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Paradigm Shift of Energy from Past to Present

Ar. Rakesh Kumar[1], Ar. Mustakeem Raza Khan[2]

[1]*Assistant Professor, Amity School of Architecture and Planning Amity University Gurgaon, Haryana, India*
[2]*Assistant Professor, Amity School of Architecture and Planning Amity University Gurgaon, Haryana, India*

Abstract – *This paper is all about how energy flow from one form to other form, and during the flow how humans use methods which exploits nature disturbing the ecological balance. From the past to present energy exploits in order to convert material into commodity. While living a luxurious life human's quest for faster, easier, and more efficient ways of meeting the needs of a growing human population has led to increasingly high energy demands. Although massive quantities of energy is provided by the sun in many forms, humans could not control it, and so they began to explore other sources of energy which in turn deploys environmental hazards. In the race of exploring/experimenting new energy sources we left the environment far behind. The pollution created by humans for living luxury life also causing significant damage to natural systems. Atmosphere's concentration of hazardous gases has increased tremendously which traps the heat in terms of short wavelengths causing global warming.*

***Key Words*: Climate change, Flow of energy, Global warming, Ecology, Renewable energy sources, Non-Renewable energy sources.**

1.INTRODUCTION

At Present the atmosphere's concentration of carbon dioxide (CO2) has increased by more than 30 percent over the last 250 years largely it happens due to human activity.

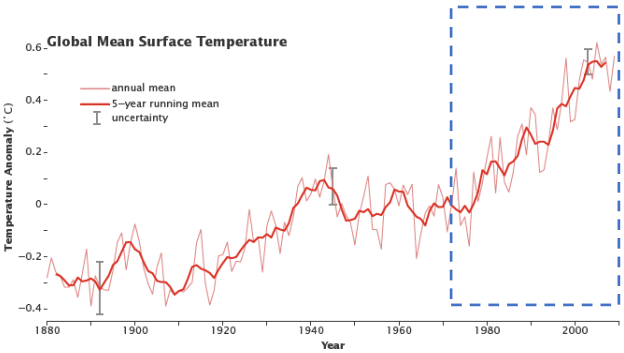


Figure -1: Global Surface Temperature

Source: (GISS Surface Temperature Analysis, n.d.)

The global average surface temperature rose from 0.6 to 0.9 degrees Celsius (1.1 to 1.6° F) between 1906 and 2005, and the rate of temperature increase has nearly doubled in the last 50 years. (Earth Observatory, n.d.).Unless there is change, the world will see much higher CO2 levels in the future, levels that are predicted to lead drastic climate change. it has been tried to understand the links between energy use, economy development and climate change. looking back into history, energy resources had played an important role in influencing the rate of economic growth and development. It has been seen as a boost to long term growth when new energy sources and technology were deployed and created abundance.

2. BASIC CONCEPT OF ENERGY

Energy, including all life cycles, and is essential in agriculture as much as in all other productive activities. An elementary food chain already shows the need for energy: crops need energy from solar radiation to grow, harvesting needs energy from the human body in work, and cooking needs energy from biomass in a fire. The food, in turn, provides human body with energy. The ultimate source of energy is Sun.

Energy can exist in various forms. Examples are:

- Radiation energy: the radiation from the sun contains energy, and also the radiation from a light or a fire. Solar energy is obtainable when the radiation is more concentrated and when it is collected over a larger area. Light is the visible part of radiation;
- Chemical energy: Wood and oil contain energy in chemical form. Above is true for all other material that can burn. Chemical energy has larger heating value (calorific value). Also, conscious energy (delivered by bodies of human beings and faunas) is, in essence of chemical energy. batteries also contain chemical energy.
- Potential energy: This is an example, when water in the reservoir falls from certain height it has potential energy. More the height more will be the potential energy.
- Kinetic energy: This is, for example, energy of movement, as in wind or in a water stream. The faster the stream flows more energy it can deliver. Wind energy is available at higher terrain and coastal area, and more of it can be tapped by bigger windmill rotors.
- Thermal energy or heat: this is indicated by temperature. The higher the temperature, the

more energy is present in the form of heat. Also, a larger body contains more heat;

- Mechanical energy or rotational energy, is also called as shaft power: This is the energy of a rotating channel. Large amount of energy available depends on the flywheel of the shaft, i.e., on the power which makes the shaft rotate;
- Electrical energy: A dynamo or generator and a battery can distribute electrical energy. The higher the voltage and the current, the more electrical energy is made available.

Energy used in human applications is broken down into two types: renewable energy source (Solar, Wind, Water, geothermal, Biomass) and non- renewable sources (mostly fossil fuels). Presently most of the activities based on non-renewable source of energy.

2.1. Definitions

Energy:

According to physics- The capacity for doing work is energy. It may exist in the form of potential, kinetic, thermal, electrical, chemical, nuclear energy, or other various forms. Heat and work are the form of energy that can be transferred from one body to another. After being transferred, it is always designated to its nature. Hence, heat transferred may become thermal energy, while work done may manifest itself in the form of mechanical energy. (Britannica, 2001)

According to Economics: The Studies forces that main economic agents – firms, individuals and governments which supply energy resources, to convert these resources into other useful energy forms. Hence transport them to the users for their use and dispose of the residuals. Furthermore it studies the role of alternative market and regulatory structures on activities, economic distributional impacts, and environmental consequences. Thus economic efficient provision for the use of energy commodities and resources leading away from economic efficiency. (Sweeney, 2005)

2.2. Law of Thermodynamics

- **The First Law of Thermodynamics**

The first law of thermodynamics, also known as Law of Conservation of Energy, it states that energy can neither be created nor destroyed, energy can only be transferred or changed from one form to another. For example, turning on a light would seem to produce energy; however, it is electrical energy that is converted.

$\dot{\Delta}E = q + w$

- **The second law of thermodynamics**

It states that the entropy of any isolated system always increases. Isolated systems naturally evolve towards thermal equilibrium—the state of maximum entropy of the system. More simply put: the entropy of the universe (the ultimate isolated system) only increases and never decreases.

- **The third law of thermodynamics**

It states that the entropy is an approach of a constant value as the temperature approaches absolute zero. The entropy of a system at absolute zero is typically zero, and in all cases, is determined only by the number of different ground states it has. Specifically, the entropy of a pure glassy substance (perfect order) at absolute zero temperature is zero. This statement holds true if the perfect crystal has only one state with minimum energy.

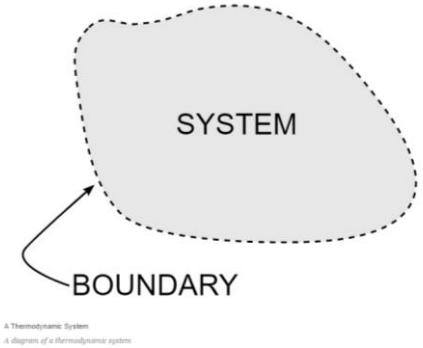
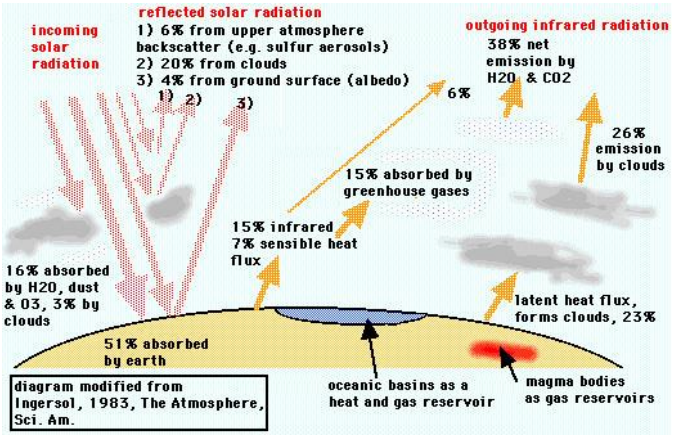


Figure -2: A thermodynamics system

2.3. Flow of Energy on Earth

Transport them



2.4. Energy and Production

Technical progress mainly consisted in the introduction of changes in natural resources so as to exploit some indirect effects of these changes, today defined as energy. In this long history, the main developments were supported by the increasing knowledge about the possibility of "extracting" energy from the input of natural resources. The production process and the role of energy can be represented by the following diagram. (Malanima, 1996)

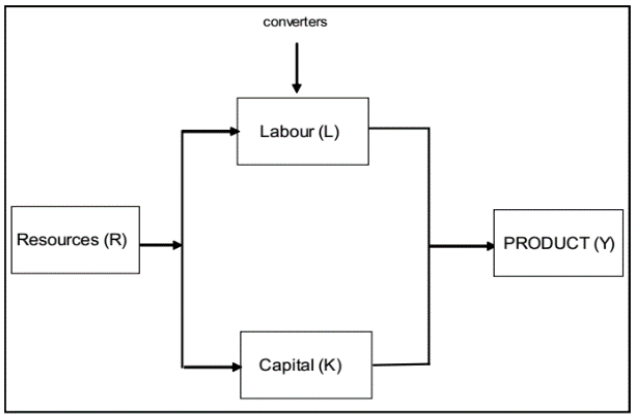


Figure -3: Natural resources, converters of energy, product

The diagram can be seen as an illustration of the ordinary production function:

$$Y = AF(L, R, K)$$

Labour (L) and capital (K), the inputs of any productive process of useful goods and services (Y), can be better defined, from the viewpoint of energy, as *converters* able to extract from matter the energy exploited in order to transform materials into commodities. The progress of technical knowledge embodied in A, plays a central role in the production function. Since, energy is the main input; that is to say, the main input is that part of matter changed into energy by the converters, that is by workers (L), who metabolize food; natural resources (R),which convert a part of the matter used as food and firewood into biomass, through solar radiation; and capital (K), which transforms some materials such as coal, oil, gas and electricity into mechanical work, heat and light.

3. EVOLUTION OF HUMAN USED ENERGY

Throughout recorded history, humans have searched for ways of putting energy to work for them. Humans have found ways of growing food instead of foraging it out in the wild. Instead of walking, they ride in cars built for moving from one place to another. Humans even learned how to send messages electronically instead of using a messenger or a postal service. This quest for faster, easier, and more efficient ways of meeting the needs of a growing human population has led to increasingly high energy demands. But the resources currently used for generating energy are running out. The pollution created by the use of these resources is also causing significant damage to the planet's natural systems. For these reasons, people started to turn towards substitute or alternate energy sources to reduce pollution while meeting their energy needs.

The timeline illustrates a variety of major events and changes in human populations, climate and human-environment relationships from late Pleistocene to present, and beginning with anatomically modern humans in Africa ca. 200 ka (map, left). Genetic evidence indicates population dip at 70 ka (Toba eruption), followed by rapid growth and expansion out of Africa and across Eastern Hemisphere by the Last Glacial Maximum (map bottom). Rapid climate change, widespread extinction of megafauna and human colonization of the Western Hemisphere follow. (Erle C. Ellis, 2017)

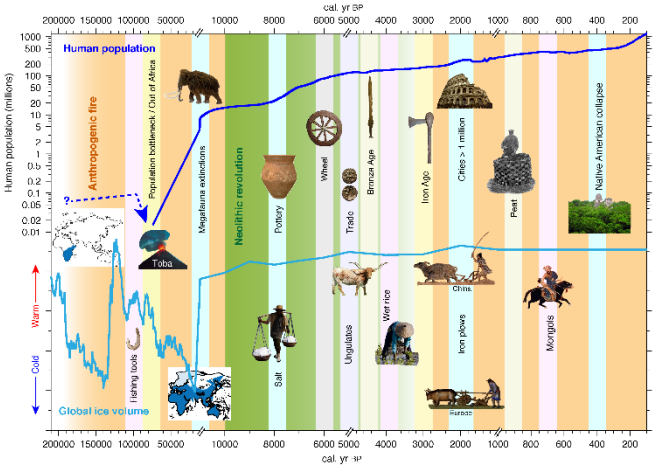


Figure -4: Global timeline of human transformation of the terrestrial biosphere. **Source**: (Erle C. Ellis, 2017)

3.1.1. From pre- historic times to the onset of agriculture:

The dawn of man about 200,000 years back in time until the beginning of agriculture about 100,000 years ago, Man's need was fulfilled by the ecosystem. The radiant energy was converted into chemical energy by photosynthesis. This bioenergy was used as fuel.

The sun is the oldest source of energy. It provides heat and light for millions of years and is directly accountable for sustaining all life on earth. Energy, in almost all its forms, starts with the sun. For example, wind is created by temperature changes caused by the sun. (clarified, 2011). Plants and trees, which provide energy in numerous ways, gain their nourishment from the sun. Streams and rivers, providing energy by downhill flow, are formed from rain and snow, Rain and snow fall at high elevations after being evaporated from lakes and oceans by the sun. The variety of life-forms depending on the sun's energy in one or other manner is impressive.

Although the sun provides massive quantities of energy in many forms, humans could not control it, and so they began to explore other sources of energy. For example, humans revealed a way to generate energy from wood, somewhere between five hundred thousand and seven hundred thousand years ago, by most scientist's estimates. At first, wood was burned for warmness, light, and for cooking food. Then the heat from fire started to be used to change the form of some materials to make them more useful, such as clay into pots or bricks, and certain types of metal, such as copper, bronze, and iron, into tools.

Figure -5: This ancient Egyptian mural depicts farmers at work. By exploring new ways to utilize the sun's energy humans began to grow and harvest food. Source: (Clarified, n.d.)

As the human population increased over time, so did humanity's dependence on fire. This increase in population led to severe shortages of wood in some regions of the world. For instance, by the sixteenth century, Great Britain had very few trees left because of overcutting of it, so the Britishers had to switch to a completely new source of energy. In place of trees, they began to use coal, oil, and gas which are extracted from deep under the ground known as fossil fuels. (Clarified, n.d.) Fig: 5.

3.2.1. During Middle Age

There was no consensus about what caused the rise of agriculture. One hypothesis is that the energy provided by the ecosystem was insufficient for a growing population's demands, which in turn forced to devise new methods to generate energy. In Europe, during the middle ages there was the development of wheeled plough and methods of rotating crops. This lead to population growth, gradually an increasing pressure on new energy base, i.e. cultivated crop, as well as on natural ecosystems.

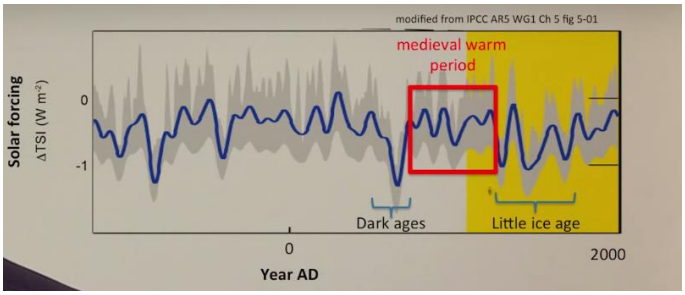


Figure -6: at the Medieval Warm Period Solar Forces

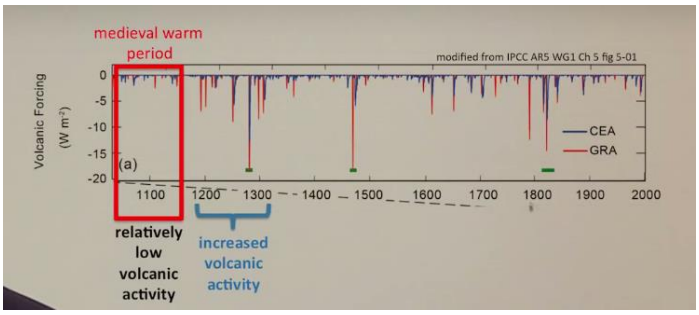


Figure -7: Medieval Warm Period Volcanic Forces

Source: (Matutis, 2011)

Ship building, which requires lots of timber, (fig: 8) contributes to the exploitation of the ecosystem, and so did production of Iron by keeping a mixture of ore and charcoal on fire with the help of Bellows. Technology development used bio-fuel or renewal sources.

Figure -8: Manufacturing of wooden ship

3.2.2. Industrial Revolution:

In England, coal replaced wood because of its scarcity mainly for the production of Iron. The development of new energy sources came with the invention of steam engine i.e. shift from bio energy to mechanical energy. This was the time of

the Industrial revolution and its driving fuel was coal fossil fuels. The revolution not only meant increased prosperity but also pollution of rail roads and cities, one can speak of the epoch of soot.

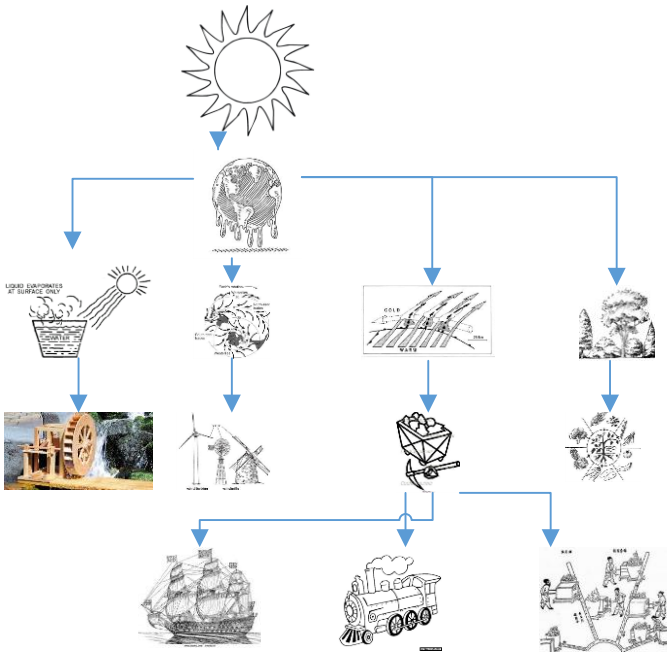


Figure -9: Shifting of energy from one form to other.

3.2.3. Present times:

From the second half of the nineteenth century onwards many things happened. Scientific advancement helped in technological development. Technological and economic speeds gets more and more hectic. The flow of energy on earth at presents is illustrated in figure:

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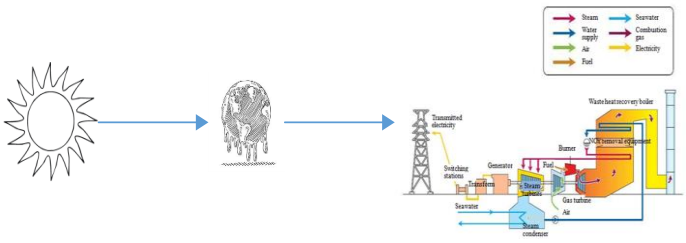

Figure -10: Energy use in Industrial Society.

It shows that how nature, technology and society are interrelated in terms of energy. The energy originated from nature (source sun), solar energy into ground heat, wind energy and electric energy. It finally linked up with the help of technical systems giving way to global economy.

4. CONCLUSIONS

- The consumption of fossil fuels in last few decades has contributed much to the degradation of our environment.
- In general, the best times for man in the last 18,000 years were the warmer periods. The times of the disruption of civilization were the cooler and more arid times.
- Global warming, climate change, extinction of wildlife species, depletion of ozone layer, and increase in air pollution are few of the problems from which our environment is suffering.
- Burning of fossil fuels, deforestation, industrialization and increase in pollution through human activities are considered as few of the factors responsible for global warming.
- "The next century of human-made global warming is predicted to be far less extreme than that which occurred at 9600 BC. At the end of the Younger Dry as, mean global temperature had risen by 7°C in fifty years, whereas the predicted rise for the next hundred years is less than 3°C. The end of the last ice age led to a 120-meter increase in sea level, whereas that predicted for the next fifty years is a paltry 32 centimeters at most. (Watts, 2013)
- It seems doubtful that this warming period will be a problem for man to adapt. It may be quite a task for anyone to find some solid global warming facts to alarm for some action.

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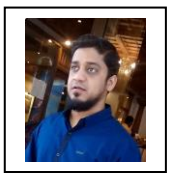
BIOGRAPHIES

Ar. Rakesh Kumar
Graduated(B.Arch.) from MANIT Bhopal, M. Plan. from SPA Bhopal. Currently working as Asst. Professor in Amity University, Haryana.



Ar. Mustakeem Raza Khan
Completed his B.Arch. from V.T.U, Belgaum-India and M.Arch. From Jamia Millia Islamia University – New Delhi. Along Architecture practice, rendered service as visiting faculty at Amity University Haryana. Currently working as Asst. Professor in Amity University, Haryana.