

Fossil Fuels: Factors of Supply Reduction and Use of The Renewable Energy As A Suitable Alternative

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ABSTRACT

In this article we will review the consumption of fossil fuels in the world. According to the exhaustible resources of fossil fuels, and the damaging effects of these fuels on the environment and nature, we introduce renewable energy sources as perfect replacement for fossil fuels.

Keyword: Fossil fuels, renewable energy sources, Environmental effects, fuel resources

INTRODUCTION

Coal, oil and natural gas are kinds of fossil fuels that we have mostly depended on for our energy needs, from electricity and home heating to fuel for our automobiles and mass transportation. [1] Alternative energy for Fossil Fuels is renewable energy sources that have no undesired consequences such for example fossil fuels or nuclear energy. The oil, coal and natural gas companies know these are serious problems. But until our renewable energy sources become more viable as major energy providers, the only alternative for our global population is for these companies to continue tapping into the fossil fuel reserves to meet our energy needs. Alternative energy sources are renewable and are thought to be free energy sources. They all have lower carbon emissions, compared to conventional energy sources. This energy source is Biomass Energy, Wind Energy, Solar Energy, Geothermal Energy, Hydroelectric Energy sources. Combined with the use of recycling, the use of clean alternative energies such as the home use of solar power systems will help ensure man's survival.

Types of fossil fuels: In this section we will look at a variety of fossil fuels. There are three primary varieties for fossil fuels. These are coal, oil, and natural gas. The fossil fuel resources, the extraction, production and consumption of these fuels in the world will be examined.

Coal: coal is the only one still in a solid state. Coal is composed of five different elements include carbon, nitrogen, oxygen, hydrogen, and sulfur, with the distributions of those five elements varying depending on the piece of coal. In fact, because of these differing elemental make-ups, there are actually three different types of coal, each with different energy properties. The highest in energy content is anthracite coal, which is harder and has a higher distribution of carbon than the other varieties. The other two types of coal include lignite and

bituminous – aren't quite as energy-rich, but still have their uses. Lignite is high in oxygen and hydrogen instead of carbon, while bituminous occupies a sort of happy medium between the two extremes. The most abundantly existing of all fossil-based fuels, coal is formed from the decay of vegetative matter such as ferns, plants, trees, moss swamp vegetation that thrived on the surface of the earth millions of years ago. Nowadays, most heavy industries use coal as their fuel resource and industries like the steel and iron industry are completely dependent upon coal supply. Uses of coal span from acting as a domestic fuel to providing thermal energy to industrial units. Coal today is used for everything from producing steel and cement to keeping the lights on in homes and businesses. [2]

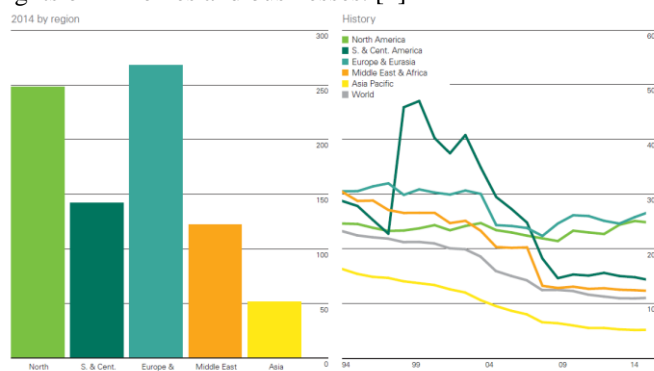


Fig 1 : World proved coal reserves in 2014 were sufficient to meet 110 years of global production, by far the largest R/P ratio for any fossil fuel. By region, Europe & Eurasia holds the largest proved reserves and has the highest R/P ratio – 268 years, compared with 248 years for North America. The lowest R/P ratio is in the Asia Pacific region (51 years).

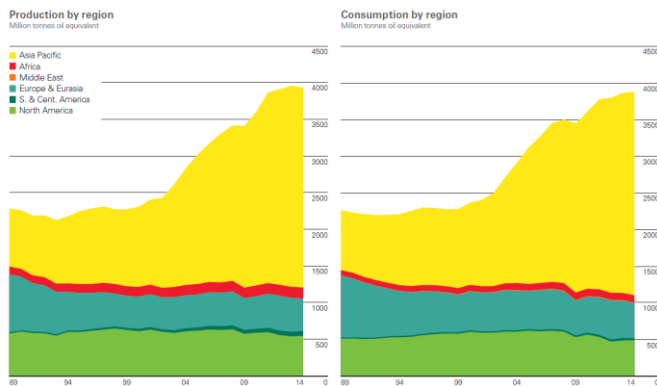


Fig 2: World coal production declined by 0.7% in 2014, while consumption grew by 0.4%. India (+6.4%) recorded the largest production increment, while China contributed the biggest decline (-2.6%). India accounted for the largest increment to consumption (+11.1%) and Ukraine for the largest decline (-20.2%).

Oil: Oil is a fossil fuel. Most of the oil extracted today has been formed from prehistoric organisms whose remains settled at the bottoms of lakes and oceans millions of years ago. As layers of sediment covered them, the pressure on them increased which in turn increased the temperature. This process changed their chemical composition; eventually transforming them into oil. Generating electricity by burning oil is costly and releases a high level of greenhouse gases. Consequently, oil-fired power stations are currently used only to provide backup power, when there is a chance that demand for electricity might not be met by less costly energy sources. [3]

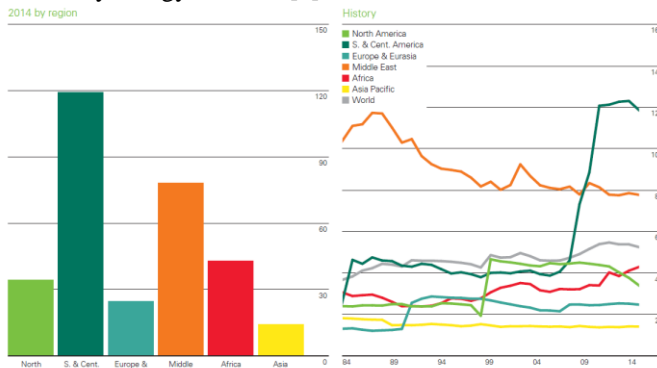


Fig 3: Total world proved oil reserves reached 1700.1 billion barrels at the end of 2014, sufficient to meet 52.5 years of global production. The largest addition to reserves came from Saudi Arabia, adding 1.1 billion barrels. The largest decline came from Russia, where reserves fell by 1.9 billion barrels. OPEC countries continue to hold the majority of the world's reserves, accounting for 71.6% of the global total. South & Central America continues to hold the highest R/P ratio, more than 100 years. Over the past decade, global proved reserves have increased by 24%, or more than 330 billion barrels.

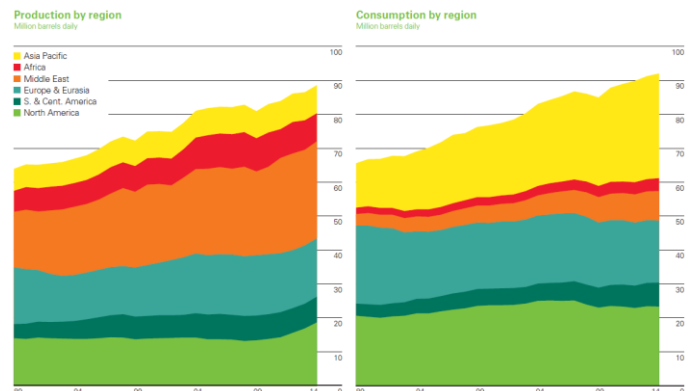


Fig 4: World oil production significantly outpaced consumption in 2014, rising by 2.1 million b/d; all of the growth was in non-OPEC countries, which recorded a record increase. US output grew by 1.6 million b/d, its largest increase on record. OPEC production was essentially flat, with declines among African OPEC producers offset by rising Middle East output. Global consumption increased by 840,000 b/d, with emerging economies accounting for all of the growth; China saw a below-average increase but still accounted for the largest increment to consumption.

Natural gas: Natural gas is a fossil fuel formed when layers of animal matter and decomposing plant are exposed to intense heat and pressure over thousands of years. The energy that the plants originally obtained from the sun is stored in the form of chemical bonds in natural gas. Natural gas is a nonrenewable resource because it cannot be replenished on a human time frame. [4] Natural gas is a hydrocarbon gas mixture consisting primarily of methane, but commonly includes varying amounts of other higher alkenes; it is also the main source of helium and sometimes a usually lesser percentage of carbon dioxide, nitrogen, and hydrogen sulfide. [5] The World Bank estimates that over 150 billion cubic meters of natural gas are flared or vented annually. [6]

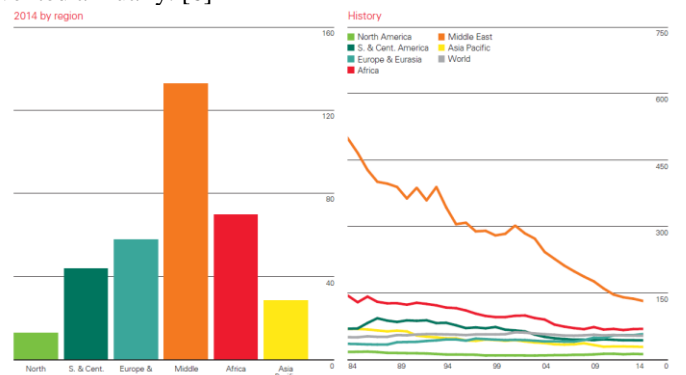


Fig 5: World proven natural gas reserves at end-2014 stood at 187.1 trillion cubic metres (tcm), sufficient to meet 54.1 years of global production. Proved reserves grew by 0.3% relative to end-2013. Growth in Russia (+0.4 tcm), Azerbaijan (+0.3 tcm) and the US (+0.2 tcm) accounted for all of the gross increase in global proved reserves in 2014. Iran (34.0 tcm) and Russia (32.6 tcm) hold the largest proved reserves.

Based on an estimated 2015 world consumption rate of about 3.4 trillion cubic meters of gas per year, the total estimated

remaining economically recoverable reserves of natural gas would last 250 years at current consumption rates. An annual increase in usage of 2–3% could result in currently recoverable reserves lasting significantly less, perhaps as few as 80 to 100 years. [7]

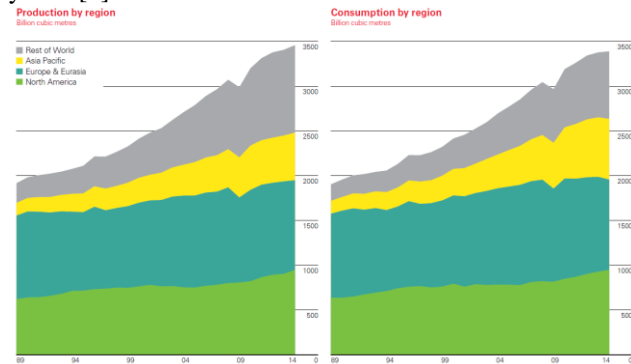


Fig 6: World natural gas production increased by 1.6% in 2014, four times the growth rate of global consumption (+0.4%). Production growth was below average in all regions except North America. The US (+6.1%) recorded the largest growth increment while Russia had the largest decline (-4.3%). Consumption growth was below average in all regions except North America and the Middle East. The US (+2.9%) recorded the largest growth in consumption in the world while the EU had the biggest decline on record (-11.6%).

Fossil fuels in the world:

Fossil fuels coal, oil, and natural gas - organic compounds are focused in crust of the earth. They are the remains of plants and animals that lived millions of years ago have been established in the form of focused biomass. According to the US Energy Information Administration (EIA), fossil fuels around 82% to meet our energy demand. [8] Fossil fuels make modern life possible. This is a great source of energy to generate steam systems, electric power and transportation. They generate tens of thousands of commercial goods possible. Although fossil fuels have become synonymous with modern industrial society, it's potential to solve some of the challenges of daily life in history to understand. [9]

Scattered history of the use of coal to date at least 1100 BC. By the middle Ages, small mining operations began to spread in Europe. Coal was established firmly as an internal fuel in much of Europe by the 1570s and on behalf of the major heat source for buildings, especially in cities located far from easy access to forms of biomass energy is lower. Coal for the first time to go to the widespread use of fossil fuels, the movement of low-energy wood as a fuel source in the United States, and stimulate its production in the second half of 19th.[10]

Ancient China's pioneer in natural gas, using it in salt brine in the evaporator fired, boring shallow hole, and deliver gas to the evaporator through bamboo pipes. Century, 19th, natural gas is widely used in Europe and the United States were used as fuel for electricity bulb by Thomas Edison's light until it was displaced.[11] [12]

COMPARISON OF FOSSIL FUEL SUBSIDIES: IEA & IMF (BILLION DOLLARS)

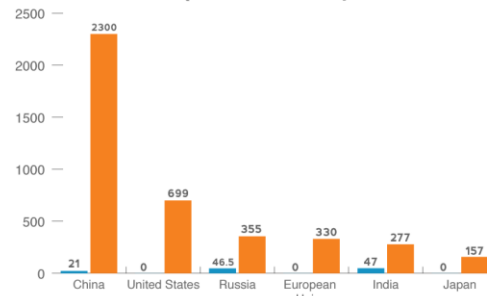


Fig 7: China is the largest energy consumer in the world and the largest consumer of coal in the world.

The distributions of the various components of the \$5.3 trillion that IMF estimates for 2015 are given in the chart below. Note that local pollution costs represent over half the total and global warming represents less than a quarter of the total, while the actual financial costs represent just 6 percent of the total.

Local pollution a major component of energy subsidies (Energy subsidies by component, 2015)

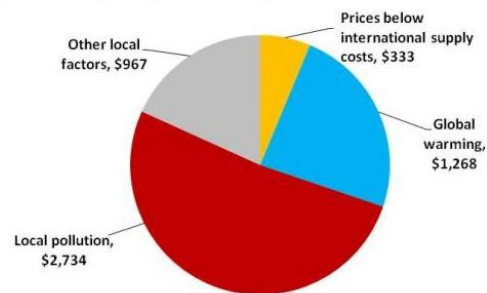


Fig 8: local pollution a major component of energy subsidies According to the International Monetary Fund fossil fuel subsidies in both countries, and developed. Developing Asia account for about half of the total, while advanced economies account for about a quarter. (See chart below) subsidy estimates of the IMF in 2015, more than double the previous estimate of \$ 1.9 trillion for 2011. More than half of this increase due to the "other" side calculates the cost of it. While the IMF calculated a huge increase in the value of fossil fuel subsidies in a period of 4 years, the calculation of the International Energy Agency fossil fuel subsidies has decreased by 4% between 2012 and 2013.[13]

Energy subsidies are pervasive

(Share of global energy subsidies, 2015)

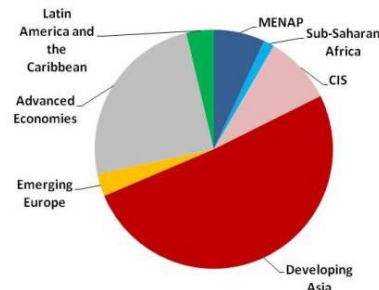


Fig 9: energy subsidies are pervasive

Future supply and demand of fossil fuels

Energy Information Administration (EIA) Annual Energy Outlook 2015 America in which liquid fuel consumption to increase by 3.3 percent between 2013 and 2020, and then reduce remained above 2013 levels in 2040.

Between 2013 and 2040, natural gas consumption is expected to increase 13.4% and consumption of coal by 5.6 percent. [Xv] EIA predicts fossil fuels to maintain its status as the leading source of America's energy consumption between now and 2040 to supply 80 percent of the energy needs of our country in 2040. The International Energy Agency (IEA) predicts that energy world energy Outlook 2014 fossil fuels will dominate the world image as it is in the past, representing almost 75% of global energy demand in 2040.[14]

America is with vast quantities of fossil fuels. Responsible use of these resources, factories, furnaces, houses, highways and hospitals have sparked their first use. Huge amounts of pure forms that hold promise to be there for future generations.

Advantages of Fossil Fuel: [15]

1. Fossil fuel has the unlimited potential to generate huge amounts of electricity, within a single location.
2. Fossil fuels are extremely easy to find. They can be found in almost everywhere beneath the earth's surface.
3. Fossil fuels are very cost effective, especially coal.
4. Transporting petroleum is made easy through pipes. It does not require oil companies to extract the oil from beneath the ground and transport them through land to other locations.
5. Power plants that use fossil fuels can be constructed in almost every location. As long as large quantities of fossil fuels can be brought easily to power plants, power stations can be constructed any anywhere.
6. Fossil fuels are regarded with their stability. Gas, oil, and coal are composed of molecules of carbon and hydrogen. Due to their stability and consistency, fossil fuels are easy to store. They do not even form into other compounds even if stored in cans for an extended period of time.
7. Fossil fuels have high calorific value. All types of energy they produce have the same calorific value. In energy, the more calorific, the more effective the energy is. This is probably the reason why fossil fuels are still preferred by people instead of renewable energy.
8. Gas, oil, and coal can produce a large amount of energy. Fossil fuels are fast combustible, which means that power plants can generate large amounts of energy.

Disadvantages of Fossil Fuels: [15]

Pollution is a major disadvantage of fossil fuels. This is because they give off carbon dioxide when burned thereby causing a greenhouse effect. This is also the main contributory factor to the global warming experienced by the earth today.

1. Coal also produces carbon dioxide when burned compared to burning oil or gas. Additionally, it gives off sulphur dioxide, a kind of gas that creates acid rain.
2. Environmentally, the mining of coal results in the destruction of wide areas of land. Mining this fossil fuel is also difficult and may endanger the lives of miners. Coal mining is considered one of the most dangerous jobs in the world.
3. Power stations that utilize coal need large amounts of fuel. In other words, they not only need truckloads but trainloads

of coal on a regular basis to continue operating and generating electricity. This only means that coal-fired power plants should have reserves of coal in a large area near the plants location.

4. Use of natural gas can cause unpleasant odors and some problems especially with transportation.
5. Use of crude oil causes pollution and poses environmental hazards such as oil spills when oil tankers, for instance, experience leaks or drown deep under the sea. Crude oil contains toxic chemicals which cause air pollutants when combusted.

Reducing fossil fuel resources:

Fossil fuels are materials that are non-renewable such as oil, gas and coal. Aside from causing local air pollution from polluting particulates, the burning of fossil fuels releases carbon dioxide into the atmosphere, which is a greenhouse gas that contributes to climate change. Moreover, many fossil fuels are reaching their "peak" (oil being the most rapidly depleted). At some stage in the near future, switching from fossil fuel usage to renewable energy makes sense from economic, environmental, safety and health points of view. Fossil fuels are materials non-renewable such as coal, oil and gas. Apart from causing local creating air pollution from polluting particulates, the burning of fossil fuels releases carbon dioxide into the atmosphere, which is a greenhouse gas that contributes to climate change. In addition, many fossil fuels are reaching their "peak" (oil being the most rapidly depleted).

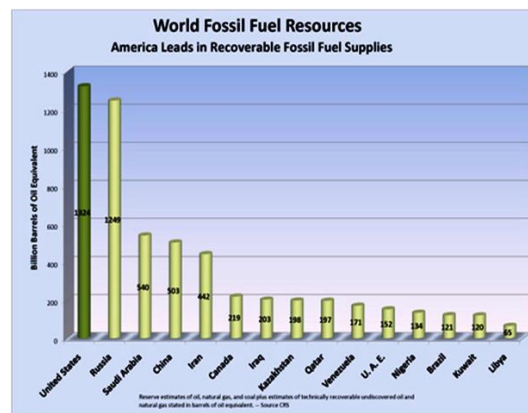


Fig 10: world fossil fuel resources

At some stage soon, change of use from fossil fuels to renewable energy feels in terms of economic, environmental, health and safety terms. Start your journey with the conservation of fossil fuel use via your variation, you can get others to see that a good and healthy life can still be consumed away this precious resource without help. [16]

The market for fuel pellets is booming in Europe due to the increased focus on environmental protection and reduction of fossil fuel resources. Renewable energy is a growing commodity, to the surprise of no one, is taking up a lot of attention utilities and energy companies around the world. Add to reduce reliance on fossil fuels such as coal and oil - be it for environmental reasons, or for fear of investing in an energy strategy that may well end up stranded - and energy renewable is a sure fire win.[17]

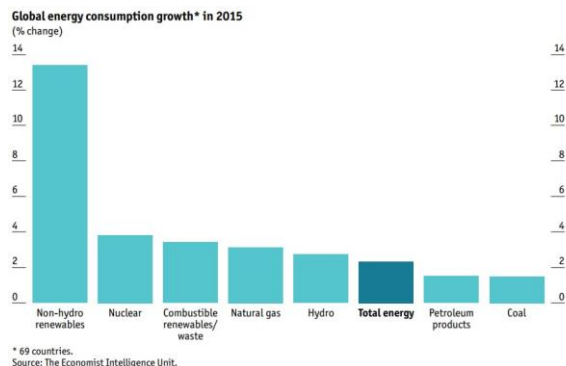


Fig 11: global energy consumption growth

List of Ways to Reduce the Use of Fossil Fuels:

Fossil fuels take millions of years to form and are thus considered to be nonrenewable. Higher energy demands and poor efficiency practices have increased fossil fuel usage, and it's now critical to find alternative means of energy generation before depleting the global supply. It takes individual and community actions to reduce the dependence on fossil fuels.

Conserve Energy : People can do simple things to decrease energy consumption. Energy consumption can be reduced by simply turning off lights when a room is not in use, replacing light bulbs with longer-lasting fluorescent bulbs and only running air conditioning when a home is occupied. Other steps to reduce fossil fuel reliance include ensuring your home has efficient insulation for heating and cooling purposes and using Energy Star-rated consumer appliances. The Energy Star label is awarded to efficient products that reduce the total amount of energy used and typically display a calculated year's savings as a percentage or dollar amount to help inform consumers.

Reuse Products: Many consumer goods can be reused instead of discarded. For example, use a fabric grocery shopping bag instead of paper or plastic. Reusable glass plates and cups will also reduce the amount of Styrofoam and plastics that require fossil fuel resources. When shopping, you can also buy post-consumer manufactured goods made from recycled materials. Some products such as computer printer ink cartridges may also be refilled and reused.

Recycle Materials: The Environmental Protection Agency estimates that 75 percent of American waste is recyclable. You can help reduce the reliance on fossil fuels by recycling your waste instead of sending it to a landfill. Donate working products such as microwaves, lights, fans, clothing that no longer fits and household goods you no longer want to charities like Goodwill instead of throwing them away. It's also a good idea to participate in your city's recycling programs that provide trash bins for plastics, aluminum and paper.

Live Green: One solution to the depletion of nonrenewable fossil fuel usage is to go green. Going green means living your life in a way that sustains current resources for future generations. Green living always seeks to find a balance between humans and natural surroundings. This lifestyle choice focuses on respecting the environment by using as few resources as necessary; consuming only the food and energy needed for survival; participating in recycling programs that reduce municipal solid waste; using green energy electricity services such as solar power, which reduces pollution; and

working together with other community members to ensure your children and grandchildren get to experience the same high-quality life. Communities can also go green by encouraging local lawmakers and planning agencies to create walk able neighborhoods where human interactions are favored over cars that pollute the air. [18]

Replacement for fossil fuels:

We all agree that in the long run the world needs to find alternatives to oil, gas, and coal the fossil fuels. Fossil fuels generate CO₂, which adds to global warming. The power sources that replace fossil fuels must be cleaner, and not add to pollution or climate change. As an added bonus these fuels should be substances that are easily located and ideally, renewable energy sources.

Many alternative sources are already widely used. Hydroelectric and nuclear energy plants generate a significant portion of the world's power. Other sources, including solar energy, wind power, and biomass fuel provide a small share of a region's power but could provide much more. Sources such as tidal power and geothermal heat are site-specific, and of use only in the right location. Some promising technologies, for example the hydrogen fuel cell, remain under development. Advantage of sunlight, wind, water, or plants: They are everywhere, in essentially unlimited quantities. We need to find the best way to use these resources to their fullest.

Wind, water, sunlight, plants, and heat from the Earth. Some of these sources are as old as can be. Wood has been burned for heating and cooking since humans first learned to make fire. Windmills helped irrigate the fields of ancient Persians. The ancient Greeks and Romans used falling water to turn waterwheels. But by the early 20th century, cheaper fossil fuels all but replaced these traditional sources in many places as the provider of power. Unlike that from fossil fuels, energy from sunlight, wind, water, plants, and geothermal heat does not create extra carbon dioxide, and so does not add to global warming. Best of all, unlike fossil fuels, which will become increasingly scarce, these fuel sources are renewable and will never, run out. [19]

RESULT AND DISCUSSION: Renewable energy sources are good for business, providing energy security, economic development, energy price stability, and reduce the global risks of climate change. [20]

Energy Security: Renewable energy provides reliable power supplies and fuel diversification, which enhance energy security and lower risk of fuel spills while reducing the need for imported fuels. Renewable energy also helps conserve the nation's natural resources.

Economic Development: According to two studies by the U.S. Department of Energy's (DOE) Energy Information Administration (EIA) and the Union of Concerned Scientists (UCS)¹, if the U.S. were to supply 10% of its electricity from renewable by 2020 the following would occur:

Consumer savings: \$22.6 billion to \$37.7 billion in lower electricity and natural gas bills

Jobs: 91,220 new jobs—nearly twice as many as generating the electricity from fossil fuels

Economic development: \$41.5 billion in new capital investment, \$5.7 billion in income to farmers, ranchers, and rural landowners, and \$2.8 billion in new local tax revenues

Healthier environment: reductions of global warming pollution equal to taking from 25 million to 32 million cars off the road, plus less haze, smog, acid rain, mercury contamination, and water use

Price Stability :Renewable energy sources such as wind, solar, hydro and geothermal do not entail fuel costs or require transportation, and therefore offer greater price stability. In fact, some electric utilities factor this into their retail electricity prices, exempting customers that buy renewable from certain charges.

Electricity and the Environment: Traditional electricity generation is responsible for the emission of a host of chemicals with widespread environmental impacts. The same compounds that is detrimental to human health hav similar consequences for the natural environment. Electricity generation from fossil fuels is responsible for:

38% of the nation's carbon dioxide² (CO₂), a greenhouse gas and major contributor to climate change. Carbon dioxide is released into the atmosphere when fossil fuels are burned. Climate change is a serious environmental threat that may contribute to coastal flooding, more frequent and extreme heat waves, more intense droughts, an increase in the number of severe storms, and the increased spread of infectious diseases.

5-2: 66% of the nation's sulfur dioxide (SO₂) when combined with rain water, creates acid rain. Acid rain damages the foliage of forests, crops, and other plants, and eventually can kill the plants. It also acidifies rivers and lakes causing them to be biologically "dead." Acidification also alters the chemistry of soil, releasing harmful metals into rainwater runoff and groundwater. Sulfur dioxide also accelerates the decay of stone and paint, damaging many buildings and monuments.

5-3: 40% of the nation's mercury³ contributes to contamination of soil and waterways. Mercury can circulate in the air for up to one year and can be transported thousands of miles from its source. Mercury accumulates in the fatty tissue of fish and is constantly being recycled in the environment as it moves up the food chain. Mercury causes permanent damage to the liver and central nervous system and can cause birth defects.

5-4: 25% of nitrogen oxides (NO_x), which react with sunlight to create ground level ozone and smog. Nitrogen oxide deposition causes algae blooms in lakes and streams. This depletes the water of oxygen, killing fish and other living organisms. Nitrogen dioxide has also been shown to cause pulmonary disease in animals.

5-5: Particulate matter is the major cause of reduced visibility (haze) in the U.S. Coal-fired power plants are the single largest source of emissions of particulate pollution - soot particles made of ash (heavy metals, radioactive isotopes, hydrocarbons, sulfates, and nitrates) that can transport and deposit trace metals such as mercury hundreds of miles from their source. Soot stains and damages stone and other materials, damaging many of our buildings and monuments. After

traveling long distances, particles settle on ground or water, causing these effects:

- ❖ Making lakes and streams acidic
- ❖ Changing the nutrient balance in coastal waters and large river basins
- ❖ Depleting the nutrients in soil
- ❖ Damaging sensitive forests and farm crops
- ❖ Affecting the diversity of ecosystems

REFERENCES

1. Chapter 8: Fossil Fuels - Coal, Oil and Natural Gas ,<http://www.energyquest.ca.gov/story/chapter08.html>
2. What is coal , R Thiessen - 1947 - osti.gov
3. Fossil fuel combustion and the major sedimentary cycle , KK Bertine, ED Goldberg - Science, 1971 - sciencemag.org
4. "Electricity from natural gas". Retrieved 2013-11-10.
5. "Composition of natural gas". Naturalgas.org. Retrieved 2012-07-14.
6. "World Bank, GGFR Partners Unlock Value of Wasted Gas". World Bank Group. 14 December 2009. Retrieved 17 March 2010.
7. <http://www.worldenergyoutlook.org/media/weowebiste/2009/WEO2009.pdf>
8. World Fossil Fuel Subsidies and Global Carbon Emmissions , B Larsen - 1992 - books.google.com
9. Energy storage systems—characteristics and comparisons , H Ibrahim, A Ilinca, J Perron - Renewable and sustainable energy reviews, 2008 – Elsevier
10. Russian gas price reform and the EU–Russia gas relationship: Incentives, consequences and European security of supply, A Spanjer - Energy Policy, 2007 – Elsevier
11. Electricity generation and health, A Markandya, P Wilkinson - The Lancet, 2007 – Elsevier
12. Transition to hydrogen economy in the United States: a 2006 status report , WC Lattin, VP Utgikar - International Journal of Hydrogen Energy, 2007 – Elsevier
13. <http://www.imf.org/external/pubs/ft/survey/so/2015/NEW070215A.htm>
14. www.worldenergyoutlook.org
15. Advantages And Disadvantages Of Fossil Fuels , OccupyTheory ,on 9 April, 2014 ,<http://occupytheory.org/advantages-and-disadvantages-of-fossil-fuels/>
16. When will fossil fuel reserves be diminished? S Shafiee, E Topal - Energy policy, 2009 – Elsevier
17. Hydrogen as a renewable and sustainable solution in reducing global fossil fuel consumption , A Midilli, I Dincer - International Journal of Hydrogen Energy, 2008 – Elsevier
18. List of Ways to Reduce the Use of Fossil Fuels by Ben Alonzo 2015, <http://education.seattlepi.com>
19. Renewable energy strategies for sustainable development , H Lund - Energy, 2007 – Elsevier
20. <http://buycleanenergy.org/why>

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