

Secondary Research Article

# Global Energy Consumption Pattern and GDP

Khandakar Akhter Hossain

E-mail: [akhter.engineer@yahoo.com](mailto:akhter.engineer@yahoo.com)

## Abstract

In 2020, world population will grow to 8 billion, the global economy will approach US\$ 80 trillion, and the wireless Internet will be connecting almost half of humanity. In this article there will be discussion on source of energy and Global annual Energy Consumption pattern in respect of annual GDP (up to the Year of 2030). Energy is broadly classified into two main groups: renewable and Non-renewable. Renewable energy is available in plenty and by far most the cleanest sources of energy available on this planet. Non-renewable sources are not environmental friendly and can have serious affect on our health. In this article it has proved that, GDP and Energy Consumption of developing countries are increasing exponentially. Whereas GDP and Energy Consumption of developed countries are increasing linearly. **Copyright © IJRETR, all right reserved.**

**Keywords:** GDP, Energy Consumption, Renewable energy, developing country, trend analysis

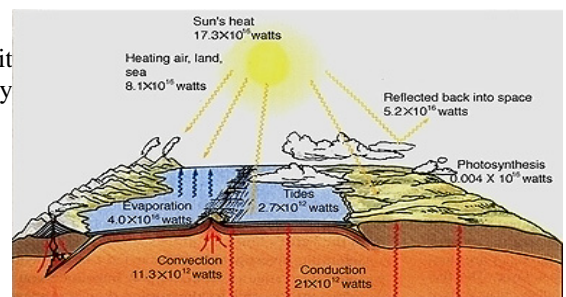
## Introduction

1. Without energy, life does not exist. Now we are living in a society where technology dominates every aspect of life and energy dictate entire technology. In 2020, world population will grow to 8 billion people, the global economy will approach \$80 trillion, and the wireless Internet will be connecting almost half of humanity. Synergies among nanotechnology, biotechnology, information technology, and cognitive science will have dramatically improved the human condition by increasing the availability of energy, food, and water and by connecting people and information anywhere, anytime. The acceleration of technological development will opened the door to continuous and rapid worldwide economic growth and will in fact allowed the world to achieve energy sustainability using many different energy sources mainly renewable energy. However in this article there will be discussion on source of energy and Global annual Energy Consumption pattern in respect of annual GDP in the next twenty years.

## Sources of Energy

2. All forms of life extract energy from the environment and convert it to forms which can be used. Our environment has three primary energy sources.

- a. Solar energy



- o radiant energy
- o  $17.3 \times 10^{16}$  watts
- b. energy the Earth's interior
  - o geothermal energy
  - o  $32.3 \times 10^{12}$  watts
- c. planetary energy
  - o energy of gravitational attraction
  - o tides
  - o  $2.7 \times 10^{12}$  watts

Energy is broadly classified into two main groups: renewable and Non-renewable.

## Renewable Energy

3. Renewable energy is energy which is generated from natural sources i.e. sunlight, wind, rain, tides, geothermal heat and can be generated again and again as and when required. They are renewable because they are naturally replenished at a constant rate. Renewable energy is available in plenty and by far most the cleanest sources of energy available on this planet. About 16% of global final energy consumption comes from renewables, with 10% coming from traditional biomass, which is mainly used for heating, and 3.4% from hydroelectricity. New renewables (small hydro, modern biomass, wind, solar, geothermal, and biofuels) accounted for another 3% and are growing very rapidly. Here are some of the advantages and challenges of using renewable sources of energy.

### Advantages

- a. The sun, wind, geothermal, ocean energy are available in the abundant quantity and free to use.
- b. The non-renewable sources of energy that we are using are limited and are bound to expire one day.
- c. Renewable sources have low carbon emissions, therefore they are considered as green and environment friendly.
- d. Renewable helps in stimulating the economy and creating job opportunities. The money that is used to build these plants can provide jobs to thousands to millions of people.
- e. We don't have to rely on any third country for the supply of renewable sources as in case of non-renewable sources.
- f. Renewable sources can cost less than consuming the local electrical supply. In the long run, the prices of electricity are expected to soar since they are based on the prices of crude oil, so renewable sources can cut your electricity bills.
- g. Various tax incentives in the form of tax waivers, credit deductions are available for individuals and businesses who want to go green.
- h. Solar energy is renewable, non-polluting and relatively maintenance free.
- i. Wave and tide is a non-polluting source of energy. Wave turbines are relatively quiet to operate and do not affect wildlife.

### Challenges

- a. It is not easy to set up a plant as the initial costs are quite steep.
- b. Solar energy can be used during the day time and not during night or rainy season.
- c. Geothermal energy which can be used to generate electricity has side effects too. It can bring toxic chemicals beneath the earth surface onto the top and can create environmental changes.
- d. Hydroelectric provide pure form of energy but building dams across the river which is quite expensive can affect natural flow and affect wildlife.
- e. To use wind energy, we have to rely on strong winds therefore we need to choose suitable site to operate them.
- f. There is less available solar energy in areas near the poles of the Earth. Cloud cover can reduce efficiency. PV cells are still quite expensive.

- g. The wave and tide turbines can be unsightly. Wave heights vary considerably, so they would not produce a constant supply of energy.

### Non-Renewable Energy

4. Non-Renewable energy is energy which is taken from the sources that are available on the earth in limited quantity and will vanish fifty-sixty years from now. Non-renewable sources are not environmental friendly and can have serious affect on our health. They are called non-renewable because they cannot be re-generated within a short span of time. Non-renewable sources exist in the form of fossil fuels, natural gas, oil and coal. Here are some of the advantages and challenges of using non-renewable sources of energy:-

#### Advantages

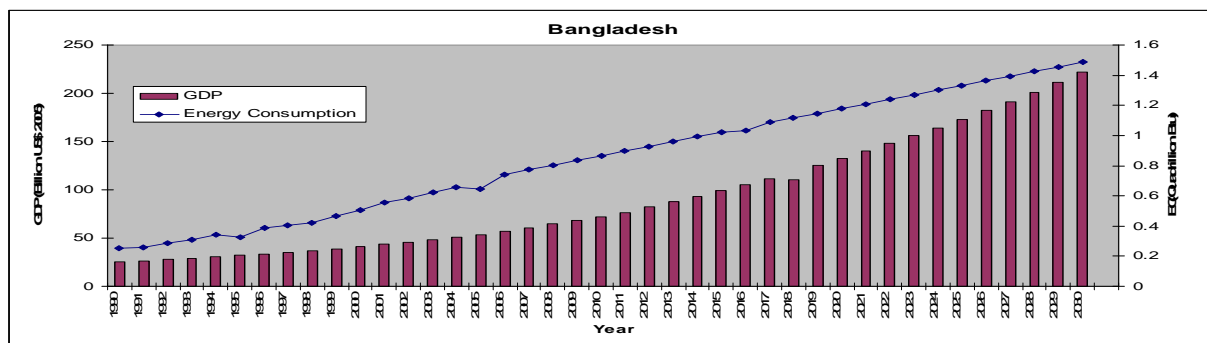
- a. Non-renewable sources are cheap and easy to use. We can easily fill up our car tank and power our motor vehicle.
- b. We can use small amount of nuclear energy to produce large amount of power.
- c. Non-renewable have little or no competition at all. For eg: if we are driving a battery driven car our battery gets discharged then we won't be able to charge it in the middle if the road rather it is easy to find a gas pumping station.
- d. They are considered as cheap when converting from one type of energy to another.

#### Challenges

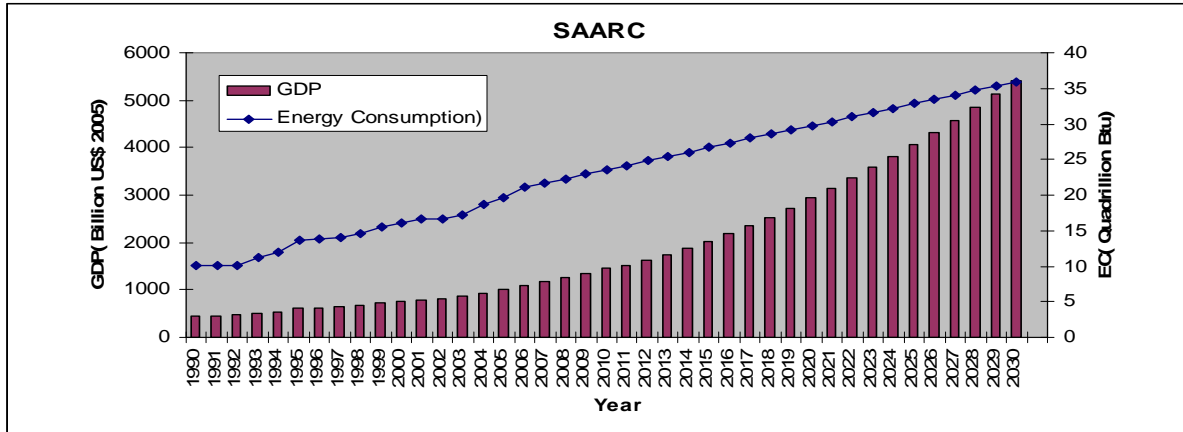
- a. Non-renewable sources will expire some day and we have to use our endangered resources to create more non-renewable sources of energy.
- b. The speed at which such resources are being utilized can have serious environmental changes.
- c. Non-renewable sources release toxic gases in the air when burnt which are the major cause for global warming.
- d. Since these sources are going to expire soon, prices of these sources are soaring day by day.

### Method of Estimation of Global Energy Consumption up to the Year of 2030

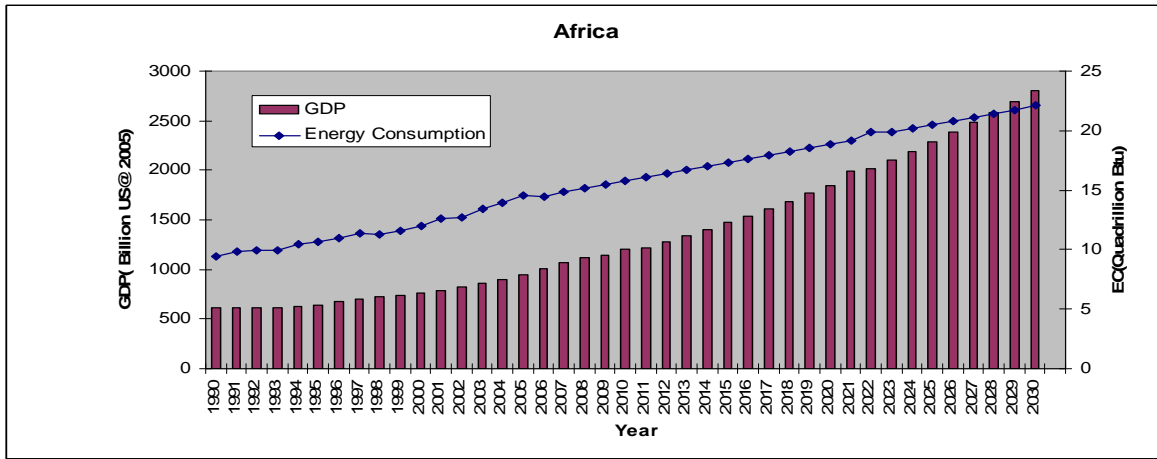
5. Global region-wise data for annual GDP and Energy Consumption has been collected from available sources and web sites (World Bank, IMF, etc). All the available data was found up to the year of 2006. On the basis of previous recorded GDP (from 1990 to 2006) future annual GDP has been calculated up to the year of 2030. Based on that projected GDP (from 2006-2030), future Energy Consumption has been calculated up to the year of 2030. From the trend (1990-2006) of Energy Consumption, average Energy Consumption has been calculated. And found a constant Energy Consumption (EC) values. This constant value is added with the previous successive years EC to get next year Energy Consumption (EC) up to the year of 2030. So, annual GDP and Energy Consumption up to 2030 have been estimated on the basis of collected data and trend analysis.



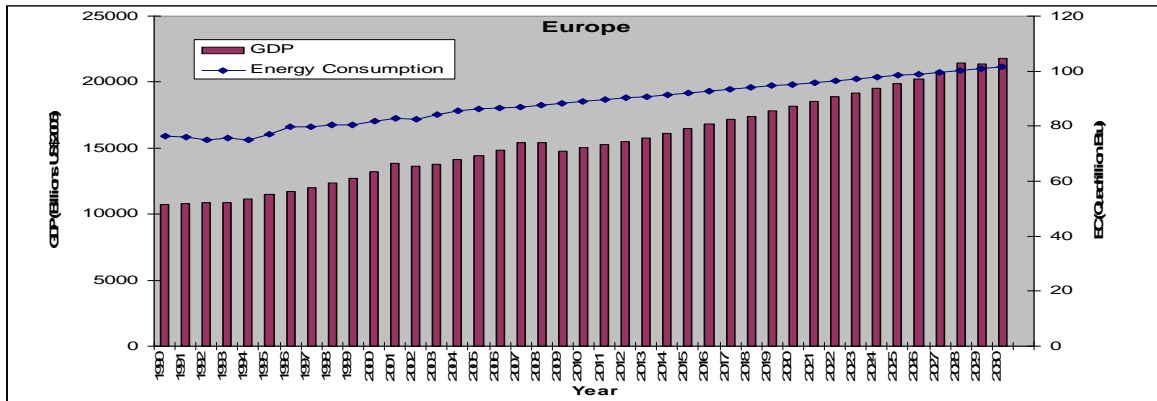
**Figure 1:** Trend of average increment of GDP and Energy Consumption in Bangladesh



**Figure 2:** Trend of average increment of GDP and Energy Consumption in SAARC



**Figure 3:** Trend of average increment of GDP and Energy Consumption in Africa



**Figure 4:** Trend of average increment of GDP and Energy Consumption in Europe

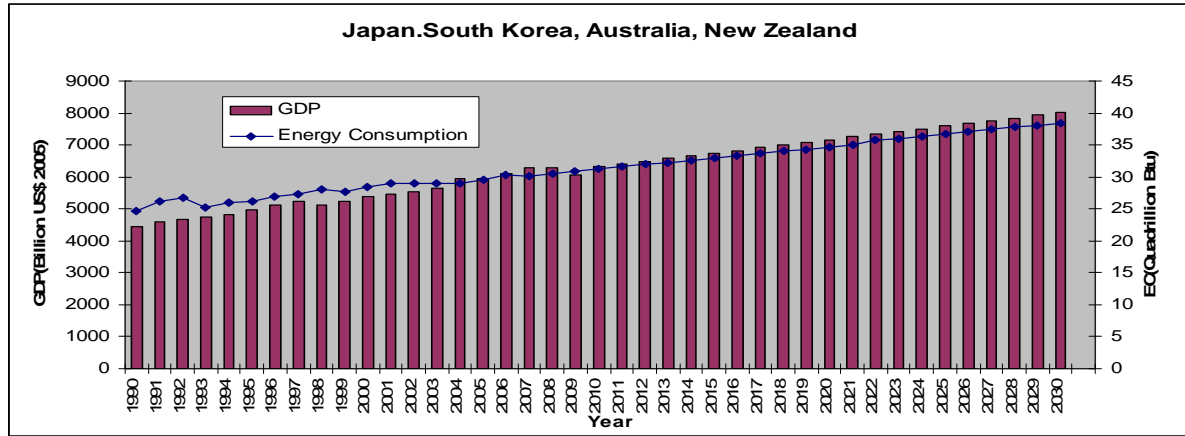


Figure 5: Trend of average increment of GDP and Energy Consumption in Japan, South Korea, Australia & New Zealand

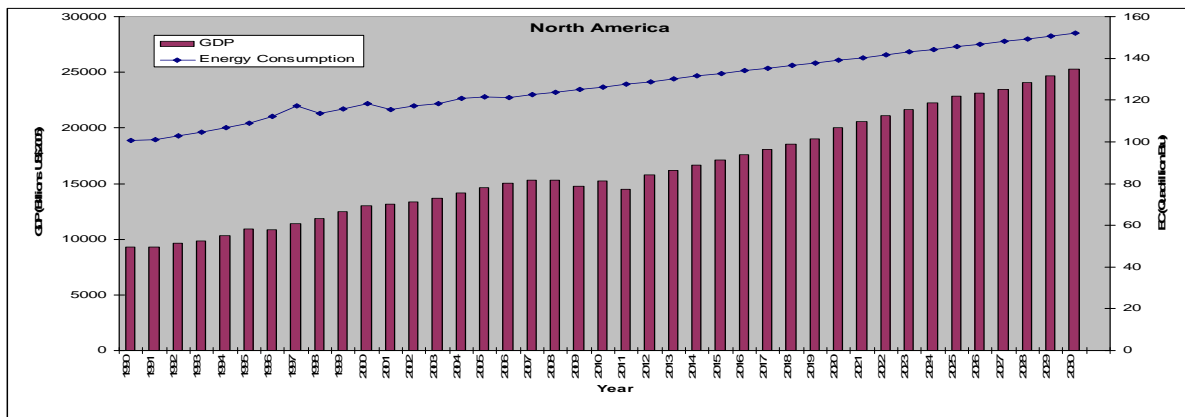


Figure 6: Trend of average increment of GDP and Energy Consumption in North America

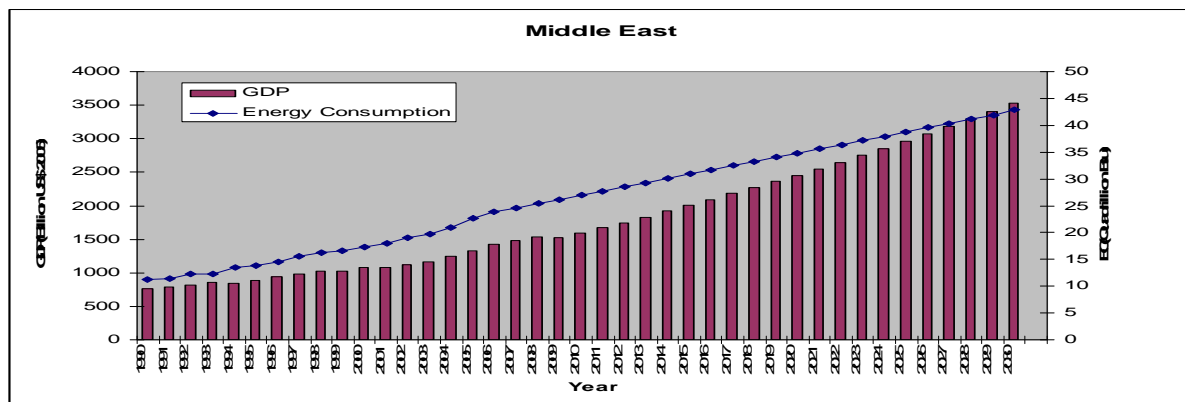


Figure 7: Trend of average increment of GDP and Energy Consumption in Middle East

### Finding of Analysis

6. Analysis and finding of trend of average increment of GDP and energy consumption of world has been summarized below.

- a. Trend of average increment of GDP and Energy Consumption in Bangladesh has been shown in figure 1. Annual GDP and Energy Consumption of Bangladesh is increasing exponentially.
- b. Trend of average increment of GDP and Energy Consumption in SAARC has been shown in figure 2. Annual GDP and Energy Consumption of SAARC is increasing exponentially.
- c. Trend of average increment of GDP and Energy Consumption in African region has been shown in figure 3. Annual GDP and Energy Consumption of African region is increasing exponentially.
- d. Trend of average increment of GDP and Energy Consumption in Europe region has been shown in figure 4. Energy Consumption of European region is increasing linearly.
- e. Trend of average increment of GDP and Energy Consumption in Middle East region has been shown in figure 7. Annual GDP and Energy Consumption of Middle East region are increasing exponentially.
- f. Trend of average increment of GDP and Energy Consumption in North American region has been shown in figure 6. GDP and Energy Consumption of North American region is increasing linearly.
- g. Trend of average increment of GDP and Energy Consumption in Japan, South Korea, New-Zealand and Australian region has been shown in figure 5. Energy Consumption of Japan, South Korea, New-Zealand and Australian region is increasing linearly.
- h. Energy Consumption of Asia or Africa or SAARC is increasing exponentially. So Energy Consumption of developing countries is increasing exponentially. Whereas Energy Consumption of North America or Japan or Australian region is increasing linearly. So Energy Consumption of developed countries is increasing linearly.

## **Economic Growth and Energy**

7. Due to the accelerated growth of many developing nations, led first by China and later by India, global economic growth has increased 4% annually on average during the first two decades of the 21st century. From 2000 to 2020, energy demand and supply have grown by 2% annually, which means a compounded growth of almost 50% during the last two decades. This indicates a very healthy expansion of the power sector and a sustained increase in energy efficiency. World economy is headed for more growth in the following years. Such growth will particularly benefit the poorer people still without any access to electricity, which has fallen from close to 2 billion in 2000 to just over 1 billion in 2020, and electricity might actually reach everybody in the planet by the year 2040. World GDP growth of 4%, due to continuous rise of China and now also India, is spreading to even poorer parts of the world. Additionally, energy intensity continued to decline, that is, the amount of energy required to produce a dollar (dinar, euro, pound, ruble, rupee, yen or yuan) of GDP. In other words, energy efficiency is increasing and less energy is needed to produce more, particularly now that so many nations are moving from industrial to post-industrial societies. Furthermore, poorer countries have been growing faster than richer countries and the economic stability is paving the road for continuous growth around the world. Fossil fuels still represent over 80% of total energy supplies today, in 2020, but the trend towards new energy sources is clear in the future. Coal production has basically remained stable between 2000 and 2020. China is still the largest producer and consumer of coal, but forecasts indicate a future decline in power plants, regardless of the existing huge coal reserves for almost two centuries. Now world is declining towards renewable and other energy sources.

## **Conclusion**

8. GDP and Energy Consumption of developing countries are increasing exponentially. Whereas GDP and Energy Consumption of developed countries are increasing linearly. However, the Earth, the Sun, the Galaxy and the Universe have more than enough energy resources to power our civilization for the following decades, centuries and millennia. With enough technology, it is basically a matter of costs and priorities. Converting the energy resources into available supplies can be done, but it will certainly take massive investments and lots of imagination, creativity, science and engineering. All resources are obviously finite, but some are almost potentially inexhaustible even with an accelerating

population and rapid technological consumption. Methane hydrate, hydrogen, helium, nuclear fusion, solar, mass-energy conversion and antimatter fuels are all eventually possible. Our civilization is still in its infancy, and barring any wild cards, geopolitical crisis, environmental disasters or extraterrestrial contacts, technology will keep pushing off the limits to growth.

## References

- [1] International Financial Statistics of the IMF
- [2] IHS Global Insight
- [3] Oxford Economic Forecasting
- [4] Estimated values developed by the Economic Research Service at 2005 base year
- [5] International Energy Annual 2006
- [6] Available online <http://www.ers.usda.gov/Data/Macroeconomics/Data/HistoricalRealGDPValues.xls>
- [7] Available online [http://ess.geology.ufl.edu/ess/Notes/020-Intro\\_ESS/Fig2.html](http://ess.geology.ufl.edu/ess/Notes/020-Intro_ESS/Fig2.html)
- [8] Available online <http://www.energyopportunities.tv/Editorial-Features/Global-business>
- [9] Available online [http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy)
- [10] Available online [www.scienceonline.co.uk/energy/renewable-energy](http://www.scienceonline.co.uk/energy/renewable-energy)
- [11] Available online <http://www.conserve-energy-future.com>
- [12] World Bank, World Development Indicators

## Author's Biography

**Dr. Khandakar Akhter Hossain** has twenty two years experience in shipbuilding, repair, re-cycling & energy field. He got commissioned in engineering branch on 01 January 1991. He did his B Sc and M Sc Engineering in naval architecture and marine engineering with distinct result from Bangladesh University of Engineering and Technology (BUET). He did his Ph D from USA. He also did MESC & ISMC from Pakistan and USA respectively. He did MDS from National University and MBA from Open University. He served as engineer officer onboard different ships and crafts such as PC, LPC, OPV & three Frigates (including modern missile Frigate BNS BANGABANDHU) and as instructor/teacher in Bangladesh Naval Academy, Marine Academy, MIST and Navy Engineering School. He also served as DGM (Shipbuilding) in Khulna Shipyard and as Staff Officer in UN Mission in Sudan. He also works in Naval Headquarters as Deputy Director in Naval Engineering Directorate. He has more than dozen of international publication/article on shipbuilding, ship re-cycling, energy and engineering technology in different technical journal.