

Challenges for solar energy and its contribution to the fulfillment of SDG 7 in Oaxaca, Mexico

Retos de la energía solar y su contribución al cumplimiento del ODS 7 en Oaxaca, México

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Abstract

This article is part of a doctoral research on solar energy in the state of Oaxaca. The aim of this paper is to identify the challenges for solar energy in the state by learning about the benefits, advantages and disadvantages from the experiences of those involved in the projects, in order to determine their contribution to the fulfillment of SDG 7 "affordable and clean energy". Semi-structured interviews were conducted with public servants and companies, and surveys were conducted with individuals and businesses to find out their perception of the use of solar energy technologies. The main results highlight that despite the great solar potential of Oaxaca, the two variables that represent the challenge for the use of this energy source is the lack of funding for projects and the lack of knowledge on the part of the people, however, there is a willingness of those involved to learn and accept proposals that allow them an energy transition that will contribute to the fulfillment of Goal 7 of the 2030 Agenda.

Solar energy, Perception, Contribution

Resumen

Este artículo forma parte de una investigación doctoral sobre la energía solar en el estado de Oaxaca. El objetivo del presente es, identificar los desafíos para la energía solar en el estado conociendo los beneficios, ventajas y desventajas a partir de las experiencias de los involucrados en los proyectos, para determinar su contribución en el cumplimiento del ODS 7 "energía asequible y no contaminante". Se aplicaron entrevistas semiestructuradas a servidores públicos y empresas, y encuestas a personas y comercios para conocer su percepción en el uso de tecnologías de aprovechamiento de energía solar. De los principales resultados destacan que a pesar del gran potencial solar con el que cuenta Oaxaca, las dos variables que representan el desafío para el uso de esta fuente de energía es la falta de financiamiento para proyectos y el poco conocimiento por parte de las personas, sin embargo, hay voluntad de los involucrados por aprender y aceptar propuestas que les permita una transición energética que permita contribuir al cumplimiento del objetivo 7 de la Agenda 2030.

Energía solar, Percepción, Contribución

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Introducción

This article is the result of the first stages of doctoral research on the incidence of solar energy projects in the sustainable development of the state of Oaxaca.

Derived from the observation, the concern arises to know the potential of this energy source and its contribution to the fulfillment of the Sustainable Development Goals, specifically number 7 "affordable and non-polluting energy" in the state, given that, At the national level, in the SEGOB report (2022) together with INEGI data, they show the percentage of participation of clean energies in the matrix of electricity generation (at the national level) in a graph, whose increase is clear from 2019 (21.6%) to 2021 with 28.6%, although the National Voluntary Report (SE, 2021) says that 32.5% has already been reached; Of these energies, the one of interest is solar with a generation of 6.7%.

It should be noted that when talking about solar energy in most cases, reference is made to photovoltaic solar energy, which is one that takes advantage of direct solar radiation to transform it into electrical energy through panels. The data mentioned in the previous paragraph consider only this form of solar energy, however, it should not be reduced to this use, since there is a whole range of technologies that use the sun as a source for various tasks on different scales: domestic, commercial, public services and industry.

The contribution of this article focuses on the benefits, advantages and disadvantages of all forms of use of solar energy considering the experiences that users and those involved in the implementation of projects within Oaxaca have had.

In the following sections, solar energy is defined and the contexts at the national and state level are discussed, the objective of this article and the methodology to achieve it are mentioned, the results are presented, the thanks for being able to carry out this research and it is finalized. with the conclusions.

Solar energy

This form of energy could be classified into 4 forms of use (Rincón, 1999, p.15):

1. Passive solarization, which avoids energy consumption through bioclimatic constructions, or in agriculture with greenhouses (Bravo, González, González, 2018; Guzmán et al, 2021).
2. Use of collectors that heat fluids at low, medium and high temperatures whose applications range from heating water in homes for the bathroom and kitchen, heating, hot water for hotels, swimming pools and in the last decade refrigerators, to industrial processes where they are required. higher temperatures. Likewise, they can be plates on surfaces that heat the air within a system and help the drying and/or dehydration process (Vázquez et al, 1997; De Castel et al, 1999; Acosta, 2006; Esquivel et al, 2006; Guzmán et al, 2021).
3. The concentration of thermal energy in a single point to reach medium to high temperatures for different purposes such as cooking food in ovens and kitchens, to thermoelectric plants whose objective is to generate electricity from heating salts that melt and can move a turbine. In addition to using residual heat for industrial processes or cogeneration (Laborde, Williams, 2016; IEA, 2019).
4. The best known is to transform it into electricity directly through photovoltaic cells. In Mexico there are two options once the decision to acquire solar panels has been made, one is to interconnect to the National Electric System through the CFE Network and pay a much smaller difference in the bill than if the system had not been installed; the other is an isolated system that is generally installed in places where there is no access to the Network, both systems can be used in homes, businesses, industries, public and service buildings, but the isolated ones can be extended to public lighting, pumping or irrigation (CFE, 2008; Laborde, Williams, 2016; IEA, 2019).

It is important to mention all the forms of use, since each one of them is so relevant within the social, environmental and economic impact that they have within the territories, which emphasizes the need to incorporate into colloquial language the breadth of applications that the concept implies. "solar energy".

Context of solar energy in Mexico

As mentioned in the introduction, the contribution of solar energy in the total generation of energy at the national level is barely 6.7%, although this only refers to photovoltaics, since other forms of use are not considered, this It could imply two things, one, there are not enough projects installed to significantly contribute to the substitution of fuels that contribute to global warming (fossils, firewood, LP gas, coal, etc.), only the percentage of private homes that have a solar heater is 3.2% according to INEGI data in 2015, being the only year where it is reported, which prevents the second implication, which is the lack of data collection, There is no record of all the solar energy projects that exist in the Mexican territory, which is why more efficient data collection and management is needed.

The results of the lack of this information translate to what Karina Cázares (2022) reports on the data gaps at the subnational level by SDG: "In the Mexican case, the largest data gaps at the subnational level are associated with SDG 7 (energy), SDG 12 (responsible production and consumption); SDG 13 (climate action); SDG 14 (life below water); SDG 15 (life and ecosystems on land)."; that is, there are not enough indicators to support compliance with the Objective of interest in this article, since there are only 2 national indicators but none at the state level.

Context of solar energy in Oaxaca

Within the same context, in the data reviewed in the first stage of doctoral research (Acosta, 2022), it is observed that Oaxaca has had the opportunity to contribute significantly to the fulfillment of objective number 7, thanks to the wind corridor in the Isthmus of Tehuantepec, despite its great potential due to the average annual radiation levels of 5.3 kWh/m², with a minimum of 4.4 in December and a maximum of 6 kWh/m² in May (Global Solar Atlas, 2020), the percentage of homes that use a solar heater is 0.6% (INEGI 2015), and those that have a solar panel is 0.4%; The large projects that are mentioned in the journalistic notes are reduced to 6, all of them involving photovoltaic energy at the household level, a soft drink company, two academic institutions that supply the energy demand of their campuses or laboratories and two solar parks in communities; There are only 4 academic publications that show the use in a desiccator for wood, disinfection of residual waters with sunlight, an economic technical study on flat solar collectors for rural areas and the same solar park of the University of the Mixteca (UTM) that It is mentioned in the journalistic notes, so there is not the same magnitude of potential in the number of projects that are taking advantage of this energy source.

In addition to these results, it is identified that in the maps of clusters of solar energy projects (PROMEXICO, 2016) Oaxaca is not contemplated and in the compliance report (SEGOB, 2022) of the SDGs objective number 7 is not even mentioned. . Even though in 2018 the Technical Work Committee and three Work, Economic Growth and Environmental Sustainability Committees were created (Government of Oaxaca, 2019) for being the state of Oaxaca, included in the Global Guide to Voluntary Local Reviews (GMRLV) of the organization United Cities and Local Governments and UN Habitat there are no results that can be consulted on the official page of the Government of Oaxaca, on the page of the Regional Observatory for Development Planning (CEPAL, 2022) or in any other means to find out about compliance of this specific objective.

General objective

Identify the challenges for solar energy in the state, knowing the benefits, advantages and disadvantages based on the experiences of those involved in the projects, to determine their contribution to the fulfillment of SDG 7 "affordable and clean energy".

Applied methodology

This part of the research is of a qualitative nature because it knows the perception of the use of solar energy as a tool for sustainable development and exploratory because it is a first approach, the problem and the context of each locality were better understood.

The sample selection is described in the first part (Acosta, 2022), in which 14 municipalities were selected based on their radiation characteristics, percentage of homes with a solar system (heaters or photovoltaics), income, population level, number of projects. of solar energy and number of companies.

3 instruments were applied to know the perception of those involved in solar energy projects:

1. Semi-structured interviews with municipal and state authorities
2. Interviews with solar energy companies
3. Surveys of the population and commercial premises of goods or services

The data was homogenized for the qualitative analysis and the variables that people rate as advantages and disadvantages of their experience with solar energy are identified, in addition to the benefits that contribute to the fulfillment of SDG 7.

Results

The results are presented with respect to the responses obtained from each group:

1. Municipal and state authorities:

10 municipal authorities (councillors, ecology coordinators, director of health and ecology, and department heads) and 2 state authorities from the Ministry of Environment, Energy and Sustainable Development (SEMAEDES) were interviewed.

When asked if there are solar energy projects implemented in the municipality, all respond that there are none or are unaware, except for the SEMAEDSO managers, who have the data on the projects with the highest investment, these are, the UTM park for its relevance and magnitude, in addition to the fact that it implied an investment from the federal level and with non-governmental organizations; some municipalities such as Santa María Atzompa who had the support of international organizations as part of the 10 municipalities integrated into the GMRLV to implement public lighting, pumping and irrigation systems; and in Oaxaca de Juárez there have also been public lighting projects, however many lights have already been stolen.

It is alluded that projects such as public lighting or solar parks have been carried out by federal or state authorities or private companies, but none have been at the request of the population. And that people are not interested in photovoltaic panels because there is very little energy consumption within homes that the investment is not profitable for them, especially because of the subsidy reflected in the CFE receipt. In addition, they emphasize that there is a lot of ignorance on the part of the population about solar systems and that their motivation to acquire this technology is economic, but not environmental.

An interesting response was that when asked for their opinion on solar energy, the majority mentioned positive concepts such as "alternative", "potential", "use", "it is necessary", plus one of the health and environment councilors mentioned Concern about the use of lithium "must take into account the production and impacts of solar cells, which should not be changed by extractivism."

Everyone speaks of a willingness and openness to receive training and knowledge on the subject that allows them to propose adequate systems for their municipalities, but that without financing the acquisition would not be possible.

2. Interview with solar energy companies

6 solar energy companies located in Oaxaca de Juárez, Xoxocotlán and Miahuatlán de Porfirio Díaz were interviewed, 4 of them are small companies, even one is only the specialist that when it has projects it hires people outside its company to support it, and the others two are the largest companies, one of them is the only one that manufactures photovoltaic panels in the state.

100% have installed solar systems in private homes and in local or small companies, 66.7% in large companies, 33% have implemented a project requested by a local or state government and only one has collaborated with farmers. This allows them to have a reference on user experiences.

Only one of the companies claims to have more than 20 projects per year on average, the others range between 11 and 20 and 2 companies have between 5 and 10. Regardless of these amounts, 100% of the projects that all have installed are still running. Most are solar heaters and to a lesser extent photovoltaic.

From their perspective, they consider that the main disadvantages and challenges that solar energy projects have is the lack of knowledge on the part of the users, since not all the population locates this technology or considers it very expensive, in addition to the fact that bad experiences by people who do not have adequate knowledge in the installation of systems and decide not to invest again.

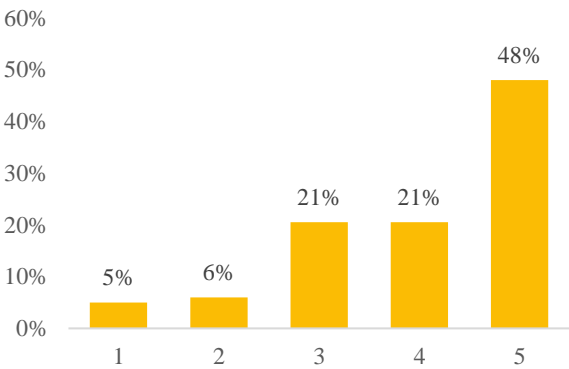
Curiously, in the same way as the authorities, they mention the willingness and interest on the part of some sectors to promote this technology and they agree that without financing the use of this technology in the state cannot grow.

3. Surveys of the population and commercial premises of goods or services

A total of 200 responses were obtained, 187 from the general population and 13 from businesses.

With a Likert scale, their perspective regarding the use of solar energy in Oaxaca is qualified, being 1 "negative, 3 "indifferent" and 5 "positive, the results show that 48% (96 people) of the respondents consider it positive , 21% between indifferent and positive (41 people), another 21% are indifferent, 6% (12 people) are between negative and indifferent and the rest 5% (10 people) are negative (graph 1).

2.5 What is your perspective on the use of solar energy in Oaxaca?



Graphic 1 Perspective of the use of solar energy in Oaxaca

Source: Own elaboration with response to question 2.5 of the surveys of the population and businesses

When asked to explain why they have given this weighting on the scale, they mention that in general their experience has been benefited by the use of energy, but that in the state the authorities are not interested in using this energy, some responded null because they did not they have been users of this technology so they feel unable to really rate it.

Of the main advantages that are observed with the use of solar energy according to the answers of the users are:

- in the social variable such as the improvement of the quality of life of the families and users who install it in their commercial premises, due to the significant economic savings, in addition to the fact that there is a feeling of well-being due to environmental awareness.
- the environmental variable such as not emitting greenhouse gases with the burning or use of any fuel.
- The economic variable due to the low return time of the investment.

One of the main disadvantages that people perceive is the high initial cost, that is, there is not adequate financing to acquire a system.

Conclusions

The main challenges facing the use of solar energy in Oaxaca are:

- The lack of initial resources to be able to acquire a system, either at the home or commercial level, or the lack of financing for municipalities that allows them to invest in solar technology appropriate to their contexts and energy needs.
- The little or limited information that is available on the use of solar energy, most users only believe that it refers to photovoltaic panels or solar heaters, when the full range of technologies that could be used has already been mentioned in this article. applying.
- The lack of regulations that promote the use of solar systems over other fuel systems that contribute to global warming.

It is then proposed that in order to meet objective 7 of the SDGs:

- Technologies that take advantage of solar energy should be promoted because their advantages are greater compared to their disadvantages, this implies regulations that benefit and encourage those users (homes, businesses, public services, industries, etc.) who decide to transition to this clean energy
- Municipal and state authorities must be trained to publicize the full range of possible projects with this type of energy and propose adequate systems for the energy needs within the localities.
- Financing networks are promoted by federal and state governments, in conjunction with international organizations and banking institutions or private companies, in order to guarantee the affordability of clean and non-polluting energy.

- Awareness campaigns on energy efficiency and solar energy aimed at the population and businesses in general are created. Workshops are given in the localities and those interested are trained so that learning is promoted and the use of technologies that take advantage of this energy source is encouraged.

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