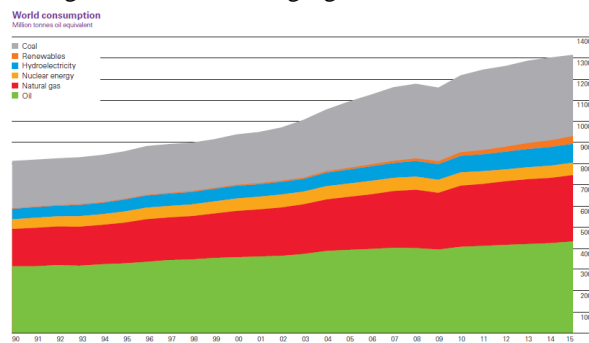


Fig: World Energy Consumption by Fuel Type

Current Scenario of Bangladesh: Total installed capacity of the power system of Bangladesh is as on 1st October, 2016 is 12160 MW. 7322 MW(60.2%) belongs to public sector and 4838 MW (39.8%) belongs to private sector. The maximum demand served on a single day is 9036 MW on 30th June, 2016. The sources of energy for the electricity generation are natural gas, coal, fuel oil, high speed diesel (HSD) and hydro power. Energy scenario of Bangladesh in 2015 is shown in following table.

Type	Production	Consumption
Oil		5.5 million tonnes
Natural Gas	24.1 Mtoe	24.1 Mtoe
Coal		0.8 Mtoe
Hydroelectricity		0.2 Mtoe
Renewable Energy		0.1 Mtoe

Table: Energy Scenario of Bangladesh (2015)

The scenario of electricity generation by fuel type is shown in following figure.

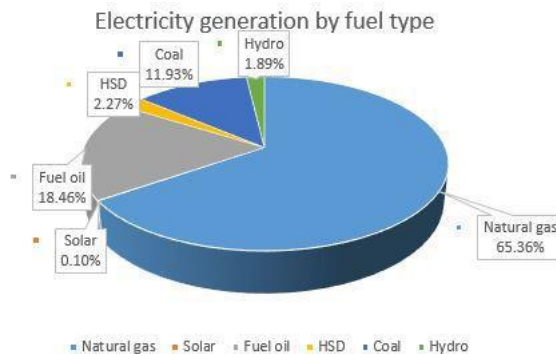


Fig: Electricity Generation by Fuel Type in Bangladesh(2016)

Future Alternatives:

Among renewable energy sources, hydro will be developed mainly in China, India and Brazil. However, due to a moderate growth in hydro power generation that will fail to increase as fast as total generation, its share of the power generation mix will decrease by 3 points. Wind and solar power generation will post a rapid increase of 3.6-fold from 1005 TWh in 2014 to 3573 TWh in 2040. accounting for 9% of total power generation. Power generation capacity will expand 3.2-fold from the present level to 1170 GW for wind and 4.9-fold to 857 GW for solar PV. Wind and solar PV will thus capture 21% of total power generation.

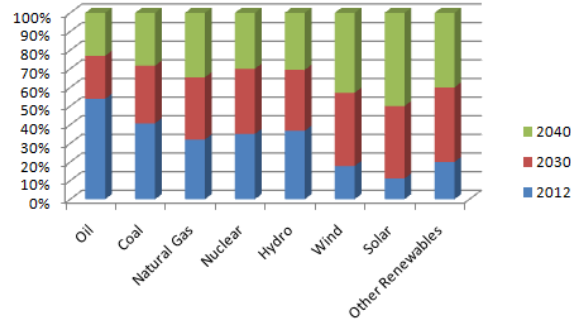


Fig: Global Power Generation Capacity Mix

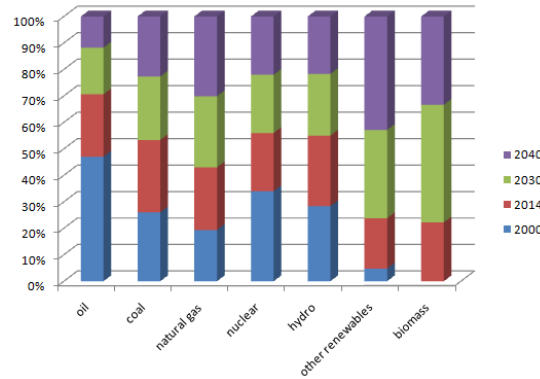


Fig: Global Power Generation Mix

Oil consumption in 2040 will expand huge from 2016. Oil production in different regions will also increase specially in middle east which is considered to be the greatest supplier of oil throughout the world. Oil will remain the most important energy source for the world. Crude oil production is shown in following figure.

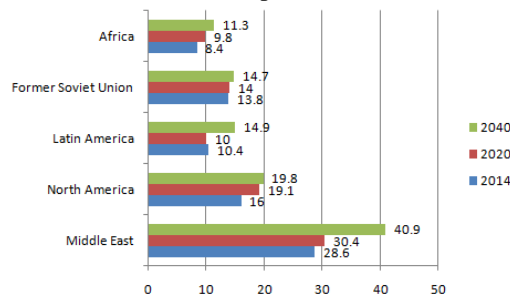


Fig:Crude Oil Production by Regions(Mb/d)

Natural gas consumption will double by 2040 of which majority will be used for power generation. Natural gas production is shown in following figure.

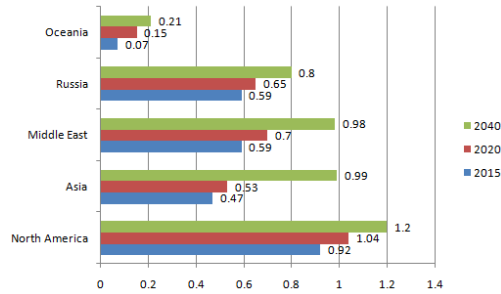


Fig: Natural Gas Production by Regions(Tcm)

Bangladesh is a highly polluted country with air quality index of 151 which is considered unhealthy. Fossil fuel power plants are one of the major contributors of pollution. In addition to low greenhouse gas emissions, nuclear power does not emit any noxious gases that create air pollutants like nitrogen oxides(NOx), sulphur dioxide(SO₂) that cause harm to human health and are responsible for poor urban air quality and regional acidification. A comparison among different energy sources indicates that introduction of nuclear power will facilitate to optimize energy mix and establish a power system portfolio by fuel diversification. Nuclear power is competitive due to its low generation cost but the capital cost is very high. Cost of electricity generation involves both internal cost such as cost of building a plant, fuel cost, operating and maintenance cost and external cost such as cost related to health, environment and security. From fig-8 it is acknowledged that nuclear based power generation has the lowest cost. Moreover nuclear is less sensitive in fluctuation to fuel price than gas, coal and any other fuels. Though there are some concern over the safety of the plants in Bangladesh like as the unsuitability of the site, nuclear waste disposal, high population density, natural calamity like earthquake etc. it is preferable than any kind of renewable energy source in Bangladesh as it will not be effective for this region.

Conclusion: Energy is the prime mover of one country's economy. The world's energy sector heavily depends on fossil fuels in terms of primary as well as secondary energy sources. The world's power infrastructure needs to be modified and reorganized. This situation indicates that current indigenous energy sources cannot meet the increasing energy demands and the solution of this problem lies in the energy conservation, energy efficiency and utilization of renewable energy sources. Various forms of renewable energy sources are being utilized in the developed countries to reduce their dependence on fossil fuels and cease greenhouse gas emissions. As greenhouse gas emission from fossil fuels are high, renewable energy sources are needed not only to reduce pollution but also to meet the expanding demand in near future. To make renewable energy sources efficient necessary steps should be taken otherwise it will not be cost effective and cannot be considered as future alternative.

Bangladesh is a highly populated country so space available for power generation by renewable energy source is very much less than required. So under the consideration of economic, space and pollution, nuclear power generation can solve the problem of the shortage of electricity and thus will provide the key to the ultimate development.

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