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Energy for All: Today and Tomorrow

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Introduction

Most of the energy we capture for use on Earth comes from the nuclear reactions on the Sun. Historically, changes in energy systems have resulted due todifferent periods of technological, economic, and social advancementstaking place by many actors at diverse locations. It is certain that the changesof the energy systems during the next few decades will be such that they will be fully differentin many issues from what they are today.

Energy systems are structured by many resources, technologies, end users, and infrastructure. They are driven by economics, resource availability, public policies, and social behaviors. The relationships between those actors are very complex.

At present fossil fuels like coal, oil and: natural gas provide around 80 percent of the world's energy mix, which warms and cool homes, charges devices and power transportation. It is, at the same time, the primary human source causing the greenhouse gas emissions.

At the beginning of the twenty-first century energy systems are changing fast due to:the costs and availability of specific energy resources, technological advancements, the environmental considerations, and need to provide energy services to billions of people in developing countries. The energy consumption will increase drastically in the coming decadeswhat will result in many environmental problems.

Energy transitions whichoccur at different places with different speeds,aiming to fulfill specific societal functions,represent complex socio-technical transformations.

Energy demand

Since the commercial oil drilling began (1850s) it has been drawn worldwide more than 135 billion tons of crude oil. At the same time around 1.2 billion people in the

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regions like Asia, Latin America and parts of Africa still do not have access to the modern energy services, while 789 million do not have access to electricity.It is forecasted thatthe world's energy consumption will increase by 50% by 2050.year.

The growth or decline in energy demand, as well as itsefficiency use, is primarilyresult ofthe state policies. The energy demand is mostly affected by a need for a better, and more sophisticated ways of meeting people's needs. Thus, the energy can be treated as service activity since consumers are buying warmth, lighting and power. It's important for energy to become part of the circular economy, keeping resources in use for as long as possible by recovering, regenerating and reusing them wherever possible. This will result in a shift away from buying energy in kWh or BTU towards buying energy as a service. This means that consumers have to pay a company for energy at the best price, while actively improving the efficiency at their homes so they use less.

With energy being a service, consumers have bigger influence and more choice on its production and use.At present the most (80%) world's energy demandto warm and mostly cool homes, charge devicesand provide transport comes from fossil fuels what has become the primary human source of greenhouse gas emissions.Along that line in many situations propersolution might be reachedby generating and using energy locally insteadhaving centralized energy systems.

It is forecasted that the global energy demand will growin average about 0.7 percent per year through 2050 year (versus an average of more than 2 percent from 2000 to 2015). It has been registered that global GDP doubles over the period whereas energy demand increases only by 30%. Lower global energydemand growth in the future will be result ofmany factors like:new technologies, greater efficiency,energy intensity,the global economic shift toward services, slower population and economic growth, lower demand in Europe and North America, and possible pandemics. This decrease indemand will be followed by lower "global energy intensity". It has been suggested that around 1 kW per capita can provide "basic needs," for energy demand, while, recently, it was proposed a "2000-watt society". Modern technologies allow much greater well-being at low levels of energy consumption.By 2050 year the demand for electricity will reach a quarter of all energy demand (18 percent in twenties). Oil, gas and coal will remain the dominant sources, accounting for more than 75% of energy supplies, up to 2035 (down from 85% in 2015).Obviously, the climate change and energy security issues will determine the energy mix in the future.

The main factors that affect energy demand include:

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- economic structure and its effect on industrial and commercial energy,
- residential energyin electricity and natural gas affectedby state policies, and
- energyused in transportation as the combination of total miles traveled and vehicle efficiency.

Market trends suggest that the demand for new energy resources will rise dramatically over the next 25year since it is expected that:

- Global demand for all energy sources to grow by 57 % over the next 25 years.
- By 2030 year, 56 % of the world's energy use will be in Asia.
- Nearly new 300power plants (1,000MW unit) will be needed to meet electricity demand by 2030 year.
- Currently, most ofgreenhouse gas emissions comes from generation of electricitywhich relies on coal and a fossil fuel.

Due to increased demand and limited supply in the coming time energy prices should rise dramatically what will have impacts on the business, like:

- Drop in profits due to high operating costs.
- Reduction of sales of energy, and disruption of supply chains.
- Loss of competitiveness in energy intensivebusinesses.

The demand is related to energy mix. The energy mix means the specific combination of different energy sources used to meet energy consumption needs, generally, on the countrylevel. The energy mix should not be mixed up with the power generation mix (the electricity mix), which describes the breakdown of energy sources used specifically to generate electricity.The energy mix depends on the energy resources being national or import available to a country, standard of living and level of development.Adjusting energy demand to energy mix, as well as integrating storage and demand flexibility within country,requires automation, machine learning and real-time price signals, what will result in the energy market becoming largely digital.Today, most of the world is dependent on electricity. It has radically influenced and changed human life in homes, architecture, communications, andtransport. It has been the main power in industrialization, too**.**One has no to neglect that electricity can be fatal to human and animals in its raw form, too.

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The key concept for energy demand is energy security, what is ability of a country to secure sufficient, affordable and consistent energy supplies for its domestic, industrial, transport and military requirements. It has to be metregardless of economic or political conditions. It should include a high level of government control, and a number of geopolitical concerns. On the world level it is often concern in the need for stability and security in the countries producing and exporting the oil. Equally, it concern might be the diplomatic relations within certain countries. An energy-secure country can be considered to be that whichhas accessible use of a variety of energy sources.

The energy security can be achieved by a variety of strategies, such as by:

- Exploiting own resources to achieve full self-competence.
- Withless dependency on imports.
- Supplementing own energy resources with reliable imports from a wide range of suppliers.
- Reducing domestic demand for energy while increasing efficiency.

Energy security has become the main force in the geopolitical landscape in the world. The countries with large oil reserves are still largely dictating energy security. With a new technologies developed it will happen a shift in the geopolitics of energy security.

The Energy Security is related to Energy Dependency, a issue that takes in consideration the consumption dependent upon imported energy. A low Energy Dependency results in higher Energy Security.

One of the biggest changes that will take place is that consumers will become the important part of the energy sector, ensuring that the energy does not have a destructive impacts on the Earth. In that sense The Internet of Things will be used to provide a greener approach to energy use. Furthermore, the ‘Internet of energy’ will make use of ’connected digital systems’ to control how we satisfy demand, use and store energy

Energy and environment

Increase of global energy production and consumption is resulting in a massive environmental degradation. Burning coal, oil and gas has been manifested in the rising levels of greenhouse gases in Earth’s atmosphere. Thus, the problem is how to use energy efficiently such to improve human well-being, while controlling environmental and consequently its public health impacts. This will depend on human ability to identify and control the consequences of: technological and

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economic developments, public policy, cultural preferences, and many environmental impacts such as climate change.

The Paris climate agreement (December 2015 year),which means having global warming “well below” 2 Celsius, while limiting the temperature rise to 1.5 degrees Celsius, is accepted to be the wayto reach a sustainable future for mankind.Basically, it implies fundamental transformationsof the energy mix by 2050 year, i.e. how much hydrogen, biomass or renewables-based synthetic fuels cansubstitute fossil fuels. Such energy transformations will be followed by many technical issues. On top,the costwill be one of the most crucial problems.The Paris agreement understands that by 2030 year there would be ensured universal access to affordable, reliable and modern energy. This should be achieved bysignificantincrease in the share of renewable energy in the global energy mix and doubling the global ratein energy efficiency. It understandsimplementing more of international cooperation such to facilitate access to clean energy and technology. That will be equally important all around the world, in particular in developing countries, as well as in small island developing states.

Energy generation and consumption, particularly from fossil fuels, have influence on environment by threatening public health and effecting wildlife habitat and biodiversity. To accomplish this, we have to come up with new ways to tackle the energy challenge. But, due to o the superior energy intensity and reliability of fossil fuels they will play significant role in energy mix all the way through 2050 year, what will result, as forecasted, in rise of energy-related greenhouse-gas emissions by 14 percent in the next period.

The trends which can provide the flexibility of energy systems allowing for a higher, cost-effective, environmentally efficient use of renewables are electrification, decentralization and digitalization. Bydecentralization of energy production - locally produced energy- it is enabled more flexible management of the energy and technologies in the system what will enable that **c**onsumers have more choices in how energy is produced, and how it effects environment. By decentralization the losses in transmission are minimized while production of wasted heat in power stations is reduced, too. Decentralization of energy production by renewable energy sources is challenge for the securityof the global energy supply.

Energy is the most important in preventing diseases and fighting pandemics. It enables tools for healthcare facilities, such as clean water, communications and IT services to provide social distancing, and many more. Access to energy is essential

to respond to the COVID-19 crises and save lives. The energy industry, these days, is experiencing the problems due to the COVID-19. There are oil and other market disruption as the result of a collapse in demand while having a surplus of supply. The unexpected pandemic COVID-19 with its consequences on society and economies is turning over many plans, interrupting and changing trends while testing assumptions, as governmentslook for economic stimulus.

It has to be noted that democracy does not improve sustainability, either it does not do worse than non-democracies, although democratization can reduce environmental damage. At the same time democracy does not have to result in more efficiently energy consumption while promoting well-being.

The environmental sustainability is significantly influencing the energy industry, too. Thus, it is very important to move focus from sellingelectricity to selling grid infrastructure and energy services what is in line with a free-market of energy.

Solutions for Renewable(alternative) **Powered future**

The greatest challenge in energy sector is to reduce use, or even eliminate, fossil fuels from many activities such as from aviation, freight and long-range transportation, as well as from certain industrial processes. Around a fifth of the world's primary energy supply already comes from renewable sources (wind, solar, hydro and geothermal), and it is expected to grow by 2.6% each year until 2050 year. Traditionally the main source of renewable energy used to be hydroelectric power but wind and sun are becoming the fastest growing renewable sources, today.Research into renewable energy sources, batteries, carbon capture and storage are helping to move the world to a more sustainable future.

It is possible to list many promising new technologies when concerning renewable energy sources of the future and environment. They might happen on the market in different time periods. Some of them look as science fiction from the point of today. In that sense listed are some of the most promising alternative energy sources of the future. Some of them may be long shots, but some may also play a crucial role in the energy mix of the future.

- Space-based solar, what requiresa satellite to orbit, as well as the conversion of electricity into microwaves to transmit energy to the Earth's surface.

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- Human power, means using the energy generated by the movement of people to power devices.
- Tidal power, which is very high and it is already in use in some cases**.**
- Hydrogen power, which is one of the most clean energy source accounting for 74% of the mass of the entire nuclear fuel, or around 5% of universe.
- Magma power, which is already used at Iceland.
- Nuclear waste, means better use of nuclear fuel.
- Embeddable solar power, such as solar windows which can harvestthe part of the light spectrum that eyes can't see.
- Algae power, that relays onenergy-rich oils which can provide,even up to 9,000 gallons of biofuel per acre.
- Flying wind power, means harvesting wind powerat higher elevation.
- Fusion power, might be solution of all problems.

Tidal power, Space-based solar, Human power, Algae power, Flying wind power, Fusion power and many others are still in development stage.At present, wind and solar are increasingly popular sources of energy, although they only have made a fractional part in the energy mix so far. With the costs coming down they are pushing on the green technologies. But, the problem isthat the sun does not always shine, and the wind doesn't always blow. In the last decades, wind and solar power had "explosive average annual growth" (23 percent and 50 percent) resulting in renewable sources of power now representing around 30 percent of the world's total capacity and 23 percent of total global electricity production.

The problem with the hydrogen, the most needed power source, is since there are no natural reservoirs of pure hydrogen. It is an energy carrier but not a primary source of energy. Although its extraction from natural gas or water requires significant amount of energy, the hydrogen fuel cells might be an important power source in the near future. Another promising energy source the biofuel is predominantlycurrently in use by grain-based ethanol, which production is energy-intensive while requiring a large amount of land and water.

Nuclear energy today provides over a third of the world's low-carbon electricity. For nuclear energy technical and institutional innovations are needed, what includes a new generation of reactors, such as small modular reactors, fast reactors, and the fusion energy. Storing carbon dioxide underground or turning it into clean fuel are still far from commercial solution. None of the possible solutions is without challenges.Storing energy to satisfy demand is not yet cheap and powerful enough. Batteries to store energy are still expensive and not much efficient.

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Many energy scenarios predict a growth in renewable energy installations, especially in expansion of offshore wind capacity, and a widespread uptake in domestic electric vehicles. On topbiogas and biofuels are often seen as the most viable alternatives to fossil fuels. Such, for example, nearly 78 % of new net GW of generating capacity added globally in 2019 year was in wind. Renewable infrastructure, excluding large hydro dams, grew 184 GW in 2019 year, the highest investment in off shore wind in one year – 29,9 billion USA dollars , 12% more than in 2018 year. Furthermore, the 2019 year was the highest solar capacity additions in one year at 118 GW, while being the highest renewable investments in developing economies (21 countries more than 2 billion USA doll.)Since 2010 the cost of concentrated solar power dropped 47%, while onshore wind costs fell 40% and offshore wind 29%

To achieve reliable, efficient power systems using large shares of renewables (solar and wind)there should be implied the following:(IRENA's 2019 Innovation Landscape study):

- More flexible generation, including interconnections and regionalmarkets.
- Renewable energy production using advanced weather forecasting.
- Renewable energy generation and demand over large distances using supergrids.
- Optimization of operation between distribution system and distributed energy sources such to provide demand on site management.

The significant decarburization of the fuel mix will happen since renewables, nuclear and hydroelectric power are going to reach half of the growth in energy supplies with investment by 2030 year, globally, over $1.2 trillion annually, more than five times into fossil fuels.Some work suggests that new capacity in the future will come from wind and solar (77 %), from natural gas (13 %), and the rest from everything else. In particular wind and solar are expected to grow four to five times faster than any other source of power up to 2050 year. This transition in energy supply and demand will result in a new global energy mix and security order.

There is, still, no rational and efficient way to store the electricity produced by renewables. Capacitors and flywheels can store/provide energy for a few minutes or hours. Using new hydroelectric dams for that purpose has become controversial issue.It might happen that the solution for storing energy comes in the form of fuel.But, due to the superior energy intensity and reliability of fossil fuels they will play still significant role in energy mix through 2050 year, what will result, as forecasted, in rise of energy-related greenhouse-gas emissions by 14 percent in the

next period.One major advantage fossil fuels have over renewable energy sources is since they are very easy to store and transport.

The shift towards renewable energy sources is resulting inreshaping energy industry. This shift is affected as well by the convergence of the energy and power industries, by the latest oil prices development, as well as by unpredictable returns in hydrocarbon investments. It is primarily environmental issue, however, there is also high economic impetus.

CONCLUSION

The most important energy issue is:will there be enough available energy in the near future appreciating increase of population and increase of standard of living? These problems have to be solved by technologies which are still in the research or under development. Furthermore, having in mind that by 2050 year we will, still, be getting most of energy from fossil fuels the question is how will be possible to obtain carbon capture storage and its utilization?It cannot be achieved only by a newenergy mix or by developing new technologies, without a shift of the geopolitics of energy sector.

The energy consumption in the countries with lower levels of economic development is linked to well-being, what is not the case with high-income nations. The level of development affects human well being via negative externalities, too. Thus, the question is how to minimize energy consumption while maximizing well-being? The solution might be in connecting the energy grids of several countries by creating "supergrids", what will result in sharing energy mix and services over a wider area.

In solving these problems energy companies may control more precisely use of our home appliances by turning them on and off depending onfluctuations in the weather or the time of day.Itwould mean a move from the "power-on-demand" way of consuming energy. Thus,it is certain that in thefuture it will happen the biggest change in the area of energy market and services, i.e. in consumers control over energy sources, and on energy consumption,as well as in control of its cost, what will enlarge management activity.

One of the biggest problem is how to cope with the rise in energy demand. In that sense there should be the most important how and where we get our energy such to cope with the immediate raise in energy demands expected in the coming decades.

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The new supply chain technologies are emerging whatis significantly improving visibility across the end-to-end supply chain. The traditional linear supply chain model is transforming into digital supply networks (DSNs). In such way it is enabled end-to-end visibility, collaboration, agility, and optimization.Whether there happen events like COVID-19, trade war, terrorism, regulatory change, labor dispute, sudden changes in demand, or supplier bankruptcy, organizations that deploy DSNs will be able to deal with the unexpected.

The future landscape of the energy industry will be transformed by technological innovations that drive towards a more convenient, efficient and ecological infrastructure. Transition to the new energy ecosystems is going to be dominated by digital technologies ”from visualization, analytics and machine learning to cloud-based technologies, artificial intelligence and digital twins”.

Energy is one of the clearest examples of a geopolitical issue. Whilst intended to hurt the economies of the embargoed countries, this also forces importing countries to look elsewhere for their energy supplies.
New energy technologies with digital possibilities will provide that the energy systems of the future will be more clean, cheap and efficient. Research and innovations are very important to keep advancement of the technologies and reduction of the cost for sustainable energy, i. e. low carbon economic development, being extremely true when performed in end use sectors like transport, heating and cooling, as well as in energy storage and green hydrogen technologies.Thus, originatingthe future infrastructure energy solutions while appreciating bigger influence of renewables provide a safe and visionary strategic choice.

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