

DOI: 10.7596/taksad.v10i1.2952

Citation: Razzaghipour, A. (2021). The Need for Efficiency of Energy Sources Management in Sustainable Architecture. *Journal of History Culture and Art Research*, 10(4), 16-27. doi:<http://dx.doi.org/10.7596/taksad.v10i1.2952>

The Need for Efficiency of Energy Sources Management in Sustainable Architecture

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Abstract

With the industrialization of the world, energy resources need management more than anything else. Because today we live in an energy-dependent world, we need energy to generate heat and cold, to create light, to start car engines, to run factory gears, to harvest crops, and so on. Therefore, the present study aimed to investigate the need for efficiency of energy sources management in sustainable architecture was conducted. In this research, a descriptive-analytical method has been used to look at the concept of energy resources management and sustainable development and their relationship, to study renewable energy sources in Iran and to propose proposed solutions in this regard. The results show that energy management requires the presentation of policies by managers of a country and also requires public education at the community level. Achieving sustainable development also requires access to sustainable energy sources that non-renewable energy and fossil fuels are not suitable sources in this regard due to unsustainability, but renewable energy will remain for future generations if used, unlike fossil fuels. They will not lead to pollution and global warming. Undoubtedly, by replacing renewable energies with non-renewable energies, the steps taken towards sustainable development will become stronger. In addition to these issues, the epidemic and the increase in the number of victims and victims of the Covid-19 virus, which led to the closure of oil fields, refineries, mines, etc., was another blow to the managers and officials of countries to find out more than ever the only solution to these problems is referring to renewable energy.

Keywords: Sustainable architecture, Energy resource management, Renewable energy, Nature-friendly.

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Introduction

Sustainable development means meeting the current needs of human beings without compromising the ability to satisfy the desires of future generations (Kotchen & Segerson, 2019). Energy is considered as a key factor in creating development in different dimensions in different societies, which are traditionally used in poor countries and in more developed countries, or in the form of new energies and using advanced technology (Ferraro et al., 2019). The use of different forms of energy or different sources of its extraction has consequences for human life, and choosing the right source is one of the most important things in any country. Sustainable development is a development that meets the needs of the present generation without compromising the ability to meet the needs of future generations (Van Song & Phuong Thuy, 2006). This development has three dimensions: social, environmental and economic, and the common chapter include these three social dimensions. Sustainable development should avoid disturbance of ecosystems and biodiversity, climate pollution, disruption of the landscape and foundation of national culture, and the production of large amounts of community effluents, or at least if the inability to avoid, local to a minimum. The use and exploitation of renewable/non-renewable resources have been done responsibly and fairly in order to improve it. (Hollingsworth & Rudik, 2019).

Energy is an important and necessary factor to achieve sustainable development in any country, but the type of energy, technology used in production with energy consumption, etc. can have a negative impact on some aspects of sustainable development. Pollutants from energy production or consumption have a negative impact on the environmental dimension of sustainable development, and finding a solution to reduce pollution in production by consuming the desired energy or even changing the choice and use of energy sources is very important (Hoang, 2019).

In this study, while describing sustainable development, energy and its types, energy resources have been evaluated with criteria extracted from the literature. In this regard, the AHP method has been used to prioritize energy resources that are relatively compatible with sustainable development. Expert Choice software has been used to speed up the research process and also to achieve more accurate results.

Theoretical foundations of research

Sustainable Development

Prior to the 1980s, the economic dimension of development was increasingly emphasized, resulting in underdevelopment, development instability, and environmental degradation, especially in poor and developing countries (Badiu et al., 2016). For this reason, from this time on, sustainable development, in other words, ecological development, green development, nature-friendly development and environmental protection, found a special place among thinkers. This type of development has different environmental, economic, social, cultural and even political dimensions that together form the development process. Each of these dimensions is important in the development process (Grunewald et al., 2017).

By changing the development paradigm from classical to modern, sustainable development, including environmental issues has become the main pillars of development. Meanwhile, increasing public awareness of the importance of environmental issues in the form of sustainable development in the world has a high coefficient. So that various international organizations are working in this direction, includes UNESCO. This organization tries to encourage countries to formulate sustainable

development education development strategies by forming agencies in different countries. For this purpose, it is very important to pay attention to the characteristics, potentials and empirical and indigenous knowledge in the national field of sustainable development (Hegetschweiler et al., 2017).

The texts of sustainable development show that the third millennium AD, the main concern of international organizations and thinkers and scientific and research centers, the emergence of environmental problems and its increasing trend is expected, man as an influential factor and victim of this crisis. Therefore, the reform of the environmental crisis is believed to depend on the reform of human teachings and changes in attitudes, insights and knowledge of human beings about their own destiny and the environment (Kabisch et al., 2016).

It should be noted that the protection of the environment and natural resources must be within the framework of national interests, and the existence of national interests among them are considered as those interests that governments as a whole and on behalf of their nations. In their relations with other countries, they seek to achieve it (Stessens et al., 2017).

Sustainable development is, in fact, balancing development with the environment. In 1980, the name of sustainable development was first mentioned in a report by the World Conservation Organization. In a report called the Natural Resources Conservation Strategy, the organization used the term to describe a situation in which development is not only harmful to nature, but also helpful. And sustainability has four aspects: sustainability in natural resources, political sustainability, social sustainability, and economic sustainability (Wüstemann et al., 2017).

Although many government officials and environmental activists these days are looking for sustainable development, some environmental activists do not see this option as sufficient to protect the environment. They believe that the term "sustainable development" is not appropriate due to the process of using depleting resources and wasting resources in the world, and an alternative word such as "sustainable development" should be used so as not to evoke the concept that new resources are to be produced (Pour Ahmad et al., 2015).

Goals and foundations of sustainable development

The concept of sustainable development is an important change in our understanding of the relationship between humans and nature and humans. This is at odds with the view of the past two centuries, a view that is based on the separation of environmental, social and economic issues. It can be said that sustainable development and sustainable architecture, according to their early ideas, consider protecting the environment by changing the approach to nature, modifying our view of nature, and consequently changing human behavior, leading to change. Culture will be consumed, a very important step in sustainable development. In essence, neither natural nor social conditions can be superior to each other. A cross-linking process must be identified and searched. In this way, instead of considering nature as an independent and external entity that must be stored or exploited, one must understand and interact with nature in various ways (Maleki et al., 2015).

Overall, sustainable development has three main characteristics:

- A) Sustainable context of resources derived from productivity of populations and ecosystems.
- B) Biodiversity of individual species in the context of ecosystems relative to human exploitation and more generally human interventions
- C) Sustainable economic development without destroying the resources available to future generations.

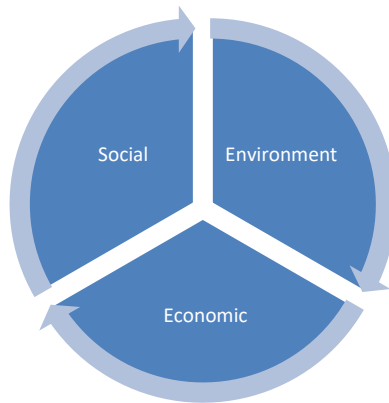


Chart 1: Areas of sustainability

In fact, sustainable development is the concept of a whole and a set, and the set itself is subdivided into the topics of sustainable transport, sustainable community, sustainable city and sustainable architecture.

Following the environmental protection movement of the 1960s and 1970s, "sustainable development" has become a general reform of state development strategies since the early 1980s. Although defined differently by different governments, the basic concept put forward by the World Commission on Environment and Development has been endorsed: "sustainable development is to meet current needs without hurting the ability of future generations to it is their own special needs" (Cvejic et al., 2015).

In essence, sustainability of environmental systems and generational justice are key concepts of sustainable development. Sustainability refers first to "environmental sustainability" or "environmental sustainability", which refers to the long-term ability of the earth to meet the ever-increasing needs and wants of humans, which would have devastating effects on the natural environment. As the debate on sustainable development has expanded, many have argued that other approaches to environmental sustainability, namely 'social sustainability', 'cultural sustainability' and 'economic sustainability', must be recognized because they both are key aspects of development. These four sustainability approaches are in fact interdependent and will affect one another (Aronson et al., 2017; Hamstead et al., 2018).

"Sustainable development is a concept that has been seen in recent years as a global issue. Sustainability is a multidimensional process that, while improving the economic situation (economic sustainability) and creating social well-being combined with social justice (social sustainability), is far from harmful environmental effects (environmental sustainability) and social anomalies while meeting the needs of the present generation. At the same time, it maintains the capacity to meet the needs of the next generation with respect to conservation and improvement of the environment. For sustainable housing, physical interactions with human behaviors create social sustainability by enhancing the quality of life, providing justice and social supervision, enhancing cooperative morale, active participation, and collectivism in humans. In a sustainable city, the sense of belonging to the place must be created and enhanced. By maintaining healthy congestion and communication and predicting the proper size for the habitat of desirable social relationships, develop another concept of civic life" (Hatami et al., 2016).

As mentioned above, sustainable development is an issue that has been the focus of scientific circles around the world since the second half of the 20th century, and today it has a special place in various sciences and every day a new angle of sustainable development it is shaped to serve the purposes of this global debate. Architecture is one of the disciplines that have a particular tendency for sustainable development, which is what is known as "sustainable architecture" in the world. Sustainable buildings may be defined as buildings strive to achieve complete quality (including economic, social and environmental aspects) (Artmann et al., 2019).

Sustainable architecture and design encompasses three main goals: economic goals, environmental goals, and social goals. In this regard, Beth McCarthy points out the following in relation to the above three goals defined in sustainability:

- 1) Environmental goals: creating superior environmental quality, reusability, waste and waste disposal, consuming less transformative materials, recycling materials, recycling water from wastewater, eliminating pollutant emissions.
- 2) Economic Goals: creating superior values, reducing current costs, reducing energy consumption, offering perfect solutions to ease of production, prospective solutions.
- 3) Social goals: security, adaptability, quality service, elimination of energy poverty, sound insulation, flexible programs, healthy living, home care, permanent education (Wolch et al., 2014).

Sustainability in architecture can be studied in two main areas. The first is "physical sustainability", also referred to as climate sustainability or green architecture, which focuses on building physical stability and optimizing the use of materials and energy. This view has been greatly developed in recent years and has been divided into different branches. But another area in which architectural sustainability can be examined is non-physical sustainability, here referred to as "social sustainability" (Artmann et al., 2017).

What we know today as sustainable architecture is actually a subset of the category of sustainable development synthesized at the end of the second millennium, along with many actions in thought and practice that go hand in hand with the knowledge of the third millennium (Wolch et al., 2014).

Sustainable development, energy and existing challenges

Sustainable development has three dimensions: social, economic and environmental. On the one hand, energy is an essential means of living today; on the other hand, it is a threat to the environment and the destruction of the planet. Statistics show that deaths due to infection are far higher than deaths and diseases due to cancer, AIDS and malaria. Air quality is the biggest cause of damage to human health in 85% of the world's fastest-growing cities where pollution is on the rise. Increasing access to energy, the impact of energy on the environment and its sustainability, and complex energy management are the three main energy challenges. To boost economic growth, improve living standards, increase energy consumption is inevitable.

The second challenge means that almost all forms of energy are harmful to the environment. Energy plays a catalytic role in promoting development in developing countries. Energy is linked to sustainable development through productivity, revenue growth, environmental health, health and education. The role of energy in sustainable development is to provide services that enable development (while respecting all three economic, social and environmental pillars) in the form of annual climate change in the Northern Hemisphere (Newell et al., 2013).

Investing in the energy sector, in addition to meeting the essential needs of the people, will create jobs and increase income and entrepreneurship.

But greenhouse gas (GHGs) and carbon emissions from fossil fuels are known to be major threats to the world's climate. At present, fossil fuels produce carbon pollution annually. Using current technologies to produce and consume these fuels will double or triple this pollution.

Increasing the amount of carbon in the atmosphere increases the amount of acid in the environment, increasing the amount of acid in the upper layers of the oceans also causes the destruction of coral layers. Therefore, we must somehow control the amount of carbon pollution, that is, we must adopt a method that, while creating economic growth, produces energy with higher efficiency and less pollution. Of course, reducing the energy unit in terms of economic activity to stabilize the concentration of carbon in the atmosphere is not the right way. Also, renewable energy sources and cleaner sources, but alone do not meet energy needs are not produced economically. Therefore, turning to nuclear power plants can be one of the approaches (Dennis et al., 2019). However, in the event of an accident at a nuclear power plant, the depth and extent of the danger and its consequences are high. Therefore, methods of converting one type of fossil fuel to other types to reduce pollution will be one of the best choices. In this regard, one of the theories is fission with carbon decomposition. That is, decompose the carbon from the combustion of fossil fuels before entering the Earth's atmosphere. Geological and chemical decomposition methods have been proposed for the decomposition of carbon dioxide, but the necessary and complete econometric analysis of their operation has not yet been performed. It is interesting to note that countries with larger populations do not require more carbon dioxide. The United States, for example, has only 4.5% of the world's population, while 25% of the total carbon dioxide emitted into the atmosphere is from this country.

Energy, sustainable development and its measurement: For measurement by evaluating sustainable development in different countries, indicators have been provided by different institutions that may be slightly different. Energy affects both social and economic development and affects economic growth, the environment, climate, and social issues such as poverty, population, and health. One of the five key areas of sustainable development is waste and waste from the use of related resources and technologies. Energy is essential for socio-economic development as well as improving the quality of life of the people, but most of today's energy is produced and consumed in a way that cannot maintain its stability in the long run. To achieve a sustainable energy, indicators for it is necessary to evaluate measure and control energy (Dai, 2011).

Indicators introduced by the United Nations Commission on Sustainable Development (CSD) include social indicators, environmental indicators, economic indicators and current indicators. The ESDI Association of Canada introduced the "Environmental and Economic Situation" indicators of information systems at the national level, the sustainability of a dynamic and healthy economy and the consideration of other important national assets such as the environment as indicators for assessing sustainable development (Schetke et al., 2016).

In 1999, the International Atomic Energy Agency (IAEA) brought together representatives from seven international organizations and seven countries to review existing energy indicators (Sanesi et al., 2017). These indicators have recently been officially tested in the country, including Argentina, China, Cuba, Indonesia, Mexico, Pakistan, Turkey, Eastern European countries and Western Russia and the United States, and finally 41 indicators have been selected. The main indicators are the total population of the country and the population of the city, 7 GDP per capita, energy prices for the final consumer with no taxes and subsidies, distances traveled per person, freight transport activities, area of house per person, energy production efficiency, energy consumption per unit of GDP, per capita energy consumption, depletion of net energy efficiency, injustice or income discrepancy, energy

consumption in terms of potential daily income of each Air with the amount of pollution (CO, O, SO, ...) Concentration of pollutants in cities (SoyNox, Co, OZONE, ...) Soil acidity, amount of greenhouse gases but waste and radioactivity in the atmosphere, discharge rate Sewage and oil into water, renewable resources, longevity of speed sources with explored resources, and longevity of explored uranium resources (Maes et al., 2015).

Renewable energy sources

Before the Industrial Revolution, energy production in the world depended on manpower and animals and natural currents. These energies have either been the product of the conversion of chemical energy into thermal energy or light through fatty combustion, and so on. The use of windmills is also a clear example of that time (Pour Ahmad et al., 2015).

But after the industrial revolution, due to the need for more energy in industries and also in homes for the greater welfare of traditional energy families are no longer responsible, higher quality fuels such as fossil fuels have been identified and used. What is important is that the increase in energy consumption is non-linear with the increase in population, so that energy consumption in 1800 was equal to EJ 20, while in 2000, despite the six-fold increase in world population, to EJ 430, i.e. 20 times its rate has reached that year. Renewable energy sources are energy flows that occur naturally and frequently and can be beneficial to humankind. Recent conflicts in the Middle East, declining oil reserves, and the impact of fossil fuels suggest the need to replace fossil fuels with environmentally friendly fuels. Given the high cost of producing renewable fuels, focusing on creating new technologies to produce these fuels cheaper and more economically is a priority. What is certain is that energy demand in developing countries is growing rapidly due to industrialization and population growth, as well as urban population growth in rural areas and the consequent need for more lighting, heating, mechanical energy, transportation, and communications. As much as 2.3 percent of global energy demand growth will occur in developing countries over the next 25 years (Cvejik et al., 2015).

This figure was 38% in 2002, while in 2030 it will reach 48% of total world energy demand. In other words, in 2030, about half of energy demand will be allocated to developing countries. Renewable resources form the basis of sustainable energy. Currently, about 75% of the energy required worldwide comes from fossil fuel sources, which are not renewable sources. But it will be difficult to remove these major fuel sources from the list of energy sources. Therefore, it is necessary to create technologies that have the least impact on the climate, make it possible to provide enough energy (Grunewald et al., 2017; Hegetschweiler et al., 2017).

Sustainable development at a glance

Sustainable development is development that meets and meets your current needs without compromising the capabilities of the next generation. In this definition, the right of each generation to enjoy the same amount of natural capital that was available to other generations is recognized and the use of natural capital to the extent of its interest is allowed (Nabi and Madi, 2014). In another definition, sustainable development is a process that improves economic, technological, social and cultural conditions towards social justice and is not in the direction of ecosystem pollution and destruction of natural resources (Artman et al., 2017).

Undoubtedly, achieving sustainable development, which requires the movement of factory gears, is impossible without considering energy sources; Energy sources in general (based on the time of production and their re-replacement are divided into two categories of renewable energy sources and non-renewable energy sources; the following is a brief description and explanation:

Non-renewable energy sources

The first category of energy sources is non-renewable energy; Because this group of energy sources, which naturally takes a long time (at least several million years) if consumed, produced, and replaced naturally, they are called non-renewable energy. Such are fossil fuels (crude oil, natural gas, coal, etc.), earth minerals and water in aquifers (Stessens et al., 2017).

Renewable energy sources

The second category is renewable energy, this group of energy sources, unlike the previous group, is naturally replaced after consumption and regenerate in a short period of time. Geothermal energy, wind energy, hydropower, wave energy, etc. are different types of renewable energy sources (Richardson et al., 2012).

Overview of renewable energy sources in Iran:

- Solar energy of Iran with a latitude of 25 to 45 degrees north is one of the suitable areas in terms of solar radiation; Also in Iran, except for the Caspian Sea coast, the percentage of sunny days per year in the country is between 63 to 98%, ie in most areas it is more than 280 days in a sunny year, based on which we can say that Kerman, Yazd, Sistan and Baluchestan, Khorasan, Semnan, Markazi, Qom, Isfahan and Fars are located in Tabesh region to an appropriate extent (Hoang, 2019; Badiu et al., 2016; Kabisch et al., 2016).

Nuclear energy

Nuclear energy has been considered renewable in some studies and as non-renewable energy in others. Although nuclear energy itself is a renewable energy, the material used in power plants is renewable; Nuclear power plants typically use a very rare type of uranium, ²³⁵U, which is a non-renewable material. But two perspectives on nuclear energy have led to a brief overview of that energy. Because many have named it as the best energy in Iran, in Iran, nuclear energy is known as the best and most suitable renewable energy according to the results of research (Aronson et al., 2017).

Wind energy

Wind energy is one of the cheapest sources of renewable energy (Dominique, 2014); Iran has many beaches with high winds in those areas, this feature causes a lot of electricity generation. Wind turbines have easy technology and it is possible to install these turbines on boats, buses and other devices that need power supply. In Iran, areas such as Jask, Aligudarz, Torbat-e Jam, Bandar Mahshahr, Chabahar, Ardestan, Boroujerd, Abu Musa, Tabriz, Zahedan, Nojeh, Manjil, Hamedan, Sardasht, Nain, Jask, and Kahnooj are known as suitable for this work (Tien, 2020).

Geothermal energy

Iran is very rich in geothermal energy resources and is located on the geothermal belt of the world and is ranked 14th in the world internationally. History of volcanic activity in Iran, good earthquake and hundreds of hot springs in different parts of the country.

- Wave energy: This energy is renewable and usually has more production capacity than wind energy (Pour Ahmad et al., 2015); the north and south of Iran, due to the favorable geographical conditions, are favorable for the exploitation of this energy

Iran has a very favorable environment for using this type of energy and replacing it with fossil fuels due to its numerous sources of renewable energy; but this is not enough, but requires a process in which research and study, diagnosis, operation, protection and proper use of renewable energy sources; this process is called "energy management".

Energy Management

Energy management is a set of methods and actions that are performed in different systems with the aim of correct energy consumption and maximizing benefits or minimizing costs without reducing the quality of products or services; Energy management is also responsible for overseeing the proper performance of executive and managerial activities of rational energy consumption (Kabisch et al., 2016). This will lead the country to take a big step towards sustainable development; but there are two very important points that if you ignore either of these two items, the efficiency of the whole process will be lost (Dai, 2011).

Consumption management

In order to move towards sustainable development and conservation of natural resources, energy waste must be prevented as much as possible and renewable energy sources must be replaced as the main source of energy production.

It is impossible to manage energy consumption without considering public education at different levels of society; because what has been extracted from energy sources with effort and effort will be wasted if manpower and people do not know its value. Replacing non-renewable energy with renewable energy requires public education and the dissemination of public culture; in fact, creating a cultural context and education to promote proper energy consumption is the way to preserve it for future generations (Dennis et al., 2019; Sanesi et al., 2017). For this reason, the Supreme Leader of the Islamic Revolution has been trying to explain this important issue to the people for many years. At the beginning of 1988, he said in the reform of the consumption pattern: "Saving means consuming properly, consuming instead, not wasting property, consuming efficiently and productively." The choice of the slogan of 2009 by the Supreme Leader as "reform of consumption pattern" shows the importance of consumption and its management. The reason for this can be stated as one of the most basic and fundamental principles of economics are "lack of resources". Increasing consumption in society increases the use of limited resources and thus reduces investment.

Production management

Production management and control include total production planning, material coordination, workload control, and unit production control [26]; Management theory covers various issues such as quality control, procurement control, productivity, human resource management, innovation process, etc. (Schetke et al., 2016; Sanesi et al., 2017). Production management is a function that is responsible for the tactical and strategic planning of existing and new products. At present, this activity is the responsibility of the government in the macro arena, and it should carry out the following activities by setting codified policies:

- Creating the ground for greater efficiency of renewable energy sources
- Planning to achieve clean and renewable energy in accordance with the Vision 1404 document
- Supporting knowledge-based projects in the fields of production, maintenance and use of this type of energy
- Providing facilities for the use of renewable energy (especially solar energy) to rural and deprived areas
- Using non-governmental sectors to produce energy from renewable energy sources in accordance with Article 44 of the Constitution of the Islamic Republic

Discussion and conclusion

For many years, global developments regarding the price fluctuations of non-renewable energy sources such as coal, oil and gas, as well as the oil crisis since the 1970s have shown the great importance of sustainable development for different countries of the world; The coronavirus crisis (19-Covid), whose devastating effects on the international economy and consequently the economies of countries will be more exposed later, has made the need to move and achieve sustainable development one of the priorities and requirements of various governments. Because one of the main factors in the development and progress of societies is energy, the amount of access or non-access of countries to its various resources shows the ability of each country to achieve political, cultural, economic, social and.... Over the last few decades and the development trend has grown significantly, the production and emission of greenhouse gases and carbon dioxide, unprecedented global warming, acid rain, surface water and even groundwater pollution, rising energy prices, pollution and inversion. The weather has created a variety of environmental problems and disasters, and has led to more governments turning to renewable energy. In addition to these issues, the pandemic and the increase in the number of victims and victims of the 19-Covid virus, which led to the closure of oil fields, refineries, mines, etc. was another blow to the managers and officials of countries to find out more than ever before. Solving these problems refers to renewable energy.

Many researchers and experts have risen to show the potential talent of various new energy sources in Iran and have been able to demonstrate this well, but few studies to explain or provide solutions for the efficiency of these resources, such as solutions to improve consumption patterns. And new in-house technologies have been developed to make the most of these resources, and researchers need to work on that. One of the limitations of this research is the lack of time, which if we had more time, we could add to the quality and quantity of research.

As mentioned, energy is of great importance in the modern world, and planning for the operation, maintenance and consumption of energy resources is one of the most essential actions of a country's officials; Iran has many non-renewable energy sources, including fossil fuels (oil and gas) and also has a very favorable environment for the use of renewable energy sources. Energy management requires the presentation of policies by the managers of a country and also requires public education at the community level. Achieving sustainable development requires access to sustainable energy sources, of which non-renewable energy and fossil fuels are not suitable sources due to unsustainability, but renewable energy, if consumed, will remain for future generations. Unlike fossil fuels, they will not lead to pollution and global warming. Undoubtedly, by replacing renewable energy with non-renewable energy, the steps taken towards sustainable development will become stronger.

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