



# Energy Production and Consumption in the World and in Iran with A Look at Future

Allahbakhsh Kavooosi

Associate Professor in faculty of Architecture from Razi University, Kermanshsh, Iran.

**Abstract:** *Important events of the world that are affected by the industrial revolution have caused greater need to energy. Development of the industry of responding to this need increased energy consumption and caused oil crises that affected fossil energy sources. Increased energy consumption, on the other hand, led to environmental crises. Statistics show an increase in demand and an increase in consumption and, consequently, an increase in the environmental crises on a global scale. Despite having huge fossil energy resources, Iran has been affected by these crises such that with the current technology of energy consumption, Iran has the highest energy intensity index. The results show that Iran and other countries of the world are faced with a crisis of energy production and consumption. The way to get out of the crisis is changing the pattern and technology of energy production and consumption and changing energy sources from fossil fuels to renewable sources in line with supporting existing fossil resources and protecting the environment.*

**Keywords:** *Energy, World, Iran, Crisis, Renewable*

## INTRODUCTION

Industrial Revolution was a source of enormous changes in the world, especially in the energy sector. Population increase affected by the positive impact of technology on health and longevity, the development of plants, and more need to labor caused migration from the countryside to the city and created a new style of life for urban and rural communities that its most important outcome is great need to energy and its various uses. What is more important in this regard is considering sources of energy supply. Use of available resources while leads to the running out of the resources, causes crisis in environmental dimensions. Now, different types of energy, status of resources, and developments resulting from their use, and their need are studied in the below.

### Different types of energy

In general, the world's energy resources are divided into two categories:

- A. Non-renewable energy sources: including fossil fuels (oil, gas and coal) and nuclear energy.
- B. Renewable energy sources: including solar, wind, hydropower, geothermal, biomass (biofuels) and tidal energies.

### World Energy Outlook

Predictions of global energy outlook in different time horizons (2035, 2040 and 2050) indicate that primary energy demand will increase and fossil fuels, including oil, natural gas and coal, despite the decline in their share of the global composition, will still have a dominant share in primary energy demand. According to some estimates, energy consumption will increase by more than 50 percent over the next 30 years and the majority of the growth belongs to non-member countries of the Organization

for Economic Cooperation and Development. On the supply side, the fastest growth belongs to natural gas and renewable energy (Manzour, Houshnezhad, 2014).

**Future of World Energy**

Iran’s world primary energy demand in 1990 was 8769 million tons of oil equivalent that had an increase of 49 percent by 2011 and reached 13070 million tons of oil equivalent. It is projected that primary energy demand will have an increase of annual growth of 1.2% and a sum of 33% by 2035 and will reach 17,387 million tons of oil equivalent by 2035 (Energy Balance Sheet of the year, 2014).

**Table 1.** Vision of initial energy demand of the world by source 4

Carrier type	1990	2011	2020	2025	2030	2035	Annual growth from 2011 to 2035
Coal	2230	3773	4202	4312	4379	4428	0.7
Oil	3231	4108	4470	4548	4602	4661	0.5
Gas	1668	2787	3273	3576	3846	4119	1.6
Nuclear energy	526	674	886	979	1053	1119	2.1
Hydroelectricity	184	300	392	430	467	501	2.2
Bioenergy	893	1300	1493	1604	1719	1847	1.5
Other Renewable energy	36	127	309	426	559	711	7.4
<b>Total</b>	<b>8769</b>	<b>13070</b>	<b>15025</b>	<b>15877</b>	<b>16623</b>	<b>17387</b>	<b>1.2</b>

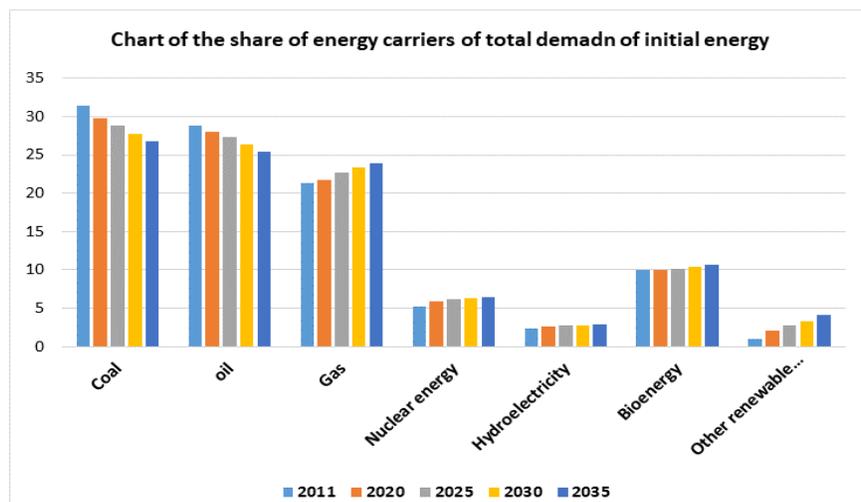
Based on the energy balance of 2013 and investigations of the share of energy in final consumption of world, it is shown that 40/7% of the total final consumption belongs to crude oil and oil products, 20/9% belongs to electricity and heating, 15/5% belongs to natural gas, 10.1% belongs to coal, and 12.8% belongs to renewable energy and biofuels and waste (Energy Balance Sheet of the year, 2014)

**Prediction of demand for the share of energy carriers in the future of the world**

The considerable point in the prediction of primary energy demand outlook in Figure (1) is the change of energy source. This source was coal in the past and then, it changed to oil; forecasts suggest replacement of gas instead of oil the reason of which is the protection of the environment and control with regard to reduction of pollutants and greenhouse gases.

**Prediction of demand of energy carrier share**

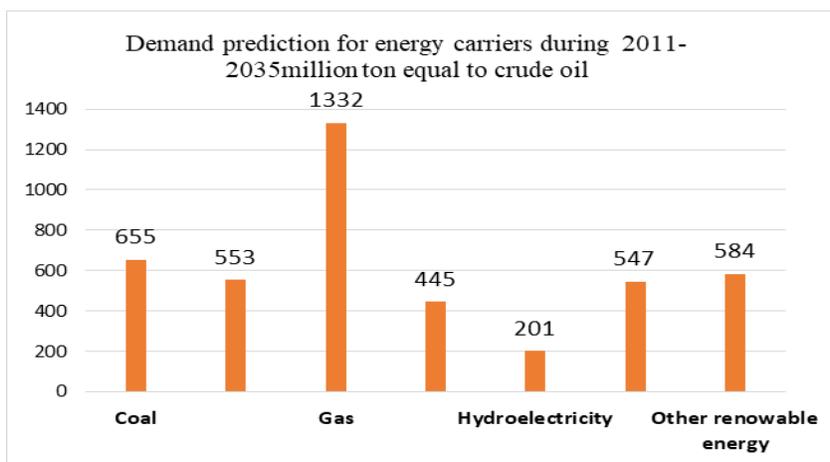
Energy Statistics indicate the occurrence of two important issues along with increased human need for energy in the world. The first issue is increase in demand for energy due to lack of resources and the second issue is increase in environmental pollution in the use of existing sources of energy.



**Figure 1.** The share of energy carrier in the total primary demand in 2011 and forecasts up to 2035 (drawn using reference (Global energy outlook, 2013))

### Renewable energies

According to data obtained from Figure (2) and by comparing the share of renewable energies with fossil fuels since 2011 to 2035, it is anticipated that the greatest demand belongs to natural gas by 1332 million tons (crude oil equivalent), coal with 655 million tons (crude oil equivalent), and crude oil with 553 million tons. Based on drawn figures, forecasts and demand for other renewable energy is impressive at a later stage in the years 2011 to 2035.



**Figure 2.** Anticipated demand for energy carriers (drawn using reference (Global energy outlook, 2013))

The above chart shows that based on the information, during 2011-2035, it is predicted that highest demand for natural gas with 1332-million-ton crude oil and coal with 655-million-ton crude oil and then crude oil with 553 million ton. In next stages, demand for renewable energies is considerable. Based on the above Tables and charts, we can say demand for initial energy by 2035 is increasing and fossil energy of oil and gas and coal have high share in initial energy demand. Based on the policies by developed countries as the majority of fossil fuels are consumed and to determine standards of vehicle fuel and increase of using biological fuels (plant), reduction of consumption growth of these types of energy are used. The share of fossil fuels of global demand of initial energy is reduced from 82% in 2011 to 76% in 2035 but it has dominant share.

Based on the above table, demand for primary energy will have ascending trend by 2035 and fossil fuels of coal, oil and natural gas have a dominant share in primary energy demand.

### The future of Iran's energy

Based on the energy balance of the whole country from 2005 to 2014 in Table (2), energy Consumption in Iran has had an ascending trend and the differences show a sharp drop in energy production to consumption that is due to the energy-hungry facilities and technology.

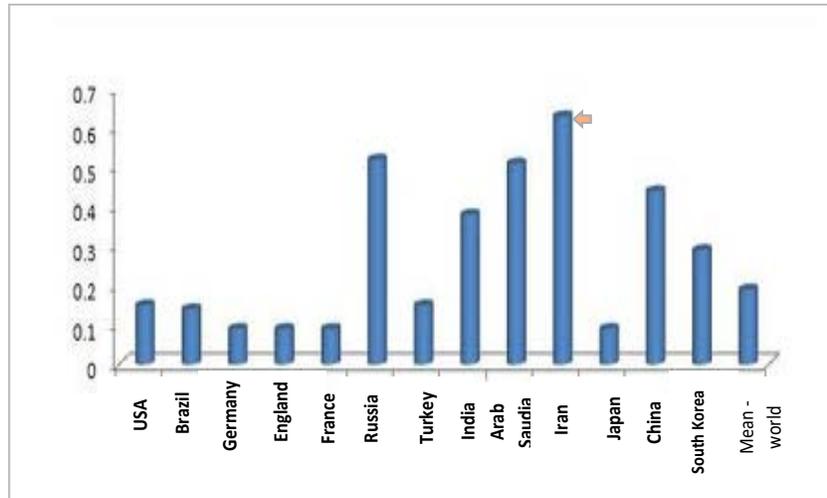
**Table 2.** 10-year energy balance of Iran based on million barrels of oil equivalent (drawn by the author using reference (Energy Balance Sheet of the year, 2014))

Supply/year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
<b>Primary energy</b>	2225.5	1317.1	1429.5	1491.8	1547.5	1536.9	1593.3	1598.2	1666.9	1799.4
<b>Final consumption</b>	896.6	990.1	1081.1	1106.3	1158.3	1134.9	1184.6	1181.1	1228.6	1320.7

- **Status of energy consumption in Iran**

Iran, having one percent of the world's population, consumes nine percent of the world's oil productions. In recent years, annual world energy consumption growth has been one to two percent and five to eight percent in Iran (Zabihi, 2011).

Iran's energy consumption intensity is three times higher than the average energy intensity in the world. On average, .19 tons of crude oil equivalent of energy is consumed to produce \$ 1,000 of GDP in the world, while based on Figure 3 in Iran, .63 tons of oil equivalent energy is consumed to produce every thousand dollars of GDP. Based on reviews in 13 countries, energy intensity index in Iran is higher than other countries.

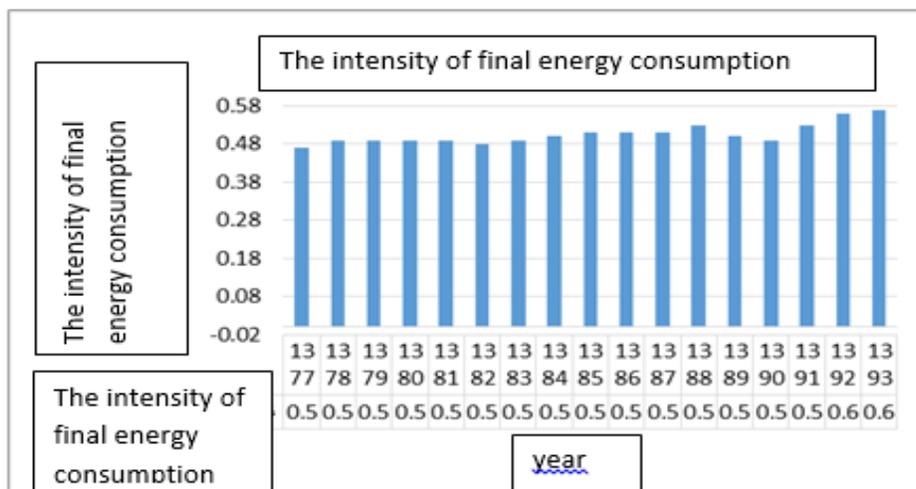


**Figure 3.** Energy consumption intensity index in Iran (drawn using reference (Manzour, Houshnezhad, 2014))

Based on the above figure, energy consumption intensity index in Iran is more than 12 other Countries and Japan, France, Britain and Germany have the lowest energy intensity, respectively.

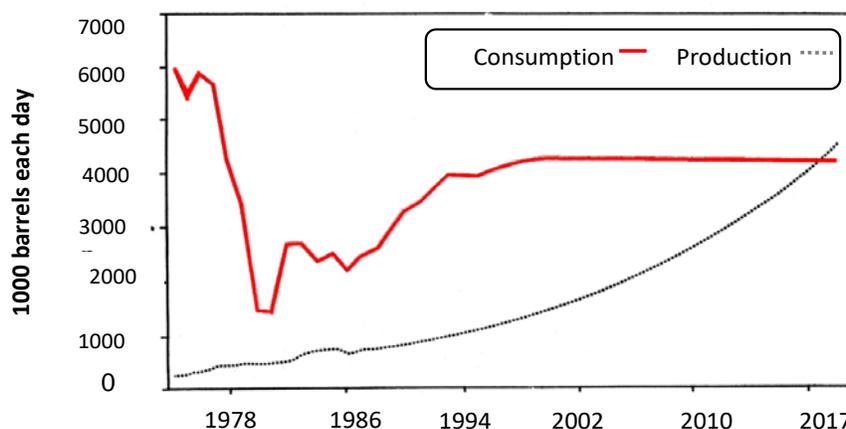
- **Energy intensity index in Iran over a 15-year period**

Comparison of energy intensity index over a period of seventeen year in Figure (4) shows the great loss of energy in the cycle of production from source to consumption and from GDP to the total supply of primary energy and its final consumption.



**Figure 4.** Energy intensity index of Iran in a 17-year period by millions of barrels of oil equivalent (drawn by author using reference (Energy Balance Sheet of the year, 2014))

Comparison of production and domestic consumption of oil products in Iran for a period of about 50 years in Figure 5 is indicative of an increase in production and an increase in domestic consumption of oil products for a period of almost 50 years.



**Figure 5.** Energy production and domestic consumption of oil products between 1974 and 2021 (Global energy outlook, 2013)

With the current trend of energy consumption, all domestic oil and gas productions of the country do not suffice consumption up to 1404 and import of crude oil and gas is inevitable (Global energy outlook, 2013).

**Relationship between an increase in demand for energy and production of gases such as CO<sub>2</sub>**

Beginning of industrial revolution and technological progress in the early nineteenth century and industrial expansion, growth of global population, economic growth and energy consumption increase that is the result of economic development led to the use of fossil fuels such as oil, coal and natural gas and increase of gases such as CO<sub>2</sub>. Since the industrial revolution, human industrial activity has led to the addition of greenhouse gases to the atmosphere. The main component of greenhouse gases is carbon dioxide derived from combustion of fossil fuels (Boyle, Godfrey, 2007).

• **Impact of energy production and consumption on the environment**

The major consequence of energy production and consumption in the world is increased CO<sub>2</sub> gas resulting from the combustion of fossil fuels, basic changes in weather conditions, increased warming, and increased pollution of the planet. Undoubtedly, these contaminants have a significant impact on the health of organisms, social and economic issues.

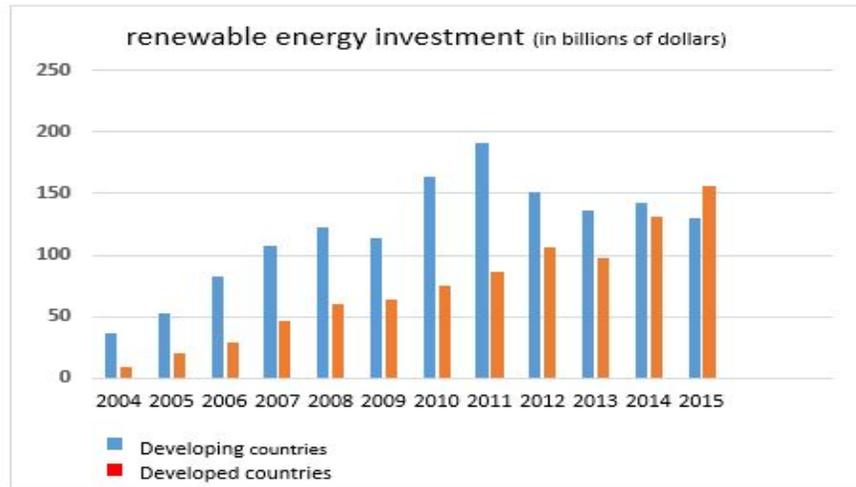
Statistics obtained from reliable global sources in Table (3), especially for our country, is remarkable and alarming.

**Table 3.** Pollutants and greenhouse emissions caused by energy production and consumption country (In tonnes (4))

N <sub>2</sub> O	CH <sub>4</sub>	CO <sub>2</sub>	SPM	CO	SO <sub>3</sub>	SO <sub>2</sub>	NO <sub>x</sub>	gaz/year
11525	43001	492264957	367239	8456502	14951	1424973	1378957	2008
12101	46214	523293617	386757	8973628	15853	1598617	1808553	2009
12147	50314	538527894	393399	8651070	16953	1678078	1836265	2010
11967	52236	532324843	655600	8201223	13896	1355656	1805823	2011
11283	53307	547014571	393055	8033989	13471	1425800	1843831	2012
11609	57049	556866442	400983	8523752	13636	1540500	1861374	2013
11888	59181	587445727	411516	9136589	14619	1612823	1946838	2014
11473	60102	602267376	413592	9295476	15011	1482577	1973926	2015

### Comparison of investment in renewable energy in the world and Iran

To check the status of investment in new energy sources by comparing the amount of investment in the developing countries with developed countries in (6), it can be concluded that the investment in developing countries is more than developed countries.

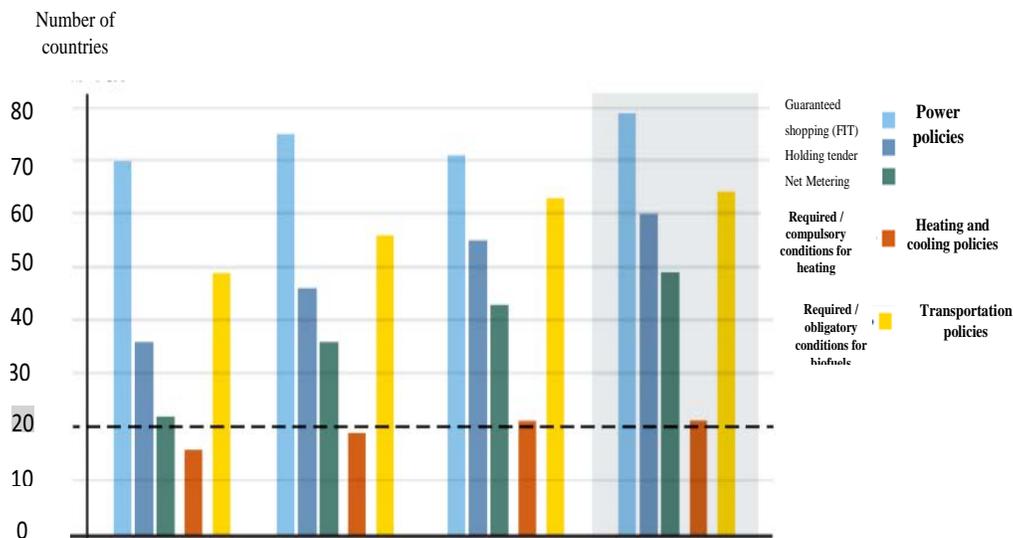


**Figure 6.** Investment in renewable energy in the world over eleven years (2004 to 2015) (drawn by author using reference (Outlook of global primary energy demand, 2013))

- **The process of political applications in the world to use renewable energy**

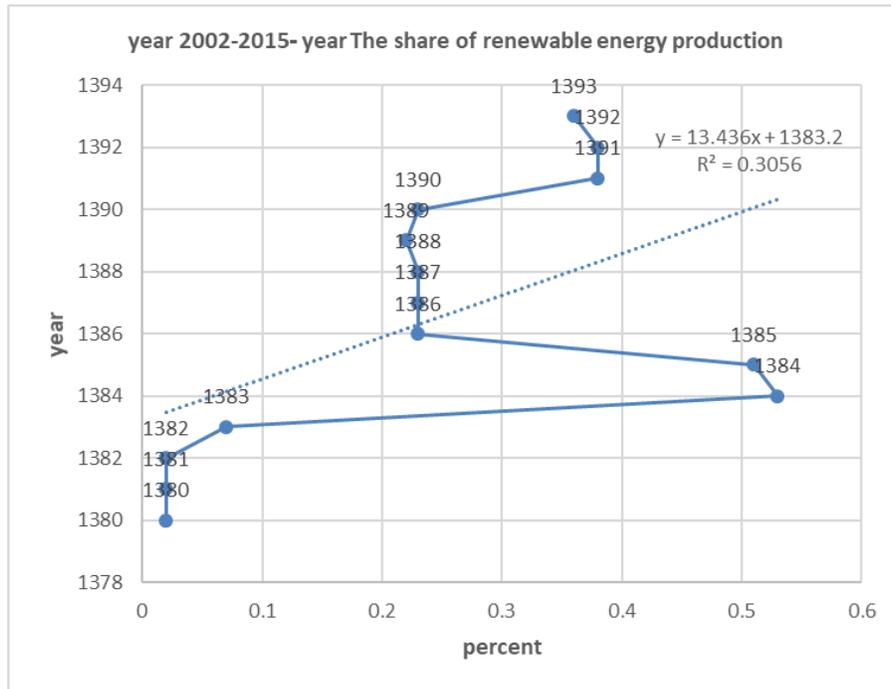
Facing increase in energy consumption in the world and a sharp decline in oil prices in the second half of 2014, renewable energy dramatically expanded in terms of installed capacity and energy production (Global Renewable Energy Status Report, 2015).

The growth in renewable energy by Fig (7) shows that despite the reduction in global oil prices and the reception of new energy, policy making and international attention to control and reduce emissions of greenhouse gases and carbon resulting from global energy consumption is witnessed.



**Figure 7.** The number of countries with renewable energy policies based on type from 2011 to 2015 (Source: (Global Renewable Energy Status Report, 2015))

Investment status and the share of renewable energy sources in the world are shown in figure (8) during the period from 2004 to 2013. This share has been increasing in this period.



**Figure 8.** Investment in renewable energy in Iran during Thirteen years (2002 to 2015) (drawn by author using reference (Energy Balance Sheet of the year, 2014))

This comparison shows the striking difference of Iran and the world in the use of renewable energies, which requires more attention to planning and development of new energies' sources in Iran so that while filling the gap with the world, the substrate supporting fossil energy resources and environmental protection in Iran is realized.

## Conclusion

The comprehensive development of technology affected by the industrial revolution and its significant growth, which led to increased levels of health, longevity, population, increased job and income, and economic prosperity created the ground for the production and development of energy-consuming technologies and high relative prosperity of mankind. Increased welfare required change in the pattern of energy consumption and consequently, with the increased energy consumption, environmental pollution also increase until authorities and experts recognized the risk and informed people of upcoming crises. In the meantime, remedy of the problem was controlling and reforming the energy consumption and switching to the alternative energy. The results of this paper, which considered the importance of energy in the world and Iran in the current situation with a view to the future and compared the two, suggest that the right solution is controlling the pattern of energy consumption and energy supply from renewable resources such as new energy in order to preserve and protect the environment. Statistics show that great measures have been taken in this regard all over the world, but despite Iran's geographical status that is the evidence of great potential to employ renewable energies, no significant measure has been taken. Although studies and practical measures has begun, the use of these resources is still far away from available and appropriate level and expected capabilities.

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