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*Araştırma Makalesi*

# THE ROLE OF GREEN BUILDINGS IN SUSTAINABLE PRODUCTION: EXAMPLE OF INCI AKU INDUSTRIAL BATTERY FACTORY, TURKEY

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***Abstract***

*The excessive consumption of natural resources has required a reinterpretation of traditional development approaches. Thus, the term sustainability was suggested in the late 1980s as a key to change in production, as in many other areas and it ultimately leads to the eco-friendly manufacturing model called sustainable production. Today, the understanding of sustainability is becoming widespread, not only in the manufacturing sector but also in building construction. Green building applications are the reflection of the idea of sustainability in the construction sector and their aim is to transform structures into eco-friendly buildings using various grading systems. This paper's goal is to discuss the dilemma between environmental protection and development and to point out the role of green buildings in sustainable production. The perspectives of industrialists on environmental sensitivity were investigated based on the interviews conducted by the authorities of an industrial battery firm, INCI, which has the first facility with a green building certificate in Turkey. This paper's conclusions are: (1) Construction of green buildings can be effective in sustainable production. (2) Investments on environment protection can increase the interest rates of firms and (3) Sustainable production can be a solution for the environment-development dilemma.*

***Keywords:*** *Sustainable production, Green building, environment production, sustainability.*

# SÜRDÜRÜLEBİLİR ÜRETİMDE YEŞİL BİNALARIN ROLÜ: İNCİ ENDÜSTRİYEL AKÜ FABRİKASI ÖRNEĞİ, TÜRKİYE

***Öz***

*Doğal kaynakların aşırı tüketimi geleneksel kalkınma yaklaşımlarının gözden geçirilmesini zorunlu kılmıştır. Bu zorunluluktan doğan sürdürülebilirlik, birçok alanda olduğu gibi üretimde de değişimin anahtarı olmuştur. Sürdürülebilir üretim olarak tanımlanan bu modelde, kaynakların etkili kullanımıyla birlikte çevreye ve insana saygılı bir üretim amaçlanmıştır. Günümüzde üretimde olduğu gibi önemli bir kaynak kullanım alanı olan binalarda da çevre dostu uygulamalar yaygınlaşmaktadır. Yeşil bina olarak tanımlanan bu uygulamalarda amaç, çeşitli derecelendirme sistemleriyle binaları çevreye duyarlı hale getirmektir. 1990'da İngiltere'de başlayan BREEAM, bu derecelendirme*

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*sistemlerinin ilkidir. Bu çalışma, Türkiye'deki ilk BREEAM sertifikalı yeşil binada üretim yapan İnci Akü örneğinde; çevre – kalkınma tartışmalarındaki güncel literatürü değerlendirmeyi, yeşil binaların sürdürülebilir üretimdeki yerini ortaya çıkarmayı ve çevre - sanayi ilişkisine sanayicinin gözünden bakmayı amaçlamıştır. Bu amaçla, İnci Akü yetkilileri ile görüşmeler yapılmış ve üretim sahasında incelemelerde bulunulmuştur. Çalışma sonucunda: (I) Yeşil binaların sürdürüelibilir üretimde etkili bir yöntem olabileceği, (II) çevre yatırımlarının sanılanın aksine firmaların kar oranlarını artırabileceği ve (III) sürdürülebilir üretim anlayışının çevre – kalkınma tartışmalarında bir çözüm olabileceği ortaya koyulmuştur.*

***Anahtar kelimeler:*** *Sürdürülebilir üretim, yeşil bina, çevre koruma, sürdürülebilirlik.*

## INTRODUCTION

The Industrial Revolution, which started with the invention of the steam machine by James Watt, resulted in the quick extraction of fossil fuels, created by biological wastes piled up underground for millions of years. This process, which started with the discovery of the fossil fuels and the technological progress, enabling the maximum use of these fuels, as the population increased, resulting in the over consumption of the natural resources and the breakdown of the ecosystem. The considerable increase in the activity of humanity in the last couple of hundreds of years, resulted in our entrance into an age, which Crutzen (2002) defines as *Anthropocene*, an age where humanity, it became a defining power due to its activities. As a result of the "Great Acceleration" in this age, the material life standard of most people has increased and the gap between poor and rich has narrowed (Folke, 2013). This narrowing in the 19$^{th}$ and 20$^{th}$ Centuries, and one of its results, the principle of "produce to develop", has accelerated the competition in industrialization, bringing along international competition with itself.

Today, the world hosts 7 billion people and this number increases every day. The speed of this population increase on earth has pointed to the question of the ability of natural resources in meeting the human needs. The "ecological footprint" theory, developed by Rees (1992), tries to find answers to this question. The ecological footprint, which is used for measuring the effect of human needs to the biosphere, is generally defined as "producing the resources that are consumed by a personal, a group or an activity via the method of the present technology and resources, and biologically fertile land and water area that is needed for getting rid of the produced waste" (Ewing et al., 2010, p. 8). *The Living Planet Report* of WWF has stated the number of worlds to meet the human needs at 1.5 according to ecological footprint indicators, and pointed that for more than 40 years, human needs have surpassed the bio - capacity of the planet (WWF, 2014, p. 9). The result of another research study, carried out in 2009, confirms the same situation. According to the report, while the extracted natural resource of that time has increased 50% and amounted to 60 billion tons, it is expected that by 2050 this will be 100 billion tons (SERI et al., 2009, p. 3).

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On a planet where resources are limited, trying to meet unlimited needs has resulted in an irreversible situation and increased the pressure on the natural resources. In 2007, during the 1 (IPCC), organized by the United Nations (UN), it has been stated that the main reason for this situation is the carbon dioxide gas emission, and that humans are responsible for these emissions (Yavuz, 2010, p. 65). Today, the amount of carbon dioxide released into the atmosphere has exceeded the safe level for humans, which is 350 ppm, and in reaching 392 ppm (Aşıcı 2012a, 129), it has created a pessimistic portrait of the future. In 2009, a group led by Johan Rockström did a study which put forward the concept of "planetary boundaries". In this study, nine boundaries were determined as: climate change, rate of biodiversity loss, nitrogen cycle, phosphorus cycle, stratospheric ozone depletion, ocean acidification, global freshwater use, change in land use, atmospheric aerosol loading, and chemical pollution. As a result of the study, it

was stated that climate change, rate of biodiversity loss, and nitrogen cycle boundaries were surpassed, and that resource consumption pressure quickly drags along other boundaries to global limits (Rockström et al., 2009). Costanza et al. (2013), pointed out that this much consumption of the resources is not sustainable because of the planetary boundaries and stated that this kind of growing will eventually decrease human welfare and lower social and natural capital.

It is stated that, on the basis of today's environmental problems, lies the mainstream economy model (Davidson, 2004; Aşıcı, 2012b; Şahin, 2012; Lawson, 2006; Costanza et al., 2013). The fact that the mainstream economy model focuses on growth causes excessive resource consumption. The fact that today's countries' economic developments are calculated according to GNP rates increases the growing competition between the countries (Aşıcı, 2012b, p. 35) and causes sustainable development. As a result, the green economy is winning supporters from many different factions. Such that, the green economy was seen as a solution to the crisis and the drawing of a road map was attempted by UN Environment Organization (UNEP, 2011).

## METHOD

Industrialization and its byproduct, environmental problems, which gained speed with the development competition between countries, made it necessary to view the concept of development from different perspectives. Being one of these perspectives, sustainable production, and green buildings are among the formulas that are presented as solutions to today's environmental problems. However, as much as these concepts, which are proposed as solutions to existing environmental problems, have supporters, there are also those who see these concepts as empty delusions. The basic argument of those people is the opinion that the dominant comprehension of the economy in the world only tries to survive under this new mask of "green". According to them, the existing economic system tries to keep its development and existence under the mask of "sustainability", and, therefore, the real solution to the existing problems is the downsizing of the economy (Boochin, 1996; Robinson, 2004). According to the view that supports the concepts of sustainability and green economy, via the developments in science, technology, and environmentally friendly applications in production, countries will both continue their developments and the environmental problems will be solved. The ones who support this idea claim that industrialists should be encouraged for sustainable production with the mentality of environmentally friendly production, or else there should be precautions for those who oppose this kind of production (Mattar, 2012; Sukhdev, 2013).

However, one way or the other, as long as the industrialists who are seen as the basis of the problem with most fractions, are not willing to be a part of the solution, it seems inevitable for the problems to continue. This opinion lies at the

basis of choosing Inci Battery as an example in this study, for being one of the few green buildings certified factories in Turkey, together with Siemens Gebze and Schneider Electric Manisa. For Inci Battery, which willingly searched for environmentally friendly production methods, and which founded its production facility in Turkey with the BREEAM (Building Research Establishment Environmental Assessment Method) green building certificate, is the first national company to have this certificate.

In this study, apart from defining the place of green buildings in sustainable production, it is our aim to find out what environmental investments mean for industrialists by viewing the environment-industry relationship from the point of view of, especially, the local industrialist. With this, it is our goal to find out the real effect of the investments, which are usually seen as a burden by most of the industrialists, for protecting the environment. In the conclusion and discussion part of the study, in light of the discussions on the environment-development dilemma, discussions on the concepts of sustainability and green economy are mentioned. Thus, it is our aim to create a discussion platform on the existing production models by locating the place of sustainable production and green buildings within these discussions.

Case study, which is one of the qualitative research methods, is used as the main method in this study. The aim in the case studies approach, which is defined as deep analysis of a concept, a person or a group within itself, is to have detailed information about a person, group or a society that is being analyzed (Kaya, 2014). In this study, there have been meetings held with the authorities by the company, Inci Battery, starting from July 2014, for seven months. The information obtained as a result of these meetings has been noted and recorded, and then with the related literature research, the subject has been deeply analyzed. Moreover, with the guidance of the company authorities, inside and outside photographs of the building have been taken and the production facility has been observed. In this sense, the study was widened and an attempt was made to find the place of the building within sustainable production.

## SUSTAINABILITY AND SUSTAINABLE PRODUCTION

In economic activities, which can be defined as all the activities people carry out to survive and meet their living needs, agriculture was the main activity until the Industrial Revolution. Production and trade carried by small workshops were the main economic activities in this period. However, as a result of the fast and condensed production needs that started with the Industrial Revolution, a dominance of the industry in economic activities started. This period, where the development of countries depended on the density of their industrial activities, is also a period during which the demand for natural resources increased. The fact that the industrialization competition gained speed contributed to the increase in

this demand and the ecosystem went under great pressure. The increase in population along with the industry caused disorder in the natural systems and thus created environmental problems.

The changes in the biosphere that have brought the ecosystem to an irreversible point have sparked discussions about industry-environment relations and existing economic model. These discussions which had their place in the international community's agenda with the report called *Secrets of Growth*, published by the club of Rome in 1972, were carried on to a new level by the *Brundtland Report* by The World Commission on Environment and Development (WCED) in 1987. This report focuses on the concept of *sustainability*, and it has been presented as a solution to human-environment problems and defined as "meeting today's needs without ignoring future generations' ability to meet their needs" (Rosenberg et al., 1993). The concept of "sustainability", which was used with the same meaning as "sustainable development", has succeeded in being subject of many discussions and studies since its birth.

Sustainability, which is usually used with economic development, in recent years, became a subject of environmental and social studies. Despite that the concept is used by many different factions, its usage in many unrelated places causes the loss of its meaning in the eyes of the society (Barlas, 2013, p. 236). Engelman (2013) has defined this situation as sustainability "chewing-gum" and stated that its wrong and widespread usage causes the loss of its meaning. Besides, discussions on the deficiency of the content and the lacking parts in its definition are shared by many people today. Kayıkçı (2012) has divided the concepts, sustainability and sustainable development into four main points. These are uncertainty in the definition of the concept, the way that it speeds the development with its placing the right to develop on a principle, the problems in comprehension of intergenerational equality and the relation of the concept to capitalism (Kayıkçı, 2012).

The sustainability's meaning should be fulfilled with the utilities that will allow it to be used in daily life. One of these utilities is the realization of sustainable production. The concept of *sustainable production*, which appeared for the first time in UN Environment and Development Conference in 1992, is closely related to the concept of sustainable development. At the end of the conference, it was stressed that the existing global problems of environment are especially the results of the comprehension of unsustainable production and consumption in industrialized countries (Veleva and Ellenbecker, 2001), and that sustainability in production should be realized.

Garetti and Taisch (2011), cite sustainable production is the most important subject in the realization of sustainable development. According to them, sustainable production is the smart usage of natural resources via new technologies, regulative precautions and bond of social behaviors, and thus improving the quality of human life while the protection of the environment is granted. Ron (1998), states

that sustainable production is the outcome of the definition of sustainable development and defines the concept as the industrial activities that lead to products that will meet today's society's need and demands without endangering future generations' ability to meet their needs and demands. O'Brien (1999), maintains the existing model of production is not sustainable because of its pressure on the natural resources, and therefore the sustainable production model will be the basic concept for the production industry of the 21st century. According to him, sustainable production is not only a way of providing the wealth that societies need, it is also a way of sustaining the economic progress. The Lowell Center for Sustainable Production (LCSP), which was founded within Massachusetts Lowell University, defines sustainable production as; "a production type that uses non-polluting procedures in material and service production, protects energy and natural resources, economically applicable, healthy and safe for the workers, society and consumers, and in which procedures and systems that reward all the employees are used" (Veleva et al., 2001).

Velleva and Ellenbecker (2001), state that sustainable production has six basic aspects. These are energy and material usage (resources), natural environment, social justice and social development, economic performance, workers, and production. According to them, if the companies want to be more sustainable they must aim to develop all these six points. LCSP, however, has defined the structure of production as five basic questions, and stated that sustainability in production will be realized according to the content of every answer for these questions (Figure 1).

**Figure1.** The Structure of Sustainable Production, According to LCSP


**Source:** LCSP (2009) *A New way of thinking: The lowell center framework for sustainable products.* www.sustainableproduction.org

It is possible to track down the emergence of the concept of sustainable production to the times when the environment-development dilemma started. The wastes caused by production and the awareness in society, which started with the emergence of the problems because of these wastes, have forced the companies to find new production models. Yavuz (2010) states this situation as a matter coming into question as a result of the strategies applied by the companies, in accordance with their social responsibilities, to eliminate the negativity in the production process. Aracıoğlu (2010), however, sees the sustainable production concept as a model change and companies' willingness for meeting their clients' needs and demands which change with postmodernism, and they need to set up long-term relationships with them. Many non-governmental organizations', governments' and individual's sensibilities about environment forced the companies to change their attitude in this respect. To the extent that, while a research's results show that 50% of the consumers changed their consuming habits due to their concerns for the products' effect on the environment, the results of another research show that 80% of the consumers believe that it is important to buy from green companies and are willing pay more for such purchases (LCSP, 2009). As a result, many international companies promote their products by stating that they use environment friendly technologies in their production and also that they do not engage in activities environmentally harmful activities, publish their reports on sustainability and thus, try to attract the attention of the consumers.

## GREEN BUILDINGS - SUSTAINABLE PRODUCTION RELATIONSHIP

In pursuit of solutions for the problems in human-environment relations, applications on buildings in recent years are worth considering. Being indispensable for such areas like residence, industry, hotel, hospital and school, buildings are important in the way that the majority of them are consumption centers of natural resources. With the effect of the widespread usage of the concept, sustainability, green applications in buildings started to gain importance. The concept of green building, in this respect, has become a vital structural part of sustainability (Arslan, 2014). The main reason lying behind the searches for sustainable use in buildings is that the buildings are important natural resource consuming areas. This excessive use of resources has turned buildings into a root of many environmental problems in construction, execution and maintaining processes. Vyas et al. (2014) stated this situation as because of consuming high amounts of energy and natural resources, and affecting the water and air quality in cities, buildings are also effective in climate change. Patel and Chugan (2013), stating that the building sector is the greatest contributor in global greenhouse gas emission, mark that 1/3 of the energy is consumed by buildings worldwide. The present data show that the construction sector surpassed other sectors in carbon footprint increase. Buildings, using 1/3 of natural resources, are responsible for 40% of total solid waste (Erten, 2011). Buildings consume 70% of energy and

material, 17% of water, 25% of the forests, and besides, cause 33% of the total $CO_2$ emission (Yaman, 2011). In light of these data, it is possible to say that in sustainable use of resources, buildings are a source of both the problem and solution as important areas of consumption of natural resources and waste production.

Increasing worldwide awareness of environmental protection and usage of resources is an important factor that motivates the search in light of the sustainability principle. Especially, in the western countries, which are accepted as developed countries, the buildings have had their share in these searches. For example, the European Union (EU) has set some rules to give utmost savings in energy usage and limit greenhouse gas emissions in buildings, which have an important share of 40% in total energy consumption and $CO_2$ emission. In this respect, with the current application called the Directive of Buildings' Energy Performance, it is a must to take precautions for increasing the energy performances of the buildings (İSO, 2010). Again, the fact that the president of the United States, Barack Obama set goals like a net zero energy houses for 2020 and net zero energy buildings for 2025 (Çakmanus et al., 2010), shows the importance of this subject in western countries.

The worldwide increase of attention towards environmentally friendly buildings caused the appearance of buildings called green buildings. World Green Building Council (WGBC) states that the green buildings began as a reaction to excessive consumption of energy and natural resources, then with time their meaning changed and meant more than the effective energy usage (WGBC, 2013). Vyas et al. (2014), sees the meaning of green building at the same with the green structure and sustainable building concepts, and defines it as respectful of environmental values and effective usage of resources beginning of its designing process to its construction, repair, maintenance and usage processes. According to them, green building's structure that are designed for eliminating the negative effects of buildings on human and environment health. The concept of green building, as defined by the US Green Building Council, includes allocation of the building, water management, inner air quality, material usage and energy elements. Green building means healthy, comfortable, sound, energy effective, environmentally conscious and environmentally friendly buildings (Olgun et al., 2009). Patel and Chugan (2013), while defining the green buildings, focus on their minor effect on the environment during their lifetime. One of the most important green building councils, the Indian Green Building Council, IGBC (2012), defines green buildings as consuming less water, using energy at the best levels, protecting natural resources, producing less waste and protecting living things compared to traditional buildings.

Besides these factors, in order for the buildings to be called green they have to meet some standards like: sustainable land planning, water and energy, usage of ecological material, inner air quality, user health and comfort, control of

transportation and wastes, acoustic and pollution (Erten, 2011). Various certificates have been prepared to decide if the buildings meet these standards or not. Among these, BREEAM (Building Research Establishment Environmental Assessment Method) which was developed by Building Research Establishment (BRE) in England, in 1990, and LEED (Leadership in Energy and Environmental Design) which was developed and applied by the United States Green Buildings Council (USGBC) in 1998, are the most commonly used certification types today.

Today, in many building constructions throughout the world, green building standards are taken into consideration. World Green Building Council (WGBC) was established in 1988, in order to spread and accelerate green building studies. Having 26 members in 2007, the council's number of members reached 98 in 2013. Today, there are more than 140,000 buildings and more than 27,000 companies registered to WBGC (WBGC, 2014). Green buildings are becoming an important economic sector. According to researches on investment projections, it is expected that green buildings will be a billion dollar sector by 2050 and with the increasing number of green buildings, the consumed energy in all of buildings of the world will decrease by a 1/3 ratio rate (UNEP, 2011). It would be wrong to consider green buildings only as residential. Patel and Chugan (2013), state that green buildings can be used outside the residential areas. According to them, green buildings can be designed for industry (factory and other industrial facilities), institutional offices (office and research facilities) and commercial structures (shopping malls, hotel, and showrooms).

The main aim in sustainable production is to produce less waste, without polluting the environment. Besides, the recycling of the wastes, using recycled material in factory construction, using clean energy resources in production, and keeping the air in production area clean for the workers, is among the principles of sustainable production. As it is seen in Table 1, there is a parallel line between green building, grading categories (according to BREEAM and LEED) and sustainable production principles. This situation is an indicator that the construction and design of the production facility, according to the green building principles, may play a vital role in the realization of sustainable production.

**Table 1:** Sustainable Production Principles and Categories of Green Building (BREEAM and LEED)

| Principles of Sustainable Production | Green Building Categories (BREEAM)[1] | Green Building Categories (LEED)[2] |
|---|---|---|
| The working area should increase the creativity and productivity of the workers | Health and Wealth | Inner space life quality |
| Energy and material should be used in accordance with the result aimed | Energy | Energy and Atmosphere |
| The working area should be designed against all kinds of danger | Water | Water saving |
| Materials that will harm human and environment, health should always be decreased | Utility of land and ecology | Sustainable land |
| The product and the packing should be sensitive to the environment | Material | Materials and sources |
| The management should be open for all kinds of evaluation and amendment | Innovation | Innovation |
| Wastes should be decreased or should be organized towards recycling | Wastes | |
| The welfare and security of the workers should be a priority | Pollution | |
| Economic, social and cultural development of those who live around the working area should be realized. | Transportation | |

**Source:** Prepared with the help of Veleva, V., Ellenbecker, M. (2001). Indicators of sustainable production: framework and methodology. *Journal of Cleaner Production* (9), 519-549.

## INCI INDUSTRIAL BATTERY FACTORY

INCI, which has one of the few production facilities in Turkey with a green building certificate, has started production at its first factory in the Manisa Organized Industrial Zone, in 1984. INCI, whose main production area is to produce batteries for the automotive sector, has become one of the most important battery companies in Turkey by exporting 60% of its products. The construction of Inci Industrial Battery Factory, which is the first factory in Turkey to have a BREEAM Certificate, was started in 2010, and in 2011 it was completed and the production started. This factory, where traction and stationary batteries are manufactured for industrial applications, with 52.5% grading, got its certificate with the degree, "BREEAM Good", in 2011.

[1] Somalı, B., Ilıcalı, E. (2009). LEED ve BREEAM uluslararası yeşil bina değerlendirme sistemlerinin değerlendirilmesi, IX. Ulusal Tesisat Mühendisliği Kongresi, 06 – 09 Mayıs 2009, İstanbul

It is possible to evaluate the sustainable production in Inci Battery green building under these subtitles:

**Energy:** In turn the raw material into the last product, the energy which is used at every moment of the production like air conditioning and lighting, constitutes and important problem for the industrialists,Turkey, which provides 60% of its required energy from petroleum and natural gas, is not rich in terms of these resources. It is also clear that this situation has caused Turkey to become a country that depends on import in terms of energy. In Turkey, where the import dependability of energy is 72%, it is expected that this rate will increase to 80% in the following years (Bulut, 2013). In developing countries like Turkey, whichproduce the majority of the energy it uses from the resources it imports, this dependency on import makes the resources of energy and their usage even more important. Green buildings and sustainable production, the targeted aim in terms of energy, is to produce the energy with cheaper and clean energy resources and use as little as possible.

In Inci Battery green building, energy saving is mostly realized in areas of lighting and air conditioning. In order to save on lighting, which is a huge energy consumption area in production facilities, precautions were taken in the considered working area, starting from the first phases of the planning of the building. One of these precautions is the lighting gaps, which are situated mostly in the east and south sides of the building. With the help of these gaps, it was targeted that the building would get more light from outside (Figure 2a and 2b). Moreover, there is a dome-like area on the roof, and not closing it completely; they have covered the sides of that part with glass. Thus, there is an utmost utilization of the sunlight and a subsequent saving on lighting (Figure 3a and 3b). Berk GÜNŞEBER[2], who is the manager of INCI Industrial Battery Factory, states that as a result of the green building applications, 20% savings on lighting and in 70% savings on general energy consumption was achieved.

**Figure 2a and 2b.** Lighting windows that are placed on eastern and southern sides of the building.

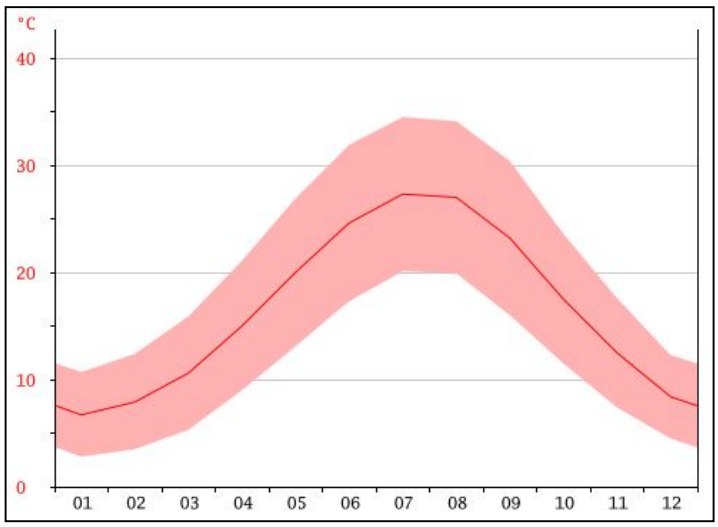
[2] B. GÜNŞEBER, personal communication, 14 August, 2014.

**Figure 3a and 3b.** Sunlight gaps that are left on the roof production area.

The construction direction of the buildings is an important aspect of the green buildings. The main reason of this is the construction direction of the building plays an important role in the energy consumption of that building. For example, in places like Turkey, where the exposure direction is south, the construction of the buildings in north-south direction increases the energy consumption to a great extent. If the production area lies in the north-south direction, air conditioning is needed in summer months for reducing the heat and in winter months for increasing it. One of the criteria of the green buildings is to save energy by keeping the air conditioning at the minimum level. The temperature is around 30°C degrees in the summer and the winter temperatures are around 7°C in study area (Figure 4). Inside the Inci Battery green building, to realize these savings, the building was planned in the east-west direction and thus the summer-winter energy loss due to air conditioning was avoided. No door was made at the northern direction of the Inci Battery green building. So, the cold air that might enter from the north in winter was avoided, thus the heating expenses in winter were reduced (Figure 5). GÜNŞEBER[3], emphasizing that in an average factory, 60% of the energy consumption will be in air conditioning, states that as a result of the building lying in the east-west direction, the inside heat in summer is 10-15 degrees less than the open air, and subsequently they reduced the air conditioning expenses that would take place in summer.

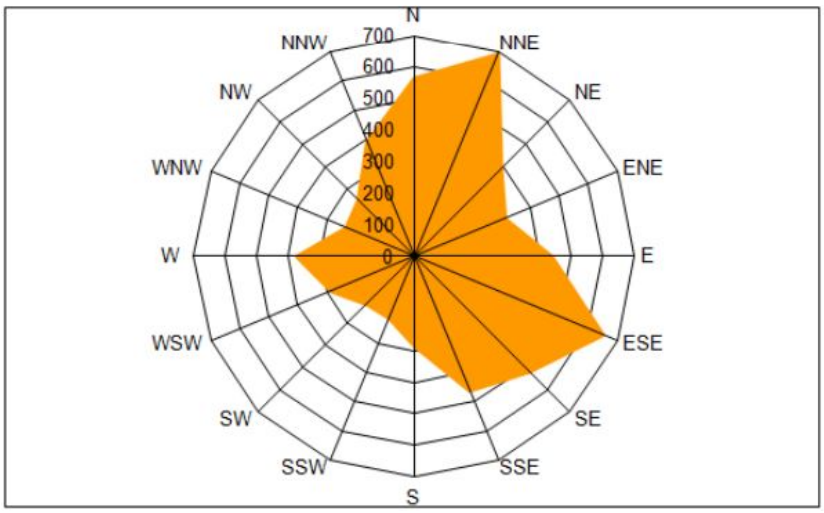
[3] B. GÜNŞEBER, personal communication, 14 August, 2014.

**Figure 4:** The temperatures graph of Manisa




**Source:** CLIMATE-DATA.ORG (2016) *İklim – Manisa.* http://tr.climate-data.org/location/192/

**Figure 5**: The wind speeds in Manisa




**Source:** Aydın, İ. (2012). Manisa Bölgesinde Verimlilik Amaçlı Ölçülen Rüzgar Yönlerinin Fizibilite Değerlendirmesi. *Electronic Journal of Map Technologies.* Vol: 4, No:1, p. 40.

Green buildings and sustainable production, it is essential that energy is supplied from renewable energy resources like sun and wind. Though the roof of the Inci Battery green building was designed so that it would be suitable for producing energy from the sunlight, the required energy is not produced by solar panels but by buying energy from the network system. GÜNŞEBER, states that the reason for this is that they are not able to use the energy they produce directly and that they give it to the network, then the network, buying this energy for 0.14 TL[4], sells it back to the company for 0.25 TL. GÜNŞEBER, stating that as a result of the feasibility study, they carried on, they figured out that an investment for producing electricity from sunlight would pay itself back in 10-12 years, and he also says that this period is longer for industrialists, and, therefore, they prefer supplying their energy needs from the network.

In Turkey, which is dependent on foreign sources in terms of energy, diversification of energy resources is important. However, although Turkey has especially great potential in terms of solar and wind energy, and there is considerable progress in terms of wind energy, producing energy from the sun is still in its infancy period. As in the Inci Battery green building, although everything is ready for solar energy production, the main reason lying beneath the fact that the network electricity continues to be used is that it is still not profitable for the industrialist to produce solar energy. According to GÜNŞEBER, the solutions for this problem are: the network should pay higher amounts for the electricity the factory produces, the price for the required tools for solar energy production should be lowered (which are too expensive in Turkey), and tax incentive.

**Water:** The utility fields of water, which is an inevitable life source for living things, varies. The water resources, which are used for drinking, agriculture, and industry, are facing important problems in recent years. Drought and pollution are the first of these problems. While the amount of water decreases due to droughts in many parts of the world, pollution of the water due to wastes has increased the need for clean water sources.

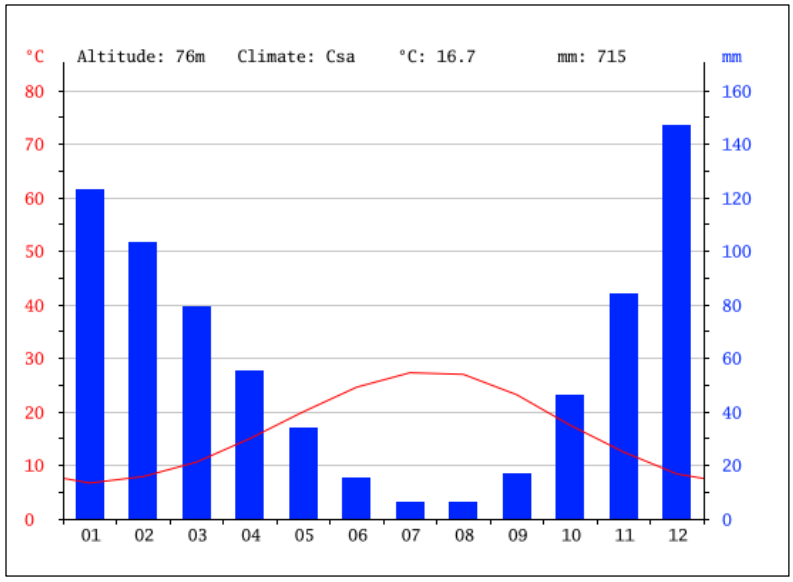
In the world, where 2 billion people cannot reach clean water, 30% of the 39% of the accessible surface water is used. 70% of this accessible water is used for agriculture, 20% in industry and 10% is used in cities (WWAP, 2014). When Turkey is analyzed in this sense, one can see that 16% of the usable water potential is used for drinking and daily use, 12% for industry and 72% is used for agriculture (Çakmak et al, 2009). According to 2023 expectations, these ratios are expected to be 64% in agriculture, 16% drinking and daily usage, and 20% in industry (Uzen and Cetin, 2012).

Sustainable production and green building principles, the sustainable usage of water is essential. The reuse of the water that was used in the production and purification of the waste waters before letting them flow into sewers or city

[4] TL: Turkish Lira (Turkish currency)

networks are important for the sustainability of the water resources. Manisa has a semi – arid climate. While the maximum rainfall falling in the winter season, the summer months are drier in Manisa (Figure 6). This situation increases the importance of water in study area.

**Figure 6:** The climate graph of Manisa




**Source:** CLIMATE-DATA.ORG (2016) *İklim – Manisa.* http://tr.climate-data.org/location/ 192/

In Inci Akü green building, the purification or recycling of water is highly valued. A lead, which is the main source used in battery production, is a poisonous mineral, it could have serious damages when it merges into soil or water. To prevent this, water tunnels surround the factory, while rainwater and wastewater tunnels are separated from each other (Figure 7a and 7b). Moreover, the wastewater that leaves the factory is purified and the leads that is inside is precipitated. Thus, while the rainwater is let into the soil without pollution, mixing of the poisonous lead with soil or clean water is prevented. Furthermore, the maximum utilization of water is realized with the usage of the purified wastewater many times in production. As a result of all these applications, GÜNŞEBER[5] states, that they reached an 80% decrease in their water consumption and save on water, which is one of their important expenses.

[5] B. GÜNŞEBER, personal communication, 21 August, 2014.

**Figure 7a and 7b.** The water tunnels that separate the water used and the rainwater in the production area

**Recycling:** Today, with the increasing population, the demand towards natural resources is also increasing. However, as the resources are limited, it is a must that the resources should be recycled. Moreover, in the production activities, which mean the transformation of raw materials into final products, the recycling of the natural resources is an important level of sustainable production.

Natural resources are indispensable aspects of industrial production. Apart from all kinds of production of final products, also in the processing of the raw materials, the need for the natural resources is increasing day by day. This is a well-known truth for sectors whose raw materials are minerals, as in the case of battery production. However, the fact that these minerals, which were easily extracted in the past, are now hard to extract and requires three times the removal of rocks and other materials (Renner, 2012), makes it hard to produce the products whose raw material is mineral. Besides, the extraction of more mines to meet the demands results in rivers of waste and significant environmental problems.

Apart from production, natural resources are also used in the construction of buildings. Construction materials constitute 40% of the materials in the world; every year, about 3 million tons of stone, soil, minerals, wood, petroleum and other materials are extracted and processed to be used as construction materials, and these processes, in turn, have some environmental effects (Erten, 2011). As a result of these, industrial facilities, using natural resources to a great extent in during both the production phase, and during the construction of the industrial buildings, may play a vital role in the realization of sustainability. This is only possible with the recycling and reusing of the natural resources.

Recycling is highly valued in the Inci Battery green building. Especially, with the recycling of the lead, water, and packaging material that is used in production, sustainability in production is targeted. GÜNŞEBER[6], stating that via

[6] B. GÜNŞEBER, personal communication, 21 August, 2014.

recycling, they can reuse the lead, which constitutes 80% of the material they use and prevent 15-20 tons of possible monthly losses, also adds that with their new packaging system called "returnable pack", they gained about 700 thousand TL per year. Recycling in the Inci Battery green building is done in two ways. Firstly, the water used in production, which has lead, is purified with the purification facility; the lead that is inside is precipitated and dried, so that it is again ready for use (Figure 8a and 8b). The second way is that a ventilation system is set for the lead, which is in the air in the form of dust particles within the production facility. The air in the production facility is vacuumed and the lead that is inside is precipitated in a separate place (Figure 9a and 9b). In the second system, apart from the recycling of lead, the air in the production facility is also kept clean, so the workers are guarded against any harm. GÜNŞEBER emphasizes that labor force is the most important resource for a company, and therefore companies will have protected its most valuable resource by protecting their health and security. According to him, as most of the manufacturers are not aware of the advantages of protecting the health of workers, they see this kind of investment as a burden and lose efficiency of their production without recognizing it.

**Figures 8a and 8b.** Purification of the water used in production and the precipitation of lead

One of the questions that this study tries to find answers for, in the example of Inci Battery which has BREEAM Certificate, is why would the industrialist chooses to build such an environmentally friendly building while it is possible to build a normal building with the same capacity and less cost? With this, it is our aim to understand the environment policy at the background of the green building in the example, and hence, figure out how the "sustainability" and "environment" are comprehended by the industrialists. According to the general manager of Inci Battery, Cihan ELBİRİK[7], the answer to this question should be searched on the way that the companies today, have to continue their production with a mission of a sustainable world in mind. According to him, all through the process, from the raw material to the waste, the companies which do not shape every step of a

[7] C. ELBİRİK, personal communication, 17 August, 2014.

product in its lifetime in accordance with the sustainable production, comprehension will not be preferred by the customers; because the customers today do not only buy a product, but also question its production process.

**Figures 9a and 9b.** Ventilation system, which helps to store the lead that roam in the free to air in the production area.

Actually, it is possible to understand from this answer that sustainability and production that is sensitive to the environment are more of the necessities of the companies, rather than matters of choice. Especially, the way that the customers choose environmentally friendly products, as they become more and more environmentally conscious, is one of the important factors in this respect. "Best Global Green Brands" list, published by one of the most important consultancy companies in the world, Interbrand and Deloitte, every two years, are a result of this situation. This list, consisting of 50 companies and to which many companies would like to get in, has become a way of showing their environmentally friendly products for the companies. Nükhet ÜNVEREN[8], who is in charge of the institutional credit of the company, states that they have the green building certificate and that they use this certificate as a serious element of promotion; especially in panels, meetings, in newspapers and magazines, continually expressing what activities they have done to the environment and thus making it clear in the minds of the customers that they are an environmentally friendly company.

[8] N. ÜNVEREN, personal communication, 19 August, 2014.

When profiting is thought of as the basis of the production activities of the companies, the investments that will not bring profit in the short term are not appealing for many industrialists. In contrast with many developed countries, in undeveloped or developing countries, companies do not prefer the investments for protecting the environment, as they are not seen as profit bringers. According to GÜNŞEBER, this is for the fact that the companies are after short-term gains. Stating that they had many difficulties about environmental issues in the first factory of their company, founded 30 years ago, and faced many unexpected expenses, GÜNŞEBER says that their past experiences are also a factor in deciding to build a building with a green building certificate. According to him, having a production facility with the green building certificate, helps companies to save on areas like electricity and water consumption, therefore when thought in the mid and long term, these kinds of investments help companies in promoting themselves and gaining profits.

A study on green buildings reveals that if the buildings are designed and used this way there would be a decrease of 24% to 50% in energy usage, 33% to 39% of $CO_2$ emissions, 30% to 50% in water consumption, 70% in solid waste production and 13% in maintenance costs (Erten, 2011). These values show that having a building with a green certificate will bring profit for every administrator in terms of energy, water, waste and maintenance costs. According to GÜNŞEBER, the critical point in this subject is that the investments in green buildings or sustainable production should be included in the planning from day one. According to him, in the opposite situation, such as turning a building that is already in use into an environmentally friendly one increases the expenses; these expenses discourage the administrators at the beginning.

## DISCUSSION AND CONCLUSION

The industrialization process, and as one of its results, the environmental problems because of the development of competition between the countries, has brought out some arguments. These arguments, which peaked in the second half of the 20$^{th}$ Century, have generally focused on production and development.

The discussions that started with the Adams Smith's statement that economic growth and increasing incomes will create societies with welfare has been carried on to a new level with Malthus' theory. According to him, if the excessive population increase cannot be controlled, the production in agriculture will not be enough to meet the needs and there will be famine. As opposed to Malthus's theory, Engel's theory that the improvements in science and technology will meet the population's demands is still a reference point today, for those who believe that ecological problems can be solved by technology (Aşıcı, 2012b). This approach, which can be defined as "ecological modernism", has suggested that giving up modernism for solving the environmental problems would be wrong.

According to those who support this approach, because of the fact that development requires continuity, production activities shouldn't be postponed, but revised and made environmentally friendly (Kayıkçı, 2012). Bahro (1996), however, states that technology - centered solutions are nothing but painting the existing system green and trying to ignore environmental problems. Davidson (2014), supporting this view, defines the idea that environmental problems and famine can be solved with technology as "Custer's Madness", and claims that this is nothing but a big illusion.

Besides the discussions on whether the technology will solve the existing environmental problems or not, there are also discussions on economic growth which takes their place in literature. The "degrowth" movement, which was started by the economist, Nicholas Georgescu-Roegen, is one of them. This movement, which suggests that production and consumption should decrease, has supported the idea that there should be degrowth in economies and stated that at the heart of today's problems lies the growing competition between the countries. Tim Jackson, the author of *Welfare without Growth* (2009), however, criticizes the degrowth movement and states that the humanity should aim zero growth rather than degrowth, thus provides a different aspect of the discussions on development (Aşıcı, 2012b).

The concept of "green economy" which was put forward by the UN as a solution to today's economic problems, has found itself a place within these discussions. Green economy, which can be defined as a production that is respectful of nature, nonpolluting the environment, and using recyclable energy, has become a concept in which intense discussions gather. Lawson (2006), stating that the existing economic system is not sustainable because it sees profit as a priority and thinks that resources are for free, and claims that the green economy should be preferred because in this view the sustainable use of the resources are of great importance. Aşıcı (2012a), states that the green economy is important for today's problems, however, claims that many companies just eyewash with "green painting" and just try to continue the old system. According to him, companies will only realize green production with the policies that will touch on the system. Engelman (2013), on the other hand, has an attitude against the green economy and stating that green growth will be nothing but optimism, claims that as green growth targets the welfare of 7.1 billion people on Earth, it is not possible.

One of the questions for which the answer was sought in this study, using the Inci Battery example, was to define the place of green buildings in sustainable production. As a result of the study, it is seen that the use of green buildings, which were planned to reduce the share of buildings in usage of natural resources and effect on the environment, in industry will play a vital role in sustainable production. When the basic criteria of the sustainable production and the standards for a building to be called green are compared, similar properties can be seen in both paradigms. Construction of the building where the production is made via

green building standards, providing especially the least usage of resources and a decrease in waste amount, is effective in realization of sustainable production. Besides, as it is seen in Inci Battery green building, green buildings are effective in the protection of the health of the workers, which is an important criterion in sustainable production, and preparation of the suitable grounds for production. Thus, the continuity in production is provided.

Another question, to which the answer was sought in this study using the Inci Battery example, was to figure out how the local industrialist saw the investments towards the environmental protection. While it is not possible to arrive at generalizations for all industrialists, as a result of the meetings carried out by the authorities from Inci Battery, it is seen that these kinds of investments are compulsory, especially for big companies. Today's consumers' tendency towards buying the products of environmentally friendly companies, due to the fact that they have an increasing environmental awareness, makes it compulsory for companies to carry out environmentally friendly production. The fact that, as in the example of Inci Battery, big companies try to announce on every platform that they follow clean production is an evidence of this situation. There are no doubt that, as well as non-governmental organizations, the responsibilities due to Environment regulations of the EU, to which Turkey is trying to be a member of, are also effective in this situation. The companies like Inci Battery, which want to export most of their products to EU countries or other western countries, must carry out environmentally sensitive production. Knowing that, otherwise, they won't be able to export to the countries in question is effective for the companies to invest towards the protection of the environment.

Both the changes in the purchasing attitudes of the customers and the fact that the companies should be willing in their investments towards environmental protection, regardless of regulations, should not be ignored. No doubt that, it is impossible for the industrial companies ignore the environmental problems in the world. As a result of the meetings with Inci Battery authorities, it is possible to conclude that the environmental problems they met in the first factory, they produced, forced them to gain awareness on this subject. With this awareness of the big companies like Inci Battery, it is clear that they will be willing to carry out environmentally friendly production. Moreover, as stated by the Inci Battery authorities, though the investments for environmental production may seem like an economical burden at the start, the fact that they will return in the long run will encourage the companies in this subject.

As a result, it can said that, though the discussions between economic growth and environment continue with increasing speed, it is also a truth that developing countries like Turkey will continue to develop their industrial production to increase their welfare and to develop. What is important here is what costs will be paid for this development. The real question that should be answered is: will the countries that want to develop, realize this development with the

development, comprehension of over consumption of the natural resources and harming the environment, as the other western countries once did? When it is thought that the countries that want to develop will not give this idea up in the near future, it is clear that the model of sustainable production, which is defined as nature friendly production, will be an answer to this problem. As in the Inci Battery example, constructing a production facility with the green building certificate, to decrease its negative effects on the environment, may play a key role in the realization of sustainable production. However, the point that must be paid attention here is the need for adequate support for those companies that try to do environmentally friendly producing. For example, economical support in producing its own electricity, rewards for competing with companies that ignore environmental issues and the tax reduction will increase the motivation of the companies in realization of the sustainable production.

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