
Energy Demand

ARNAB CHATTERJEE

Department of Construction Engineering
Jadavpur University
Salt Lake Campus, Kolkata
India

PRANTI K SAMANTA

Department of Construction Engineering
Jadavpur University
Salt Lake Campus, Kolkata
India

Abstract:

In the wake of modernization, energy consumption has become the yardstick for the measure of the development. Greater energy demand reflects the precocity of the nation associated. Thus we take a look at the energy demands in the various parts of the world. We also throw some light on the study of the energy demand of the United States of America, arguably the most developed nation in the modern world. There is a lot to learn from the U.S. when it comes to both energy generation as well as its apt utilization and more so for a nation like India, often called the dark horse in the current economy.

Key words: energy demand, modernization, energy consumption, development.

Energy Demand

Energy demand refers to the total energy requirement of all human civilizations. The energy as mentioned above involves all energy harnessed from every energy source we use. These

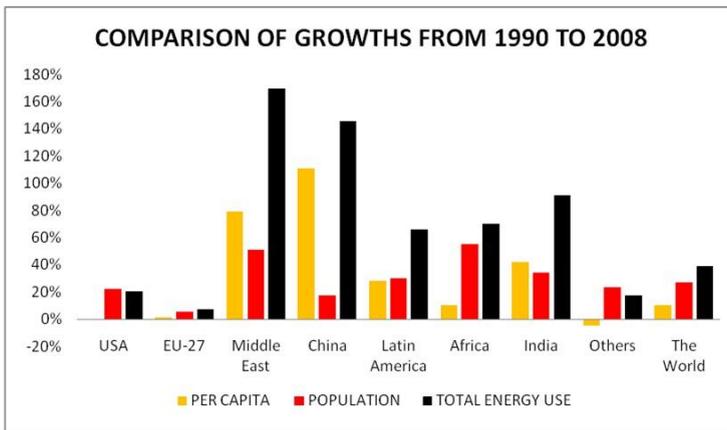
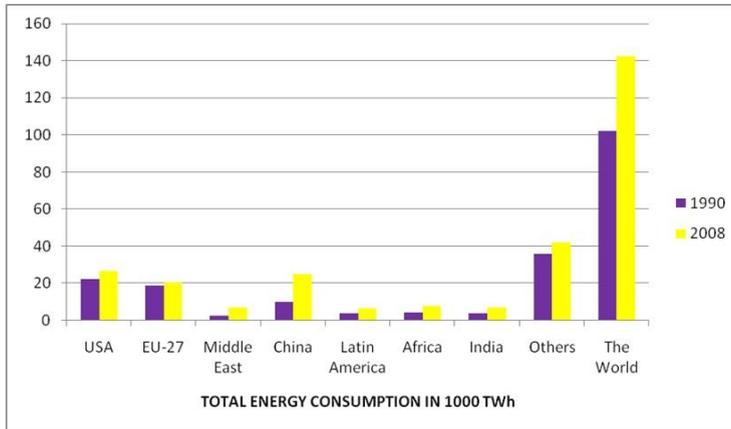
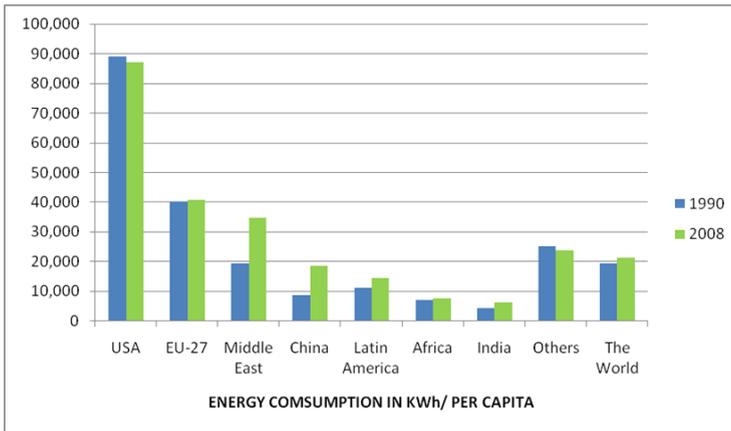
energy sources may be of the renewable type such as wind, nuclear, solar, hydroelectricity etc or of the non-renewable nature i.e. coal, petroleum, natural gas to name a few. Some of the sectors that consume a large fraction of the total energy production are industrial, residential, commercial, transportation. The energy consumption has deep implications for humanity's social-economic-political sphere. For instance, if we say that the energy demand of a particular country is comparatively high, it may indicate the technological advancement of the nation associated. But on the other hand if the majority of this energy demand is met by consumption of fossil fuels and other conventional sources of energy it presents a negative projection. Thus the study of energy consumption is a very important issue.

Regional energy use (kWh/capita & TWh) and growth 1990–2008 (%)									
	kWh/capita			Population (million)			Energy use (1,000 TWh)		
	1990	2008	Growth	1990	2008	Growth	1990	2008	Growth
USA	89,021	87,216	-2%	250	305	22%	22.3	26.6	20%
EU-27	40,240	40,821	1%	473	499	5%	19.0	20.4	7%
Middle East	19,422	34,774	79%	132	199	51%	2.6	6.9	170%
China	8,839	18,608	111%	1,141	1,333	17%	10.1	24.8	146%
Latin America	11,281	14,421	28%	355	462	30%	4.0	6.7	66%
Africa	7,094	7,792	10%	634	984	55%	4.5	7.7	70%
India	4,419	6,280	42%	850	1,140	34%	3.8	7.2	91%
Others	25,217	23,871	-5%	1,430	1,766	23%	36.1	42.2	17%
The World	19,422	21,283	10%	5,265	6,688	27%	102.3	142.3	39%

Source: IEA/OECD, Population OECD/World Bank

Energy use = kWh/capita* Mrd. capita (population) = 1000 TWh

Others: Mathematically calculated, includes e.g. countries in Asia and Australia. The use of energy varies between the "other countries": E.g. in Australia, Japan, or Canada energy is used more per capita than in Bangladesh or Burma.



The table and the graphs above show the regional energy use and their growths in past two decades around the world. For furthering our discussion we would take up the study of the energy demand of the United States, one of the leaders in energy consumption as well as production.

U.S. Energy Demand

The United States is the 2nd largest energy consumer in terms of total use in 2010. The U.S. ranks seventh in energy consumption per-capita after Canada and a number of small nations. Not included is the significant amount of energy used overseas in the production of retail and industrial goods consumed in the U.S.

The majority of this energy is derived from fossil fuels: in 2010, data showed 25% of the nation's energy came from petroleum, 22% from coal, and 22% from natural gas. Nuclear power supplied 8.4% and renewable energy supplied 8%, which was mainly from hydroelectric dams and Biomass but also included other renewable sources such as wind power, geothermal and solar energy. Energy consumption has increased at a faster rate than domestic energy production over the last fifty years in the U.S.(when they were roughly equal). This difference is now largely met through imports.

According to the Energy Information Administration's statistics, the per-capita energy consumption in the US has been somewhat consistent from the 1970s to today. The average has been 334 million British thermal units (BTUs) per person from 1980 to 2010. One explanation suggested for this is that the energy required to produce the increase in US consumption of manufactured equipment, cars, and other goods has been shifted to other countries producing and transporting those goods to the US with a corresponding shift of green house gases and pollution. In comparison, the world average has increased from 63.7 in 1980 to 75 million BTU's per person in 2008. On the other hand, US "off-shoring" of manufacturing is sometimes

exaggerated: US domestic manufacturing has grown by 50% since 1980.

Energy in the United States				
	Capita	Prim. energy	Production	Import
	Million	TWh	TWh	TWh
2004	294.0	27,050	19,085	8,310
2007	302.1	27,214	19,366	8,303
2008	304.5	26,560	19,841	7,379
2009	307.5	25,155	19,613	6,501
2010	310.1	25,776	20,056	6,205
2012	312.0	25,484	20,757	5,322
Change 2004-10	5.5 %	-4.7 %	5.1 %	-25.3 %

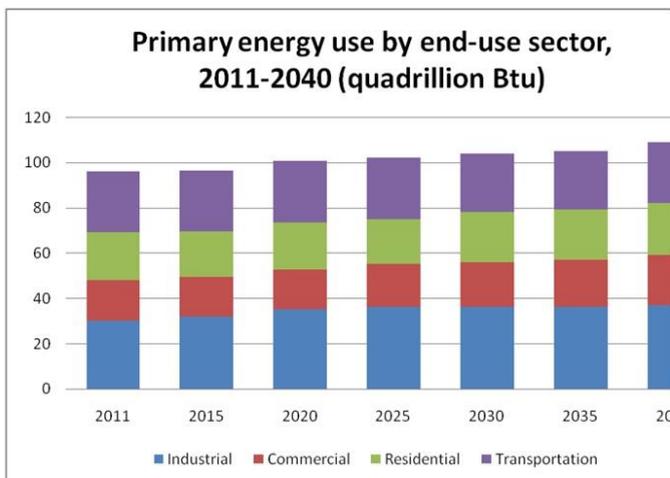
Consumption by Sector

The U.S. Department of Energy tracks national energy consumption in four broad sectors: industrial, transportation, residential, and commercial. The industrial sector has long been the country's largest energy user, currently representing about 33% of the total. Next in importance is the transportation sector, followed by the residential and commercial sectors.

Sector Summary		
Sector Name	Description	Major uses
Industrial	Facilities and equipment used for producing and processing goods.	22% chemical production 16% petroleum refining 14% metal smelting/refining
Transportation	Vehicles which transport people/goods on ground, air or water.	61% gasoline fuel 21% diesel fuel 12% aviation
Residential	Living quarters for private households.	32% space heating 13% water heating 12% lighting 11% air conditioning 8% refrigeration 5% electronics 5% wet-clean (mostly clothes dryers)
Commercial	Service-providing facilities and equipment (businesses, government, other institutions).	25% lighting 13% heating 11% cooling 6% refrigeration 6% water heating 6% ventilation 6% electronics

Total primary energy consumption, including fuels used for electricity generation, grows by 0.3 percent per year from 2011 to 2040, to 107.6 quadrillion Btu in 2040. The largest growth, 5.1 quadrillion Btu from 2011 to 2040, is in the industrial sector, attributable to increased use of natural gas in some industries (bulk chemicals, for example) as a result of an extended period of relatively low prices coinciding with rising shipments in those industries. The industrial sector was more severely affected than the other end-use sectors by the 2007-2009 economic downturn; the increase in industrial energy consumption from 2008 through 2040 is 3.9 quadrillion Btu.

The second-largest increase in total primary energy use, at 3.1 quadrillion Btu from 2011 to 2040, is in the commercial sector, which currently accounts for the smallest share of end-use energy demand. Even as standards for building shells and energy efficiency are being tightened in the commercial sector, the growth rate for commercial energy use, at 0.5 percent per year, is the highest among the end-use sectors, propelled by 1.0-percent average annual growth in commercial floor space.



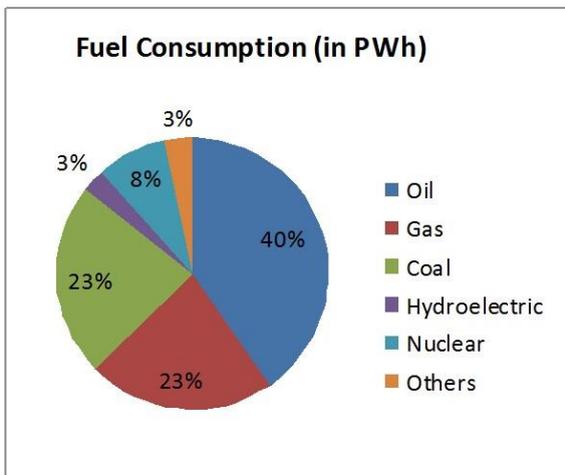
Primary energy use in the residential sector grows by 0.2 percent per year, or about 1.6 quadrillion Btu from 2011 to 2040, but it does not increase above the 2011 level until 2029.

Increased efficiency reduces energy use for space heating, lighting, and clothes washers.

In the transportation sector, light-duty vehicle (LDV) energy consumption declines as a result of the impact of fuel economy standards through 2025. Total transportation sector energy use is essentially flat from 2011 through 2040, increasing by about 140 trillion Btu.

Consumption by source

The breakdown of energy consumption by source is given here:



Fuel type	Consumption in 2006 (in PWh)
Oil	11.71
Gas	6.50
Coal	6.60
Hydroelectric	0.84
Nuclear	2.41
Others	0.95
Total	29.26

Scenario in India

Today, India is the fifth largest energy consumer in the world. While the world consumes 12000 million tons of oil equivalent (mtoe) of energy resources, India consumes 4.4% of the world total (524.2 mtoe). Global consumption of primary commercial energy (coal, oil & natural gas, nuclear and major hydro) has grown at a rate of 2.6% over the last decade.

Although India ranks high in terms of energy consumption, the per capita energy consumption (500 kgoe) is significantly lower than the global average (1800 kgoe), indicating significant growth potential of the energy demand in the country. According to the International Energy Agency estimates, India will need investments worth nearly US\$600 billion during the years 2011–2030, across various segments of its hydrocarbon chain, to increase its energy supply and improve the infrastructure to enable this. This provides ample opportunities for companies across the hydrocarbon value chain.

India has a potential to do big when it comes to most fields and holds true for proper energy management too. If money and hard work is invested in right areas then we are surely looking at a prosperous future for India.