

Energy efficiency and the promotion of renewable energies, the inevitable conditions for sustainable development: the case of Algeria

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Abstract:

The purpose of this paper is to highlight the importance of renewable energies and the efficient use of available energies to ensure sustainable development.

This study focuses closely on the particularity of renewable energies and energy efficiency in Algeria.

The results of this research confirm that enormous efforts should be spent to develop renewable energies and achieve energy efficiency in Algeria.

Keywords: renewable energy; energetic efficiency; sustainable development

JEL classifications codes: L72 ; L73

I- Introduction:

According to the report of the World Economic Forum 2020, we observe a clear progression of renewable energies, while the traditional fossil energy sources are less and less exploited. But we can also see that the place granted to the exploitation of natural gas and hydrocarbons is still important during the phase of transition towards a supply exclusively provided by renewable energies. In this context, renewable energies appear as an interesting alternative to preserve both the comfort of human beings and the quality of the environment.

The question of the study:

.How to ensure a successful energy transition by resorting to the promotion of renewable energies and the use of available energies in an efficient way to ensure sustainable development (SD)?

The hypothesis:

The successful energy transition is based not only on the promotion of renewable energies but also on the means of using the available energy in an efficient way.

Research objectives:

The objective of this research is to highlight the importance of the development of renewable energies to fight against greenhouse gas emissions. This is only one aspect of sustainable development in the field of energy. It also presupposes access to resources, without their depletion and without immediate or future damage to the environment, and access that respects equity.

Sustainable planning and development of the territory contribute to the protection and improvement of the environment, ensure energy independence, reduce the energy bill and make it possible to respect international commitments, particularly in the context of the fight against

climate change. It is all these advantages that encourage the promotion and development of renewable energy sources.

The importance of research:

The challenge posed to the energies of the future is therefore not only to cover energy needs but also and above all to avoid the production of toxic residues.

Substantial progress must be made on both fronts and on a global scale if we want to be able to reduce climate gas emissions to reasonable values and ensure sustainable development (DD

Methodology and work plan

1-Definition of key concepts and theoretical foundations

What is sustainable development and the energy transition?

What is Renewable Energy? What is energy efficiency and how do they contribute to SD?

2-state of play and particularity of renewable energies and energy efficiency in Algeria?

3-results and conclusion

II- The theoretical basis of the research:

1- I renewable energies

1 1- Definition of renewable energy:

Renewable energy refers to forms of energy whose rate of generation is equivalent to or greater than the rate of their consumption. (International Days on Desertification and Sustainable Development. .They are provided by the sun, wind, heat of the earth, waterfalls, tides or the growth of plants, their exploitation generates little or no waste and polluting emissions. These are the energies of the future. Today, they are under-exploited in relation to their potential

1-2- The different Renewable Energies sectors

1-2-1 Solar energy:

The term “direct solar energy” refers to technologies that draw their energy directly from the sun. Some renewable technologies, such as those based on wind power and ocean thermal energy, use solar energy after it has been absorbed on Earth and converted into other forms of energy. (Soporama, 2015)

Solar energy provides temperature conditions favorable to life and animates the water, wind and carbon cycles in the biosphere. But it can also be used directly to produce heat at different temperature levels for various

uses: heating and air conditioning of premises, drying of agricultural products, production of hot water and steam, production of electricity through thermodynamic cycles. The production of electricity can also be obtained directly by the photovoltaic conversion of solar energy by means of solar cells (also called solar cells: solar cell).

There are two types of solar energy:

a)- Solar thermal energy:

It is the transformation of the sun's rays into heat. This transformation into heat, and therefore into thermal energy, makes it possible to heat water or air and use them in different situations.

b) Photovoltaic solar energy

Sunlight can be transformed directly into electricity by photovoltaic panels, without rotating parts and without noise.

The electricity produced can either be stored in batteries or converted by an inverter to be distributed to the network according to standards.

1-2 -2 Biomass:

Bioenergy can be produced from various reserves of biomass "(which is made up of all living organisms on the continents and in the oceans, whether they are micro-organisms, plants or animals. However, its energy exploitation mainly concerns plants and trees, thanks to photosynthesis.)" (Bouчекима B.*, Bechki D., TekhaM., Bouguettaia H., Boughali S, 2015). (Thanks to various processes, these raw materials can be used directly to produce electricity or heat or indirectly to obtain gaseous, liquid or solidfuels.

1- 2- 3 geothermal energies

Geothermal resources consist of thermal energy that comes from inside the Earth and is stored both in rocks and in trapped steam or liquid water. They are used to produce electrical energy in thermal power plants or for other domestic and agro-industrial applications requiring heat as well as for combined heat and power (cogeneration) applications.

1-2- 4- Wind energy

Aeolus = ancient Greek god of the wind

Wind energy is the kinetic energy of moving air in a stream of wind. Its transformation into mechanical energy is done by means of wind turbines

Wind energy can be used in two ways:

a) Conservation of mechanical energy: the wind is used to propel a vehicle, to pump water or to turn the wheel of a mill.

b) Transformation into electrical energy: the wind turbine is coupled to an electrical generator to produce direct or alternating current.

I-2-5 Hydraulic energy:

"In "high fall", the water from a spring or a stream is captured by a summary water intake. It is then directed through a pipe to a turbine located below. The flow of water turns the turbine which drives an electric

generator. The electricity produced can either be used directly or stored in accumulators⁷. Finally, the water is returned to the river. In "low fall", we no longer go through a pipe. The water is diverted into a channel. (energy course, scientific culture).

1-2- 6- Marine energy

Marine energy comes from the potential, kinetic, thermal and chemical energy of seawater (Intergovernmental Panel on Climate Change (Geneva, Switzerland) 2011), which can be used to produce electricity, thermal energy or drinking water

1-3-The relationship between climate change and renewable energies:

All societies need energy services to meet basic human needs (lighting, cooking, comfort, mobility, communications, etc.) and to support production processes. Since around 1850, the global exploitation of fossil fuels (coal, oil and gas) has grown to provide the bulk of energy supplies, leading to a rapid increase in carbon dioxide (CO₂) emissions. Greenhouse gas (GHG) emissions resulting from the provision of energy services (fossil fuels) have contributed significantly to a historic increase in the concentration of GHGs in the atmosphere.

The fight against climate change, initiated since the Kyoto agreements in 1997, and confirmed in Marrakech, is associated in everyone's mind with the development of renewable energies and increased energy efficiency. However, the fight against greenhouse gas emissions is only one aspect of sustainable development in the field of energy. It also presupposes access to resources, without their depletion and without immediate or future damage to the environment, and access that respects equity.

2- Sustainable development and successful energy transition

2-1- concept of sustainable development

Sustainable planning and development of the territory ensure:

- the protection and improvement of the environment,
- energy independence,
- the reduction of the energy bill
- compliance with international commitments, particularly in the context of the fight against climate change.

It is all these advantages that encourage the promotion and development of renewable energy sources and the efficient use of available energies to ensure a successful energy transition (Bernadette Merenne)

2-2-Successful energy transition:

In addition to increasing the share represented by renewable energies, it is also essential to find ways to use the available energy efficiently.

Substantial progress must be made on both fronts and on a global scale if we want to be able to reduce emissions to reasonable values.

Climatic gases. “Currently, there are mainly two possible ways of acting. The first is to reduce the consumption of energy receivers and increase the productivity of power plants by improving their efficiency respectively. A second method is to find and develop new sources of energy.”

(Benmedjahed Miloud ,2013).

2-2-1 Efficient use of energy

a-Definition of energy efficiency:

The concept of energy efficiency (or efficiency) of a system, in physics, is defined by the ratio between the level of useful energy it delivers and that of the energy consumed, necessary for its operation.

More broadly, the concept designates a set of technical and/or logistical solutions making it possible to reduce the energy consumption of a system for an identical or even superior service, as well as their evaluation procedures.

Systems integrating energy efficiency criteria and actions are mainly found in the following sectors:

- the building (suburban or collective housing, urbanization, equipment, etc.),
- transport (private vehicles, public transport, freight),
- industry (goods and services).

b-Why energy efficiency?

Energy efficiency contributes to the achievement of ecological objectives: fewer greenhouse gases, fewer atmospheric pollutants, less pressure on non-renewable resources while stimulating the economy, less energy dependence, lower bills, and increased activity...

Increasing the energy efficiency of buildings not only improves indoor air quality and comfort, but also reduces energy bills and promotes jobs in areas such as construction, insulation and systems. heating and cooling.

<https://youmatter.world/fr/definition/energy-efficiency-definition-and-fields-of-application/Nov 20, 2017>

2-2-2-Promotion of renewable energies in the world

“Countries around the world are increasingly aware of the crucial role of renewable energy and energy efficiency in the fight against climate change; the creation of new economic opportunities; and the expansion of access to energy for the billions of people still deprived of any modern energy service” (2)

The development of renewable energies is profitable and desirable for the three main energy sectors: electricity, heat and transport. In addition,

the use of this type of energy can guarantee universal access to modern energy services.

The results of a study carried out in Germany (Pilot Study 2010 for a given scenario) confirm the expected reduction of CO₂ emissions for Germany in million tonnes per year (Mio t/a) for the period from 2010 to 2050. Germany will achieve a total CO₂ reduction of 703 Mio t per year between 2010 and 2050. In 2050, CO₂ emissions will be only 152 Mio t, in total. (.renewable energies and energy efficiency english PDF)

Power generation from renewables makes the highest contribution to this CO₂ reduction. A similar contribution is made by increasing the efficiency of heat and power generation. The scenario is based on the end of the exploitation of nuclear energy by 2020 (renewable energies and energy efficiency agency, 2020).

a- Investment in renewable energies

Investors and the industry itself need information to understand and limit the risks associated with investing in renewable energy projects.

Projects must offer satisfactory guarantees of returns over their entire lifetime, as some investments are made over decades. A relevant and stable policy framework, inspiring confidence, as well as long-term national objectives supported by good quality market forecasts, are also essential elements in the decisions of investors and industrialists. Decision-makers have a fundamental role to play in breaking down barriers related to non-economic issues (relating to institutions, regulations, knowledge, information, infrastructure, technology and the market, among others) in order to develop a conducive environment for investors and entrepreneurs.

b -The advantages of using renewable energies:

- The non-polluting character. Reduced greenhouse gas and greenhouse gas emissions
- Dispersion in space. They can therefore be used wherever they are.

- Significant potential, particularly solar (Algeria is the first deposit in the Mediterranean basin).

- Reduction of effects on air and water, absence of waste production.

- Renewable energy production facilities have a low impact on the environment, biodiversity and climate and are therefore beneficial for human and animal health.

- The fight against climate change, the development of decentralized electricity production.

c - The disadvantages of using renewable energies:

Among the significant disadvantages of on-site renewable energy:

- In terms of the environment, the impact of renewable energies is low, but there are the problems of landscape impact for wind energy; atmospheric emissions for certain uses of the biofuel;

- Disruption of the local ecosystem for small hydro,

- The intermittency of the availability of renewable energies or, to put it another way, the fact that it is impossible to guarantee the power supplied. This is particularly the case for solar energy, whether thermal or photovoltaic, and wind energy.

d-How to develop renewable energy?

To evolve renewable energy it is necessary:

- Breathe new life into onshore wind power

- Take advantage of the advantages of hydroelectricity

- Placing renewable energies at the heart of the building and combating energy poverty

- Create new industrial sectors

- Exploit all the potential of biomass energy

- Facilitate the integration of renewable energies on the electricity networks

- Achieving energy autonomy in overseas regions

II empirical research:

1-Energy transition in Algeria:

Algeria is initiating a green energy dynamic by launching an ambitious program for the development of renewable energies and energy efficiency. This vision of the Algerian government is based on a strategy focused on the development of inexhaustible resources such as solar energy and their use to diversify energy sources and prepare the Algeria of tomorrow. Today, energy needs of Algeria are satisfied, almost exclusively, by hydrocarbons, in particular natural gas, the most available energy.

The massive integration of renewables into the energy mix is, in this sense, a major challenge in order to preserve fossil resources, diversify the electricity production sectors and contribute to sustainable development.

All these considerations justify the strong integration, as of today, of renewable energies in the long-term energy supply strategy, while granting an important role to energy savings and energy efficiency (see energy program).

1-1-Energy efficiency in Algeria

Algeria adopted in February 2011, an ambitious program of renewable energies and energy efficiency. All the attention of the public authorities is mobilized in order to make a success of this program based on a green strategy drawn up for 2030.

The energy efficiency program shows Algeria's desire to preserve the country's resources and optimize their use.

The energy saving potential is estimated at more than 10 million toe by 2030, i.e. more than 15%.

1-1-1-Instruments of the national energy efficiency policy:

The means of overseeing the national energy efficiency policy have been defined within the framework of law n° 99-09 of July 28, 1999 relating to the control

Energy. Concerning the creation of: The Agency for the Promotion and Rationalization of the Use of Energy (APRUE);

- The National Energy Management Fund (FNME);
- The Intersectoral Committee for Energy Management (CIME);
- The National Energy Efficiency Program.

1-1-2-The law relating to energy management

This law also covered the implementation of the regulations, in particular:

- Thermal regulations in new buildings;
- The energy audit of large consumer establishments;
- The energy efficiency classification of appliances for domestic use;
- The methods of organization and exercise of energy efficiency control;
- Energy labelling.

Funding for actions included in the National Energy Efficiency Program is mainly supported by resources from the National Mastery Fund Energy (FNME).

1-1-3-Expected results:

The results expected from the implementation of this program are as follows:

- an energy saving deposit of around 63 million toe (i.e.: nearly \$38 billion valued for export)
- an avoided power of more than 1500 MW (nearly \$2 billion)
- a reduction of more than 193 million tonnes of CO₂ (i.e.: \$1.1 billion)
- creation of 500,000 new jobs.

1-1-4-Report on the implementation of the first phase of the national energy efficiency program

- Thermal insulation of 600 new homes: 160 homes
- Thermal insulation in existing buildings: thermal insulation of 620 m²
- Installation of individual and collective solar water heaters: 407 units
- Replacement of mercury lamps with sodium lamps “Public lighting”: 10,000 lamps
- Conversion of VP to GPLc: 9100 kits converted
- Installation of GPLc Kits for captive fleet vehicles: 48 kits have been installed
- Feasibility study: 08 studies have been carried out
- Energy audits: 33 operations were carried out
- investment aid: 18 operations were carried out.

1-2-- Renewable energies in Algeria:

Algeria initiated an ambitious program for the development of renewable energies and energy efficiency in 2011 which provided for the production of 40% of electricity from renewable sources by 2030.

1-2-1-Solar energy

Algeria, which has one of the highest solar deposits in the world, embarked on experimental projects in the southern region in the 1990s to achieve a few years later an ambitious program of rural solar electrification.

photovoltaic. This program was carried out by Sonelgaz, more specifically by engineers from the Center for Research and Development of Electricity and Gas.

1-2-2-Biomass energy

The current potential of forests in Algeria is estimated at around 37 million TOE (tonnes of oil equivalent). The recoverable potential is around 10%. The energy potential of urban and agricultural waste is estimated at 5 million tons of urban and agricultural waste that is not recycled. This potential represents a deposit of around 1.33 million TOE/year.

1-2-3-Geothermal energies

Like, there are several geothermal springs, especially in the south. A third (33%) of them have temperatures ranging from 50 to 110°C: this is low energy. The exploitation of this energy can be used for the development of greenhouse agriculture (heating of

greenhouses) and home heating (solar floor). Currently, there are several hectares of greenhouses heated by geothermal energy in southern Algeria: Biskra, Ouargla and Tougourt.

1-2-4-Wind energy

In Algeria the moderate wind regime (2 to 6 m/s). This energy potential is perfectly suited for pumping water, particularly in the highlands (semi-arid regions) and even in certain regions of southern Algeria (arid regions).

1-3- Taka Nadifa Program

With a budget of 11 million euros, including 10 million euros from the EU contribution and 1 million euros from Algeria's contribution, the Taka nadifa program takes place on a period of 4 years (April 2019 - April 2023).

The program aims to support Algeria in the development of institutional and regulatory mechanisms favorable to the deployment of renewable

energies, in particular through the acquisition of a clear vision of the power levels of wind and solar parks that it is possible to integrate into the Algerian electrical system; support for energy efficiency actions is also a major objective of the program.

Conclusion

This research aimed to highlight the importance of energy efficiency and the promotion of renewable energies to ensure a successful energy transition and contribute to sustainable development.

Renewable energy sources today bring a new dimension to our society with technological, economic and sociological challenges in accordance with the requirements of SD. In particular, the generation of thermal and electrical energy

The intense insolation, the vast spaces for the installation of solar energy collection and conversion systems, the existence of pipelines for the evacuation of solar hydrogen from sites in the south to potential users in the north and even for export make Algeria a place of choice for the production of solar hydrogen.

Despite the ambitious renewable energy and energy efficiency programs adopted, the energy transition in Algeria remains in an embryonic state.

Enormous efforts should be made to develop renewable energies and achieve energy efficiency in Algeria.

The bibliography:

-Benmedjahed, Miloud. choice of site and optimization of the sizing of a. wind turbine installation in northern Algeria and its impact on the environment doctoral thesis 2013/014. University of Tlemcen.

- Renewable global status report, 2015:

<https://www.google.com/search?q=2.+renewables+2015+global+status+report&rlz>

-Bernadette Merenne –schoumaker, 2015, World Atlas of Renewable Energies What choices for tomorrow?

International Days on Desertification and Sustainable Development.

-Solarama pdf; solar energy a solution for tomorrow? 2015 <http://col89-ramon.ac-dijon.fr/solarama.pdf>

-Boughali, s.; bechki, d.; menstruation, d.; mahcene, h.; bouguettaia, h.; bouchekima, b., 2013 opportunities and challenges of promoting renewable energies in Algeria. Annals of science and technology, c. 5, no. 1, p. May 10, 11, 2013

-Course energy, scientific culture
<http://gric.univlyon2.fr/gric3/decouverte/enseignement/pagewebphysique/coursenergie2.pdf>

- Renewable energies union, debate on energy policy 20202030, the white paper on renewable energies, choices that underpin our future.
https://inis.iaea.org/collection/nclcollectionstore/_public/43/054/43054798.pdf

- Intergovernmental Panel on Climate Change (Geneva, Switzerland). Renewable Energy Sources and Climate Change Mitigation. united nations environment program published by: G iec ; 2011

-John twidell, tony wear. 2015, renewable energy resources. ebook published London

. Brown, matthew a. introduction to renewable energy technology. 10-