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Original research

Environmental assessment of industrial development plans in Suez Governorate through energy sector indicators using the DPSIR model.

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Abstract:

The problem of the research was the absence of systems of environmental indicators for the various environmental sectors, despite the importance of the existence of systems of environmental indicators, which are the most important mechanisms and tools that contribute to achieving sustainable environmental management globally, and development indicators serve many purposes, It measures and tracks the rate of achievement in the implementation of development strategies, policies and programs, and it provides the decision-maker with comprehensive and integrated information about a truth or fact, In the reality of sustainable urban development, however, there are no specific systems for environmental indicators to assess the environmental and development performance of the various environmental sectors. The research aims to identify the environmental indicators for the energy sector appropriate to the Egyptian case so that these indicators can be used as a tool for evaluating industrial development programs in Suez Governorate. The research carried out a set of methodological steps in order to be able to achieve the main objective of the research and come up with the results of the research, which were represented in first: determining the indicators of the energy sector for the Egyptian case, secondly determining the interrelationships of the indicators of the energy sector using the DPSIR model, and thirdly evaluating the environmental performance of the sector and industrial development programs in Suez Governorate Through the previously identified energy sector indicators, determining the interrelationships of the energy sector and industrial development programs in Suez Governorate using the DPSIR model.

Key words
Environmental indicators, energy sector, environmental assessment, industrial development programs, DPSIR model.

1- Research Methodology

The research carried out a set of methodological steps in order to be able to reach the main objective of the research, as shown in fig1.

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In the first step, the research studied the environmental indicators of the energy sector. secondly The researcher studied environmental models to measure indicators, then the researcher chose the DPSIR model as one of the most suitable environmental models for research, then the researcher studied the interconnected relationships of the energy sector using the DPSIR model in the Egyptian case. Through the indicators of the energy sector previously identified, with access to determine the interconnected relationships between the energy sector in Suez Governorate to achieve industrial development in the governorate.

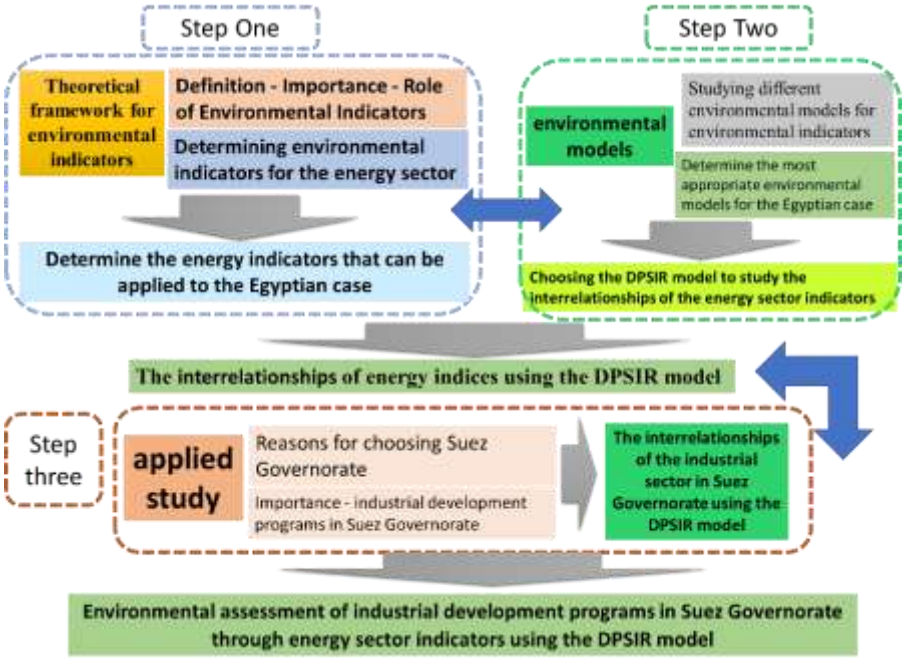


Fig 1 Research Methodology

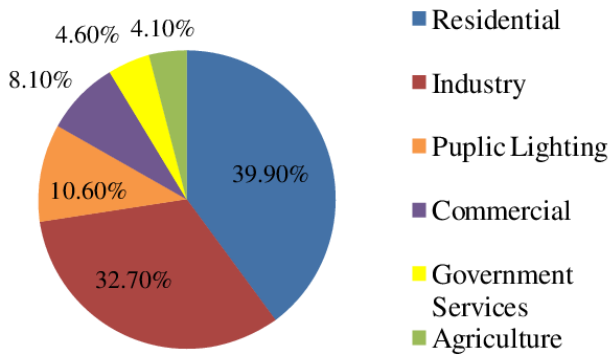
2- Introduction

The industrial sector is one of the most important sectors in the Egyptian economy due to its ability to drive production and increase the rate of economic growth, in addition to being one of the main sectors that provide employment opportunities and contribute to solving the problem of unemployment, in addition to its ability to diversify sources of income and contributes to increasing the domestic product. The growth of the industrial sector leads to an increase in the level of productivity because the industrial sector is one of the sectors most able to apply the use of modern technology and technology, and this contributes to raising productivity, and the industrial sector also contributes to providing foreign exchange resources and treating the problems of the balance of payments deficit.

Industry is the world's largest user of energy, and growth in industrial energy use would have been even higher had it not been for reductions in industrial energy intensity. (industry, 2011)
The vision of the industrial development strategy in Egypt is represented in "industrial development being the locomotive of sustainable, inclusive economic growth in Egypt, meeting local demand and supporting export growth, so that Egypt will become an effective player in the global economy and able to adapt to global changes." This vision stems from the vision of the

economic axis and the strategy of Sustainable development: Egypt's Vision 2030, which is represented in: "The Egyptian economy should be a disciplined market economy characterized by stable macroeconomic conditions, capable of achieving sustainable inclusive growth, characterized by competitiveness, diversity and knowledge-based, so that Egypt becomes a significant player in the global economy, able to adapt to Global changes by creating a supportive climate for sustainable inclusive growth based on knowledge, competitiveness and diversity that allows maximizing added value and providing decent and productive job opportunities. From this strategy emerge sectoral strategies targeting the industrial sectors, and others specialized in topics such as the energy rationalization strategy, given the importance of the energy sector in industrial development. (Industry, 2020)

The importance of the issue of energy consumption in the industrial sector also comes in light of the sustainable development strategy currently adopted by Egypt, which aims to expand a number of industrial projects within the major national projects, which require securing the necessary energy sources in all its forms, which contributes to increasing The growth rate of the industrial sector and raising its contribution to the GDP.



Source: (Renewables, 2020)

Fig 2 The proportional distribution of electrical energy consumed

The industrial sector is one of the sectors that consumes the most various sources of energy, as this sector comes in second place with regard to the consumption of petroleum products and natural gas with 16%, after the electricity sector, which consumes 44% (Renewables, 2020), as shown in fig2.

From the foregoing, given the importance of the energy sector and its role in achieving the development of the industrial sector, it was necessary to have systems of environmental indicators that contribute to the assessment of the environmental performance of this sector, and in this context, the importance of the existence of systems of environmental indicators, which are the most important mechanisms and tools that contribute to achieving globally sustainable environmental management, It is one of the effective mechanisms for measuring the targeted progress of urban communities at their various levels towards the desired results of sustainable development, On the other hand, these indicators, in their entirety, represent a solid and realistic ground for the process of making an efficient development decision. In terms of their effectiveness in development measurement, they provide a normative or quantifiable normative

conception, It gives a clear picture of its developmental status, and in terms of its efficiency in the decision-making process, through which it is possible to follow up on periodic changes, to achieve real and meaningful improvements, Where these indicators are reflected on development decisions and work to guide them in the right path through a methodology to guide the environmental management of urbanization, it is the framework that combines the process of planning, implementation and evaluation, It delineates the role of the planning team, defines its objectives, puts forward the priorities and needs that direct it to the type of plans required and achieve development goals, Hence the importance of environmental management of urbanization and the role it plays in achieving sustainable development goals, as plans cannot be implemented without an effective and sustainable environmental management of urbanization. (Mostafa, 2008)

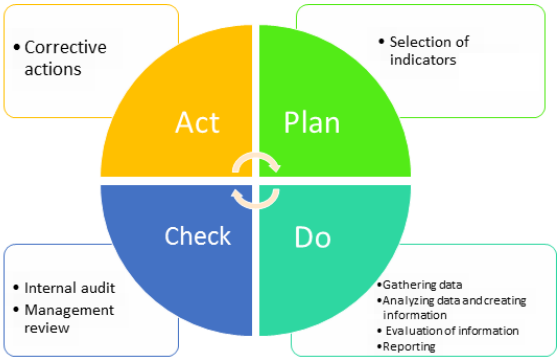
There is a global trend by international and regional bodies such as the United Nations and the European Group to prepare a set of environmental indicators, In addition to the 2015 global sustainable development goals related to research, the Arab countries (ESCWA) in response to global trends have prepared their own indicators on sustainable development since 2001, developing indicators in the field, Environmental indicators are a summary and simplification of information through qualitative and qualitative data that are collected, tabulated and analyzed for different years with the aim of evaluating the performance and achievements in order to identify the differences in knowledge.

The research adopted the causal framework of one of its global systems, which is the DPSIR system, the latest global systems and the most widely used of them in environmental organizations and indexes (for assessments), In order to formulate a reference framework for defining environmental indicators to achieve the stages of sustainable management and guiding the environmental assessment of urban development programs). It is based on five packages of environmental indicators and the interrelationships between those packages to solve environmental problems, which are the driving force indicators, pressure indicators, status indicators and influence indicators. (OECD, 2003) (Forum, 2005)

1. The importance and role of environmental indicators in environmental assessment

Indicators are measures that directly or indirectly reflect the quality of environmental conditions and are used to evaluate the state of those conditions and their variables, These variables may refer to the causes and pressures resulting from human or natural activities affecting the environment, the ecosystem, the condition or status of natural resources, and the responses of society to reduce that pressure, Perhaps one of the most important characteristics of indicators is their sensitivity and measurability, simplicity and interpretation, and their predictability, And then, it helps in planning and decision-making, meaning that it is of political relevance, and the indicator must be of importance to the community as it helps to quantitatively evaluate the situation and monitor the monitoring of monitoring, Presenting them in a framework that is directly related to the problem being addressed, and thus helps decision-makers to use indicators in planning, setting priorities, evaluating policies and options, and comparing their reflections on the environment, in addition, can be a means of early warning to decision makers and to the general public of potential or expected environmental problems.

The importance of environmental indicators comes from being the most accurate and appropriate measure to express the occurrence of a particular environmental phenomenon and the change that occurs on that environmental phenomenon over time, It is also used to compare environmental



Source: (Academy, 2022)

Fig 3 The role of indicators in the environmental management cycle

phenomena in different geographic areas to evaluate the performance of the urban environmental management system to the extent of achieving its objectives, which gives decision makers the ability to evaluate the correct progress, as shown in fig3.

The role of environmental indicators is clear at the stages of the environmental management cycle to assist in making political decisions, The indicators clarify the problems and the relationship between those problems and the political decisions in the stage of evaluating the current environmental conditions, Monitoring is also part of the environmental management cycle that refers to the messages provided by indicators, and data monitoring and rely on data collection to provide inputs (CSIRO, 2004)

The use of environmental indicators is one of the pillars of the Integrated Environmental Assessment (IEA), which aims to identify the state and trends of the environment based on the data and indicators of the processes, In addition to the weariness of environmental policy analysis and its repercussions on the state of the environment or future scenarios and their impact on urban development plans and programs.

2. Global Initiatives for Environmental Indicator Systems

Global models of environmental indicators are logical structures through which environmental indicators are identified and developed, Models help to clarify and focus on what can be measured and what can be expected from the measurement, which were drawn from current data to develop indicators.The methodological frameworks link the environmental indicators by introducing a set of indicators and statistical models, To come up with an analysis of the case study and its impact on the external environment with the existence of mechanisms for environmental accounting and from here we prioritize the desired goals, Which comes out with decision-making and environmental policies oriented towards the environment, and then achieve the correct environmental management.

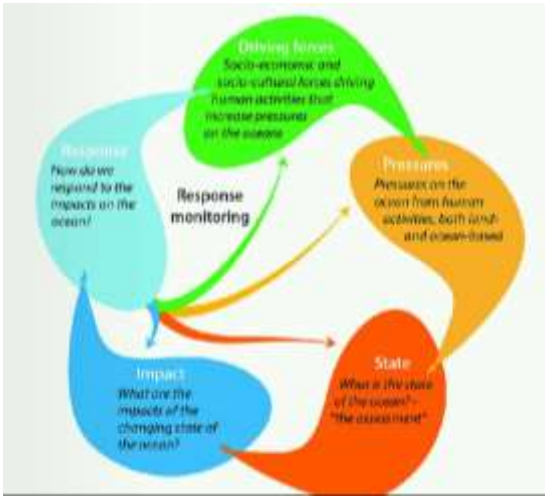
In response to global trends to achieve environmental sustainability, many international organizations have monitored and evaluated environmental indicator, the most important of these global initiatives is the (UNEP, EEA, UNCSD, WEF, OECD), and for each organization that monitors or evaluates environmental indicators, according to a model of environmental

indicators, to achieve policy indicators, several activities are needed. Monitoring and evaluating indicators to achieve the policies and objectives set by those organizations, to enable them to improve their environmental performance and progress towards achieving SDG goals. One of the most famous organizations for monitoring and evaluating environmental indicators is the Organization Economic Cooperation (OECD) for Cooperation and Development, which has identified 18 main environmental indicators (Press-State Models-Re-Ponse-Presse-30) by application and application, One of the most famous organizations for monitoring and evaluating environmental indicators is the Organization Economic Cooperation (OECD) for Cooperation and Development, which has identified 18 main environmental indicators (Press-State Models-Re-Ponse-Presse-30) by application and application, The World Economic Organization, in cooperation with the Yale Center for Environmental Laws and the Columbia University Center, issued the Environmental Sustainability Index (ESI), Which has been applied to 164 countries using the Pressure-State-Response (PSR) model, in addition to issuing the Environmental performance Index framework. It was applied to 133 countries using DSPS-causal model.

The comparison between these initiatives showed that the most widely used methodological framework among global initiatives for monitoring and evaluating environmental indicators is the causal framework using the DPSIR model, which is based on data-based indicators. This model is considered the most successful model for monitoring and evaluating environmental indicators because of its importance in highlighting the relationship between cause and effect for policy guidance.

3. DPSIR model

There are many global models of environmental indicators, including the Capital Accounting Framework, the Causal Framework, the Issue-based, goal-oriented or thematic framework, the Sectoral or domain framework, the Urban model framework, and the Component System environmental framework.



Source :((EEA), 2001)

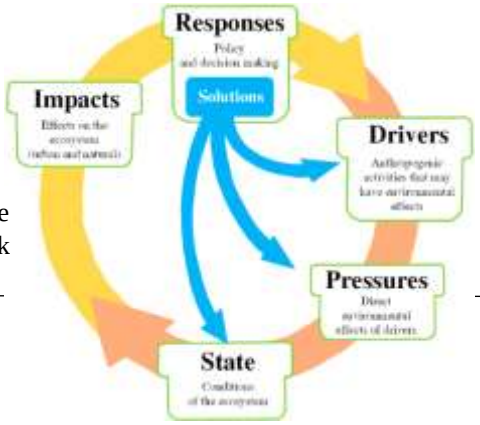
Fig 4 DPSIR System (Drivers - Pressure - State - Impact - Responses)

Several developments were issued for this model until the issuance of the Driving force-pressure-state-impact-response (DPSIR) system model, which was adopted by the European Environmental Agency (EEA) (Eurostat, The EU Sustainable Development Strategy - A

Framework Indicators, 2004, As a system of indicators for assessing and managing environmental problems to describe the interaction between the environment and society, this framework is based on five elements, which are: The fig4 shows that the DPSIR system is based on a set of:

D ... Driving force indicators These are the driving force indicators that guide the urban development process and the resulting decisions and policies, and others, Thus, we were able to identify the priorities of the forces affecting development and the real direction to sound decisions when setting the appropriate strategy to enable sustainability in its development plans.
P.... Pressure indicators: Pressure indicators in this matrix are interpreted as the pressures resulting from human activity (industry, agriculture....) on the environment, that is, they represent the sustainability issues that are generated from the resource use.
S....State indicators: State indicators refer to the changes that occur in the natural environmental state as a result of the unsustainable use of the environment from the presence of human activities of the population that stress its condition.
I... Impacts Indicators: Indicators mean the impacts on the environment due to changes in the environmental state, and include such impacts on the human health and human ecosystem and human health.
R... Response indicators: Response indicators mean that the actions taken by the entities that are most affected by the changes that occur in the environment, by taking measures to restore what happened to the environment by human activities and development patterns, Through several axes to respond with technological, political, legal or institutional indicators to control the links within and between indicators of driving force, pressure, status and influence, The DPSIR model represents a detailed framework for monitoring environmental issues and developing policies aimed at resolving those issues through monitoring and analyzing the relationships between the variables of the DPSIR model and dividing them into two parts. (al, 2011) The fig5 Describes the elements of (DPSIR) indicator system.

This framework is the most recently used framework for linking environmental indicators to achieve progress in environmental performance, ie, achieving healthy sustainable environmental management for urbanization, and then reaching the sustainable development goals of sustainable development (SDG), And understanding the pressures resulting from human activities and identifying them, their effects and the changes they cause in the environment, and then the societal responses that aim to address those impacts, and reduce pressures on the environment and the environment. The DPSIR framework usually does not use indicators of sustainable development as they are, but rather identifies and classifies indicators according to pressure forces, environmental conditions, impact and reactions in response to achieving sustainable



Source : (Eurostat, The EU Sustainable Development Strategy – A Framework Indicators, 2004)

Fig 5 Describes the elements of (DPSIR) indicator system

development.

4. Industrial development programs in Suez Governorate

4.1- Reasons for choosing the governorate of Suez (the relative importance of the governorate)

Suez Governorate is located in the northwest of the Gulf of Suez and at the southern entrance to the Suez Canal is bordered by the Ismailia Governorate to the north, To the south is the Red Sea Governorate, to the east are the governorates of North Sinai, South Sinai and the Gulf of Suez, and to the west are the governorates of Cairo and Giza, as shown in fig6. The area of the Suez Governorate is about 21,9002 km2, or 5,2142 thousand feddans, representing 2.11% of the total area of the Suez Canal region and approximately 9.0% of the total area of the Republic.

Fig 6 Suez Governorate location

The Suez Governorate is rich in minerals and wealth, especially petroleum and quarry products from Wadi Hajul and Jabal Al-Jalala. Therefore, many industries are endemic to the Suez Governorate, such as cement manufacturing and … etc., And the products of the Suez Governorate are mostly exports that are added to the total domestic product and the improvement of the trade balance in favor of Egypt, in addition to industry The government and the public sector are among the most important service sectors for the local economy, and the presence of ports, tourism and the Suez Canal are all of the non-commodity, productive service sectors that play a role in the local economy, They all play a pivotal role in the development of Egypt, and the production of electric energy and the role of the three stations in the export of energy outside Suez and the Republic . (Environmental, 2005-2022)

- From here, Suez Governorate was chosen for the following reasons :
- As one of the environmental patterns of the Egyptian case, and with the different environmental characteristics that exist, there is a difference and diversity in the urban development programs
- Suez region is an international gate according to the national plan 2052
- The state directs investments in the Suez region
- There is a diversity in urban development programs between industry, tourism and agriculture.
- Availability of data about the state of the environment

4.2- Industrial development programs in Suez Governorate:

The urban development strategy of Suez Governorate focused in light of the general objectives on the industrial sector: (Suez, 2008)

Industry, mining and petroleum sector: It is the main sector in which the governorate enjoys a large comparative advantage by adopting the concept of concentrated spread of industrial settlement - Within the framework of the national spatial strategy – with the establishment of industrial zones with integrated services, while emphasizing balanced development at the level of the main industrial groups (industrial industries) Enhancing its export orientation and providing its service and marketing requirements, which leads to spontaneous growth in all activities related to it, and consequently an increase in the total national, regional, gender and national product.

The transformational, handicraft and handicraft industries sector: Where there is a strong basis for some of them in the governorate in terms of diversity and spread, in particular, which has an increasing demand from the sectors.

4.3- The pressures of industrial development programs affecting the deterioration of the environmental situation in Suez Governorate

Industry and mining: It is considered a key sector in the economy of Suez, as the governorate produces many petroleum products and fuels, Many building materials such as dolomite, tooth, cobble, and marble are also produced, and many main industries such as cement and fertilizers are endemic to the governorate, all of which have voracious production activities for commercial, industrial, and industrial resources, Whereas, most industrial emissions contain sulfur oxide, suspended particles, hydrocarbons, nitrogen oxides, and ammonia, in addition to carbon oxides and other dusts.

4.4- Impacts of industrial development pressures on the state of the environment and on human health:

Industrial pollution: The existing industries in Suez have a severe impact on the environment and public health, for example, lead foundries cause large amounts of total particulate emission , Which contains sulfates, oxides of lead and other metal oxides, in addition to carbon 33 minutes, and the industry produces many solid or liquid pollutants, including a threat to the health of the environment.

Air pollution: More than 15 million Egyptians residing in crowded cities are exposed to high levels of pollution from dust and smoke, for example, the total suspended particulate matter that exceeds the standards of the Organization 4 of the Regulations 19, Depending on the size of these particles, they affect vision as well as respiratory functions .

Water pollution: The random discharge of human waste into waterways has generated major pollution problems with serious health implications, The analysis of random samples collected from emptied sewage in wastewater treatment plants indicates a high percentage of violating the criteria established in the executive regulations of Law 44 of 1999, Industrial wastewater is the main source of heavy metals that stick to the deposited particles, Economic problems: the failure of markets, institutions, and public policies to provide incentives for economic and investment incentives is the real main factor that explains most environmental problems, and therefore government policies can have deliberate and other spontaneous effects, and appropriate and cost-effective government intervention can have a positive effect, Without imposing rules on new

activities in tourism development in order to save natural resources and preserve Egypt's antiquities, the tourism industry will surely lose out on tourism losses, There must also be rules and control over the use of pesticides and chemical fertilizers, rationalization of water use and improvement of other conditions for cultivation.

4.5- Defining criteria for choosing environmental indicators to guide the environmental assessment of the industrial development program in the Suez Governorate

A set of criteria has been developed to determine the selection of environmental indicators that can be applied to the governorate of Suez to guide the environmental assessment of industrial development programs

- Achieving the indicators for the objectives of environmental management in line with the industrial development programs for the 2030 SDGs
- Availability of data, information sources and stakeholders
- Environmental characteristics (characteristics of the aquatic environment - characteristics of the terrestrial environment - the aerobic environment)
- Periodicity of the indicator
- Type of activity (industrial-agricultural-touristic)
- Input activity into the production process (use of water, use of natural resources, such as non-renewable energy and materials, electricity)
- The outputs of the activity in the production process and its impact on the environment (what it produces in terms of emissions, and wastes)

5- Results

1. Determining the environmental indicators of the energy sector:

Energy resources are essential in all sectors of urban development, especially the industry and transportation sector, despite that, the effects of its production, distribution and use on the environment are greatly increasing, The presence of some industries consuming energy in the world has led to a large increase in per capita energy consumption during the past decades, and it can be challenged to find a way to harmonize between the need and the stimulus and the environmental need, In this direction, indicators were chosen that reflect energy consumption in urban development, energy production and reserves, in addition to indicators of emissions resulting from consumption, especially the agricultural sector, The following is a presentation of the most widely used and well-known global indicators:

1. Energy Renewables indicator
2. Energy development indicator
3. Energy sustainability indicator
4. Energy risk security indicator

2. Energy Indicators that can be applied to the Egyptian case:

A set of criteria has been developed to determine the selection of environmental indicators that can be applied to the Egyptian case from:

- Availability of data, information sources and stakeholders .
- Periodicity of the indicator
- Achieving indicators for environmental management objectives

- Directed by the current global and local legislative frameworks associated with the achievement of the indicator

In the next part, the environmental indicators of the energy sector that can be applied to the Egyptian case will be identified as one of the pillars of the proposed methodological framework in accordance with the standards that have been set and that aim to achieve successful implementation:

2.1 Energy Renewables indicator

Definition of the indicator: This indicator expresses the total use of alternative/renewable energy including wind, sun, biomass, geothermal, water or other renewable sources of your total consumption. (Agency, 2015) Objective and importance of the indicator: It reflects the availability and identification of priorities and policies of renewable/alternative energy sources, In addition to identifying the best sources of renewable energy that can be invested in, the indicator consists of two sub-indicators: priorities of renewable energy, financing. (Agency, 2015)

:Prioritization of renewables

- Share of renewable energies in total energy consumption
- The amount of energy generated from renewable energy sources
- The total primary energy supply

Financing Renewable Energy Resources

- Total bank financing for renewable energy sources annually
- Total cost and availability of funding for urban development programs and projects
- Renewable Energy Selling Policies

2.2 Energy utilization indicator

Definition of the indicator: This indicator measures the total energy consumed in the various uses of residential, commercial, agricultural and industrial uses, This indicator deals with energy use, the efficiency of its use, and energy-using sectors. (Sunday Olayinka, 2012) The following table also shows the purpose and importance of the indicator: This indicator shows the quantities of energy used in the various urban development sectors in view of the energy resources of all sectors of industry, agriculture ... etc. Which gives a complete picture of the various uses of energy sources and the quantities of energy required for each activity, which guides decision makers to take sound decisions. (Sunday Olayinka, 2012)

Energy intensity: the amount of energy required per unit of production or activity of GDP **.**

Energy Consumption

- annual energy consumption Per capita
- The amount of energy used in the agricultural sector
- The amount of energy used in the industrial sector
- The amount of energy used in the transportation sector
- Total energy-intensive industries
- The amount of energy used in the domestic sector.

2.3 Energy sustainability indicator

Definition of the indicator: This indicator measures the ability of countries to provide sustainable energy through three dimensions: energy security, energy equity (access and affordability) and environmental sustainability. (Council, 2013) The purpose and importance of the indicator: This indicator is used to assess the sustainability of energy policies and to understand the impact of policy making on achieving a sustainable energy future. (Council, 2013)

Energy Security

- The ratio of total energy consumption to production
- Percentage of fuel exports from GDP
- Diversity of sources of electricity generation
- The amount of energy produced from fossil fuels
- Proven reserves of fossil fuels
- Self-sufficiency in terms of energy resources, power supply and/or power generation
- Efficient transmission and distribution of energy sources

Energy equity: the financial ability to bear the costs of connecting electricity and gas

Environmental sustainability

- Total primary energy use densities
- CO2 concentration
- Total pollutants in air and water
- governance
- effective government

2.4 Energy risk security indicator

Definition of the Indicator: An annual energy risk index that uses measurable data and information about historical trends and government expectations to determine policies and other contributing factors. The index provides a retrospective view of energy security that policy makers and energy professionals can use to track shifts in energy security over time and to assess the potential cost implications. Objective and importance of the indicator: This indicator provides an understanding of energy security risks, and hence provides insights into market conditions, policies and other events that affect energy security. The indicator has economic and economic dimensions. The indicator is measured through a set of indicators for sub-topics that achieve the indicator: energy intensity, imports, exports, tunnels. (Energy, 2016)

Energy use intensity

- Annual per capita energy consumption
- Quantity of primary energy used in the local economy from GDP
- The amount of energy used from fossil fuels in the local economy from the total output
- The total amount of energy used in the transportation sector per capita per year
- Percentage of total electrical energy generated from renewable energy sources

Imports: net imports of primary energy

tax:

- Implicit tax rate on energy
- The ratio between tax revenue for energy and final energy consumption

Expenditures: the total expenditures of the residential sector on household energy

Price:

- The annual and average change in crude oil prices over a period of three years
- The annual and average change in crude oil prices over a period of three years

Environmental:

- Amount of co2 emissions per capita (energy-related)
- Amount of CO2 emissions to GDP

2.5 Energy development indicator

Definition of the indicator: The International Energy Agency issued the Energy Development Index in 2015. It measures the total per capita commercial energy consumption and the share of commercial energy from total commercial use to commercial use. Objective and importance of the indicator: This indicator shows the role of energy in development and assessment of energy use patterns, It first assesses the contribution that energy makes to the economy, sustainable development and the achievement of the Millennium Development Goals by the year 2015 to alleviate poverty, the relationship between the human development indicator and the developmental indicator. (Agency, 2015)

Power distribution:

- consumption of electrical energy Per capita
- Residential Electricity Consumption Per Capita
- The share of the use of electric energy from the total use of electric energy
- The share of renewable energy sources from the total energy use of the development sectors (residential sector, agriculture,...)
- Percentage of the population with access to electricity

Pollution:

- The amount of greenhouse gas emissions, according to the sources
- Average distance traveled per person by means of transportation
- Kilometers traveled / per car / per person
- Fuel for the consumer / type of transportation / fuel

3. The interrelationships between the environmental indicators of the energy sector using the DPSIR model.

Environmental indicators systems are automated that have been used in the research to achieve sustainable environmental management of urbanization, and this can only be done through a system of indicators linking the environmental indicators of the energy sector in the energy sector, In addition to clarifying the interrelationships between environmental indicators through the DPSIR system of indicators (motive force indicators - pressure indicators - status indicators - impact indicators - response indicators), What is appropriate for the Egyptian state of the energy sector to understand the current situation and future responses from indicators to environmental problems with regard to the energy sector, The following table also shows that the type of environmental indicators appropriate to the Egyptian situation within the DPSIR system has been clarified, such as driving force indicator - pressure indicator - condition indicator - impact indicator - responsive indicator, Hence, we are able to understand the relationships at the sector level between packages of indicators, which helps decision makers to guide decisions to achieve sustainable management of the energy sector.

Table 1 the interrelationships between the environmental indicators of the energy sector using the DPSIR

Response indicators	Impact	State indicators	Pressure indicators	Driving forces indicators
The total primary energy supply	Total pollutants in air and water	co2 . concentration	The amount of energy required for each unit of production or activity of GDP	The ratio of total energy consumption to production
Policies for selling renewable energy	Percentage of the population with access to electricity	Annual change in the amount of co2 . emissions	Annual per capita energy consumption	Percentage of fuel exports from GDP
Diversity of sources of electricity generation	Average distance traveled per person by means of transportation	The amount of greenhouse gas emissions, according to the sources	The amount of energy used in the agricultural sector	Share of renewable energies in total energy consumption
Self-sufficiency in terms of energy resources, energy supply and	Kilometers traveled / per car / per person		The amount of energy used in the industrial sector	The amount of energy generated from renewable energy sources
Efficient transmission and distribution of energy sources			The amount of energy used in the transportation sector	Total bank financing for renewable energy sources annually
Governance			Total energy-intensive industries	Total cost and availability of financing for development programs and urban development projects
effective government			Total primary energy use densities	The total primary energy supply
Percentage of total electrical energy generated from renewable energy sources			Annual per capita energy consumption	Policies for selling renewable energy
Fuel for the consumer / type of transportation / fuel			Quantity of primary energy used in the local economy from GDP	Diversity of sources of electricity generation
			The amount of energy used from fossil fuels in the local economy from the total output	The amount of energy produced from fossil fuels
			The total amount of energy used in the transportation sector per capita per year	Proven reserves of fossil fuels
			The total expenditures of the residential sector on household energy	Self-sufficiency in terms of energy resources, energy supply and .....
			The amount of energy-related co2 emissions per capita	Efficient transmission and distribution of energy sources
			Amount of co2 emissions to GDP	The financial ability to bear the costs of connecting electricity and gas
			Per capita consumption of electrical energy	Percentage of total electrical energy generated from renewable energy sources
			Per capita electricity consumption in the residential sector	net imports of primary energy
				Implicit tax rate on energy
				The ratio between tax revenue for energy and final energy consumption
				Annual change in average and crude oil prices
				Real Gross Domestic Product (US$ per person)
				Share of electrical energy use in total energy use
				The share of renewable energy sources from the total energy use of the development sectors (residential sector, agriculture....)
				Fuel for the consumer / type of transportation / fuel

Source: The author

4. Environmental indicators for achieving sustainable urban management will be determined by application to industrial development programs given:

Due to the relative importance of industrial activity within the framework of the comprehensive development of the region, industry is considered one of the most important economic sectors through which it is possible to make radical changes in the Egyptian society, both economically and socially, As the industry contributes to achieving optimal use of resources and maximizing the comparative advantages in all urban sites in the Egyptian world, In the Egyptian conditions, it is expected that the industry will play a major role in the economic life in the future due to the limited agricultural area, as well as the share of Egypt's water from the sources of the Nile, and the industrial sector plays a major role:

- It has strong front and back links with other important economic sectors such as agriculture and services. It has great potential to provide employment opportunities, especially in labor-intensive industries.
- An important means of transferring technology and attracting foreign direct investment.
- Providing great prospects for deepening the integration of the Egyptian industry with the global economy

It sets the ninth United Nations Sustainable Development Goal up to 2030 and is an important step forward to address global development by highlighting sustainable and inclusive industrialization and economic growth, The concept of comprehensive and sustainable industrial development is part of the ninth goal of sustainable development, which provides for the establishment of resilient infrastructure, stimulating inclusive and sustainable industrialization and encouraging innovation.

The industry and mining sector is considered a key sector in the economy of Suez, as the governorate produces many petroleum products and fuels, It also produces many building materials such as dolomite, tooth, gravel and marble, and many major industries such as cement and fertilizers are endemic to the governorate, all of which are voracious and polluting.

Industrial development programs in Suez Governorate are among the most important urban development programs, but it is necessary to identify environmental indicators for development programs that differ according to the characteristics and objectives of investment programs in the field of investment management, Hence, the necessity of having a system of environmental indicators that enables us to monitor, analyze and evaluate the various urban development programs in line with the ninth and eleventh goals of the 2030 Millennium Development Goals.

As will be clear from the following tables and figures used To identify environmental indicators to guide industrial development programs in Suez Governorate There is a difference within the sub-indicators in the main indicator packages according to the type of industrial urban development programs, according to a set of criteria that have been established for the possibility of defining them in a more systematic way.

By clarifying the packages of environmental indicators and the interrelationships at the level of the environmental sectors together, Through it, we can truly understand the urban development programs and what they represent of pressure on the environment in Suez Governorate, in addition to clarifying the gaps in the monitoring of the systematic periodic systematic indicators.

The following table shows the interrelationships of energy indicators and the industrial sector in Suez Governorate.

Table 2 The interrelationships of energy indicators and the industrial sector in Suez Governorate

Industrial Development Program				
Response indicators	**Impact**	**State indicators**	**Pressure indicators**	**Driving forces indicators**
The ratio of compatible transmission systems	Efficiency level	annual migration rate	The volume of emissions generated from different sources (industry - transport -...)	Diversity of sources of electricity generation
air quality monitoring	Environmental Equality of Distribution	The total area of terrestrial protected areas	Total acid emissions from different sources	Diversity of renewable energy sources
Financial resources to tackle climate change	Total carbon density	Total area of marine protected areas	Annual consumption rates of substances that deplete the ozone layer	Self-sufficiency in terms of energy resources
carbon tax	Noise measurement in different areas using L evening- L night- L day	Total gaseous emissions resulting from burning fuel (sulfur dioxide and nitrogen - nitrogen - volatile organic matter - suspended particles)	Total ozone concentration	Share of renewable energy in total energy consumption
health measures	The percentage of industrial waste that is disposed of by unsafe methods	Surface water discharge rate	The amount of primary energy used in the local economy	The amount of electricity generated from renewable energy
Monitoring Mechanisms	Proportion of population with sustainable access to improved water sources	Surface water quality (nitrogen concentration, dissolved oxygen...)	The amount of energy used from fossil fuels	Total bank financing for renewable energy sources annually
pollution max	Diarrhea morbidity in children less than 5 years old	Concentration of ammonia - phosphorous - nitrate - chlorophyll	The total expenditures of the residential sector in household energy	Total cost and availability of financing for projects
Maximum permissible concentration of toxic substances	The number of waterborne disease outbreaks	Sediment stock in waterways	Ratio of consumer spending to output	The financial ability to bear the costs of electricity and gas connection
emission standards	Percentage of the population with access to safe drinking water	Ground water quality	Total CO2 emissions per capita	Energy tariff
Emission scenario	Percentage of water samples whose specifications do not conform to the national standards (probable number of Streptococcus-Ecoli)	The total amount of emission of CO2	Discharge rate of cooling water loaded with chemicals, organic matter and toxic alkali	International climate policy to address climate change
National Climate Policies	Safe sewage coverage rate	Annual change in the amount of CO2 emissions	The amount of heat loads that are eliminated	National Climate Policy
Total treated sewage water	The percentage of solid waste that is disposed of by unsafe methods	Amount of greenhouse gas emissions by source	The amount of cooling water subjected to the suspended system to the amount of cooling water in the total activity	average carbon price
coastal area management	Failure to cover the available water resources for multiple uses (water deficit)	surface water quality	Use of organic solvents	air quality standards
Actions of countries in coastal areas	Total air and water pollutants	The total services provided by the ecosystem	The total amount of hydrocarbons from fuel annually in tons resulting from industrial activity	net imports of primary energy
international climate policy	Percentage of the	Total co2 emissions	Average industrial	Efficient transmission and

	population with access to electricity	from energy	exchange rates entering treatment plants m3/day	distribution of energy sources
Efficiency level	Kilometers traveled/car/per person	Total CO2 emissions from industry	Quantity of hazardous substances that enter industrial uses and the rate of their use	The annual amount of water withdrawn from surface sources and its proportion to the amount of available water
carbon swap	Concentration of pollutants in the atmosphere in urban areas	Total CO2 emissions from road traffic	Consumption of the industrial sector in relation to the total demand for water	The total water used by industrial facilities for cooling
Ecosystems (closed cooling system)	Mortality rate for all ages from respiratory diseases and cancer	total co2 emissions per year	The annual amount of water available from its traditional sources (rain - surface water)	Burning process efficiency
Determining fines for industrial violations		Total concentration of greenhouse gases	The percentage and quantity of liquid fuel used in the combustion process	The percentage and quantity of liquid fuel used in the combustion process
Thermal energy storage systems (combustion of fuel)		The concentration of thoracic particles with a diameter of less than 10 microns	Total water used directly or indirectly to produce goods and services that are consumed by humans	The annual amount of water available from non-conventional sources (seawater desalination.....)
Energy balance models to avoid burning (treatment of chimney emissions - replacement of liquid with natural gas - air control systems)		Nitrogen dioxide concentration	Total demand for water	Average per capita investment cost in the water sector
Quantity and percentage of treated industrial wastewater (cooling water and effluent circulation networks)		sulfur dioxide gas concentration	The total amount of wastewater from industrial activity	The limit of water security for industrial activity at the level of water rationing of activities
The capacity of dams to store rain to the total rainfall		The concentration of total suspended particles	The rate of depletion of water resources	The amount of industrial and sanitary sewage that is mixed with cooling water before it is drained
water governance		average temperature	The amount of energy required per unit of production or activity of GDP	Total amount of water lost by source
water policy		The area of current ecosystems	Total primary energy use densities	Percentage of water used by households to the total volume of available renewable water resources
The effectiveness of water quality monitoring networks		Number of endemic - threatened - weakly resistant species	Annual per capita energy consumption	The cost of producing a cubic meter of water for domestic use
water pricing		The number of species in each area unit and the number in the area of habitat	The amount of energy used in the industrial sector	Percentage of available renewable water resources that exceed environmental water needs
Quantities of treated and desalinated water			Total energy-intensive industries	Economic return on water consumption
General treated water volumes			The amount of energy used in the transport sector	Allocation of water resources
water resources management system			Average distance traveled per person by means of transportation	The ratio of energy consumption to production
Rationalize water consumption			The amount of energy used in the service sector	Ratio of fuel exports to GDP
Standards and procedures for water conservation			Per capita anthropogenic CO2 emissions	traditional energy resources

Effective Institutions			Total CO2 emissions according to consumption	The amount of energy produced from fossil fuels
Energy tax rate				Proven reserves of fossil fuels
The share of renewable fuels in the total energy use of the residential sector				Annual change in crude oil prices and average GDP
Spent fuel/Type of transportation/Fuel/Subsidy				spent fuel/type of transportation
The amount of electricity generated from renewable energy				The total primary power supply
sustainable energy management				
power purchase agreement				
energy storage systems				
thermal energy storage				

source: The author

As Fig. 7 shown the interrelationships between the packages of environmental indicators for the energy sector and the industrial development programs in Suez Governorate using the DPSIR model, which clarified the strengths of the packages of indicators that are monitored in a periodic manner and the shortcomings that need environmental monitoring to direct sustainable management in the right track.

Source: The author

Fig 7 The interrelationships of energy indicators and the industrial sector in Suez Governorate

By comparing the environmental indicators that were determined to guide the industrial development programs in Suez Governorate, a difference was found in the priorities of the main environmental issues that are affected and affect the urban development programs. We find that the industrial development programs water and energy are the most priorities that affect industrial development.

Conclusion:

It was necessary to develop a set of criteria consistent with the main objective of the research, which is to determine the environmental indicators of the Egyptian state to guide the sustainable management of urbanization, A set of indicators were selected, which are the most commonly

used indicators globally and appropriate to the Egyptian state of the energy sector, after they were audited through the criteria set by the researcher.

A set of main indicators expressing the total use of alternative/renewable energy, including wind, sun, biomass, geothermal, water or other renewable sources has been identified, Of the total energy consumption, it expresses the availability and identification of priorities and policies of renewable / alternative energy sources, in addition to identifying the best potential renewable energy sources that can be found.

A set of main indicators that aim to measure the total energy consumed in the various uses of residential, commercial, agricultural and industrial has been identified, This indicator deals with the energy use, the efficiency of its use, and the sectors used for energy, which gives a complete picture of the various uses of energy sources in the different sectors, as well as the range of quantities.

A set of key indicators that measure a country's ability to provide sustainable energy through three dimensions of energy security has been identified, Equity in energy distribution (access and affordability), and environmental sustainability to assess the sustainability of energy policies and understand the impact of policymaking on achieving the future.

A set of key indicators that indicate an understanding of energy security risks have been identified and hence provide insights into market conditions, policies, and other events that affect energy security.

A set of main indicators that refer to the role of energy in development and assessment of energy use patterns have been identified, It evaluates whether or not the contribution that energy makes to the economy, sustainable development and the achievement of development goals to alleviate poverty "the relationship between the human development index and the energy development index" Which is illustrated by the energy distribution indicators.

The environmental indicators that have been identified on the Egyptian case refer to the main themes related to the energy sector in the Egyptian case in terms of energy use, energy sustainability, and risks of energy security and capacity development.

A set of key indicators and sub-indicators were identified in the energy sector Five key themes were identified from Energy, Energy sustainability index, Energy risk security index Energy utilization, renewable energy index, development index, determining 15 sub-topics within the main themes and within them the indicators that are used for measurement.

Data related to those environmental indicators in the energy sector have been reached by many global and local organizations that periodically assess the environmental situation, such as World Bank and World Bank statistics, Statistics of the Ministry of Petroleum and Mining, statistics of the Ministry of Finance, statistics of the Ministry of Electricity, New and Renewable Energy, etc.

Packages of indicators have been identified for the energy and industry sectors that are the most familiar and discussed among global organizations, and its development as a guide that can be used, but with the difference in the Egyptian case, as a codification of those topics and indicators has been done through the development of a set of standards and objectives to choose them to suit the conditions of the case.

The interrelationships between the energy sector were clarified using the DPSIR model, Which indicates the necessity of having a system of indicators for monitoring, analysis and evaluation among the indicators in a more systematic, accurate and measured way to guide the environmental management of urbanization in the right direction towards sustainable development, Achieving environmental development returns from those current and proposed programs whose objectives is to achieve the SDGS2030 sustainable development goals.

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