

# **Renewable Energy and Green Economy: Two sides of Sustainable Development**



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## **Renewable Energy and Green Economy: Two sides of Sustainable Development**

### **Egyptian Coalition for Human Rights and Development**

It is an initiative launched by Forum for Development and Human Rights Dialogue, and consists of 500 development associations and organizations in 9 Governorates, in order to promote human rights conditions in Egypt, strengthen partnerships, and exchange experience.

The NGOs and institutions participating in the initiative were distributed in 9 governorates: Cairo, Gharbia, Beheira, Alexandria, Beni Suef, Sohag, Luxor, Qena and Aswan.

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## **Introduction:**

Sustainable development is the main and ultimate goal of the whole world, including countries and national, regional and international institutions, and no one can deny the fact that energy is the main engine and the active element of all growth and development, as it is the basic element for all sectors of the economy. Moreover, most of the energy used in the world is traditional and unsustainable energy, as well as it pollutes the environment and causes harmful emissions. Because sustainable development is based primarily on protecting the environment and ensuring the optimal use and equitable distribution of resources between the current and subsequent generations, it has become necessary to move from fossil fuels or traditional energy that hinder the achievement of sustainable development by accelerating global warming to clean energy for the environment in light of the increasing global energy consumption due to the increase in the rate of population growth, urbanization and industrialization.

**Therefore**, renewable energy sources are currently receiving great international attention for their important role in achieving sustainable economic development, especially because of their role in achieving energy security, as the requirement to achieve sustainable development goals has become global sought by all countries, which includes poverty reduction and social justice, as well as supporting economic growth and environmental sustainability.

Hence, the governments of different countries have tended to develop renewable energy sources and achieve energy efficiency and sustainability as prerequisites for achieving sustainable development. Moreover, the world has witnessed a growing increase in the use of renewable energy during the past decade, due to the policies pursued by many countries to develop these sources with a noticeable decrease in the cost of technology associated with their development.

**All this in order to achieve a "green economy", which is not a new term; it grows along with the environmental movement, offering a fair vision of economic life, as the process of "greening" the economy brings many benefits, as it helps to alleviate concerns about the provision of security in the fields of energy, food, and water. Moreover, it is a strong supporter of sustainable development; and an appropriate opportunity to re-examine the current governance structures and examine whether these structures allow society to address current environmental challenges and the future, and how to take advantage of emerging opportunities.**

**In general, the green economy aims to achieve economic development through the implementation of many eco-friendly projects and using new technologies in the fields of renewable and clean energies. As well as it calls for the "greening" of existing sectors, changing unsustainable consumption patterns, creating new jobs with the aim of reducing poverty, and reducing energy intensity and resource consumption and production.**

**In this context, all countries of the world seek to develop a clear vision and perspective to launch an economy based on a strategy aimed at moving to a green economy, taking into account four basic and important axes, which are: the energy crisis, the rise in oil prices, whose stocks are threatened with depletion in general, economic crises and the employment of green investments as a means of economic recovery, policies to mitigate greenhouse gas emissions, and the strong convictions of most Countries need to develop a new model for sustainable development that is based on the need to change consumer behaviors and current marketing models.**

Because Egypt is the largest country in North Africa and the Arab region in terms of population, this has led to a growing demand for energy, and the problem has been exacerbated by the exacerbation of the burden of the energy subsidy bill. The financial statement of the draft state budget for the fiscal year 2022/2023 revealed that the allocation of EGP 28 billion and 94 million to support petroleum products compared to EGP 18 billion and 411 million in the budget for the fiscal year 2021/2022, an increase of about EGP 9,683 million.

To meet the growing demand for energy, the Egyptian government has developed an energy diversification strategy known as the "Integrated and Sustainable Energy Strategy until 2035", with the aim of ensuring the continued security and stability of the country's energy supply. This strategy involves enhancing the role of renewable energy and energy efficiency, while targeting the diversification of the energy mix by increasing reliance on renewable energy sources, especially wind and solar energy.

In accordance with the strategic vision for energy until 2030, the energy sector will be able to meet all the requirements of sustainable development of energy resources and maximize the use of their sources (non-renewable and renewable), with the aim of effectively contributing to enhancing economic

growth, competitiveness, and social justice, in addition to preserving the environment and achieving leadership in the development and development of renewable energy sources, while keeping pace with the central international sustainable development goals. There is no doubt that the development of renewable energy is changing the pillars of basic development in the energy, health, infrastructure and education sectors, whether developed by governments, the private sector or non-governmental organizations.

**Therefore, the report addresses some points related to Renewable Energy and its relationship with achieving Sustainable Development, especially in Egypt, which are:**

1. The concept of Renewable Energy and Green Economy.
2. Sources of Renewable Energy.
3. Vital sectors in the transition to Green Economy.
4. Advantages of Renewable Energy and Green Economy.
5. Strategies and Requirements of Green Transformation.
6. Renewable Energy as a mechanism for Transition to Green Economy.
7. New and Renewable Energy as a Leading sector for transition to a Green Economy in Egypt.
8. The international Vision towards the Egyptian efforts in the field of Renewable Energy and Green Economy.
9. Conclusion.
10. Recommendations.

## **1. The concept of Renewable Energy and Green Economy:**

### **✓ First: The concept of renewable energy:**

**There are many definitions of renewable energy, including:**

- **Renewable energy is** the energy derived from natural resources that are renewed, that is, that are not implemented, and it is fundamentally different from fossil fuels from oil, coal and natural gas, so renewable energy can be defined as: It is those resources that we obtain through energy currents that are repeated in nature automatically and periodically.
- **Renewable energy is** a permanent and inexhaustible natural source available in nature, whether limited and unlimited, but constantly renewable, and it is clean and does not result in environmental pollution relatively.

- **According to the International Energy Agency (IEA):** "Renewable energy is formed from energy sources produced by nature's spontaneous pathways such as sunlight and wind, which are renewed in nature at a higher frequency than they consume."
- **According to the Intergovernmental Panel on Climate Change (IPCC):** "Renewable energy is any energy that comes from the sun, geophysical or biological that is renewed in nature at a pace equivalent to or greater than its use and is generated from successive and continuous currents in nature such as biomass energy, solar energy, underground energy, water movement, tidal energy in the oceans, and wind energy. As well as there are many mechanisms that allow converting these sources into primary energies such as heat and hydropower and into kinetic energy using multiple technologies that allow the provision of energy services such as fuel and electricity."
- **According to the United Nations Environmental Protection Program (UNEP):** "Renewable energy is energy whose source is not a fixed and limited stock in nature, which is periodically renewed faster than the pace of consumption and appears in the following five forms: biomass, sunlight, wind, hydropower and underground energy."

✓ **Second: The concept of green economy:**

We must clarify at the outset what the concept of the word "green" means, and the word green means: everything that exists in the environment, provided that it is friendly to it and does not cause pollution to it, or at least does not add or increase to the environment more burdens that harm it, or lead to its degradation. The economic aspect of the environment takes many forms, including groundwater, minerals in quarries, soil, air, forests, and trees, and all of this applies to the rule in order to achieve economic development, and in order that the excessive use of all these elements will lead to the destruction of the environmental organization, and therefore the green economy appeared; to preserve the environment and even protect the global environment from degradation.

**A green economy can be defined as follows:**

- The green economy is an important tool for sustainable development; it is inclusive and can drive economic growth, employment and poverty eradication, while maintaining the healthy functioning of the Earth's ecosystems.
- A means to stimulate the renewal of national policy development and international cooperation and support sustainable development.

- A model of economic development based on sustainable development and knowledge of environmental economics, as it is a kind of organized way to create a clean society and environment that raises the economic level and pushes society towards a better life, and maintains the balance of the environment from all forms of biodiversity.
- A new economic model requires the preparation of all professions, and a focus on goods and services that we will need more specific changes to improve energy efficiency and reduce resource use, as university education has an important role in maintaining this model.
- It is to provide clean energy and improve the quality of the environment by reducing greenhouse gas emissions, reducing environmental impact and improving the use of natural resources, comprising several economic sectors and not only the ability to generate clean energy, but also technologies that enable cleaner production processes.
- It is a new model of fast-growing economic development that is based on knowledge of environmental economics and that aims to address the interrelationship between human economies and the natural ecosystem and show the adverse impact of human activities on the ecosystem, such as climate change and global warming, which is the opposite of the model known as the "black economy", which is based on fossil fuels such as coal, oil, and natural gas.
- According to the United Nations Green Economy Program, it is an economy that leads to improved human well-being and social equality, while significantly reducing environmental risks and scarcity of environmental resources, yet the transition to a green economy requires specific enabling conditions consisting of regulations, policies, supports, resources, incentives, international legal and trade structures, aid and trade protocols.
- According to the United Nations Conference on Sustainable Development, held in Rio de Janeiro, Brazil, in mid-2012, the green economy is an important path to sustainable development.

**In general,** the concept of green economy involves the processes of separating the use of resources and environmental impacts from economic growth and is characterized by a clear and huge increase in the volume of investments in green sectors, supported by a larger area of empowerment and policy reforms. Such public investments are supported by the fact that the private sector provides the necessary mechanism to reshape the characteristics of business, infrastructure and institutions, and works to pave the way for the adoption of sustainable consumption and production processes, while working

to increase the share of green sectors in the economy while increasing the number of jobs. Green and decent.

**The concept of green economy also includes three basic elements or indicators:**

- **Environmental elements:** reducing the proportion of carbon dioxide in the air, protecting biodiversity and ecosystems, and optimizing the use of energy and natural resources.
- **Social elements:** creating appropriate (non-polluting) jobs, achieving justice for countries and future generations, reducing poverty, increasing welfare, improving the standard of living, working to provide social protection, and access to appropriate basic services.
- **Economic elements:** driving innovation, encouraging technology transfer, maintaining the continuity of economic growth, and working to achieve sustainable development.

**It can be said that the green economy consists of:**

1) Creating new green opportunities, i.e.: providing new economic and social opportunities based on new green activities through which:

- Improving trade flows, with a focus on goods and services that serve the environment.
- Renewable energy production and distribution.
- Support innovation, research and development, technology transfer, and encourage increased business.

This brings many benefits, including promoting low-carbon activities, opening up new areas of economic security, creating new jobs and new sources of income.

2) Making existing economic activities more environmentally friendly, i.e., greening economic activities. This brings many benefits, including reducing carbon emissions, improving public transport, reducing water wastage, improving food security, and mitigating agricultural land degradation and desertification.

**2. Sources of Renewable Energy:**

a) **Solar Energy:**

Solar energy is the most abundant of all energy sources, and can be generated in cloudy weather. Earth's solar interception rate is about 10,000 times higher than that of humans.

Solar technologies can provide heat, cooling, natural lighting, electricity and fuel for a range of applications. Solar technologies convert sunlight into



electrical energy either through photovoltaic panels or through mirrors that focus solar radiation.

If not all countries are equally solar, a significant contribution to the direct solar energy mix is possible for each country.

The cost of manufacturing solar panels has fallen dramatically in the last decade, making solar energy affordable and often the least expensive. Solar panels have been in use for about 30 years, and their grades vary depending on the type of material they are manufactured.

**b) Wind Energy:**

Wind energy is extracted from the kinetic energy of the wind using large wind turbines located on land (onshore) or in the sea or freshwater (offshore). Wind power has been used for thousands of years, but onshore and offshore wind technologies have evolved over the past few years to produce the largest volume of electricity using longer turbines and larger rotating diameters.

Although average wind speeds vary greatly by location, the global technical potential of wind power exceeds global electricity production, and ample potential exists in most regions of the world to enable significant diffusion of wind power.

Many parts of the world have strong wind speeds, but the best locations for wind power generation are sometimes far away. Offshore wind power offers huge potential.

**c) Geothermal energy:**

Geothermal energy uses the thermal energy available in the ground. Heat is extracted from geothermal reservoirs using wells or other means.

Naturally, sufficiently hot and permeable reservoirs are known as hydrothermal reservoirs, while sufficiently hot reservoirs that are optimized by hydraulic stimulation are called improved geothermal systems.

Once they reach the surface, liquids of different temperatures can be used to generate electricity. The technology of generating electricity from hydrothermal reservoirs is mature and reliable, and has been in use for more than 100 years.

**d) Hydropower:**

Hydropower uses the energy of water flowing from top to bottom. It can be generated from reservoirs and rivers. Hydroelectric power storage plants rely on water stored in a reservoir, while downstream hydroelectric power plants exploit energy from the riverbed.

Hydroelectric reservoirs often have multiple uses: supply of drinking and irrigation water, flood and drought control, navigation services, and power supply.

Hydropower is currently the largest renewable energy source in the electricity sector. They generally depend on stable rainfall types, and may be adversely affected by droughts or changes in ecosystems that affect rainfall types

The infrastructure needed to generate hydropower can also affect ecosystems in a negative way. For this reason, small-scale hydropower is considered by many to be a greener option, particularly suitable for communities in remote areas.

**e) Marine Energy:**

Marine energy is derived from technologies that use the kinetic and thermal energy of seawater (e.g. waves or currents) to produce electricity or heat..

Offshore power systems are still at an early stage of development, with a number of prototypes of wave devices and tidal currents explored. The theoretical potential of marine energy far exceeds today's human energy requirements.

**f) Bioenergy:**

Bioenergy is produced from a variety of organic matter, known as biomass, such as wood, coal, and other manure to produce heat, energy, and agricultural crops for liquid biofuels. Most of the biomass in rural areas is used for cooking, lighting and heating, and generally by poorer populations in developing countries.

Modern biomass systems include dedicated crops or trees, residues from agriculture and forestry, and various organic waste streams.

Energy from burning biomass produces greenhouse gas emissions, but at lower levels than burning fossil fuels such as coal, oil or gas. However, bioenergy should be used for limited applications only, given the potential negative environmental impacts associated with large increases in forest plantations and bioenergy, and the resulting deforestation and land-use change.

**3. Vital sectors in the transition to Green Economy:**

**The most important sectors that will contribute to the transition to a green economy according to the outcomes of the Rio de Janeiro Summit in 1992 are:**

- 1) **Renewable energy represents a major economic opportunity**, and this sector requires replacing investments in carbon-based energy sources with investments in clean energy. Alternative energy is defined as energy obtained through energy streams that exist spontaneously and periodically in nature, and defined by the International Energy Agency as energy that can be derived from natural phenomena; like the sun, wind, which regenerates at a rate greater than the rate at which it is consumed. Which are represented in:

- **Conventional renewable energy (biomass energy):** It depends on the use of biogas, and includes plant and animal organic waste that can be treated by bacterial fermentation or thermal combustion.
  - **New renewable energy:** solar energy, wind energy, hydro energy, and geothermal energy.
  - **Green buildings:** they require the transition to a green economy by focusing on green architecture, which is the use of eco-friendly materials, conserves water in light of the limited water resources, and reduces the consumption of electrical energy despite the increase in demand for it. As well as the transition to a green economy in the construction sector is an important economic and social issue.
- 2) **Sustainable transport** works to provide the basic needs of individuals and communities in a safe and assured manner, without causing harm to health, the ecosystem and the interests of future generations. Moreover, it is the least polluted, whether to air, water or soil, because transportation is based on renewable energy sources, and cars and public transport are partially powered by electricity.
  - 3) **Water management:** Water is an essential element of sustainable development, and ecosystems have a key role to play in conserving water in quantity and quality. Water management is linked to irrigation, the availability of healthy drinking water, and sanitation, so the green economy will collect rainwater, reuse it, and desalinate seawater.
  - 4) **Waste management:** It is the recycling of waste to produce other products of lower quality than the original product, including recycling paper, plastic, metal waste, and glass. Green waste management works to create jobs, and provides unique investment opportunities in recycling, composts production, and energy generation, which improves the economic and environmental situation and raises the health and social level.
  - 5) **Agricultural land management (sustainable agriculture):** Attention must be paid to the concept of green economy to green the agricultural sector, work to support rural livelihoods, integrate poverty reduction policies into development strategies, adapt new agricultural technology to mitigate the effects of climate change, and strengthen development partnerships in order to face contemporary environmental challenges, such as desertification, deforestation, urban sprawl, and soil erosion. **The greening of the agricultural sector aims mainly to:**
    - Restoring and enhancing soil fertility, through increased use of natural and sustainable inputs of nutrients produced, diverse crop rotation, as well as livestock and crop integration.

- Reducing food spoilage through expanded use of post-harvest storage equipment.
- Reducing global warming, by using a no-till farming system, as a result of the lack of a great need to operate agricultural machinery, so we can reduce carbon dioxide in the atmosphere, and reduce fuel use.

#### **4. Advantages of Renewable Energy and Green Economy:**

##### **First: Advantages of Renewable Energy:**

- **Available in most countries of the world:** There are several types of renewable energy classified based on the sources from which it is taken, and the most prominent feature of renewable energy is that it is available in all parts of the earth in one way or another, as it is energy derived from natural sources capable of regeneration within a period of time that does not exceed human life without causing depletion of the planet's resources.

However, there are downsides to renewable energy, and renewable energy types include sunlight, wind, rain, tides, waves, biomass and thermal energy stored in the earth's crust, making it an inexhaustible source and energy that does not run out, not to mention that its climatic or environmental damage is almost non-existent.

- **Constantly renewed:** Renewable energy comes from natural sources or from renewable natural processes, and its abundance may depend on time or climate; although it is referred to as a modern technological innovation, humans have long relied on natural sources for heating, transportation, lighting, etc. The wind has always been a source of energy for ships and mills, and the sun provided warmth during daylight hours and helped ignite fires that last until the evening, as solar energy is one of the most important sources of Renewable energy.
- **Eco-friendly:** The consumption of any source of energy has negative effects on the environment, and renewable energy is not exempt from this rule. Each source has its pros and cons, but the negatives of using renewable energy are negligible in comparison to the destructive effects of fossil fuel sources, as they reduce water and land consumption, as well as the loss of wildlife and the natural environment. Moreover, perhaps its most prominent advantages on the environmental level are that it does not cause environmental pollution, and it reduces heat emissions.

Renewable energy does not pollute the air or water, and its environmental impact on the climate is almost non-existent, so instead of depleting our limited resources, polluting the environment and negatively affecting our health as in fossil fuel sources, renewable energy contributes to preserving the environment.

- **Reduces heat emissions:** Renewable energy consumption does not emit as much greenhouse gas emissions as in fossil fuel sources, they either emit a minimum or are completely zero emitting, which contributes to limiting global warming.
- **Raise the level of economic growth:** By 2030, it is estimated that doubling the share of renewable energy in the global energy sector will increase global GDP by 1.1%, equivalent to \$ 1.3 trillion, which contributes to raising the level of economic growth at the global level, while at the international level, expanding the adoption of renewable energy sources will create new jobs and protect the economies of countries from external influences.
- **Creating new jobs:** The renewable energy sector is labor-intensive, which means that it contributes to the creation of thousands of jobs that support local communities. Renewable energy provides a huge and increasing number of jobs globally every year, according to estimates, the renewable energy sector employed about 10.3 people in 2017, due to massive investments and falling renewable energy costs, in addition to technological developments and supportive government policies.
- **Protects the economy from external shocks:** Renewable energy provides a good example of adaptability, as energy systems with high renewables are able to resist external shocks better than fossil fuel sources, because these systems are controlled locally, making them more vulnerable to the negative effects of external crises.

However, in most fossil fuel-based systems, there is no autonomy and freedom in power generation and distribution, which has implications for the way energy is collected during crises, but renewable energy is generated, managed and maintained domestically, making it not dependent on external energy sources.

- **Reduce the material cost:** Various countries have access to electricity at low prices currently thanks to renewable energy, which adds stability to energy prices in the future, although renewable energy facilities require initial investments for construction, but their operating costs are low, as operating fuel is free for most renewable sources, which makes their prices more stable over time.

The use of renewables more frequently means a reduction in the price and volume of demand for natural gas and coal, given the increased competition between these sectors and the diversity of access to energy, as the increasing adoption of renewables contributes to protecting consumers in the event of a sudden rise in the price of fossil fuels.

- **Low availability of fuel and energy:** The cost of renewable energy has steadily declined recently and is expected to fall further. The cost of installing solar panels fell by more than 70% between 2012 and 2017, the cost of producing electricity from wind energy fell by 66% between 2009 and 2016, and costs are expected to fall further as the renewable energy market matures and companies continue to reap these fruits on a large scale.

Renewable energy is currently much lower than coal and gas-fired energy, and more than 50% less expensive than nuclear power, and recent estimates suggest that building renewable energy facilities is less expensive than operating existing coal plants.

- **Reduces maintenance cost:** Renewable energy technology requires less overall maintenance than conventional fossil fuel sources, because solar and wind turbine installations have little or no moving parts, and they do not rely on flammable sources to operate them, making their operating costs low.

In addition, once the infrastructure needed to generate renewable energy is built, maintenance is either non-existent or minimal, meaning that the owners of these facilities will reap huge benefits by generating free electricity for people.

### **Second: Green Economy:**

- **Promoting sustainable development** through the adoption of sound economic policies that preserve the environment and limit its deterioration as a result of climate change, in addition to seeking to reduce the effects of poverty exacerbated in many countries. Therefore, the green economy is a means to achieve sustainable development and not an alternative to it, as it works to achieve integration between the dimensions of sustainable development.
- **A green economy that preserves natural resources sustainability:** The green economy scenario gives long-term growth from 2011 to 2050 by no less than the business-as-usual approach, while avoiding significant downside risks, such as the effects of climate change, increased water scarcity, and the loss of ecosystem services. Global economic growth under the business-as-usual approach will be constrained by the increasing scarcity of energy and natural resources, while the green investment scenario achieves higher rates of where annual growth over time.

On energy, core demand is expected to return to current levels by 2050, 40% lower than expected under the business-as-usual approach, and supply-demand sideways measures will reduce energy prices below business prices

in the coming decades, limiting the rapid impact of potential energy price shocks on the global economy.

- **Saving part of non-renewable energy** by creating new energies, reusing them to allow their exploitation, and using renewable energy in environmental projects.
- **Protecting the environment from pollution**, by reducing harmful emissions from fossil fuels, and reusing resources and raw materials through recycling.
- **The green economy contributes to poverty alleviation** through prudent management of natural resources and ecosystems to flow benefits from natural capital and deliver them directly to the poor, in addition to creating new jobs, especially in the sectors of agriculture, plants, energy and transport.

**However, there are some challenges facing countries in their transition to a green economy and reliance on clean green energy, and the challenges are as follows:**

- Lack of good and well-planned development policies.
- Lack of health services and clean water in some areas, and lack of efficient use of fresh water and energy sources.
- Imbalance in the division of jobs, with an excessive number of employees in some departments and the lack of human resources in others, leading to widespread unemployment.
- **Financing challenges:** The process of transition to a green economy requires huge sources of financing, and the provision of these sources is one of the most important and largest challenges that hinders this transformation at all. Financing is an essential issue for the formation of productive assets for the poor and the creation of new job opportunities in sectors of the economy based on natural resources, in light of the spread of poverty at rates that may be worrying in some countries.
- **Economic challenges:** Many countries of the world suffer from many economic problems, which are illustrated by the noticeable decline in many economic indicators, such as low economic growth rates, high inflation, and unemployment, as well as the worsening of the public budget deficit, the balance of payments deficit, and the accumulation of debt. To other economic problems prevent the success of sustainable development plans, and the transition towards a green economy may force countries to abandon high-return economic activities that harm the environment.

- **Environmental challenges:** The whole world is witnessing various environmental challenges, which threaten current and future generations, due to the interest in achieving economic progress and rapid material wealth at the expense of the optimal exploitation of natural resources and because of the increase in the unemployment rate among many segments, especially the youth, and therefore the cost of environmental degradation may be significantly high in some countries.

## **5. Strategies and Requirements of Green Transformation:**

**Transitions to a green economy require many necessary assumptions, which aim to facilitate the passage to the green economy, including:**

- Adopt a social perspective by having a clear and well-defined global vision of working towards good job creation (working conditions, career progressions, wage level, etc.).
- Ensuring the integration of social partners at all levels.
- Not neglecting non-green activities, and ensuring overall consistency between functions, i.e. clarity and stability of different projects and strategic decisions.
- Creating favorable conditions in the context of domestic regulations and policies while providing elements of material support, incentives, international legal and trade structures, aid and trade protocols.
- Ensure that institutions are proficient in technology and have the necessary skills, with the need to acquire new skills in order to have a system of continuing education.
- The state should develop the countryside by paying attention to agriculture, preserving forests, using them as important resources in the state, and improving the standard of living of the rural population.
- Paying attention to water resources, treating unclean water, rationalizing consumption, preserving water resources, and protecting them from pollution.
- Reviewing government policies, making them subject to the green economy system, and adapting market policy to it to encourage production.
- The green economy must recognize the national policy on natural resources, focus on their efficiency, and make production sustainable and sustainable.
- The state addresses the problem of waste, works to treat it, recycle it again, and make it a resource, instead of causing pollution to the environment.
- Supporting the mass transit sector, improving education and encouraging innovation.



## **6. Renewable Energy as a mechanism for Transition to Green Economy:**

Energy is closely related to economic activity and growth rates, as it represents the primary key in life. However, Human is still searching for new sources of energy to cover his growing needs of them, as fossil energy sources are known for their depletion, high cost, and their negative impact on the environment, which causes ecosystem degradation, and this makes new and renewable energy the best choice for the transition to a green economy and achieving sustainable development.

The green economy can be seen as an economy that is characterized by the use of new and renewable energy within the framework of sustainable environmental practices, where energy is obtained from clean sources that are naturally renewable, such as solar energy, hydropower, and wind energy. Unlike the brown economy that depends on fossil energy, which pollutes the environment and is not characterized by sustainability, such as coal, oil, and natural gas.

**The "Towards a Green Economy" report, prepared by the United Nations Environment Program (UNEP) as part of its Green Economy Initiative in 2011, showed** that investments by public and private institutions in key economic sectors fueled by renewable energy sources could enable long- and medium-term economic growth beyond business as usual between 2010 and 2050.

**The green economy model shows** that raising energy efficiency in various sectors, expanding the use of renewable energy will create many job opportunities, in addition to gradually securing energy, protecting the environment from pollution, and thus achieving sustainable development.

## **7. New and Renewable Energy as a leading sector for the transition to a Green Economy in Egypt:**

The environment depends on the economy to provide the capabilities that protect the environment and works to improve its quality, and therefore any damage to the environment as a result of the misuse of resources negatively affects those resources and the level of economic activity. Therefore, the existence of economic activity and its ability to grow and continue depends on the ability of the ecosystem to provide resources and eliminate waste. So, the green economy is a basis for achieving development and social justice, through the peaceful management of natural resources and ecosystems, in light of the environmental conditions that society is going through.

The Egyptian state has paid great attention to protecting the environment and its natural resources and alleviating pressure on them because protecting the environment and natural resources has become a protection for life on the surface of the earth in order to secure the rights of future generations to those resources to reap the fruits of development and preserve public health. Within the framework of preserving the environment and natural resources from the effects of environmental violations that lead to damage to natural resources, the state is making great efforts to address these violations in order to achieve the national goal, which is sustainable development. While the green economy is one of the most important mechanisms for achieving sustainable development, as it can involve many and varied opportunities, including creating job opportunities and contributing significantly to poverty reduction, encouraging innovation, and establishing new markets.

In addition, Egypt seeks to open new horizons for green economy projects and renewable and clean energy, and aims to raise its share of renewable energy in the electricity mix to 10,000 megawatts by next year. Egypt has huge and great potential in the field of eco-friendly energy, in addition to its distinguished location between global markets, including Asian, African and European, and continues to promote green economy plans ahead of its hosting of the COP27 climate summit on its territory.

Moreover, Egypt is also taking steps to support energy transition investments and the expansion of green projects with international companies, through Egypt's strategy, which aims to transition to a green economy at its core on many of the principles and objectives of the green economy; the general strategy aims to expand the range of goals set for specific sectors.

#### ❖ **Egyptian Steps in Renewable Energy and Green Economy:**

- **EBRD** investments in Egypt have further enhanced the diversification of Cairo's energy mix and committed to financing an additional 1.6 GW of installed renewable energy capacity, resulting in an emission reduction of 8,303 kt.
- In September 2020, **Egypt issued the first green bonds** worth \$ 750 million to finance its projects, and to have a precedent in the transition to a green economy, which Standard & Powers association considered as one of 3 bond issues in the Middle East and North Africa.
- **The Ministry of Planning** confirmed that the proportion of achievements in green economy projects estimated at more than 30% and aims to reach more than 50% within the next three years.
- **About 691 projects have been listed**, with a total cost of about 447.3 billion pounds, and according to the statements of the Ministry of Planning,

15% of them are green projects, and the state aims to reach that percentage to more than 50% in 2024.

- The **number of electric vehicles** during 2020 is estimated at more than 60 buses and more than 200 cars, while the number of charging stations for **electric vehicles** reached about 150 charging stations (slow and fast) and is on its way to expand the establishment of stations with their geographical diversity.
- Within the framework of keeping pace with the global and technological trend in the field of electric car industry, Egypt seeks to become a regional center for this industry in Africa and the Middle East.
- **Egypt Car Exchange and Recycling Program:** The Ministry of Finance, in cooperation with the private sector, some commercial banks and an insurance company, facilitated the process of replacing and recycling cars, while the private sector reduced the prices of cars and recycled them. Therefore; commercial banks reduced the interest rate in order to increase the demand for loans, so 41 thousand cars were replaced, which helped reduce carbon dioxide emissions by 61 thousand tons per year.
- Egypt has diverse opportunities for the private sector, especially in the field of agriculture and labor availability, and therefore there are steps with regard to climate and dealing with fertilizers and agricultural waste, especially since the agricultural sector contributes more than 33% of the economy.
- The Egyptian state aims to expand reliance on renewable and clean energy on a large scale, so that its adoption rate is estimated at about 20% of the electrical energy mix, and aims to reach 42% by 2035, based on interest in solar and wind energy.
- **In the field of green hydrogen production**, the government signed an agreement to produce green hydrogen in Egypt in quantities ranging from 50-100 MW, as a feedstock for the **production of green ammonia**, in partnership between the Sovereign Fund of Egypt, the Norwegian renewable energy company Scatec, Vertiglobe owned by the Dutch companies Orascom, and the UAE's ADNOC.
- **The Ministry of Environment is working on providing gradual support from the state to reduce the use of plastic bags**, and to provide environmentally friendly products. Moreover, the Environmental Affairs Agency of the Ministry launched the **Egyptian Pollution Control Project** with the aim of improving public information, and worked to spread environmental awareness, and highlight environmental problems related to industry in Egypt.

- **Engineering Activities Group for Machinery and Equipment Design Group** treats and disposes of solid waste in the Middle East, and is an Egyptian company founded by a group of Egyptians to provide high-quality environmental services.
- **Onera Power Systems:** Established by Middle East Engineering & Telecommunications Company (MEET), an Egyptian joint stock company specializing in renewable energy equipment, including solar system, wind system, and fuel cells.
- The government decided that 50% of the plan's standards for the state comply with environmental standards, in order to integrate the environmental dimension into the projects of other ministries, so that 50% of the projects of the various ministries reach green projects during the coming period.
- **The Ministry of Trade and Industry established Cleaner Production Center**, in cooperation with the United Nations Industrial Development Organization, to provide services to the industrial sector in Egypt, **which are represented in:**
  - Providing technical assistance to Egyptian industry through clean production programs, and providing studies showing the impact of various industries on the environment.
  - Provision of assistive technology for the use of chemicals, e.g. industrial waste handling and recycling.
  - Providing financing advice and acting as an intermediary to provide access to loans from the World Bank and the German Agency for Technical Cooperation (GTZ) due to the high cost of environmentally friendly projects.
  - Providing training programs and working to participate in international projects.
- Egypt is **financing the Green Economy Program** by introducing a specific mechanism to finance green projects for the first time in more than 20 years, represented by the **Egypt GEF** Program, which aims to improve the performance of renewable energy as well as energy efficiency in general. The program aims to support the Egyptian state in its transition towards a green economy with funding estimated at 140 million euros and it is an existing project in partnership with a number of local banks. As well as the program was also developed through the bank European Reconstruction and Development Bank in cooperation with the European Investment Bank and the French Development Agency.

### ❖ Sustainable Energy Strategy 2050:

The Sustainable Energy Strategy aims to increase the contribution of renewable energy in the electricity mix, as the electricity production from renewable energy is set to reach 42% of total electricity produced in 2035, compared to 20% in 2022.

- **For sources of electricity production from renewable energy (current and targeted) include:**
  - Solar energy will increase by 2% in 2022, while it is targeted to reach 26% in 2035.
  - Wind energy will be 12% in 2022, while it is targeted to reach 14% in 2035.
  - Hydropower will be 2% in 2035, up from 6% in 2022.
  - Energy generated from renewable energy sources (solar-wind) has increased since 2014/2015 about 7 times (100 GWh), reaching 10.4 in 2021/2022, compared to 10.2 in 2020/2021, 8.7 in 2019/2020, 4.5 in 2018/2019, 2.9 in 2017/2018, 2.8 in 2016/2017, 2.2 in 2015/2016 and 1.4 in 2014/2015.
  - The total installed capacity of renewable energy (solar-hydro-wind) amounted to about 7000 MW.
- **With regard to wind energy projects**, the implemented projects have a capacity of 1635 MW, as Jabal Al-Zayt produced 580 MW, Zafarana 545 MW, Ras Ghareb 260 MW, and West Bakr 250 MW. As well as the projects under implementation in the Gulf of Suez with a capacity of 250 MW, and projects under development in the Gulf of Suez (private sector) with a capacity of 2800 MW.
- **For renewable energy projects**, it includes solar energy projects, where the implemented projects have a capacity of 1756 MW, most notably Benban photovoltaic cells projects 1465 MW, thermal sun creams 140 MW, and rooftop photovoltaic cells 121 MW.
- **The presence of photovoltaic projects under study** with a capacity of 770 m, including 700 private sectors, while renewable energy projects also include hydroelectric projects in Naga Hammadi with a capacity of 64 MW, and Assiut with a capacity of 32 MW.

### ❖ The most prominent conventions and memorandums of understanding in new and renewable energy projects:

- Saudi Arabia's ACWA Power will make measurements for **the 10 GW wind energy project** it wants to implement in Egypt.

- The Emirati Nois Group is purchasing power from **solar power plant in Kom Ombo in Aswan amounted by 500 MW**, in addition to the same company purchasing power from **wind power plant in the Gulf of Suez amounted by 500 MW**.
- The English Lekela Company buys **energy from the wind farm in the Gulf of Suez with a capacity of 250 MW**.
- The EBRD has **provided around \$1.3 billion to promote green transitions**, eliminate old power plants and contribute to a new wind and solar project.
- Saudi Arabia's ACWA Power and the European Bank for Reconstruction and Development (EBRD), **pumped US\$114 million in partnership with international financiers to develop the Kom Ombo solar power plant, which will add 200 MW of generating capacity**.
- The **signing of 16 memorandums of understanding for projects within the industrial zone in Ain Sokhna and East Port Said area**, with the aim of establishing industrial facilities and complexes for the production of green fuel and its use for ship supply purposes or export to foreign markets, with expected investments of more than \$ 20 billion.
- A memorandum of understanding with the Norwegian company Scatec, which aims to **produce one to 3 million tons per year of green ammonia**.
- The Indian ACME Group's production **targets of 2.2 million tons per annum of green fuel**.
- Australian company Fortescue Future Industries targets **production of more than 2 million tons of green ammonia annually**.
- Britain's Global Ec aims to **produce around 2 million tons a year of green hydrogen**.
- Saudi Alfanar Company aims to **produce 500,000 tons of green fuel annually**.
- The **establishment of the German company H2 Industries** (East Port Said Industrial Zone) the first waste-to-green hydrogen station with a production capacity of 300 thousand tons per year.

#### ❖ **National Green Hydrogen Strategy:**

The National Green Hydrogen Strategy is being prepared, which would be announced at the COP 27 conference, as it aims to benefit Egypt from its competitiveness to reach 8% of the global market for hydrogen. Egypt has the ability to produce green hydrogen at the lowest cost in the world, and the cost

of production is scheduled to decrease to reach \$ 1.7 / kg in 2050, compared to \$ 2.7 / kg in 2025.

**Strategy targets:**

- Increase in GDP of \$10-18 billion by 2025.
- More than 100,000 new jobs created.
- Contribute to reducing Egypt's imports of petroleum products.
- Reduce carbon emissions.

The strategy is implemented in cooperation with the European Bank for Reconstruction and Development (EBRD) and the Arab Union for Sustainable Development and the Environment (ARISE).

❖ **Electrical interconnection projects with neighboring countries:**

Electrical interconnection projects with neighboring countries contribute to meeting their energy needs, and the continents of Africa and Europe are among the world's least electrically producing continents for the year 2021, after the proportion of electricity generated in Africa reached 3.2% of the world's total production, while the production of Europe reached 14.2% of the world's total production, and the proportion of the Asia-Pacific production of electricity reached 49.2% of the world's total production, knowing that the rest of the world's production reached 33.4%.

Europe is the most importing electricity in 2019 according to the latest available data, as the proportion of electricity imports for Africa reached 4.4% of the world's total imports, Asia and Oceania reached 10.9%, and Europe reached 62.8% of the world's total imports, while the remaining of total imports reached 21.9%.

- **With regard to the electrical interconnection with African countries,** the target capacity of the electricity interconnection line between Egypt and Sudan reaches 300 megawatts, in addition to the target capacity of the electricity interconnection line between Egypt and Libya reaching 2000 megawatts.
- **With regard to the electrical interconnection with Asian countries,** the target capacity of the interconnection line between Egypt and Saudi Arabia reaches 3,000 megawatts, while the target capacity of the electricity interconnection line between Egypt and Jordan is 2,000 megawatts.
- **As for the electricity interconnection line with European countries,** according to the report, the target capacity for interconnection between Egypt, Cyprus and Greece is 3,000 megawatts.

### **As a result of these distinctive efforts:**

- Egypt has become **the leading Arab country in solar and wind energy production capacity, with a capacity of 3523 MW**, while the UAE's production reached 2600 MW, Morocco 1867 MW, Jordan 1669 MW, Saudi Arabia 776 MW, Algeria 444 MW, Tunisia 253 MW, Oman 180 MW, Mauritania 95 MW, Kuwait 30 MW, Qatar 15 MW, and Somalia 10 MW
- Egypt **advanced 5 places in the Climate Change Index CCPI**, after occupying 21st place in 2022, compared to 26th place in 2014, and it advanced 13 places in the index of the most attractive countries in the renewable energy sector, where it occupied 26th place in May 2022, compared to 39th place in March 2015. As well as Egypt advanced 5 places in the Energy Transition Index, where it occupied 76th place in 2021, compared to 81st place in 2018, and advanced 35 places in the Energy Transition Index. Environmental sustainability, which ranked 42nd in 2021, compared to 77th in 2015.
- Egypt has **become one of only 5 countries in the Middle East and North Africa that accounts for three quarters of the expansion of the absorptive capacity of renewable energy sources**, which is expected to double during the next five years according to the International Energy Agency. Moreover, Egypt has become the third Arab and the first in North Africa in the expected growth rate of the absorptive capacity of renewable energy sources in the next five years "according to the International Energy Agency", which expected to grow the absorptive capacity for renewable energy in Egypt by 68%.

### **8. The international Vision towards the Egyptian efforts in the field of Renewable Energy and Green Economy:**

**In 2021, British Petroleum** ranked Egypt as the first Arab country in generating renewable energy with a capacity 10.5K GW, while Morocco had a capacity 6.9K GW, the UAE 5.2K GW, the KSA 0.8K GW, Algeria 0.7: GW, Iraq and Oman 0.4K GW and Kuwait and Qatar 0.1K GW.

**“Fitch”** expected strong growth in the renewable energy sectors compared to 2021, as it expects the growth rate of electricity generation from renewable energy sources (other than hydropower) will reach 13.9% in 2021, compared to 22.6% in 2022 and 23% in 2023. As well as that Egypt will be one of the fastest-growing non-hydroelectric renewable energy markets in the region over the next 10 years. Moreover, it expects that Egypt will enhance its competitiveness and become an attractive destination for investors in



renewable energy sources because of the Egyptian state's support for the potential of solar and natural wind energy.

**Fitch stressed that** electricity exports and green hydrogen projects will drive the long-term growth of the Egyptian energy sector, and Egypt's surplus of energy supplies will remain high within the next 10 years, as the Egyptian State prioritizes to investing in new electrical interconnection projects in order to become a regional center for electricity supply. Moreover, it stressed that the current electrical interconnection plans will enhance its view of the growth of Egyptian electricity exports, including the interconnection projects between Egypt, Greece and Cyprus, which will provide a reliable source of electricity from Egypt to the interconnected European Network across Greece.

**In a related context, the International Energy Agency stressed that** Egypt has realized the opportunities provided by relying on renewable energy sources with its integrated strategy 2050, which seeks to ensure energy security, stability, and sustainability, and Egypt's renewable energy projects reflect its determination to turn this vision into reality. It added that Egypt has achieved remarkable progress in developing effective policies and regulatory frameworks to enable and employ renewable energy sources. As well as gaining experience in implementing a wide range of projects, especially those related to electricity generation from solar and wind energy.

**The International Energy Agency pointed out that** the electrical interconnection project between Egypt and Saudi Arabia will allow the exchange of up to 3,000 megawatts of energy, as the project is the first of its kind in the Middle East and North Africa.

**Bloomberg explained that** Egypt has advantages as a producer of renewable energy, and is trying to exploit them in addition to its electricity surplus to become a regional center for electricity exports, considering the signing of an electricity interconnection agreement by Greece and Egypt is the first agreement of its kind between Europe and Africa in the southeastern Mediterranean.

**Oxford Business Group highlighted** Egypt's planning to maintain surplus power generation capacity enabling it to increase its exports to neighboring countries, where several interconnection agreements have already been concluded with Saudi Arabia, Sudan, Cyprus and Greece.

## **9. Conclusion:**

The world's countries are currently paying great attention to economic and technological development and growth, and the ability to achieve this goal, but not at the expense of environment in which we live, as the traditional energies like petrol, coal and gas, have only destroyed the environment. Therefore, the solution to maintaining the pace of economic and technological growth while preserving the environment is to resort to other sources of energy that do not negatively affect the environment, like solar energy, water energy and wind energy.

The Egyptian state has not been immune from keeping pace with these global developments; especially it is among the countries most affected by climate change.

## **10. Recommendations:**

- Accelerating the transition to renewable energy is important, as it is important to raise awareness about the importance of the transition to the use of renewable energy and work to expand this use by drafting legislation that stimulates investment in the renewable energy industry and encouraging private sector investment in renewable energy projects by providing loans at low interest and reducing fees and taxes on green energy technologies.
- Encouraging collaboration in interdisciplinary research in the fields of energy while raising awareness among members of the society, by organizing intensive campaigns on energy maintenance and environmental sustainable.
- Ensuring national hydrogen strategy prioritizes the national development while protecting Egypt's economic and political dominance as it is the largest economy in the Middle East. Therefore, the development of hydrogen in Egypt is vital and will include addressing some issues, such as the modernization of existing technologies to provide hydrogen at a reasonable price. Moreover, the national strategy shall be developed based on further investigation and evaluation in 3 main fields: global energy knowledge, blue hydrogen from natural gas, and green hydrogen from renewable sources.
- Supporting creative ideas in the fields of renewable energy by the state and private sector, in order to reduce the gap between research activities and applied reality.
- Reducing energy consumption in buildings through modern energy systems.
- Using highly efficiency means of energy storage.

- Using saving technologies in seawater, rain and drainage treatment.
- Expanding the use of renewable energy systems for various tourism projects, especially pumping and desalination of water as it consumes great amounts of energy.
- Encouraging investment in projects and works related to new and renewable energy, of an economic nature that contribute to the process of sustainable development.
- Using solar energy systems in remoting villages and agricultural areas, to reduce the costs of transporting fuel needed to produce the electrical energy.
- Increasing attention to media awareness to educate the society about the importance of the role of metro, trains and Eco-friendly means of transportation in raising the level of traffic safety, enhancing air quality, protecting and improving environment, and protecting the huge gains of infrastructure.
- Developing incentive policies for the success of public transportation projects and reduce the use of private cars, including: the ticket prices are affordable for all society's segments, facilitating the use of Eco-friendly public transport, strict commitment to preserve environment, and imposing fees on those who pollute the environment.
- Learning from the international experience, as Egypt can benefit, for example, from the German experience of temporary state support for solar energy, which contributes to increase the use of solar roofs, as well as encouraging the use of solar air conditioning through the banking system, like in case of German Development Bank. In addition, Egypt can learn from German financing methods and economic policies, including carbon emissions certificates and tax incentives.
- As Egypt has a plan to abolish gradually fossil fuel subsidies, the legislation can focus on directing the subsidies to renewable energy sector known as Green Subsidies, to promote the transition to net-zero carbon emissions, as the green support is a unique type of financial incentives and tax tool aimed at improving the quality of environment and natural resources. In 2017, the International Renewable Energy Agency estimated green subsidies at around \$ 167 billion, while the EU countries have received about 54% of total green subsidies, followed by the USA (14%), Japan (11%), China (9%), India (2%), and the rest of the world with 9%. This support should be directed to develop the energy-efficient technology and green energy to reduce the impact of carbon dioxide emissions.