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The Energy Resources and Their Importance in the Local Environment

Abstract

This paper deals with the naturally occurring energy sources; introduces their physics and basics, accurately defines their terms and types, and assorts them into groups. It explains their importance in human history, reflects on their communal impacts of, e.g. settlement establishment and development, industrialisation and the formation of modern societies along with their consequences. It also shows methods and possible way-outs of their tight dependency and highlights the importance of locality and the possible co-operation in a widely globalised world.

Key words

Associative definitions of energy; Sustainability; Newly built settlements; Energy efficiency; Waste reduction; Local stability; Global integrity

„Most people spend more time and energy going around problems than in trying to solve them."

Henry Ford (1863–1947)

Introduction

It is, obviously, an interesting coincidence, yet a bit controversial and ironic that the introductory quote for this geographical serial publication's first study has been borrowed from that *Henry Ford*, who himself had significantly contributed to the emergence and development of the globalist perspective and its tightly associating 20th century's modern manufacturing sector. Its arrival onto the place of this study's introduction, of course, has no certain connections with the personal nature of the captains of industry; it, however, is increasingly mediated by its underlying message content, reflecting on the human way of *energy squandering* on all imaginable levels. In spite of that, it must be stressed that globalisation is not inherently wrong, but the local importance of global value of significance is being completely homogenised by many of today's political concepts of the social world and to top it off, the inhabitants—who live in and form these human systems—are made dependent from external and also unsustainable factors, therefore their local values could permanently be damaged.

Besides this, today's social complexity does not only have its weighty role in the global degradation of natural environment, but it also objectifies the humane values and all of its expressions by money are the benefit of a poorly structured globalisation. Moreover, one of its negative achievements is the individualistic lifestyle, which of its inorganic emotional spreading frequently results in making the weight of local spaces and their potentials unnoticeable. The modern man believes that one can live fully and independently solely, and that for its development, in addition, energy must be invested in exceeding their own capacity (even the working conditions expect this from them). Therefore, it is more likely that wrong and unsustainable decisions are born within an incohesive community which will eventually weaken all of the present social spheres even further.

This present study is not going to venture in making opinions on the negative impacts of globalisation on the social sphere; on the contrary, it is going to discuss the physical and human systems' basis-forming energy resources to make understand their nature, origins, natural connections and importance of utilisation in local dimensions, in accordance with the social sphere. After having clarified the definitions, the spotlight will be directed on, specifically, the energy resources to highlight their importance in mankind's social structure throughout its history. The aim of this study is to help understand the geographical energy systems in public interpretations and hence to present the tightening connections between the physical and human, and also the local and global spheres.

1. The bases in a nut-shell

Today's socialised man may doubt the otherwise obvious fact that human itself is part of nature, because most of the *Earth's* advanced-called societies already live in an artificially developed milieu where nature only has a subordinate role and the positive feedbacks are being cut down (HAJNAL, K. 2010). Human life is filled with, among other (mostly unnecessary) things, strange rules and laws, much paperwork, artificial and genetically modified foods, chemistry substances, and medicines. The natural contacts are being more increasingly weakened and almost everything that this world consists of can only be measured by money (e.g. GDP, GNP) (BOKOR, L. – SZELESI, T. 2011). Thus, for the social developments and their preservation, undoubtedly, the *Earth's* surface's naturally occurring processes (whether in a negative or a positive sense) play key roles. In the absence of nature and its given 'goods', the technological progression of currently on the highly-developed level of human societies would not have been possible.

At the dawn of humanity, most importantly, natural processes, physical interactions and earthly laws had fostered a rock-hard-long-standing relationship between humanity and nature. Man used only locally accessible and technically easily exploitable energy resources, for example solar energy and its closely related associates, such as

wind energy, hydro energy and also—in accordance with the early harnessing purposes of biomass—a variety of timber produces were used straight for production (SOLOMON, B. D. 2010). However, the natural degradation of these resources, i.e. their recirculation into the physical systems, was also positive; there was no accumulation of useless by-products, waste or scrap. The manufactured goods served local interests; therefore, the demand supported life-sustainment.

By the beginning of the 18th century, because of the impacts of the *Industrial Revolution*, the wide expansion of factorial use of coal resources, and also the results of the technical–technological development, a change had begun on a larger scale than ever before. This dominant type of fossil fuel (coal) resource, in almost all areas, directly or indirectly showed its impacts and contributed to the sweeping of electricity and its energetic utilisation (DAEMEN, J. J. K. 2009). However, this had also transformed the ways of energy devouring and its consumption structure which has established the most sensitive basis and structure of the present social world.

Fossil fuels are also naturally occurring and basically "renewables" (but in a much longer period of time). However, their continuous availability and exploitability—along with their current rate of consumption—is not constant and all of their uses have become a more widespread issue on environmental levels (e.g. global warming and climatic changes [Henson, R. 2008]). In fact, in the last several decades human has "rediscovered" the physical sphere's constantly and continuously available energy resources and, at present, is increasingly integrating them into their daily lives. According to the above mentioned facts, we are now going to discuss the logical system of energy resources—try to establish new aspects of their classifications and fulfil their definitions with new contents—starting with the *energy* itself which is not as simple as our regular wordy use would indicate …

2. Energy, energy bearer, energy source and energy carrier

In the title of this section, there have been words mentioned that are terms which we often encounter in a variety of media feeds. We are,

more or less, aware of their meanings and it is also easy to realise that they are integrated parts of our lives. However, we seldom bother with nuances in their meanings and with the differences in their contents; but their distinguishing is important, especially, if they are checked from the point of view of geography. Whilst the majority of human beings can describe energy with an acceptable intellectual content, the differentiation between *energy bearer*, *energy sources* and *energy carrier* can hardly be understood, and they are often treated—also by experts—with synonymous meanings. Obviously, this does not mean that the terms' synonymous concept would raise doubts; however, their definitions can be fine-tuned, because synonyms do not always give the same meaning to different words and terms, which could easily result in misunderstandings (BOKOR, L. 2010).

2.1. Energy

Everything that exists in our *Universe* is composed of either *matter* or *energy*. The co-operation of these two is essential, because energy is what makes matter change through time, which causes the shaping processes of our *Planet* (STRAHLER, A. H. – STRAHLER, A. N. 2002).

The term *energy* was first used by the 17th century's iconic astronomers, mathematicians, philosophers and physicists such as *Johannes Kepler*, *Sir Isaac Newton* or *Gottfried Wilhelm Leibniz*. However, it was first formally used as a technical term in modern interpretations in 1807 by *Thomas Young* (CREASE, R. P. 2009). Contemporary physicists state that *energy* is one of the most common and basic science concepts (BONIFERT, D. 1993) which, in a special sense, means the ability to do work (BREUER, H. 2002; LITZ, J. 2005). It, in general terms, represents an opportunity for change because *the second law of thermodynamics* limits the work of thermal processes (BONIFERT, D. 1993). Accordingly, it is not easy to define energy (it is not even our goal), but whatever it is, it seems to move with or within forms of matter (STRAHLER, A. H. – STRAHLER, A. N. 2002).

The energy is nothing more than stored "work or force" which is rereleased under appropriate conditions (GULYÁS, J. *et al.* 1995). This

appears in different forms, such as *thermal*, *electric*, *nuclear* and *mechanical* (BREUER, H. 2002). The forms of energy may be divided into three main groups: *kinetic energy, potential energy* and *chemical energy* (STRAHLER, A. H. – STRAHLER, A. N. 2002). The forms of energy may be traced back to one of the four *fundamental interactions of physics* (fundamental forces/interactive forces). The known fundamental interactions are: *gravitation*, *electromagnetism*, *strong nuclear* and *weak nuclear* (HOLICS, L. 2009).

2.2. Energy bearer and energy source

The *energy* itself is invisible, rather than a factual, objectified material. This is typically transmitted by the *energy source*. However, this is already a more evident material that is always a source of energy stored in a characteristic *energy bearer*. This latter principle may be anything, as everything is abundant in stored energy (so-called *subatomic energy*) that can be handled or seen (EDDINGTON, A. 1935). From the point of view of, and in the earthly dimensions of our geographical approach, *Earth*, in this sense, is one of the biggest energy bearers. It bears different types of energy sources that may be objectified in materials (e.g. hard coal), or in the direct or indirect results of physical processes and phenomena that cannot be detected with a naked eye (e.g. wind). Its nature and manifestation vary by *geographic dimensions*, i.e. most of the energy bearers can conclude in the existence of more energy bearers. This *spherical structure* may include the whole lithosphere or a single mountain range that bears various *energy sources*. There can—for the modern society's needs and use—be *thermal energy* or *electric energy* transformed from *(Figure 1)*.

2.3. Energy carrier

The principal difference between the energy bearer and the energy source is that the source can be exploited for its electric power and thermal unit, but the energy bearer does not function as a source. The *energy carrier* is, according to *ISO 13600*, either a substance (energy form) or a phenomenon (energy system) that can be used to produce

mechanical work or heat, or to operate chemical or physical processes (ISO, 2007). The energy carrier is a product that can be directly used in demand of energy, for example batteries, petrol.

Sometimes, it is very difficult to see the differences among the bearer, the source and the carrier. To make their terms clearly understandable, our approach has to be simplified: in this sense, the bearer is, for example, a mountain where the source (e.g. black coal) may be found; and the carrier is, for example, the electricity itself that is transformed (produced) from the source and is either directly used (for lighting homes) or stored for further use in a particular device (e.g. battery) *(Figure 1)*.

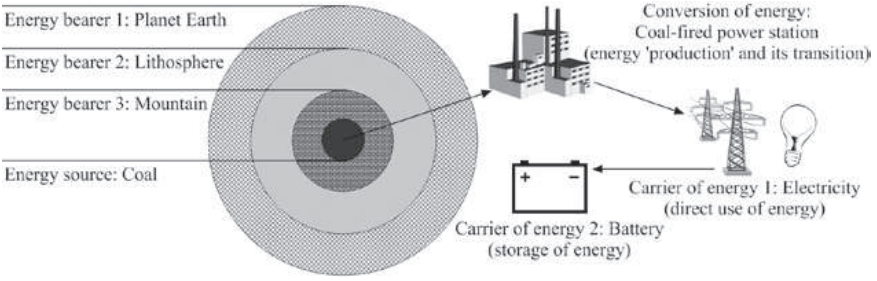

Figure 1 – A simplified example of the spherical structure of the energy Resources
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According to the above broadly explained terms and also to the clarification of physics along with the *law of conservation of energy*, the *energy in no processes can be created or destroyed; it can only be transformed from one form to another* (Gazda, I. – Sain, M. 1989; Huber, T. M. 2010). The total amount of energy in a closed system remains constant over time. Within the system, energy can change its location and it can change its forms, as well. The system energy may be exchanged with the system's surroundings (Bonifert, D. 1993).

In an open system—like the planet where we live or even our body—we can experience a so-called *wastage of energy* where the energy is transformed into an economically useless form. The process

is also known as *Rudolph Clausius*'s term of *entropy*. In this sense, when a piece of coal is burnt, it will have no energy left to be exploited for human energetic purposes. The employed materials can be converted into different forms of energy to obtain electricity or heat, but the available amount of many of the *Earth's* materialistic energy resources is limited. The whole process may be drawn as a flow system in which matter, energy or both move through time from one location to another (STRAHLER, A. H. – STRAHLER, A. N. 2002). In this interpretation, this is the so-called *energy flow system* (open, closed or isolated).

This clearly shows that the term *production* is by no means, because energy is certain in a pre-given material or vehicle that cannot be produced but it can be transformed into types of energy (e.g. electricity) that can be utilised in the human environment *(geographical sphere)*. This transformation can be achieved by technological equipment such as a coal-fired power station. Therefore, terms as "production" could be dispensed with a general sense. However, the word "production" is strongly associated with the human *economic sphere* where energy development has principal importance, thus, the terms *energy production* and *consumption* are used to describe a series of social activities (e.g. transportation, heating and ventilation).

The electric and thermal energy are obtained by the conversion of specific materials or by harnessing the types of physical phenomenon. This specific thing is the so-called energy resource which types can be placed into three groups: *non-renewables* (non-constants), *renewables* (constants) and—considering the creation of a new group between the previous two that we are now going to mention for the first time and name it as—*sensitively renewables* or shortly *sensitives* (or semi-constants) *(Figure 2)*.

According to the ways of consumption, the energy sources can be:

a. *primary* (they can be used directly without modification, for example: black coal);
b. *secondary* (they are converted from primary sources, e.g. electricity from black coal generated by a power station. Having referred to *ISO 13600*, these are the so-called energy carriers);

c. *tertiary* (normally a "waste of energy" that comes to existence as a by-product of the secondary energy source, e.g. thermal pollution).

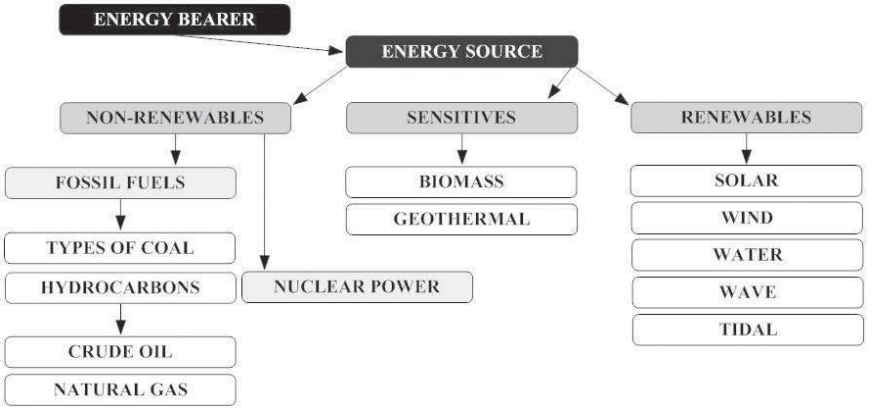

Figure 2 – The structure of energy resources
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3. The very first energy resources of humanity

The human's first source of energy was its own *muscle power* which was later complemented by those of the animals—e.g. *horse* or *bull power* (Solomon, B. D. 2010). However, in order for a living organism to be able to use its own power, a very important *external energy source* is required: according to historical information, human, who at the dawn of its evolution conducted fishing, hunting and berry gathering activities, found its first energy source in the form of *food* (van Ginkel, A. 1999). For living organisms, the energy for life is the process called *energy intake* which is operated by the *aerobic respiration* (respiration of glucose) (Beckett, B. S. 1986) and can be clearly understood by the open flow system of energy. The energy of food for life, like most of the *Earth's* energy resources, originates from the *Sun* (Strahler, A. H. – Strahler, A. N. 2002). At this stage of energy utilisation, a link already appears among food, muscle power and also the *Sun*. This was accelerated by the discovery of *fire* (the most common chemical reaction in

nature) which changed the human's habits in its roots. The custody of fire brought serious challenges into human life which, in all probability, contributed to the development of the first human settlements. If the fire guarding facilitated the establishment of the first settlements, it was also necessary that those settlings must have had a protective location (environmental factors) where the significant energy resources (e.g. water, wood, berries), for the human living, were also provided by nature. These are the so-called *local energies*. These settlements were mostly created in different landscapes that had a decisive encounter, e.g. mountain/hill meeting with alluvial plain/river or all of them together, and had a great influence on the development of agriculture (HAJNAL, K. 2010). Consequently, the settlements were mostly established on sites where the differently strengthened *locus* formed energy centres *(potential of energies),* and where these vital resources were given. This evolutionary progression also affected the development of settlements and the natural sphere had been transmitted into a *geographical sphere*.

4. Locality and the Energy Resources

The *geographical sphere* emerged from the encounter of the *natural* and *human spheres*. The latter is now independently shown as *social sphere*. The two are separated from each other, although it is very difficult to draw a line between them. Having set our focus on locality only, we can, more or less, talk about *geographical spheres* in plural. The society itself is also integrated into these spheres which of its most important basis components are, undoubtedly, the *energy resources,* and their day-to-day role show a greater significance in the survival of the currently advanced forms of societies (JUHÁSZ, Á. 2009).

While the natural sphere is an efficient and self-sustaining mechanism, the human sphere is increasingly moving away from nature and it tries to operate independently by adopting special rules, and attempts to exclude nature from this mechanism (HAJNAL, K. 2010). This also means that the inherent bond between the physical and the social spheres is being increasingly cut down. Therefore, a stable, effective

and sustainable mechanism is tipping over for an unstable, inefficient and unsustainable state. Within this sphere, according to the needs of human society, today there is hardly any tool which, in some ways, is not in association with electricity. The buildings where we dwell, the vehicles that we drive, but in smaller dimensions mobile phones, laptops, GPSs and the recently expanding market of electric books and even electric cigarettes (!) are just few examples of the highly demanding devices of electricity in our spheres. To use these kits and gadgets, our world constantly requires the availability of electricity that must be continuously obtained from somewhere and from, somewhat, a specific source of material. In this context, a sustainable social milieu is unimaginable without the presence and usage of energy resources and this, most importantly, is the reason for our dependency in a de-facto dependent and limited natural/physical system.

In the recent centuries, the formation of industrial locations—primarily in connection with the conventional energy resources (e.g. coal and hydrocarbons)—initially at a local level, thereafter at a relatively wider area, have affected not only the local settlements but have also had their impacts on the development of vast regions. This type of energy production—based on trade (export and import) that reaches immense distances—has transformed many countries of our planet into "high-standard" communities. Nonetheless, the social-shaping processes of the 20th century, such as the boom in population growth and technical revolution, have had even worse impacts on those regions where the world economic production and competition were not guaranteed without the local presence of energy resources. Even though an area has significant local resources and reserves, it can hardly compete with cheap and concurrent types which results in import energy dependency (or sensitivity) and/or leads to the devaluation of a region. The consequences of this dependency mean constant import which makes the country's products expensive in the world market, and these are the countries of the planet which are the most vulnerable by the periodical economic or energy crises of the social milieu. These are the countries and regions where the life has become

or can become difficult in the near future. These differences, of course, may show even worse distinction within a state's social sphere, too.

In the availability of conventionally utilised fossil energy resources, the importance of locality remains significant but their demand reaches global dimensions which can be seen in the developed countries like *Japan*. The latter forms one of the most important pillars of the world's economic centres. However, being in the central vein of this system's circulation without being noteworthy locally, it is not capable of exploiting usable resources to keep their industry or economy independent. In this case, there are no other possibilities but import; however, the conventional energy sources, regarding their extremely slow renewing period, are not suitable to keep up sustainable growth in a limited environment and physical sphere (HAJNAL, K. 2010).

It is then not surprising that, because of this sensitivity in energy demand and supply, the locality's role has been steadily increasing and the *renewable*, *sensitive* and *alternative energy resources* are highlighted in this context even more than ever before. The truth of the latter sentence is most valid for those countries which are protected and secured by archaically structured high-standard societies (e.g. most of *Europe's* countries) and are seeking alternatives, or in those regions which lack fossil fuels but could achieve astonishing development by setting their basis on local—especially renewable or sustainably maintained sensitive—resources (e.g. *Japan*).

5. Conclusion

The achievement in modernisation of the present world's energy consumption, locality and decentralisation should be given wider authority. This, of course, means that to bring off an efficient and secure energy production, the whole energy system must be installed on diversity formed by the variety of resources that are naturally occurring and given in a specific area of the natural sphere. The local demands, industry and economy, however, must be shaped by these natural resources that could then be integrated into the g*lobal sphere* as a working mechanism where co-operation has a major importance.

On *Earth*, there are still regions in existence that those basis of energy producing systems are fully (100%) established on only one source of energy; although, it requires another approach and angle to observe whether this resource makes the country dependent or independent. In the case of the electricity 'production' of *Bhutan*, this means exactly 100%, locally-sourced hydro energy which exceeds its own demands, so the country has enough potential to export electricity to the neighbouring *India* (BOKOR, L. – SZELESI, T. 2011). In the opposite case, *Malta* and *Cyprus* are two extreme examples of those where the current fragile structures of economy are due to the majorly imported resources which make these countries fully dependent to the outer world. In *Bhutan*, there are even initiatives to exploit local renewable energy resources (such as wind and solar) approached by holistic methods (PAULI, G. 2010) but opposite to this fully independent country, there can hardly be seen a good example for local progressions in *Malta* or *Cyprus* which already has an effect on a wider European energetic instability, dependency and, therefore, vulnerability.

If—within a circle of cohesive society—the energy production were established on a multi-sourced basis and everything were locally used and integrated into this, and these sources were utilised by state-of-the-art equipment (importance of *high technology* must be highlighted) that were efficiently obtained in connection with the reduction of unnecessary wastage regarding sustainability, then a nearly independent state could be achieved within a flexible and complex community. By this system, a locally-based and stable circumstance could be granted that would also give the opportunity to widen the natural co-operation among the other localities. These local strategic points could, altogether, be integrated into a wider system and linked to other systems which could all contribute to the creation of a successfully sustainable global network that could help reduce or completely wipe out the unnecessary dependency *(Figure 3)*. In this context, by borderless, logical and responsible co-operation, the global connections would appear as *cohesive power points*. There are already similar examples for this sort of system that can be found in the co-operating networks of *eco-*

villages. Without working together every step that human tried to take forward, it would be sentenced to death. PAULI, G. (1998) describes this importance also as an example that arises to represent this positive energy flow: *"In nature, bacteria, enzymes, mushrooms, earthworms, insects, birds, bees, bats, rodents, deer, bushes, and trees—just to take a dozen living species in the forest—all depend on each other. It is only by co-operating in a tightly knit fashion that they have a chance of surviving, an opportunity to develop and generate an ever-improving system in which all evolve."*

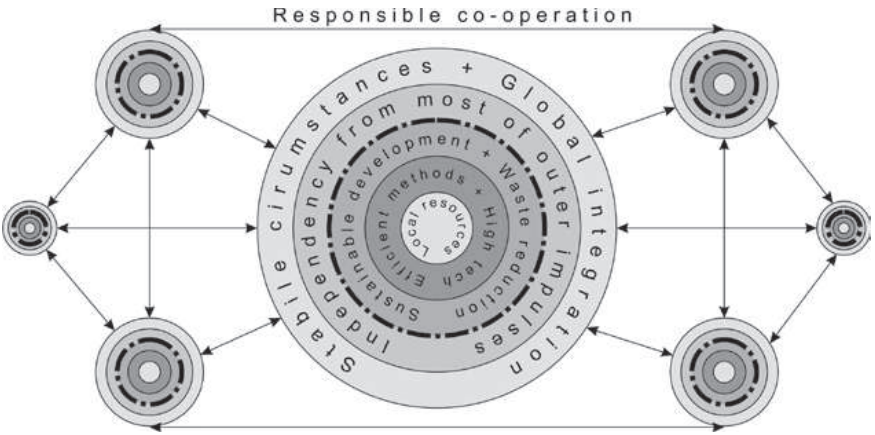

Figure 3 – The structure of a sustainable entity
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The creation of the system mentioned in the previous sentences is not impossible, however, at the moment, it may seem to be a utopian venture, because the majority of regions, micro-regions and their settlements (especially monster cities and their satellite settlements), and in the present vulnerable and instable social sphere, are being based on archaic and obsolete systems. Their, sometimes, overgrown collective population does not allow any reformer change or straightforward transformation to the local resources. Accordingly, this reflects on sensitive structural problems of the old settlements, which require complete transformation or even withdrawal and rebuilding from their

roots by adapting new reforms in the traditional architecture and also in settlement planning for the sake of sustainability.

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