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RENEWABLE ENERGY INVESTMENTS IN THE GULF COOPERATION COUNCIL COUNTRIES AND THE CHALLENGES THEY FACE

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A B S T R A C T

This study aims to demonstrate renewable energy investments in the countries of the Cooperation Council for the Arab States of the Gulf and the challenges they face. Nuclear stations such as the Emirati Barakah nuclear plant and the nuclear plant that will be built by King Abdullah City for Atomic and Renewable Energy, which aims for the peaceful use of nuclear energy, which is considered one of the largest renewable energy projects in the region as a whole. Full on power generation by traditional methods of oil and gas.

K E Y W O R D S

renewable energy, Gulf Cooperation Council, Arab Gulf countries, challenges.

Introduction:

Diversifying sources of income across non-oil sectors is considered one of the most important pillars of the economic plans of the Gulf Cooperation Council countries 2030, especially investment in renewable energy projects. Building and constructing nuclear plants such as the UAE's Barakah Nuclear Power Plant and the nuclear power plant to be built by King Abdullah City for Atomic and Renewable Energy, which aims For the peaceful use of nuclear energy, which is considered one of the largest renewable energy projects in the region as a whole, where the remarkable growth and increase in the volume of government investment in renewable energy projects contributes to not relying entirely on power generation by traditional methods of oil and gas, which will positively reflect many benefits on the economy The state, especially the environmental sector in the countries of the Cooperation Council for the Arab States of the Gulf.

In 2010, renewable energy provided nearly 17% of total global energy consumption. Nearly 8% of this total came from modern sources of renewable energy, including hydro, wind, solar, geothermal, biofuels, and modern biomass. In the energy sector, renewable resources provided nearly 20% of the world's electricity, including 15% generated using hydropower.**(Emirates Center for Strategic Studies and Research, 2013).**

Statistics indicate that the countries of the Cooperation Council for the Arab States of the Gulf are among the countries that consume the most electric energyThe demand for electricity is growing7% annuallyOn average since the year 2000 AD, when electricity consumption increased from 81 gigawatts in the year 2005 AD to 140 gigawatts in the year 2015 AD until it reaches 180 gigawatts in the year 2020 ADThis means that there is a need to double production once every decade, which is expensive and not easy at the same time. The production of electricity from renewable energy sources

would provide more crude oil and gas for export purposes, and thus enhance opportunities to raise the level of public treasury revenues.

The countries of the Cooperation Council for the Arab States of the Gulf relied almost entirely on gas, crude oil and some of its heavy derivatives as fuel for power generation and water desalination plants. And its production of natural gas by exploration for it**(Shihab El Din, 2011)** . In April of 2018, the Kingdom of Bahrain announced the discovery of a large resource of light shale oil, the quantities of which are estimated to be many times the Bahrain field, in addition to the discovery of large quantities of natural gas, which is the first discovery since 1932.

The production of the Gulf Cooperation Council countries reached 17.1 million barrels of oil per day and 370 billion cubic meters of liquefied natural gas during the year 2012. The GCC countries have the largest reserves of oil in the world, estimated at 496 billion barrels, equivalent to 34% of the total. It also owns 21% of the world's gas reserves, and it ranks second in the world after Russia, with gas reserves of 42.2 trillion cubic meters (**General Secretariat of the Gulf Cooperation Council)**, and wowA report issued by the "Diplomatic Center for Strategic Studies" stresses the need for the Gulf countries to invest in renewable and alternative sources of energy, not only to meet their needs, but also to maintain their position and competitiveness in the global oil market, considering this approach as a "strategic choice" in light of the rapid growth witnessed by those countries in Energy demand, especially electricity.

(Diplomatic Center for Strategic Studies),https://dcss-center.org/business_economy_report/energy_report.php

Almost 3% trillion dollars, which is more than the gross domestic product of the economies of Chile, South Africa and Switzerland combined. Achieving the necessary development in the sector will not only result in reducing global warming, but will also contribute to reviving the economy, enhancing human well-being and providing more job opportunities. Enriching renewable energy sources to achieve the Gulf goals and plans will reduce energy and water consumption by 50% in the United Arab Emirates, 23% in the Kingdom of Saudi Arabia, and 21% in the State of Kuwait, and will reduce the carbon footprint per capita in the region by 8%. The shift to investing in renewable energy leads to a 16% reduction in water consumption in the Gulf energy sector, given that renewable sources, especially solar photovoltaic systems, may be less water consuming than fossil fuel technologies.**(Gulf Link Magazine, 2018)**.

It is widely expected that the cost of production associated with renewable energy sources will decline in the coming years. Due to the development of technology and the high levels of production,It is reassuring that the GCC countries have set targets to benefit from renewable energy sources up to a year2030,Due to the need for proper planningDespite the abundance of solar energy in the GCC countries, which calls for more attention to its development and expansion of its use as one of the sources of electricity production and water desalination, its contribution will remain limited due to its frequent nature and the variation in its supply throughout the day and year. Its contribution will be limited to complementary tributaries to electricity generation and water desalination during times of peak demand during the day, especially in the summer, to provide fuel from gas, oil and its derivatives, as solar energy can constitute an economically competitive future for thermal stations designated to meet peak loads. In all cases, it is not expected that its contribution will exceed 20% of the total electricity consumption after about two decades. On the other hand, nuclear energy is today one of the best options for generating electric power centrally. After more than two decades of stagnation, the

world is witnessing, since the third millennium, an increasing interest in expansion. In the use of nuclear energy to generate electricity in industrialized and developing countries alike. This is due to several factors, the most important of which is the improvement of safety and security techniques and systems for nuclear plants and the accumulation of technical expertise. Nuclear stations have also become the best in terms of operating ratio compared to other stations, and their fuel prices are stable and relatively low (GOIC, 2012)..

Therefore, the importance of this research comes from the limited applied studies of renewable energy investments in the countries of the Cooperation Council for the Arab States of the Gulf and the challenges they face in light of the continuous growth of large projects undertaken by the countries of the Cooperation Council for the Arab States of the Gulf in renewable energy of all kinds (solar energy, wind energy and nuclear energy). .

This study aims tothe following:

1- Learn about the concept of renewable energy and its characteristics (advantages and disadvantages).

2- investigation efficiency consumption energy renewable in Countries council cooperation for countries Gulf Arabic.

3- knowledge highlighted challenges that face energy renewable.

4- Identify on investments Countries council cooperation for countries Gulf Arabic in projects energy renewable.

5- Knowledge of the most prominent renewable energy projects in the countries of the Cooperation Council for the Arab States of the Gulf, and determining the percentage of renewable energy generation from them.

6- Coming up with conclusions that contribute to the development of renewable energy in the GCC countries.

- **Renewable energy**

Energy in life is divided into renewable energy and non-renewable energy, as non-renewable energy is represented in natural gas and oil and is formed in limited quantities in the ground and over long years, and its combustion results in a lot of pollution, while renewable energy is inexhaustible energy such as energy The sun, water energy, wind, etc. are clean and do not cause pollution when used, so the tendency to use them has become greater. There is also nuclear energy, which is also a renewable energy source.**(Emirates Center for Studies and Research, 2009)**, asBLGThe volume of investments in the renewable energy sector for the countries of the Cooperation Council for the Arab States of the Gulf from the year 2013-2017 ($ 218.1 billion).whereThe value of solar energy generation projects8.5billion dollars in generating capacity4 GageWowAccording to the official website of Masdar City (https://masdar.ae/ar/about-us/management/about-masdar).

Investments in the countries of the Cooperation Council for the Arab States of the Gulf

thatThe economic concept of investment It is one of the operations of exploiting capital with the aim of achieving a financial surplus, and accordingly some define it as the formation and use of capital with the aim of achieving profit in the short or long term, directly or indirectly.AndIn order for it to be said that there is an investment project from an economic point of view, three conditions must be met:

1- Class: It means the participation or contribution made by the investor within the framework of the investment project in the host country, and this investor is required to be a person of private law, whether a natural or legal person.,This share may be in kind or cash.

2- The element of time: It means that a period of time of no less than three years must pass in the life of the project in order for it to be considered an investment project in the economic sense. The lesson in that is the distinction between investment operations and commercial operations.

3- The element of risk: It means the possibility of making a profit and the possibility of achieving a loss, and it also means within the framework of distinguishing between the commercial business that the profitability of the project is achieved in a periodic and recurring manner, increase or decrease, while the commercial project is often achieved in which the profitability is achieved in one go. **(Abdel Moneim, 2001).** Investments in the Gulf Cooperation Council countries are distributed in infrastructure projects, power generation, water and sanitation projects, in addition to huge investments in industrial cities, in addition to investment in the telecommunications and transportation sectors, investment in the industrial sector such as iron and steel industries and aluminum industries, in addition to investments in the real estate and housing sector. And food industries and agricultural industries aimed at providing food commodities from external sources, and the contribution of the Gulf private sector is 70% of the total number of Gulf projects, and therefore it represents a basic pillar of investment, as it contributes a major role in various fields, through the processes of establishing various development projects financing, ownership, operation, management and production, through partnership initiatives between the public and private sectors, and the trend towards privatizing many government projects, while adopting economic policies that are more open to the world by joiningTo the World Trade Organization and the establishment of financial centers with the aim of attracting international financial institutions and multinational companies to establish investment projects in the region, **UNCTAD, 2011)).**

renewable energy

First: solar energy

It is the energy that is generated by taking advantage of the sun's rays, as scientists have proven that the solar energy that falls on the earth every 40 minutes is sufficient to meet our energy needs by 100% for a whole year. Says the British chemistGeorge PorterHe won the Nobel Prize in Chemistry in 1967.**I have no doubt that we will succeed in harvesting solar energy, and if sunlight were weapons of war, we would have had solar energy decades ago."**

Calculations indicate, through actual monitoring using ground stations, that the GCC countries are characterized by a length of sunshine that reaches about 3200 hours per year, with an average of 9 hours of sunshine per day - and suitable wind speeds (an average of 7 meters at a height of 100 meters), which qualifies them to invest in The sources of this energy (radiation, heat and wind) and converting it into electricity effectively, whether by producing it on its own or leasing its lands to friendly European, American or Asian countries to install a system that supplies these countries according to a fee per kilowatt hour, which generates income for them and a solution to energy security in them and in those countries And this is what France does, where it produces electricity from the energy of the core and sells it to its neighbors. Solar energy is economically feasible if the vertical solar radiation rate is 5 kilowatt-hours per square meter, as it reaches 7 kilowatt-hours per square meter in the Gulf region.**(Al-Fadil, 2010).**

Figure 1 Solar panels

Advantages of solar energy

1- Solar energy is a clean and renewable energy source.

2- Solar energy can be produced for free, by installing solar cells. Solar energy will last forever, while it is estimated that the global oil reserves will last between 30 and 40 years only.

3- Solar energy does not cause anypollution.

4- Solar cells make absolutely no noise compared to the giant machines used to pump oil, which are very noisy and unwieldy.

5- Solar cells don't need a lot of maintenance to keep them running, because there are no moving parts in a solar cell, which makes it impossible to damage.

6- In the long term, we can get good investments with a high return due to the amount of free energy that solar cells can produce, and it is estimated that 50% of the energy used for domestic purposes will be produced from solar cells.

conssolar energy

1-Solar cells are expensive to install, which has led to a delay of several years to use solar energy and achieve the desired investments.

2-Electricity generation is completely dependent on which countries get sun, and this can be limited by the countries climate.

3-Solar power plants do not match the power output of conventional power plants of similar size; It is also very expensive to build.

4-Solar energy is used to charge batteries so solar powered devices can be used at night, and these are oftenbatteriesBig and heavy, they take up a lot of space and need to be replaced from time to time**(Gulf Interconnection Authority, 2018)**.

Second: nuclear energy

Nuclear energy is considered one of the sources of clean energy and is complementary to other renewable energies, as it can provide basic load energy and provide energy requirements in peak hours, as it is the type of energy that is the source of the atomic nucleus. It is common for it to consist of atoms that differ in terms of their content according to the element. As each element has distinct seeds. They are arranged in what is called the periodic table of the elements. An atom is a nucleus with negatively charged electrons orbiting it. The nucleus consists of positively charged particles called protons, or other neutral particles (that do not carry an electric charge) called neutrons (Al-Hafeez, 2019).

Despite the abundance of solar energy in the GCC region, its contribution will remain limited due to its frequent nature and varying intensity throughout the day and year. Its contribution in the coming first decades will be limited to as a complementary tributary to electricity generation and water desalination during times of peak demand during the day, especially in the summer, to provide fuel from gas, oil and its derivatives, as solar energy can constitute an economically competitive future for thermal stations designated to meet peak loads. In all cases, it is not expected that its contribution will exceed 20% of the total electricity consumption after about two decades. On the other hand, nuclear energy is today one of the best options for generating electric power centrally. After more than two decades of stagnation, the world is witnessing, since the beginning of the third millennium, an increasing interest in Expanding the use of nuclear energy to generate electricity in industrialized and developing countries alike. This is due to several factors, the most important of which is the improvement of safety and security techniques and systems for nuclear plants and the accumulation of technical expertise. Nuclear stations have also become the best in terms of operating ratio compared to other stations, and their fuel prices are stable and relatively low, and with the rise in global oil and gas prices in the past decade, the economic competitiveness of nuclear energy electricity production has improved to become the cheapest for the existing and planned ones, especially with the increase in their lifespan to reach 60 years old. In addition, the safe disposal of radioactive nuclear fuel waste and its safe disposal in geological reservoirs for thousands of years has become a given today, technically and economically, as these reservoirs have been established in Sweden and Finland. Nuclear stations are distinguished by the fact that the amount of nuclear fuel required to generate a large amount of electrical energy is much less than the amount of coal or oil needed to generate the same amount. For example, one ton of uranium generates more electrical energy than that generated by using millions of barrels of oil or millions of Tons of coal. Also, if solar energy was relied upon to

generate most of the world's energy needs, its cost would be much greater than the cost of nuclear energy (Shihab El-Din, 2011).

Well-functioning nuclear power plants produce the least amount of waste compared to any other method of power generation, as they do not release harmful gases into the air such as carbon dioxide, nitrogen oxide or sulfur dioxide that cause global warming, acid rain and smog. Fuel (uranium) is abundant and dense, and is easy to extract and transport, while coal and petroleum resources are limited. It is possible that the nuclear power plants will continue to provide us with energy for a long time after the failure of coal and oil sources to meet our needs. Nuclear power plants occupy relatively small areas of land compared to power plants that depend on solar energy or wind energy.

While several negative aspects of the use of nuclear energy result in the production of highly radioactive waste, after most of the uranium (spent fuel) is fission, it is removed from the reactor and stored in cooling lakes, and these lakes absorb the heat of the spent fuel and reduce the degree of radioactivity, then it is reprocessed from In order to recover the non-fissile uranium and plutonium and use them again as fuel for the reactor, and this process results in waste with a high level of radioactivity.HLW(Spent fuel is routinely reprocessed in reactors of defense programs for use in nuclear weapons production, according to the EPA.)EPA) the highly radioactive waste (HLW(caused by defense programs constitute more than 99% of the total volume)HLW) in the United States of America. France, Belgium, Russia and the United Kingdom all have their own spent fuel reprocessing units.

According to the International Atomic Energy Agency (IAEA)IAEAEstimates of the end of 1997 indicate that the amount of spent fuel resulting from power reactors that are stored globally, which exceeds 130,000 tons, contains about 1,000 tons of plutonium, and some elements in spent fuel and waste, such as plutonium, are of the same importance. High radioactivity and remain so for thousands of years. There is currently no safe system for the disposal of this waste. The proposed plans for the disposal and storage of highly radioactive waste do not guarantee adequate protection for individuals or groundwater from radioactive contamination (Al-Hafeth, 2019).

The number of nuclear power plants in the world, according to IAEA data, reached 437 reactors by the end of 2009, with a total capacity of about 370 gigawatts. The largest number of them are located in North America, Europe and Japan, respectively. The percentage of the contribution of electric energy to the total electricity production varies in these countries. It rises to about 80% in France, which is considered one of the countries most dependent on nuclear energy, and it has 55 operating reactors, while its contribution in the United States of America is less than 20%, while it has the largest number of nuclear reactors (104) and the largest production capacity (Al-Hafeez, 2019).

Nuclear energy in the countries of the Cooperation Council for the Arab States of the Gulf

The newly prepared feasibility studies conclude that nuclear power stations in the GCC countries are the most economically viable, compared to traditional central power stations, in the event that the average oil price exceeds $45 per barrel or the gas price exceeds $7.$5 per million British thermal units, and the main determinant of the cost of electricity production in nuclear plants is the capital cost, which represents about 75% of the total cost of electricity production, and the rest is for operation and the cost of the entire fuel cycle, unlike fossil plants in which the cost of fuel is the main determinant of the cost (from 60-70%), and in this context came the announcement of the Supreme Council of the Cooperation Council at the Jaber Summit (December, 2006) to start preparing a joint study for the countries of the Cooperation Council for the Arab Gulf States to find a joint program in nuclear

technology for peaceful purposes (electricity generation and water desalination). In accordance with international standards and regulations, the preliminary feasibility study prepared by the Agency in cooperation with the General Secretariat of the Council concluded that the use of nuclear energy to produce electricity and water desalination in the countries of the Cooperation Council for the Arab States of the Gulf is one of the least expensive options in the future in the event of a shift in the current fuel pricing policies user at stationsenergy from the cost price to the net benefit price, which reflects the actual value of the fuel prices used**(Shihab Eldin, 2011)**.

Third, wind energy

Wind energy is defined as that energy that results from the process of exploiting wind movement and converting it into another form to become a form of energy based on wind turbines. It is often used for the purposes of generating electric power, and is included in the list of types of electromechanical energy and types of renewable energy alternative to fossil fuels.Electric power generationCountries have resorted to establishing wind farms. It is a series of wind turbines in one area to produce electricity, and their number may reach hundreds of individual turbines distributed in one area that extend over large areas with the possibility of using the space between these turbines for agricultural purposes, and these turbines take the same shape, as they have a rotating horizontal axis It has three blades that go against the wind. (**Scientific Knowledge website ,www.marefa.org)**

Figure 2 Wind turbines on land

The pros and cons of wind power

1- Advantages of wind energy

1. It greatly preserves the environment, as it is based on reducing carbon dioxide emission rates.
2. This energy is also free from all pollutants related to nuclear plants and fossil fuels.
3. This energy is also very inexpensive, in a matter of weeks an entire air farm can be made and contain large towers.
4. In addition to the fact that this energy is renewable, the wind is based on moving the turbines for free.
5. Never be affected by fluctuations in fossil fuel prices.
6. You also do not need to dig and excavate in order to be extracted or even transported to the locations of the generating stations.

2- Disadvantages of wind energy

1. Wind energy cannot supply the transport sector with the energy extracted from it, which leads to the dependence of the transport sector on oil products only.
2. Although the winds are renewable, they are not permanent but seasonal, and in many times the wind speed does not correspond to the required electric power.
3. And the wind turbines of this power are so noisy that they cannot be overlooked. A single wind farm or windmill can make such a loud and boisterous noise in only twenty-four hours that it is absolutely unbearable. (**Scientific Knowledge website ,www.marefa.org)**

Challenges facing renewable energy

1. operational challenges

David Fridley summarized nine of the challenges facing (alternative energy), ie alternatives to existing petroleum liquids such as biofuels, unconventional hydrocarbons, and electricity generation alternatives. In Fridley's view, the assumption that alternative energy technologies can be seamlessly built on top of the existing energy system structure is highly questionable. The alternative energy challenges identified include:

1- Material Input Requirements: Examples include neodymium for lightweight magnets for wind turbines, galleon and indium for solar cell wafers (enium is also a component of flat panel displays and reserves are limited). All alternative energy systems require inputs from fossil fuels.

2- Intermittent: The release of energy from fossil fuels can be controlled at a controlled pace. In contrast, solar energy, wind energy, and even biomass experience daily and seasonal fluctuations. Capacity factors range from 12% to 19% for solar PV, from 20% to 40% for wind power, and from 60% to 100% for fossil fuels and nuclear power. The key to addressing intermittence is storage, but batteries face limitations in terms of materials, energy density and losses.

3- Energy Intensity: It is a challenge for liquid fuels to replace oil and gas in transportation, and there are huge land use demands for solar, wind, and biomass to generate equivalent amounts of energy compared to fossil fuel-based power generation.

4- The law of receding horizons: The more energy required to produce alternative energy, the lower the equivalent prices (corn ethanol and oil shale).

5- The return on energy investments (the ratio of energy inputs to its production): While the performance of wind energy, and to a lesser extent solar energy, is relatively good in terms of its return on investment, there is difficulty in achieving a surplus of alternative energy such as unconventional hydrocarbons and biofuels.

6- The need for advances in energy storage to address the challenge of intermittence. New research on an old concept, liquid air, aims to address the need for in-grid storage and uses (false time) energy to liquefy the air to -196°C. Upon exposure to ambient temperatures, the rapid expansion of air powers a turbine.

(Technology and the Future of Energy, 2013).

2. Security challenges.

The concept of energy security is not a new concept, and its beginnings go back to the decision of Winston Churchill, who was the first to define it. And with the incidents that the international system witnessed, such as the Arab oil embargo crisis in 1973 AD and the Iranian Islamic Revolution in 1979 AD, which resulted in a significant rise in oil prices, interest in this concept increased globally, especially in the United States of America and the major industrialized countries consuming energy globally, and its importance increased. With the increase in terrorist threats after the eleventh of

September, targeting oil installations**(Abdel-Aty, 2014)**. Especially the terrorist attacks that took place on the Aramco oil facility on September 14, 2019, which disrupted crude oil supplies, which are estimated at 5.7 million barrels per day.

The International Energy Agency defines energy security as "continued stability at affordable prices, with continued concern for environmental issues" (IEA). The goal of achieving energy security at the international level was behind the establishment of the agency, as the main objective of its establishment is to develop effective mechanisms to implement policies related to the issue of energy security that are implemented on the basis of joint cooperation between the countries of the international community, and the agency believes that energy security has several faces, as it is In the long term, it is mainly linked to continuing investments in energy supplies, in line with economic developments and environmental needs. In the short term, energy security means the response of the global energy market to sudden changes in demand and supply. Given the importance of energy security at the national and global levels, the International Energy Agency has worked to enhance energy security through the following means:

1- Collective coordination to respond to changes in supply and demand.

2- Expanding international cooperation with all players in the global energy market.

The determinants of energy security are also linked to a number of determinants and challenges that affect national and global energy strategies, which force countries to adopt different policies and use different tools at different times at the national and international levels. The most prominent of these challenges are:

1- The imbalance of supply and demand in the global energy market from an economic perspective.

2- power supply restrictions.

The challenges that international oil companies face, which can be summarized in three main challenges that limit their capacity and effectiveness in the producing countries, and thus the energy supply in the global market are as follows:

The first challenge: It is represented by the security threats that its employees, facilities, areas of work and assets may be exposed to, such as the terrorist attacks that occurred on the Aramco oil facility on September 14, 2019.

The second challenge: the threats that may result from political developments that expose or threaten the investment contracts of international energy companies**(Abdel-Aty, 2014)**

The establishment of the World Energy Forum in 2005, which was based in the Saudi capital, Riyadh, to enhance energy security is considered a constructive step in enhancing energy security. In the field with countries of the European Union, the International Energy Agency and the Group of Twenty, in addition to the producing countries outside OPEC, such as Norway, Mexico and Russia, working hand in hand in securing a safe flow of supplies through dialogue and enhancing transparency in the dissemination of information and data will make it one of the goals of achieving security of supplies. (Abdul Wahab, 2012).

4. Energy security and national security of the state

Energy security is considered one of the components of the national security of the state, and its preservation and protection has become no less important than protecting the state's lands against any external aggression in light of the international competition over energy sources and control over them.

With the beginning of the eighties, energy security was given a military character, to use hard power as a means to ensure stability in the regions that produce oil and natural gas, which was stated by former US President Jimmy Carter in 1980 AD in his response to the Soviet invasion of Afghanistan in 1979 when he stated that the United States would use any means Necessary, including military force, in defending its vital interests in the Persian Gulf to ensure the flow of oil, as energy security in the 1970s and 1980s was only concerned with ensuring the security of energy supplies from oil, especially after the crises of 1973 and 1979.**(Abdel-Aty, 2014).**

The researcher believes that despite the existence of military integration (the joint defense agreement, the joint security agreement, and the joint defense strategy) in the countries of the Cooperation Council for the Arab Gulf States in confronting and deterring any terrorist threats or danger that may occur, international organizations, especially the International Energy Organization (IRNA), must The UN Security Council must also (open an international investigation urgently directly from the occurrence of the terrorist threat) and the need to take deterrent and strict measures and international political, economic and military sanctions by the seven permanent members of the UN Security Council against any threat or danger that occurs to energy sources, especially in The Arabian Gulf region, regardless of the type of this facility, whether it is oil or renewable, and in particular the recent sinful and terrorist attack on the Aramco oil facility on September 14 of this year is a major challenge to global energy security.

Investment trends in renewable energy sources

What has changed significantly since the International Energy Agency's 2003 assessment is the investment expectations in renewable energy sources, especially non-hydroelectric ones. In 2003, the agency did not provide a breakdown of investment according to the type of renewable energy, as it expected the implementation of total investments of $561 billion ($710 billion in 2010). With regard to renewable energy (including hydro) over a period of 27 years. However, the agency increased its forecast in 2012 for renewable energy investments to $6.4 trillion over the next 23 years to 2035, with 94% of the electricity sector ($2.1 trillion for wind, $1.5 trillion for hydro, and 1 $3 trillion for solar photovoltaic (PV) and the rest for biofuels.

In 2003, the agency told policymakers that in order to encourage renewables, governments would have to put in place a market framework that rewards those who invest in renewables (in other words, governments would have to frame subsidies so that renewables become economically viable). The World Economic Forum recently urged governments to show leadership with global financial institutions and private investors to address the green investment gap. However, in 2012, the International Agency issued a warning about the growing allocations of subsidies for renewable energy sources, amounting to $ 3.5 trillion, as a quarter of this amount has already been allocated, while it is scheduled to allocate about 70% by 2020. The agency warned that governments should limit these subsidies to avoid them becoming an excessive burden on governments and end users. The United Nations Environment Program, based on the Bloomberg New Energy Financing Base, issues an annual briefing on trends in (investing in renewable energy) known as the Global Status Report on Renewable Energy Sources, within the framework of the Renewable Energy Policy Network for the 21st Century. They are a useful source of information on trends. Perhaps the sudden growth in the capabilities of renewable energy sources referred to in the aforementioned global status report, as well as the enthusiasm that some government leaders possess in favor of renewable energy sources, is

understandable given the attention given by the media, environmental NGOs and the public in general to (greening the economy). ,**(Technology and the Future of Energy, 2013).**

Partnership agreements between Gulf companies and foreign companies

The countries of the Gulf Cooperation Council carried out economic reforms and improved the investment climate, which made them characterized by distinct investment climates and an attractive economic environment, which encouraged and stimulated investments and national capital to survive and continue, and various statistics show that traded companies have the largest share in the field of Gulf investments, followed by family companies, followed by companies owned by the governments of the countries, and the partnership between Gulf and foreign national companies in pioneering sectors such as Saudi Aramco's agreement withDaw chemicalsEstablishing the largest petrochemical complex in the world, with a value ranging between (18-20 billion dollars), in addition to partnership agreements between Kuwait Petrochemical Company and its counterpart in China.Sinopec, to implement a joint project for petrochemical refining at a value of 8.7 billion dollars. In the United Arab Emirates, the agreement was concluded betweenMulkRenewable Energy IncAdityaIn the transportation sector, there are giant Gulf-foreign partnership projects such as the Abu Dhabi metro project at a cost of $7 billion, and theUnion railAt a cost of $60 billion to establish an interconnected Gulf railway network, in addition to joint projects between the Gulf Steel Company and its Japanese counterpart.UNCTAD (2011),**.**

Investments of the Cooperation Council for the Arab States of the Gulf in renewable energy projects

1- **Renewable energy investments in the Kingdom of Saudi Arabia.**

The new economy of solar energy works to develop Saudi expertise and finds job opportunities for them. According to the Energy Research Center at King Abdullah bin Abdulaziz University, the Kingdom's goal is to reach the production of 10% of its need for solar energy by 2020, and about a third of its energy need from renewable sources in The year 2032, equivalent to 41,000 megawatts of electrical energy, by harnessing solar energy. Achieving this goal will require an investment of about $109 billion during the start-up period of the project.

The most important shift in the use of renewable energy is the decision of the Saudi Water Desalination Corporation, which represents one of the largest energy-consuming sectors in the Kingdom, noting that the Corporation owns 30 desalination units throughout the Kingdom and a network of pumping stations, tanks and pipes that transport desalinated water from desalination plants to centers main consumption.

1. Water desalination project, where the Saudi Water Desalination Corporation signed a three-phase contract in 2010 to generate 10 megawatts of solar cells with NATO technology to produce water at a price of 33 halalas per kilowatt hour at a cost of 1.5 riyals per cubic meter, as the cost of water is currently 2.5 to 5.5 One riyal per cubic meter, provided that concentrated solar cells are used in the third phase **(Saline Water Conversion Corporation,https://www.swcc.gov.sa/Arabic/Pages/Home.aspx)**

2. constructionKing Abdullah City for Atomic and Renewable Energya monthApril 2010, with the aim of building a sustainable future for the Kingdom of Saudi Arabia by including atomic and renewable energy sources within the local energy system., whereThe Kingdom has adopted

pressurized light water reactors as an ideal choice for reactors that produce electric power, for several reasons, the most important of which is that they are feasible and effective in producing clean energy and are easy to maintain, which makesexplains building291reactor MThis type has spread around the world so far, in addition to 50 reactors currently under construction, compared to the rest of the reactors, whose combined numbers do not exceed 127 reactors. (King Abdullah City for Atomic and Renewable Energy, www.energy.gov.sa).

3. The solar energy project with a capacity of 3.5 megawatts was completed by the German company Phoenix in 2012, and it was implemented within the Petroleum Research and Studies Center at King Abdullah bin Abdulaziz University, which is based in Riyadh. The project, launched by Saudi Aramco, consists of 12,684 photovoltaic panels produced by the Chinese company Suntech, and covers an area of approximately 55,000 square meters, to produce 5,800 MWh annually.(Ministry of Energy, Industry and Mineral Resourceshttps://www.meim.gov.sa/arabic/Pages/default.aspx).

4. The Solar Towers Project at King Abdullah University of Science and TechnologyThe tower envelope consists of two outer layers of glass curtain walls. This outer layer is completely transparent so that it allows the passage of the largest possible amount of solar energy through it, while the inner layer consists of shaded glass characterized by a high degree of absorption that collects solar energy to increase the volume of hot air inside the tower to the maximum extent, and when the hot air rises out from the top of the tower it dissolves It is replaced by cool air from the patio, AndTwo solar power plants occupy the north and south rooftops of the laboratory buildingIt is approximately 12,000 square meters, and the maximum productivity of each of them is one megawatt, and it produces up to 3,300 megawatts / hour annually of clean energy, and this production will save about 17,000 tons annually of carbon emissions.(King Abdullah University of Science and Technologyhttps://www.kaust.edu.sa/ar/about/green-campus/energy-efficiency).

5. The adoption of the King Abdullah Financial District in Riyadh in 2012 on solar energy from the German company Conergy to secure an essential part of its needs for electrical energy, through the installation of photovoltaic groups on 1300 square meters of the roofs of two of the main buildings of the center, and the solar groups have a capacity of 200 kilowatts, which is equivalent to 330 megawatts / hour per year, which can provide energy for 1500 computers in the center(Ministry of Energy, Industry and Mineral Resourceshttps://www.meim.gov.sa/arabic/Pages/default.aspx).

6. Green Duba station project bProduction capacity exceeds605 megawatts, of which 50 megawatts are renewable energyWhere it cost4.5 billion riyalsAnd in partnershipBetween the branch of the Spanish company "Onetech Energia SA" and the Saudi Company for Electrical and Mechanical Works Services Limited.(King Abdullah University of Science and Technologyhttps://www.kaust.edu.sa/ar/about/green-campus/energy-efficiency).

7. North Promise Stationto produce1400 megawatts, of which 50 megawatts are from solar energyAt a cost exceeded3,750billion riyals, which was implemented in July2018(King Abdullah University of Science and Technologyhttps://www.kaust.edu.sa/ar/about/green-campus/energy-efficiency).

8. project Sakaka , Which station energy Umbrella pv Working with energy solar with capacity 300Mega wat , And granted toACWA Power, And it started in November 2018.

9. aabecausea companysN Tech Power Holding Company of Chinain December2014 Completion of the construction work of the largest solar power plant in Saudi Arabia, and the new solar photovoltaic project capable of generating electricity is owned by3.5 megawatts to Saudi

Aramco, in addition to the completion of financing arrangements for a project in Yanbu Industrial City at a cost of $1.1 billion. It aims to produce 10,000 metric tons of high-purity polysilicon and 800 megawatts of solar wafers annually, which will be used to produce solar panels for countries in the Middle East and North Africa. **(SABIC Saudi Arabia,https://www.sabic.com/ar/collaboration/trend/energy-efficiency).**

10. Solar desalination plant with a production capacity of60 thousand cubic meters of desalinated water per day to feed Al-Khafji GovernorateAnd in January2015agreement signed betweenAdvanced Water Technology Company, affiliated to the Saudi Technical Development and Investment Company (TAQNIA) With the alliance of the two Spanish companies Abema and Tema, which are affiliated with the Spanish company Abengoa, a design contractAndIt consists of several phases. The first phase aims to build a solar-powered brackish water desalination plant in Al-Khafji Governorate60 thousand cubic meters per day, and start building a solar power plant with a capacity of 20 megawatts of electric energy in mid-2015 AD to supply the desalination plant with electricity.Where this project was launchedIn the first quarter ofgeneral2017 AD.As you planAdvanced Water Technology Company To the production of desalinated water for agricultural lands in the event of a decrease in the cost of desalinated water compared to the cost of groundwater extractionAccording to what was announced by the company's president Where is thisThe first project in the worldasThat the project cost exceeded133 million dollars (500 million riyals) and its implementation period is 24 months, and work on the project will start fromaRich site delivery **(Saline Water Conversion Corporation,https://www.swcc.gov.sa/Arabic/Pages/Home.aspx)**

Investments in renewable energy projects in the Kingdom of Saudi Arabia Table No. (1)

Project state	Generated energy/hour annually	The company implemented	Project Type	project name
run out	10 megawatts	Sun Tech Power Chinese	Solar energy	Water desalination
run out	3.5 megawatts	German Phoenix	Solar energy	solar energy
run out	3300 megawatts	German Conergy	Solar energy	Campus of King Abdullah University
run out	330 megawatts	German Conergy	Solar energy	King Abdullah Financial District in Riyadh
Underway	50 MW	The Spanish "Onetech Energia SA" company, and the Saudi Electrical and Mechanical Services Company Limited.	Solar energy	Duba green
run out	50 MW		Solar energy	North promise
run out	3.5 MW	Sun Tech Power Chinese	Solar energy	Photovoltaic solar energy
run out	20 MW	Spanish company Abengoa	Solar energy	Desalination of brackish water in Al-Khafji
Underway	300 megawatts	Aqua Power	Solar energy	stationSakaka
Underway	400 MW	source+Total French	winds	Duma dandelion/Saudi Arabia
Underway	1000 - 1600 megawatts	Russian companies	nuclear plant	King Abdullah City for Atomic Energy

prepared by the researcher himself

2- Renewable energy investments in the United Arab Emirates

The Abu Dhabi Future Energy Company "Masdar", which was established in2006, a leading global company in the fields of renewable energy and sustainable urban development. The cost of the project is estimated at about $22one billiondollars, and it takes nearly eight years to build the city, the first phase finished in a year2009, where construction began in Masdar City in 2008 and the first six buildings of the city were completed in October 2010. And due to the impact of the global financial crisis, it affected the first phase of the city, by 1,000,000 square meters (3,900 square miles), to be completed in 2015. The final completion is scheduled for between 2020 and 2025. The company aims to contribute to consolidating the leading role of the state The UAE is part of the global energy sector, in addition to supporting the diversification of its economic and energy sources for the benefit of future generationsThis is within the UAE economic plan2030.Investment amountMasdar is developing commercially viable renewable energy projects in the Middle East and North Africa region and global marketsin more than25country worth8.5billion dollars, with a total production capacity of projects around the world4GW,She checksNew sources of revenue for the UAE in the long term. Masdar, wholly owned by Mubadala Investment Company, supports the UAE's efforts to build a knowledge economy. Over the past decade, the company has contributed to advancing the growth of the renewable energy sector in the Arab world, thus consecrating the ability of the business sector to contribute to achieving the goals of the global sustainability agenda., locationMasdar City, UAE(https://masdar.ae/ar/about-us/management/about-masdar)

1. crumbledAhThe new "permanent" headquarters of the International Renewable Energy Agency (IRENA) in Masdar City, Abu DhabiAnd that in3intend on2015, in a move to diversify the UAE economy and spread renewable energy technology projects and solutions and investments in this vital sectorAnd who is consideredachievementmajor toUAEthe United Arab Emirates and the countries of the Cooperation CouncilTo host this world organization which started about7 years old.The agency aims toReduce energy consumption by42% compared to international energy efficiency standards, and 64% compared to other typical buildings in Abu Dhabi, thanks to its design that requires low levels of intervention and smart energy management systems.According to a report issued by "Masdar", the complex includes photovoltaic systems on the roofs It occupies an area of 1,000 square meters and generates 305 thousand kilowatt-hours of electricity annually, in addition to solar water heating systems that produce about 27.8 thousand kilowatt-hours. Sustainable energy systems will contribute to meeting more than 10% of building energy needs. The building requires less water50% compared to other commercial buildings in Abu Dhabi. The windows help deflect 90% of direct sunlight, and external awnings have also been installed to enhance Take advantage of the light that penetrates the interior while reducing the effect of heat. Masdar City website (https://masdar.ae/ar/about-us/management/about-masdar)

2. Establishment of the Emirates Nuclear Energy Corporation in2009It was awarded by the Emirates Nuclear Energy CorporationDuring the past five years decades for about1,100 Emirati companies to supply a range of services and materials used in the construction processes of nuclear power plants, with a value of AED 9.15 billion..

institution The UAE for energy nuclear((https://www.enec.gov.ae/ar/barakah-npp/)

3. Barakah Nuclear Power Plant, which includes four stations at a cost20billion dollars, where thepeaceful nuclear programmetoQuality, safety and securityAndTo the speed and efficiency of achievement through achievement13 important objectives of the program at the Barakah Nuclear

Power PlantShe roseinstitutionEmirates Nuclear Energyduring the yearIn 2012, the procedures for requesting a license to operate the first and second stations were completed, after the total percentage of project completion exceeded 58%.And that in February2016,whereThe percentage of completion in the first station reached more than84%, while the completion rate for the second station reached about 64%, the third station to about 41%, and the fourth station to about 25%.This station is expected to be operational next year2020After ordering its opening in the year2017According to what was announced by the UAE Minister of Energy due to difficulties in training operating personnel.

4. The waste-to-energy plant in Sharjah, where the agreement was signed between Masdar and Bee'ah in the year2017It aims to addressup to300 thousand tons of solid waste annually instead of putting it in landfills, which supports Sharjah's efforts to reach its goal of eliminating landfills by 2020 and helps treat 75% of solid waste instead of diverting it to landfills,The incineration process converts the waste into heat that is used to drive an electric turbine. The net electrical energy generated is approx27 megawatts, which will be diverted to the main electricity grid in Sharjah.

(Emirates Nuclear Energy Corporationhttps://www.enec.gov.ae/ar/barakah-npp/technology/.).

5. investments worth600One million dollars by Masdar Company to build a power plant using solar energy by the French companies Total and the Spanish company Abengoa.100megawatts west of Abu Dhabi2010As the station bears the name (Shams 1), it will be the largest in the world and will be eligible to join the carbon credit system. under the United Nations Clean Development Mechanism. It owns both Total and Abnegua20% in the station, while Masdar owns60%.

location city source Emirates((https://masdar.ae/ar/about-us/management/about-masdar)

6. Building the highest solar heating system above the surface of the earth in the Burj Khalifa in Dubai to heat the equivalent140One thousand liters of water per day and the equivalent400kilowatt.

7. The Yas Circuit race car project, the VIP suite, which is powered by solar energy and produces290kilowatt.

ProjectsAbu Dhabi Future Energy Company "Masdar".Inside the United Arab Emirates Table No. (2)

Project state	Generated energy/hour annually	The company implemented	Energy type	project name
Implemented 2012	290 kilowatts	source	Umbrella	Yas Circuit
Underway	800 megawatts	Diwa + EDF + Masdar Company	Umbrella	Mohammed bin Rashid Solar Park
Underway	100 megawatts	Source + French Total + Spanish Abengoa	Umbrella	Shams 1
Underway	Production of desalinated water from 1500 to 2500 cubic meters per day	source	Umbrella	Ghantoot Water Desalination Pilot
Underway	Treating 300,000 tons of solid waste annually (27 megawatts)	Masdar + environment company	Umbrella	Turning waste into energy
Underway	200 kW	source	Umbrella	Sea Palace
Underway	1750 kW	source	Umbrella	Photovoltaic solar energy
Underway	450 kW	source	Umbrella	Imran Hospital
executed	1400 megawatts.	Korea Electric Power Company (KEPCO)	nuclear	Barakah station

prepared by the researcher himself

Renewable energy investments in the Kingdom of Bahrain

1- Tower building center the two seas commercial world in 2008 first building commercial Complete installation turbines Wind power generation in its design, in which Harnesses appearance The Two Towers air that passes between them and converts it to energy electric renewable energy needed by the center to eliminate about 55 cubic kilograms of harmful carbon emissions that are spent in the environment every year, and by using wind turbines as an alternative source of energy, the turbines will generate between 1100 and 1300 megawatt hours per year, which is equivalent to lighting 300 homes for more than a year.Which is expected to provide between 11-15% of the electrical energy needed to operate the offices of the two towers of the Bahrain World Trade Center, which consist of 50 floors.

2- Janabiya Park Project, namelyThe first eco-park of its kind powered by 100% renewable energy% in winter and 80% in summer at the level of the Arabian Gulf regionWhere the park opened on February 27 of the year 2016,It also worksGarden (Janabiya) with solar and wind energy at the same timeA, whereThe Janabiya Park Development Project is about "using solar panels and fans to generate energy from the wind to operate the park so as to achieve the generated energy and reducefrompressure on the government networkAlso checkSelf-sufficiencywhatSupport the government electricity networkWhere aElectricity output 5900 watts, charges 16 rechargeable batteries".;The park is made from23 plankstogenerationtheenergytheUmbrellaproduction size250 watt powerper plankIt also contains two helicopters to generate electricity from the wind, the output power of each fan is 150Watt, asThe traditional high-energy-consuming lighting has been replaced by low-consumption lamps, achieving significant savings in electricity consumption by 64%.

3- The Bahrain Petroleum Company (Bapco) inaugurated the Bahrain solar energy project, which began in November 2012 and is being implemented by the US company, Petrosolar, at a cost of $27 million with the US company, Petrosolar. The project capacity is equivalent to 5 megawatts distributed in 3 regions in the Kingdom, the first in the refinery with a capacity of 3 megawatts, the Awali region with a capacity of 1.5 megawatts, and the University of Bahrain with half a megawatt.**(Abdul Wahab, 2012).**

4- Installing solar energy systems in the Avenues Mall, where 880 solar panels are installed on the car parks.

5- Public transport bus stops project. On September 21, 2019, the Assistant Undersecretary for Transport at the Ministry of Transportation and Communications announced the completion of the installation of solar panels at 32 public bus stops powered by solar energy, with the aim ofReducing the cost of lighting stationsAnd for lighting the stations and displaying advertisement boards in them, as four stations were occupied, and a site for public transport in 2016 to operate only four stations, as the implementation of the project has now been completed.

6- The inauguration of the first government building powered by solar energy, which is the Jaafari Endowment Administration, by Solar 1 in November 2018.

7- Al-Dur station, which is a project of the Electricity and Water Authority, which aims to produce approximately 3 megawatts of solar energy and 2 megawatts of wind energy. It is under implementation and is located in southern Bahrain.

3- Renewable energy investments in the State of Qatar

1. Qatar Solar Energy FacilityWhich opened in the previous year 2018with a production capacity of 300 megawatts,,It meets the needs of 66,000 homes in the first phase until 2020.
2. Siraj Energy project, where it aimsTo produce from 500 to 1,000 megawatts of electrical energy through solar photovoltaic technology.AndThe cost of the first phase is estimated at about 500 to 600 million US dollars to produce 500 megawatts of electricity. The first phase includes, until 2020,noThe production of 350 megawatts of electricityAnd work on the second phase ends in 2021**Qatar Electricity and Water Companyhttps://www.qewc.com/qewc/ar/subsidiaries/siraj-energy/).**
3. The launch of Qatar Technologies Middle East in 2010, a joint venture between Qatar Foundation (70%), Solar World (29%) and Qatar Development Bank (1%), which aims to produce 3,600 tons of polycrystalline silicon per year, for export to international markets. High solar energy, as published by the Middle East Economic Digest, quoting the director of business development planning at the Qatar General Electricity and Water Corporation, said that Qatar expects to add 16,260 megawatts of energy to its local grid from 2011 to 2036, which is about four times the current capacity.
4. Establishing the first football stadiums cooled by solar energy and clean energy, so that the temperature of its stadiums does not exceed 27 degrees Celsius, when it hosts the World Cup in 2022.

4- Renewable energy investments in the State of Kuwait

1- Al-Shagaya renewable energy stationIt opened in February of this year 2019With an operational capacity of 70 megawatts, asIt has been linked with the national electricity grid, and is produced through 3 stations in the complex, which are the solar thermal power station, the wind power station, and the photovoltaic station.. This complex can supply approximately 1,000 residential units with average consumption of electricity throughout the year, and achieves great economic returns as a result of saving consumption of more than 285 thousand barrels of oil equivalent annually.

2- stationSolar bearswhich is intended to produce1500 megawatts, and this project will secure 15 percent of the oil sectornTotal energy in the year 2030It is expected to be operational in the last quarter of 2021.

3- The Abdali project, which is a joint project between the public and private sectors, produces (280) megawatts, of which (60) megawatts is solar energy, and it is a joint project (solar energy with the double cycle of gas turbines).

4- The photovoltaic panels project on the building of the Ministries of Electricity, Water and Public Works, with a production capacity of (1) MWh, and an annual capacity of (1810) MWh.

5- Photovoltaic panels project on the canopies of the Kuwait Towers facility, with a production capacity of (117) kilowatt-hours, and an annual capacity of (211,770) kilowatt-hours.**(Kuwaiti Economist, 2019)**

6- Renewable energy investments in Oman

1. Dhofar Wind Power Plant,Located in the Dhofar Governorate of the Sultanate of Oman, the Dhofar Wind Power Plant represents Masdar's first investment in the Omani renewable energy sector. When completed, the 50-megawatt Dhofar Wind Power Plant will be the first large-scale wind project in the Persian Gulf region.,Construction work started in the first quarter of 2018.whereIt will be commercially operated in early 2021. The cost of the project, which will be fully implemented by the private sector, is estimated at about RO 155 million. The Oman Electricity Transmission Company

will transfer the electrical energy produced from the station through the main electricity network.AndThe 50 MW plant will contribute to meeting the growing energy needs of Oman, and will contribute to supplyingover 16Thousands of homes with electricity and reduce carbon dioxide emissions by approx180 thousand tons annually Reducing dependence on fuel for electricity generation, allowing it to be used in industrial activities of higher value and preserving natural fuel sources, AndThe plant is being constructed in the Thumrait region, which is characterized by a high average wind speed of 8 meters per second.AndThe plant will consist of 13 wind turbines produced by General Electric, which will increase both the production capacity of energy annually and flexibility in Employment,Where this station achieves multiple benefits, the most prominent of which are:

1- It reduces the emission of 180,000 tons of carbon dioxide emissions.
2- It provides electric power to more than 16,000 homes.
3- The station's capacity is to generate 50 megawatts of electric power.

The station provides 7% of the energy of the Dhofar Governorate. (Masdar City, UAE)
(https://masdar.ae/ar/masdar-clean-energy/projects/dhofar-wind-project

Investments in renewable energy projects in the countries of the Cooperation Council for the Arab States of the Gulf Table No. (3)

Project state	Generated energy/hour annually	project state	Project Type	project name	the number
run out	290kilowatts	Emirati	Solar energy	Yas Circuit	1
Underway	800megawatts	Emirati	Solar energy	Mohammed bin Rashid Solar Park	2
Underway	100megawatts	Emirati	Solar energy	Shams 1	3
Underway	Production of desalinated water from 1500 to 2500 cubic meters per day	Emirati	Solar energy	Ghantoot Water Desalination Pilot	4
Underway	Treating 300,000 tons of solid waste annually (27 megawatts)	Emirati	Solar energy	Turning waste into energy	5
Underway	200kilowatt	Emirati	Solar energy	Sea Palace	6
Underway	1750kilowatt	Emirati	Solar energy	Photovoltaic solar energy	7
Underway	450kilowatt	Emirati	Solar energy	Imran Hospital	8
run out	10megawatts	Saudi	Solar energy	Water desalination	9
run out	3.5MW	Saudi	Solar energy	solar energy	10
run out	3300MW	Saudi	Solar energy	Campus of King Abdullah University	11
run out	330MW	Saudi	Solar energy	King Abdullah Financial District in Riyadh	12
Underway	50MW	Saudi	Solar energy	Duba green	13
Underway	300 megawatts	Saudi	Solar energy	Sakaka	14
run out	50MW	Saudi	Solar energy	North promise	15
run out	3.5MW	Saudi	Solar energy	Photovoltaic solar energy	16
run out	20MW	Saudi	Solar energy	Desalination of brackish water in Al-Khafji	17
Underway	400MW	Saudi	winds	Dumat Al-Jandal/ Saudi Arabia	18

run out	5900 watts	Bahraini	Solar and wind energy	Janabiya Park	19
run out	5 megawatts	Bahraini	Solar energy	Awali station	20
run out	1100 and 1300 megawatts	Bahraini	wind energy	my horoscope center the two seas commercial Global	21
run out		Bahraini	Solar energy	Avenues mall parking	22
run out		Bahraini	Solar energy	Public Transport Stations (4)	23
run out		Bahraini	Solar energy	Jafaria Endowment Administration Building	24
Underway	3 megawatt solar and 2 megawatt wind	Bahraini	Solar energy and wind energy	role station	25
Underway	50 MW	Omani	wind energy	Dhofar Wind Power Plant	26
Underway	70 MW	Kuwaiti	Solar, wind and photovoltaic	Al-Shagaya renewable energy station	27
Underway	1500 megawatts	Kuwaiti	Solar energy	stationSolar bears	28
Underway	280 MW	Kuwaiti	Solar and gas turbines	Abdali station	29
Underway	1 MW	Kuwaiti	Umbrella	Ministries of Electricity, Water and Works	30
Underway	(117) kWh	Kuwaiti	Umbrella	Umbrellas of the Kuwait Towers facility	31
Underway	300 MW	Qatari	Solar energy	Qatar Solar Energy Facility	32
Underway	500 MW	Qatari	Solar energy	Siraj Energy Project	33
run out	16,260 megawatts	Qatari	Solar energy	Qatar Technologies Middle East Company	34
Underway		Qatari	Solar energy	Cooling football fields	35
Underway	1400 MW.	Emirati	nuclear	station blessing	36
Underway	1000-1600 megawatts	Saudi	nuclear plant	King Abdullah City for Atomic Energy	37

Preparation of the researcher himself

Percentage of GCC investments in renewable energy projects Table No. (4)

energy used	Investment percentage of the total projects	Number of projects	Country
82% solar, 9% wind, 9% nuclear	30%	(11) 9 solar, 1 wind, 1 nuclear	Kingdom of Saudi Arabia
89% solar, 11% nuclear	24%	(9) 8 solar, 1 nuclear	United Arab Emirates
50% solar, 33% multi, 17% wind	19%	(7) 4 umbrellas, 2 multiples, 1 winds	Bahrain
60% versatile, 40% solar	13.5%	(5), 3 multiple, 2 solar	Kuwait
100% solar	11%	(4) solar	The State of Qatar
100% wind	2.5%	(1) Winds	Sultanate of Oman
	100%	(37) 27 solar, 5 multiple, 3 winds, 2 nuclear	Total

Percentage of renewable energy generation out of the total investment projects in the countries of the Cooperation Council for the Arab States of the Gulf, Table No. (5)

The ratio	Energy type
73%	Umbrella
13.5%	multiple
8%	winds
5.5%	nuclear

Findings and Recommendations

This study found that the diversity of renewable energy projects for the countries of the Cooperation Council for the Arab States of the Gulf is one of the most important indicators of the success of the country's economic development plans 2030, especially in enhancing sources of income through non-oil sectors. This study also noted that the countries of the Cooperation Council for the Arab States of the Gulf have continuous growth and expansion It is distinguished in the quality of investment projects to generate renewable energy, which began to be realized since the beginning of the third millennium, regardless of the size of these projects. This study also found the presence of four distinct projects in the countries of the Cooperation Council for the Arab Gulf States and at the level of the Middle East and North Africa, namely:

1- Establishing the first football stadiums cooled by solar energy and clean energy, so that the temperature of its stadiums does not exceed 27 degrees Celsius, when it hosts the World Cup in 2022.

2- Sharjah Station for Converting Solid Waste into Energy, which aims to treat up to 300,000 tons annually of solid waste instead of putting it in landfills.

3- The project to generate electricity from wind turbines installed in the two towers of the Bahrain Trade Center, which is the first commercial building in the world to contain such turbines.

4- stationKhafji toSolar desalination with a production capacity of 60,000 cubic meters of desalinated water per day to feed Al-Khafji Governorate.

5- projectCreation of the first eco-park of its kind powered by 100% renewable energy% in winter and 80% in summer at the level of the Arabian Gulf regionwhich operates with two types of energy,Solar and wind energy togethera.

Looking at the percentage of GCC investments in renewable energy projects, this study found that Saudi Arabia ranked first with 30%, while the United Arab Emirates ranked second with 24%, while Bahrain ranked third with 19%. Then Kuwait ranked fourth with 13.5%, Qatar ranked fifth with 11%, and the Sultanate of Oman came in last with 2.5%. This study also noted the percentage of renewable energy generation out of the total investment projects in the GCC countries of the following four types : (solar energy by 73%), (multiple energy by 13.5%),

(wind energy by 8%), (nuclear energy by 5.5%), and the researcher attributes the reason for the concentration of most renewable energy projects from solar energy because of the advantages achieved by this technology, especially the flexibility of its cost compared to other sources of energy generation from renewable energy, in addition to nature The climatic conditions of the Gulf Cooperation Council countries are characterized by a long, hot, sunny summer season. This study also found a limited

concentration of investments in renewable energy projects in the field of wind energy by 8%.Wind turbine technology in the seas a lot during the last periodin the major industrial countriesSo that it has become a major contributor to securing needsHaof energyHowever, it was not observed that there is any project to generate energy from hydropower, especially tidal energy, in the GCC countries.

Despite the success of the countries of the Cooperation Council for the Arab States of the Gulf by not relying on traditional sources of energy generation from oil and gas only and the tendency to invest in renewable energy projects, they still lack the presence of international training centers specialized in training their citizens in the field of renewable energy, which is the reason that delayed the opening and operation of Al-Barakah Nuclear Power Plant from 2017 to 2020, when it sent its employees abroad for operation training, so the researcher proposes introducing the renewable energy engineering major as a scientific path independent from the rest of the engineering disciplines in universities and educational colleges in the countries of the Cooperation Council for the Arab Gulf states, as this study recommends in The establishment of a special body concerned with the security of renewable energy affiliated to the General Secretariat of the Cooperation Council for the Arab States of the Gulf, which includes a group of Gulf scientific competencies specialized in (renewable energy engineering). The researcher also recommends the establishment of a free market specialized in renewable energy. In the Gulf free markets, so that this market includes companies and stores that provide all the needs of renewable energy generation projects (equipment, devices, generators and batteries) for all the operation and construction of stations, whereMost foreign investors invest in free zones.This study also shows a wonderful model that is proposed to be used for the rest of the Cooperation Council countries, in the establishment ofThe first football stadiums cooled by solar energy and clean energyin the State of QatarSo that the temperature of its stadiums does not exceed 27 degrees Celsius, when it hosts the World Cup in 2022.As for the Kingdom of Bahrain, it hasMinistry of Municipalities and Agriculture AffairsRepresented in the gardens and parks sector by providing a wonderful model to be followed by the rest of the countries of the Cooperation Council for the Arab States of the GulfCreation of the first ecological parkin the areaFavoriteWorkingSolar and wind energy combineda .

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