RIHAY Zsuzsa

Energies of Renewal

The aim of this article is to elaborate the issue of renewable energies, but before touching upon renewable energies, some general comments on energy as such should be made. When speaking about the usage of energy, the question of sustainable development is usually mentioned as one of the essential ones. Therefore the discussion can begin with a clarification of terms – a definition of sustainable development: "Answer the needs of the present without compromising the capacity of future generations to answer theirs." Energy is a key question of today and serves the sustainability of the human society. Modern societies cannot function properly without energy. When we try to specify the term "energy" we have to ask the following questions: Where does it come from? How does it reach us? What do we need it for? How much does it cost?

The energy we use comes from power plants, they generate heat or electricity from fossil fuels, and it reaches us, consumers, through the national grid. We need it for everything, many different purposes, I need energy to recharge the battery of my mobile phone, energy is needed for the production of this chair beside me, etc. But we have to be aware of the fact that only 20% of the world population live in the richest countries which consume 60% of the total electricity. Another fact is that 40% of the world's population do not get electricity.

I. **Non-Renewable Energies**

1. Effects of the Industrial Revolution

To understand the concerns connected with the energy situation of today we have to go back in the history of the Earth and humankind. The fossil fuels we use for energy purposes came into being during the last 500 million years. These are being burnt, distilled, modified and used for the pro-

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duction of electricity or heat, or used by the chemical industry for the production of plastic materials. These fuels are not everlasting: the known stores are to run out. Oil and gas will run out first. Coal will last the longest, but it is the most polluting of the fossil fuels.

Since the beginning of the Industrial Revolution humankind has been using fossil fuels in an increasing amount. Nowadays we consume the same amount of oil in six weeks as we did in 1950 – in a whole year. Another factor of the global energy crisis is that the population of the Earth is growing: today the Earth has six billion inhabitants, in 2050 it will be ten billion. These facts not only affect the energy issue, but also raise many other questions. It must be mentioned in this connection that the forest-covered areas are rapidly disappearing. Rainforests are being reduced, wood is used in developing countries for heating and cooking and the deforestation leads in certain countries to desertification (and soil erosion, etc).

Global warming of the planet constitutes another significant problem. Global warming is caused by the increasing greenhouse effect, which is the result of industrial production, extensive traffic and energy-generation based on fossil fuels. When we burn oil, natural gas, or coal, CO_2 and other greenhouse gases are produced. The simplified circle of the CO_2 can be described in the following way: trees extract the C from the CO_2 plant and O_2 is released. When a tree is burnt, it releases that amount of CO_2, which it bound during its lifetime. When we burn fossils, they release CO_2 which had been bound for millions of years. There is not a sufficient amount of forests that could absorb this amount of emitted CO_2.

Increasing greenhouse effect leads to a global warming of the planet and this has grave consequences for the whole Earth. Besides desertification, there are significant changes in the weather, the ice of the North and South Pole as well as the ice of the mountains is melting, which leads to an increase of the sea level. Venice, Holland or Bangladesh could be soon covered by water.

One part of the solution for burning energy and the environmental problems can be the usage of renewable energy sources – both in the industrialised and the developing countries. A comparison of the advantages and disadvantages of renewable and non-renewable energy sources can prove vital for further considerations.

Fossils and non renewables are the following: coal, oil, natural gas and uranium (which is nuclear). Their pros are that they are cheap, they are easy to transport and they are concentrated. Their cons are that they will run out, they pollute (which causes the greenhouse effect and the acid

rains), we depend on them (e.g. not all countries have fossil-sources; and this influences the political and economic relations).

2. Nuclear Power

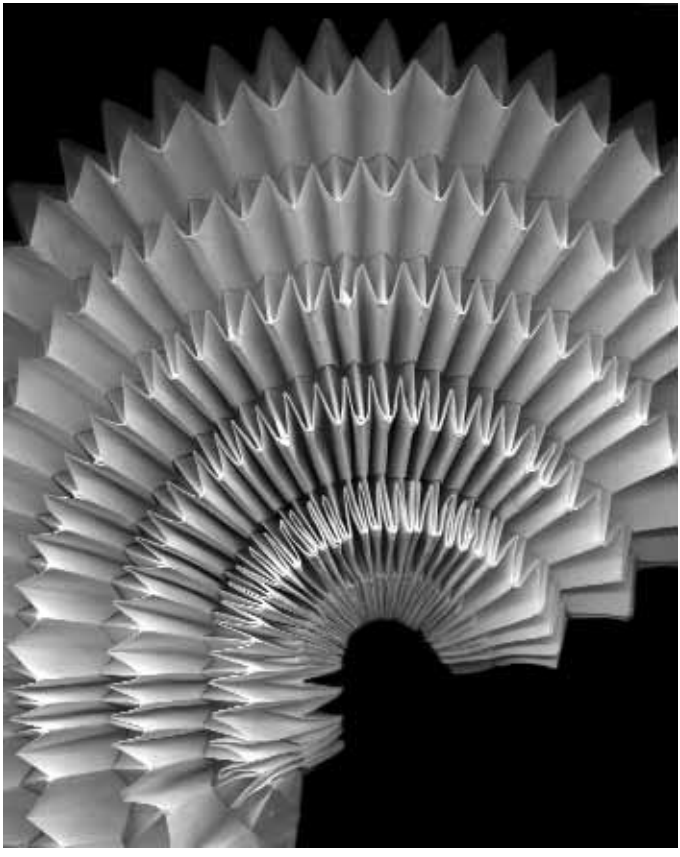
Before getting into details concerning renewable energies, some brief comments are to be made on nuclear power, which in its essence is neither a fossil nor a renewable energy source. A nuclear reaction is a change in the nucleus of an atom, and can be triggered by bombarding an atom with a subatomic particle such as a neutron or proton. In a nuclear fission reactor, a neutron strikes the nucleus of an atom with a heavy nucleus, such as a particular type – or isotope – of uranium atom. The nucleus of this atom splits, releasing huge amounts of energy, mainly in the form of heat. Other neutrons are also released, which initiate a chain reaction by striking other nuclei. Nuclear reactors control this reaction and use the produced heat to generate electricity.

Nuclear fusion – the reaction through which also the sun generates its heat – is still in development. Light nuclei, such as those of the isotopes of hydrogen, are combined to make heavier ones, such as helium, at very high temperatures and pressures. Large amounts of energy are released in the process but the reaction has proved to be difficult to contain and control. Nuclear power is currently generated from nuclear fission – splitting the nuclei of atoms. Nuclear fusion – combining atomic nuclei – is potentially cleaner because the fuels involved are different.

Nevertheless a number of scientists have been trying to harness the energy from atomic fusion for decades and some say a working fusion generator is still a lifetime away. There is a close link between civil and military uses of nuclear power. Nuclear fission power plants provide about 75% of electricity in France, a quarter in the UK and 15% in the US. More than 100 of the world's 400 nuclear power plants are in the US. Nuclear power plants provide about 17% of the world's electricity.

The pros of the nuclear power are that it can generate large quantities of energy without releasing greenhouse gases. It does not depend on the weather. The UK's largest reactor generates the equivalent output of 1188 wind turbines. A nuclear fuel pellet, about half an inch long, provides the same amount of electricity as one and a half tons of coal.

Its cons are that the fuel spent from nuclear power plants remains toxic for centuries and there is no safe permanent storage facility for it. Dismantling old reactors safely is highly expensive. Mining and enriching uranium produces toxic waste. Uranium is a finite resource, although there are ways of recycling fuel spent. Fears of nuclear material stolen from



power facilities and used by terrorists in a so-called “dirty bomb” have substantially increased recently.

II. **Renewable Energies**

Renewable energies are the following: wind, water, geotherm, sun and biomass. Their pros are that they are decentralised, they produce little or no CO_2 emission, they are not polluting, they keep the environment clean (and thus the health care costs are lower), they are unlimited (since natural cycles renew them) and they are equally distributed geographically.

Their cons are that they are unequally distributed in time, their storage is unsolved, they are not concentrated and the investment costs are high.

1. Wind Power

Windmills have been used for pumping water or grinding grain for centuries. A windmill's modern equivalent – a wind turbine – uses wind energy to generate electricity. Wind turns the turbine's blades, gears increase the rotational speeds. The rotating turbine shaft drives the generator which transforms the mechanical energy into electrical energy. Manufacturers today produce giant turbines – ninety metres tall, with rotor diameters bigger than the wingspan of a jumbo jet. One standard-issue turbine can produce at least one megawatt of electricity, enough to supply at least 800 houses.

The world market for wind turbines has been growing by an average of 40% a year since 1995. Nonetheless wind farms still produce only a tiny faction of the energy of the world. There are currently about sixty operating wind farms in the UK, supplying enough power for 250,000 homes each year, or about 0.3% of total UK electricity consumption. A good example for wind-energy use is Denmark; near Copenhagen, in Öresund, where there are 20 wind turbines, planted in the sea and they cover 3% of Copenhagen's electricity demand. By 2030 Denmark plans to cover 50% of its electricity needs from the wind energy. (Today it is 10%, world-wide only 2%.)

The pros of wind power are that it is safe, inexhaustible and free. The cons are that wind speed is variable and unreliable. Wind farms are typically located in high, exposed, rural locations, where they can be seen as eyesores. They are often noisy, although modern turbines are quieter than their predecessors. Wildlife habitats can be disrupted and there is a risk of birds getting caught in the blades. Off-shore wind farms can be an alternative solution, but they are expensive to build and maintain. It is cheaper to put more coal into an existing power station than to build a new wind farm.

2. Water Energy

A. Hydropower

Water stored in a dam is released downhill through a pipe, turning a turbine as it flows. Most water turbines look similar to propellers of a ship, with several blades set at an angle which can be adjusted depending on the output power required. The rotating shaft drives an electric generator, which transforms the mechanical energy into electrical energy. If the vol-

ume of water flowing into a dam is not sufficient to generate power continually, a pumped storage system can be used. Water which has passed through the turbine is stored in a lower reservoir and pumped back up to the upper reservoir using cheap, off-peak electricity. This water can then be reused to generate power when demand is high.

The pros of hydropower are that it is not polluting. It is renewable since water flows are replenished by the hydrologic cycle which is powered by the sun. Its cons are that hydropower only makes sense for countries with suitable climates and topographies. Building dams can involve diverting rivers, flooding farmland and countryside and displacing local people. Wildlife is disrupted and fish can die in the blades of the turbines. Forests are often eliminated to build the necessary infrastructure. Dams can trap silt which would otherwise enrich soils downstream. Flooding is a potential hazard if the dam bursts or the reservoir is filled with silt. Damming cross-border rivers can result in disputes with neighbouring countries downstream.

B. Ocean Energy

The ocean offers two types of energy – thermal energy from the heat of the sun, and mechanical energy from the tides and waves. Oceans cover more than 70% of the surface of the Earth, being the world's largest solar collectors. According to the National Renewable Energy Laboratory, if less than 0.1% of this solar energy could be converted into electric power, it would supply more than twenty times the amount of energy consumed every day in the US.

Electrical energy can be generated using a temperature difference of 20C° between deep ocean water and sun-heated surface water. The warm surface water itself can be turned to steam in a similar way to geothermally heated water, or it can be used to vaporise a chemical with a lower boiling point. The steam drives a turbine, before being condensed using the colder deep water. Tropical island states are best placed to benefit from the technology.

Several devices have also been developed to generate electricity from the motion of tides and waves. One wave power facility on the Scottish island of Islay produces enough power for 400 homes – electricity is generated as wave motion moves a column of water up and down inside a concrete pipe. Tidal power works similarly to hydropower. Water is trapped behind a dam at high tide, and then released – turning turbines to generate power – as the tide ebbs.

3. Biomass

The sources of bio-energy are first of all forestry waste, wood industry waste and agricultural by-products as well as energy plantage (like aspen, acacia, sallow and miscanthus), and communal waste. Then there are oil plants (sunflower), rape (bio-fuels); as well as alcohol (potato, corn, rape potato and sugar-beet). Finally, there are agricultural (organic and animal waste, e.g. dung) as well as industrial waste, communal waste, landfill gas, sewage gas (domestic waste water); and the gasification of biomass.

Bioenergy comes from burning biomass – organic matter such as wood or plants. It supplies more than 90% of the total energy demand in Nepal and Malawi, and 25% to 50% in large industrialising countries such as China, India and Brazil. Austria uses bioenergy for 13% of all its energy needs. One of the crudest forms of bioenergy is the open burning of dung or wood for cooking in developing countries – though one power plant in the UK burns chicken dung. This burning is often done indoors – a practice responsible for about two million air pollution-related deaths each year.

But bioenergy can also be used to convert sustainably grown crops or agricultural, industrial and municipal wastes into useful energy. Methods range from adding biomass products into coal-fired boilers, to fermenting sugar cane to produce ethanol-based car fuel and to burning methane gas produced as biomass decomposes. Burning biomass can still release greenhouse gases, although plants grown for fuel manufacture also absorb carbon dioxide while they grow. Depending on the fuel type and the applied process, bioenergy can be much cleaner, and the sources more renewable, than in the case of fossil fuels.

4. Geothermic Energy

Geothermal energy comes from the heat in the core of the Earth. In Iceland nearly all buildings are heated in this way. Geothermal power plants contribute significantly to the electricity supply in El Salvador, the Philippines, Japan, Mexico, Italy, New Zealand and the western part of the United States.

In some geothermally active regions, the heat from rocks and water is close enough to the surface and can be accessed cost-effectively. Hot water or steam is pumped from underground. Steam can be used to turn turbines directly. Hot water can be pumped to the surface under pressure and can be turned into steam by rapid decrease in pressure. Alternatively, the heat can be used to vaporise a second liquid with a lower boiling point than water – the resulting gas is then used to turn turbines. The volume of water taken out of the Earth can be re-injected, making geothermal power a sustainable energy source.

5. Solar Energy

We can talk about active or passive, thermal or photo-voltaic usage of solar energy. We talk about passive usage when in certain architectural solutions we take into account natural conditions and the orb of the sun; in the case of suitable insulation, solar-roofs, winter gardens, solar-walls, a lot of energy can be saved both on heating and on cooling.

An example of simple but effective use of solar energy can be the sun-heating of water (in barrels) in weekend-house gardens. There are of course more sophisticated versions of active solar thermal energy usage, for hot water and heating. You can see dark cells on roofs – a special kind of glass which covers a pipeline filled with antifreeze liquid. With the help of heat exchangers, pumps and tanks the inhabitants of the house can be provided with warm water in this way. Considering the Magyar average sunshine, 70% of the yearly hot-water need of a four-member family can be covered by a 4-6 m² sun collector. In Greece and Israel almost all of the hot water is generated by solar energy.

Solar power is often used to power calculators and other electronic accessories. Solar panels – made up of photovoltaic cells – are also sometimes used on roofs to provide electricity to households. The properties of the materials called semiconductors enable electrical current to flow through them when they have direct contact with light.

In a photovoltaic cell, two different types of semiconductors are layered together. Typically, the atoms on one side (n-type) have a single electron in the outer shell. The atoms on the other side (p-type) are one electron short of a full outer shell. When the two layers are placed together, electrons move from the n-type side to fill the “holes” on the p-type side. This creates an electrical field at the junction between the two layers.

Once set up, this electrical field effectively creates a barrier to more electrons trying to move from the p-type side to the n-type side. When light shines on the whole cell, it knocks electrons free from their atoms. But the charge at the junction causes all the free electrons to build up in the n-type layer. If an external electrical circuit then bypasses the junction, the electrons flow through it as a current.

There are projects that focus on the development of large-scale solar plants to produce hundreds of megawatts at a time. In connection with solar energy one obvious fact should be mentioned: the sun shines everywhere. In the rainy Belgium with governmental help and several institutions’ support a house was built whose energy demand is solely covered by sun energy.

The pros of solar energy are that it is free and renewable, silent and gen-

erates no emissions. The cost of photovoltaic cells has dropped significantly in the past few years and is predicted to fall further as mass production increases. Photovoltaics are one of the few renewable technologies that can be integrated into the urban landscape. They are useful in remote areas far from a source of conventional electricity. Unused electricity can be fed back into the national grid.

The cons of solar energy are that it is of limited use in cloudy places and also in some cities where roof space is tight. PV cells are not very efficient, absorbing only about 15% of the energy of the sunlight. There are extra costs, such as systems to store the energy for when the sun is not shining. Some of the huge batteries used contain heavy metals (e.g. Labacum) thus being an environmental danger if not properly disposed of. Toxic chemicals are also used in the production of semiconductors.

III. **Think Globally, Act Locally**

As it has been shown renewable energy resources can be used basically everywhere, taking into consideration local possibilities. But it should not be forgotten that this is but a part of the solution. To realise the idea of sustainable development it is not enough simply to change our energy sources. It requires changes in our way of thinking, way of consuming – the issue has its ethical side.

It cannot be emphasised enough that ethical consumption has a great power. Environmentally conscious decisions can be made in any field of activity. A famous slogan says: think globally, act locally. Ethically and ecologically conscious citizens do not expect someone else to do things for them, as they realise that it is themselves who are bound to act. No matter the profession, whether lawyers, theologians or engineers, ethically and ecologically conscious citizens can produce environmentally important decisions and steps, taking into consideration not only the needs of the present generation, but also of the generations to come.

Suggested Reading
http://news.bbc.co.uk/hi/english/static/in_depth/world/2002/disposable_planet/energy
http://www.yannarthusbertrand.com/fr
http://www.energiaklub.hu

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RIHAY Zsuzsa: A megújulás energiái

A cikk, mielőtt kidolgozná a megújuló energiaforrások témáját, az energiaszükséglet tényét és annak egyenlőtlen eloszlását veszi számba. Riasztó számokról szerezhetünk tudomást: a föld népességének mindössze 20%-a él a gazdag országokban, ezzel szemben itt fogyasztják a teljes villamosenergia 60%-át; vagy egy másik adat: a föld népességének 40%-a nem jut villanyáramhoz. Ezek után egyértelműen belátható az energiafölhasználás és a fönntartható fejlődés kérdésének elválaszthatatlansága. A cikk fölsorol néhány, a megújuló és a nem megújuló energiaforrások mellett és ellen szóló érvet, amelyekhez azonban nemcsak azok ökológiai és gazdasági, de politikai és társadalmi következményei is odatartoznak. Közelebbről: a nem megújuló energiaforrás (szén, olaj, földgáz, urán) olcsó, könnyen szállítható, koncentrálva fordul elő, de hátránya, hogy kimerülhet, szennyező hatása is közismert, és függünk tőle. A megújuló energiaforrás (szél, víz, geotermikus energia, napfény, biomassza) hátránya, hogy egyenlőtlenül oszlik el időben, nem sűrített alakban helyezkedik el, fölhasználása magas beruházási költséggel jár, másrészt viszont nem szennyez, korlátlan mennyiségben és egyenlően oszlik el a térben. A megújuló energiaforrások működéséről és használatuk legjobb módjáról, alkalmazásuk helyéről szintén olvashatunk. A cikk felelősségünk hangsúlyozásával, gondolkodásmódunk és fogyasztási szokásaink sürgős megváltoztatásának kiemelésével zárul.

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RIHAY Zsuzsa: Odnawialne energie

Zanim artykuł zgłębia zagadnienie odnawialnych źródeł energii, porusza on problem ważności energii i jej nierównomiernego podziału. Przytoczone są zaskakujące liczby świadczące o tym, że tylko 20% światowej populacji żyje w najbogatszych państwach świata, które konsumują 60% całkowitego zużycia energii lub że 40% światowej populacji nie dostaje elektryczności. W ten sposób ukazany jest widoczny związek pomiędzy zużyciem energii a zrównoważonym rozwojem. Artykuł wspomina wady i zalety odnawialnych i nieodnawialnych energii, które dotyczą nie tylko ich ekologicznych i ekonomicznych konsekwencji, ale też politycznych i społecznych. Mianowicie chodzi o to, że energie nieodnawialne (węgiel, olej, gaz naturalny, uran) są tanie, łatwe do przetransportowania, skoncentrowane; ale ich wadą jest to, że się skończą, zanieczyszczają, a my jesteśmy od nich zależni. Wady energii odnawialnych (wiatru, wody, energii termicznej, słońca, biomasy) są następujące: są nierównomierne dostępne w czasie, nie są skoncentrowane, wymagają wysokich nakładów finansowych, ale z drugiej strony są zdecentralizowane, nie zanieczyszczają, są nieograniczone i równomiernie rozmieszczone w przestrzeni. Funkcjonowanie źródeł oraz najlepszy sposób jak i gdzie je stosować są również omówione. Na zakończenie podkreślona jest potrzeba odpowiedzialności i zmiany w naszym sposobie myślenia i konsumowania.

RIHAY Zsuzsa: Obnoviteľné zdroje energie

V úvode článku autorka poukazuje na nepostrádateľnosť energie a jej nerovnomerné rozdelenie. Napríklad iba 20% svetovej populácie žije v najbohatších krajinách sveta, ktoré však spotrebúvajú 60% celkovej elektrickej energie, pričom 40% svetovej populácie žije bez elektriny. Z uvedenej štatistiky jasne vyplýva aká úzka spojitosť existuje medzi využívaním energie a udržateľným rozvojom. Článok sa zmieňuje o pre a proti obnoviteľnı́ch i neobnoviteýných zdrojov energie vrátane ich ekologických, ekonomických, politických a sociálnych dôsledkov. Neobnoviteľné zdroje (uhlie, ropa, zemný plyn, urán) sú lacné, ľahko prepraviteľné, nevýhodou je však zvlášť ich obmedzenosť a fakt, že sú zdrojom znečistenia. Medzi zápory obnoviteľných zdrojov energie (voda, vietor, slnko, biomasa, geotermálna energia) zas patrí ich nerovnomerná dostupnosť v čase či fakt, že vyžadujú vysoké investičné náklady. Výhodou je ich neobmedzenosť, minimálne znečistenie, atd'. Autorka d'alej uvádza, akým spôsobom tieto zdroje fungujú a kde a ako je možné ich najlepšie využiť. V závere potom zdôrazňuje požiadavku zodpovednosti a zmeny nášho spôsobu myslenia a spotreby.

RIHAY Zsuzsa: Erneuerbare Energiequellen

Bevor in diesem Artikel das Thema “Erneuerbare Energiequellen” detailliert behandelt wird, wird auf die Notwendigkeit von Energie und ihre ungleichmässig verteilte Nutzung hingewiesen. Es werden einige alarmierende Zahlen genannt. So leben zum Beispiel nur 20% der Weltbevölkerung in den reichsten Ländern, aber dort werden 60% der Energie verbraucht, auch bekommen 40% der Weltbevölkerung erst überhaupt keinen Strom. Die Verbindung zwischen Energieverbrauch und einer verantwortungsbewussten Entwicklung ist hier offensichtlich. Weiterhin werden die Vor- und Nachteile von erneuerbaren und nicht erneuerbaren Energiequellen nicht nur im Hinblick auf ihre ökologischen und ökonomischen sondern auch auf ihre sozialen und politischen Folgen näher beleuchtet. Konkret auf die nicht erneuerbaren Energiequellen, wie z.B. Kohle, Erdöl, Erdgas und Uran, heisst das, dass sie billig, leicht zu transportieren und konzentriert sind, aber auf der anderen Seite, dass sie nur begrenzt verfügbar und umweltschädlich sind und dass wir von ihnen abhängig sind. Als Nachteile der erneuerbaren Energiequellen, wie z.B. Wind, Wasser, Geothermik, Sonne und Biomasse, sind eine zeitlich ungleichmässige Verteilung, ein nicht konzentriertes Vorkommen und eine hohe Erstinvestition zu nennen, aber auf der anderen Seite sind sie dezentralisiert, tragen nicht zur Umweltverschmutzung bei, sind unbegrenzt verfügbar und räumlich gleich verteilt. Es wird ein kurzer Überblick über die Ausbeutungsmöglichkeiten gegeben. Geendet wird mit einem dringenden Appell an unser Verantwortungsbewusstsein hinsichtlich unseres Denkens und Konsumverhaltens.