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DECARBONIZATION AS THE KEY QUESTION OF SUSTAINABILITY

DEKARBONIZÁCIÓ MINT A FENNTARTHATÓSÁG KULCSKÉRDÉSE

ABSTRACT

Nowadays, one of the most widespread problems of humanity is sustainability, sustainable development from both environmental and social aspects as well. All over the globe, there are more and more groups, businesses that make efforts in order to make the planet more liveable and cultivatable for the future generations. The goal of this study is to draw attention to the importance of sustainability, its usefulness and its efficiency, and furthermore, highlighting decarbonization, to give some insight into its historical background, its present stance and to present the most important milestones of sustainability, too. It introduces a popular alternative (solar panels), then analyses the market and one of the market's largest corporation (JA Solar). Later on, the focus will shift onto a domestic enterprise (ENEREA Nonprofit Kft.) and onto one of the related, multinational projects (DeCarb project). Finally, numerous local examples to be followed will be showcased that, in the long run, can have exceptionally positive effects on the society and on the environment as well.

Keywords: sustainability, sustainable development, decarbonization, future generations

ÖSSZEFOGLALÓ

Manapság az emberiség egyik legfelkapottabb problémája a fenntarthatóság, a fenntartható fejlődés mind környezeti, mind társadalmi szempontból. Szerte a világon egyre több csoport, vállalkozás tesz erőfeszítéseket annak érdekében, hogy a jövő nemzedéke számára minél élhetőbbé és művelhetőbbé tegye a bolygót. A tanulmány célja felhívni a figyelmet a fenntarthatóság fontosságára, hatékonyságára és hasznosságára, valamint a dekarbonizációt kiemelve betekintést ad ennek történelmi háttérébe, jelenlegi álláspontjába, illetve a legjelentősebb elrendő mérföldköveket is ismerteti. Bemutat egy népszerű alternatívát (napelemek), majd elemzi a piacot, illetve az egyik legnagyobb céget (JA Solar). Később rátér egy hazai cégre (ENEREA Nonprofit Kft.) és egy hozzá kapcsolódó, nemzetközi érdekeltségű projektre (DeCarb project). Végül több lokális követendő példát is felsorakoztat, amelyeknek hosszú távon rendkívül pozitív hatásuk lehetnek mind a társadalomra, mind a környezetre nézve.

Kulcsszavak: fenntarthatóság, fenntartható fejlődés, dekarbonizáció, jövő nemzedéke

1. Introduction

Nowadays, the world's carbon-dioxide production is the biggest challenge of our society. Its history began during the first industrial revolution, around 1850. Since then, the CO₂ level in the atmosphere has raised by 50%. Deforestation, fossil fuels and cement manufacture have also contributed to this phenomenon. Based on the Paris Agreement (accepted on 12 December 2015), 195 countries have agreed that in order to stop the increase of the Earth's temperature, it is highly recommended to decrease the carbon-dioxide emission into the atmosphere. The goal of the agreement is to reach a low-emission global economic and climate neutrality through energy transmission.

2.1. The concept of sustainability

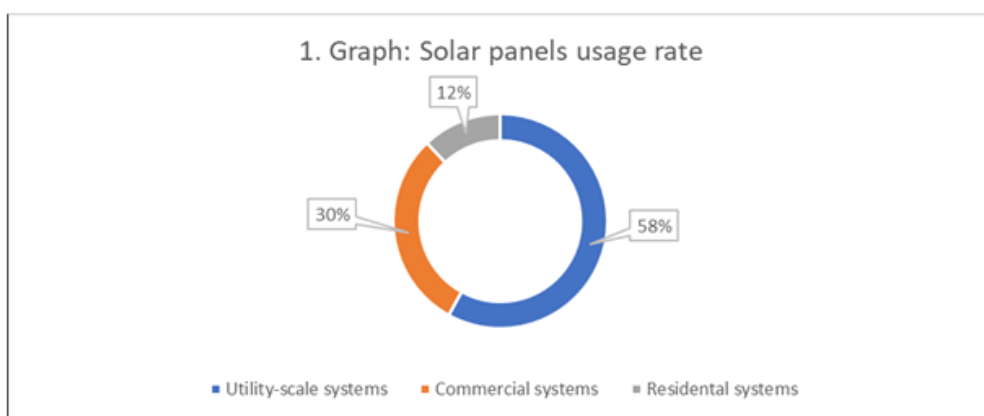
Globally, people started to deal with the problem of sustainability in the 1980s. The World Commission on Environment and Development (WCED) created the concept of "sustainable development" in 1987. This concept became a part of everyday life and the designer principle of development processes. From the perspective of sustainability, the concept of economic growth had to be redefined as well. The emphasis on growth cannot be exclusively quantitative, because the only activities that can be used must be sustainable environmentally and socially, too. As a result, the world has started to use expressions such as "environmental sustainability", "sustainable economic growth", "ecological footprint", "biodiversity", "the Earth's carrying capacity".

2.2. Sustainable development goals

The UN has an important role in sustainability, and also stated 17 goals regarding it, which include good health, clean water and sanitation, clean energy, climate action and innovation, that can be the results of the decarbonization process. Unfortunately, the organization does not have any tool which could enforce the member states to comply with the accepted conventions. If the implementation of sustainable goals depended on the specific states, the result would become really uncertain, so it is required to find a solution which can solve this problem. Furthermore, with the burning of fossil fuels (with carbon or carbon-based materials) for energy production, humankind has raised the carbon-dioxide emission, which is one of the reasons of the greenhouse effect. The solution requires an energy-mix which can eliminate the carbon-dioxide from energy production. For example, in Hungary (2020), the energy-mix included the following sources: nuclear 46,4%, fossil 37,2%, renewable 14,7%, other 0,9% (<https://www.iea.org/countries/hungary#data-browser>).

3.1. Popular alternatives: solar power, solar power plants

Using solar energy has become one of the most popular alternatives. The potential is unbelievable, because the Earth receives 200,000 times more solar energy on a daily basis than the world's total daily energy capacity. It can generate thermal and electrical energy as well. Since the demand for electricity is growing and many countries are trying to replace the majority of energy production sources with solar panels by 2030, the process requires more territory as well. At the same time, it is a low-cost investment for them. Furthermore, regarding the solar power plants, scientists want to make their capacity 6 times larger.



This graph shows the usage rate all over the world according to the IEA in 2019. Soon, it can radically change due to the increasing residential demand (regarding the costs, it can take up to 20 years until the solar investment generate a pay-back).

3.2. One of the major players in the market: JA Solar

Being a leading global manufacturer, the Chinese company was founded in 2005, and it mainly focuses on developing photovoltaic technology. JA Solar's headquarter is located in Beijing. Its products are sold in 135 countries, has 33,000 clients worldwide and 29,638 employees (as of 2021). The sales revenue of the company in 2021 was 41.3 billion yens. It is developing quickly technologically and has a secure financial background since the enterprise operates with any type of PV model and has plenty of projects in different countries all over the world (for example in the United Kingdom, in the USA, in Brazil and in Egypt).

In order to get a comprehensive picture of the industry, it is recommended to do a PESTEL analysis.

Political: after a certain amount of energy produced by solar panels, the government differentiates between the residential and commercial systems. The residential ones do not pay taxes, but the commercial ones do.

Economic: the industry may replace polluting factors or industries such as coal power plants and can offer more workplaces as the demand and the industry grows.

Social: since it is a renewable source of energy, it has an important role of reducing greenhouse gas emissions in order to protect the atmosphere, humankind and wildlife.

Technological: the capacity of solar panels is always increasing due to the advances in photovoltaic (PV) technology.

Environmental: as it reduces the effects of the climate change, the solar panels have a positive impact on the atmosphere, land, water and on living beings.

Legal: deploying and using panels fall under a lot of regulations: land rights, transaction structure, financing, incentives and energy regulations.

Unfortunately, solar panels have many disadvantages for consumers. These panels are dependent on the weather, use plenty of space and have high maintenance costs. Although they are environmentally friendly, they still pollute the environment during their transportation, installation and manufacture.

3.3. Forecast

Although solar panels have a huge potential, we can only discuss long-term goals. The growth highly depends on the development of photovoltaic technology and its costs. In 2020, the market of PV systems was USD 76.6 billion, but by 2025, it can reach up to USD 113.1 billion. This technology system still lacks skilled workforce and operational land.

4.1. The role of non-profit companies for reaching decarbonization goals: The DeCarb project

The project involves 9 companies from 9 countries (lead partner: Bulgaria, others: Hungary, Denmark, Slovenia, Romania, Poland, Germany, Greece, Spain) in order to share their experiences and knowledge about the transition between the carbonisation-era and the clean energy-era. They support numerous regions in sustainable development, in economic and social stability and in providing a role in the forming of energy-mix by 2030. The DeCarb's goal is to support the knowledge exchange regarding governmental companies in

taking advantage from the technology of carbon-dioxide limitation and storage that can significantly reduce the ecological footprint of the working coal-fired powerplants. In the project, the partners examine the aspects of coal (forming of energy-mix, renewable energy potential, opportunities of coalmines, coal power plants) and based on the results, they try to form advice that can lead to a more efficient carbon output.

4.2. The Hungarian partner: ENEREA Nonprofit Kft. energy agency

Established in 2009, the operations of the company focus on the north-east regions of Hungary. Its mission statement is to promote energy efficiency, rational use of energy, energy diversification and sustainable energy resources. The goals of the DeCarb project, the Brussels recommendation of decarbonization, the deadlines, the indicators and their process enrich the company's knowledge, which can be useful in the research of the upcoming years and in the fight against global climate change. In 2021, the company's profit was HUF 37,28 million and it has only 6 employees. In order to have a comprehensive picture of ENEREA, we have to take a look at a SWOT analysis.

Strengths: the company is efficient in project implementation, its business structure is simple, and it has accumulated a lot of experience. Since it is a public organization, the owners are members of the local government. For the local government, the costs of the project's management can be eligible, so profit can come from the local governments, which secures the company's long-term operation.

Weaknesses: since the company's profit is relatively low and there is a capacity deficit regarding the human resources, making investments can be quite difficult for the company.

Opportunities: being environmentally friendly has become a trend, therefore there are many projects and mandates related to it.

Threats: since the tender market is saturated, the company can hardly find positions in the economic sphere and there are many strict rules. Since the company has multinational projects, the exchange rate fluctuations can cause profit loss (in 2020, it was HUF 0.8 million).

4.3. The DeCarb's solution: carbon's underground capture and storage (CCS)

Carbon capture and storage would be a significant milestone for each country. CCS includes the capture of CO₂ in coal powerplants and in industrial buildings and its transportation by shipping or through pipelines to geological formations for long-term storage. CCS is going through a worldwide

development. Since the 1990s in Europe, in the USA, in Canada and in Australia, significant research has been carried out. Some of the biggest and most famous projects are the Norwegian Sleipner (from 1996), the Canadian Weyburn (from 2000), and the Algerian In Salah (from 2004). Important technical tools are now available and the technical development, the legislation, the economic and political background are set, and the social acceptance and support are being organized, too. The implementation can depend on numerous factors: financing, the investor and its operating schedule (if the investor is not a governmental company), and leakage and/or risk of accident (who is going to compensate for damage?). According to current estimates, natural processes have captured a large part of underground-stored carbon-dioxide (up to 98% and is also bound for tens of thousands of years already). Even if the worst possible thing happens and the storages are left completely alone, at least 78% of the quantity remains underground, contrary to the fact that we currently emit nearly 100% of the carbon-dioxide produced into the atmosphere. In the developing countries, it was found that carbon-dioxide storage is one of the easiest viable path to strong economic growth with low emissions. The world's countries agree that the increase in the amount of atmospheric carbon-dioxide must definitely be slowed down and be completely eliminated over time in order to be able to keep the rate of climate change within the planned framework.

4.4. Places around the world that are suitable for storing Co2 underground

The ex-sediment collector coves are spread across Europe, for example in the area of North Sea, in the Alps or in Poland. Storage capacity can only be estimated and it is based on the extent of potential storing formation.

4.5. The transportation of CO₂

Pipe transportation is currently used by oil companies (in the USA), and it is way more cost effective than shipping. It also offers continuous transportation between the power plant and the storage site.

4.6. Introduction of good examples

Orca power plant: it was established in Iceland as a result of the cooperation between the Swiss Climeworks and the Icelandic Carbfix. After one year of full capacity operation, the Orca is able to extract 4,000 tons of carbon-dioxide from the air (according to the United States Environmental Protection Agency, this corresponds to the annual CO₂ emission of 870 passenger cars). The construction of the power plant cost about 10-15 million US dollars according to Bloomberg's report.

Szeged: thanks to an investment which cost near HUF 9 billion, in the city's 5 districts, the construction of geothermal heating system has begun, so regarding heating, the natural gas usage will drop by 50% (currently, its usage costs HUF 6-7 billion to the company). With this investment, Europe's second largest geothermal heating system will be established (after the one in Reykjavík).

Mátra power plant: the power plant's long-term development program (its modernization) will be the largest Hungarian energy project in the next ten years. The transformation will be financed from partly the European Union's support. The investment of the Bükkábrány power plant (HUF 5,16 billion) was already realised in 2019. The company's goal is to maintain its market position with renewable energy developments and to produce 15% of the Hungarian power consumption. From the enterprise's strategy it can be established that the previous obsolete energy structure will be replaced by a new, modern and far more economical structure. The transformation into a more environmentally friendly operation offers many long-term workplaces for the local companies, which can contribute to a better life quality. Furthermore, thanks to the developments, the economic environment will be more predictable (the power plant will secure thousands of workplaces directly and also indirectly).

4.7. Forecast

What the DeCarb's project offers is an existing technique, but a useful one and thanks to this method, it can be used more frequently. It requires a lot of investment and process, but it can be unbelievably effective. Companies have already started investing in this or in a similar technology, and the market exponentially increases. It definitely creates a lot of workplaces directly and also indirectly and they do not require any special qualification. This method can be and it is a solution in the long term, but still needs to be improved much on the technological and efficiency sides. In addition, the concentrated carbon-dioxide can form rocks and mineral resources, so it can affect the mining industry as well.

5. Summary

Nowadays, one of the most serious problems of our society is carbon-dioxide production worldwide. The goal of this case study is to search for relevant or potential solutions while presenting a few related projects, companies, developments, investments and to make realistic forecasts. Besides the world's countries, the sustainable and environmentally friendly development call people all over the globe for action to fight against poverty, inequality and

climate change. Unfortunately, it is not likely that all the projects will be completed until their deadlines. According to scientists, because of the costs of modern technology, its special requirements and velocity, decades will be needed to reach a large-scale result, while the world's annual carbon-dioxide emission is approximately 40 billion tons now.

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