

Supplementary material for article:

Challenges for Energy Transition in Poverty-Ridden Regions—The Case for Rural Mixteca, Mexico

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Table S1. Descriptors and states.

Descriptor	State 1	State 2	State 3	State 4
A. Emigration. Last decades Mixteca region has suffered a decrease in population mainly due to emigration. Migration has been traced down mostly North Mexico to U.S. border cities and across the border to work in commercial agriculture in the U.S. According to the last census, 23% of the population originally from Mixteca, currently lives in other states of the country. This figure represents only population within Mexico. Initially, mainly men left home sending income to families left behind in the area [52]. ¹	return emigration	permanent emigration with bond	permanent emigration without bond	

B. Ethnic identification.

Ethnicity is a distinctive factor in Mixteca society. Indigenous people are the holders of a subjective sense of belonging such as culture, identity, language. Ethnicity is often a major source of social cohesion as well as a social conflict. Indigenous people hold their own diverse concepts of development, based on their traditional values, visions, needs and priorities. Indigenous groups often lack of political representation and participation, economic marginalization and poverty, lack of access to social services and discrimination. They strive for recognition of their identities and their ways of life. They form at present non-dominant sectors of society and are determined to preserve, develop, and transmit to future generations their ethnic identity, as the basis of a continued existence as an ethnic group, in accordance with their own cultural patterns, social institutions and even legal system [74].¹

low ethnic
identification

high ethnic
identification

pluricultural

C. Education. Education levels differ among generations in the area, older generation has little or no formal education. Low income population is related to low or no education level. Current earnings obtained through street vending, construction work, handcrafts, palm weaving, subsistence farming, that require little or no formal education, guarantee they remain within the poverty cycle. In addition, basic education institutions supported by the government promotes education in the country's main language (Spanish) and not in the mother tongue, restraining accessibility to indigenous groups [45], [51].

less than 5 years	from 5 to 9 years	more than 9 years
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D. Source of income.

Remittances are important source of monetary flows correlated with emigration, mainly to the U.S.A. Mixteca has a 13% share of the State's remittances, around 226 million USD received in the area. It is mostly spent on basic needs (food, clothing, health). Self-employment such as subsistence agriculture, gathering of wild fruits, palm weaving, livestock are most prominent activities to earn a living. There is also the informal economy present in urban areas such as street vendors or handcraft products whose skills require only basic education to make a subsistence living ensuring once again to continue within the poverty cycle [53].¹

labour

remittances

remittances
plus labour**E. Basic services access (water, electricity, drainage).**

Two thirds of the population in Mixteca live in rural communities of less than 2500 inhabitants. Access to basic services such as running water, electricity, basic sanitation, is not guaranteed. Moreover, despite the high percentage of population with connection to the electricity grid, availability and reliance of this service is not assured, hence, electricity cannot be used for productive uses [47-49].¹

no access to any
servicepartial access
to services
including
waterpartial access
to services
including
electricityaccess to
all services

F. Population acceptance of renewable energy plans and participation.

The awareness of a new technology of future improvement benefiting the community itself should be brought and be a topic for discussion and education in the area so that justice, solidarity are strengthened to achieve common welfare agreements. Promotion for interactive participation should be provided leading to potentially retain control as an organized self-sufficient community in energy related concerns. Individual participation in the selection of their energy technology through communal energy projects is highly desirable to fulfill this descriptor [87].¹

poor
community
organization

limited to
labour

support
includes
economic
contribution

G. Job and earnings. Even though there have been some efforts from stakeholders to provide employment sources from maquila factories, the underlying issue is the unfair wages, the disparity between the income generated at sale and the labour cost of the product. The main benefit (net income) is distributed among a few, which are the outsiders and not kept within the local community [45].¹

stable job and
minimum wage
or below
minimum wage

stable job
above
minimum
wage

no secure job
and below
minimum
wage

no secure
job and
above
minimum
wage

H. Governance uncertainties.

Mexico's present political landscape shows acute uncertainties for the future decades. It could bring ambitious social and political projects to increase standard of living to indigenous groups as well as for the poorest. Nevertheless, it could also lack the mechanism to make good intentions work and carry plans out. In the context of extreme social inequality and stagnant poverty levels, the government has to work on the high expectations to transform lives of half the population of the country [59].¹

low
uncertainties

strong
uncertainties
with growth

strong
uncertainties
without
growth

I. Governmental policies for integrated energy system.

Even though the new government has the political leverage to reform the law and the legitimate ambition to carry out structural changes needed to address the fact that the Mexican economy only benefits the rich, there are still difficulties in prioritize the comprehensive platform of the change. The government needs the country to keep running, economic and social programs are top on the list. As of past governments, there were some plans to make a switch on the share of renewable energies. However, the new government insists on boosting fossil fuels expenditure through the construction of new oil refineries in southern states. It is not certain wheather the new governmental policies would still support Mexico on the direction for renewable systems [63].¹

restrictive
policies on new
energy systems

supportive
policies on
new energy
systems

J. Investments in energy

research. A measure of commitment to the development of new energy technologies is the public and private investment on energy research. A low level of investment means not only a concern today but for decades to come. Encouraging technological changes in the energy sector means a high-technological economic driver. Public investments in energy are the most commonly used metric in international technology assessments. With more complete knowledge about the government energy innovation activities, stakeholders and government might be able to better allocate resources and share risks in collaborative activities [62].¹

low investment
or none high level of
investment

M. Cooperation between government, private investors, NGOs.

There is substantial evidence of the interplay between these three entities as a means to improve socio economic status of population leading to poverty reduction. It is desirable that the involved parties such as government, private investors, NGOs reach an agreement to create the necessary conditions to implement different responsibilities to conceal diverse energy-related challenges [84].¹

inexistent or
low existent or
good excellent

N. Added Value creation from the renewable energy sector.

The added value from renewable sources prompts for education, training and research related to human and knowledge capital. At the national level, there would be a creation of gross value added through renewable energies. This added value can support the productive potential of the society [76-77].¹

inexistent or
very low

existent or
good

O. Financial market in rural

economy. Vast majority of inhabitants in Mixteca lack access to formal financial services, moreover, rural communities do not have a point of service for residents to process basic transactions. The World Bank shows a correlation between financial inclusion and poverty alleviation: as people gain access to financial services, they can save money and start building a credit profile, leading to the potential for loans, thus grow. Among the factor impeding inhabitants to access formal banking are insufficient funds, account costs, distance, lack of documentation and distrust. A significant number of financial service providers available operate as unauthorized, nonregulated savings and credit entities. These entities offer less restrictive conditions and provide loans with high interest rates. Due to its irregular activity, they are prone to disappear along with the savings [54-56].¹

limited access
to formal
financial
market

access to
informal
financial
market

no access to
formal or
informal
market

P. Legal system. Despite a strong legal framework, Mexico's legislation is not effectively enforced. In general, organized crime, corruption, and human rights violations pose severe challenges to the Mexican governance. Corruption is a significant risk for all-size companies operating in Mexico as well as for the general population. Statistics show that bribes and irregular payments are frequently paid in the process of obtaining public services. Basic service access, construction permits and licenses, are negatively influenced by corruption [72].¹

law
enforcement

aggravate

not
effectively
enforced

Q. Climate change. Potential consequences of climate change include increased frequency and intensity of heat waves as well as droughts. Using modelling projections for future climate scenarios and based on the Intergovernmental Panel on Climate Change (IPCC) guidelines, Mixteca area could see the replacement of semi-arid vegetation by arid vegetation. By year 2050, 50% of the agricultural lands are likely to be subjected to desertification; biodiversity in natural ecosystems will be at risk. Precipitation trends for summer season are forecasted to decrease to -0.86 mm/day. A projected temperature increase in the region of about 2°C is estimated by 2040 [73].¹

high impact

low impact

R. Environmental effects on

population. Climate change may affect population in Mixteca through a range of pathways, for instance, it is likely that the frequency of heat waves will increase not only heat-related human mortality in the region but livestock as well. Rural communities may be displaced or pushed to re-integrate to a semi-urban area. Certain models project a substantial increase in the number of people at risk of infection diseases such as dengue due to changes in the geographical limits of transmission or changes in the distribution of vector-borne diseases. The overall balance of effects is likely negative and population in Mixteca is likely vulnerable to the adverse effects if appropriate measures are not taken [73].¹

high impact

low impact

S. Women's empowerment.

This descriptor goes beyond increasing literacy or gender equality. A woman in a rural community who has been directly affected by her immigrated partner or family, has carried not only the household burden but has also managed to make a living by herself. She has faced land decisions (to harvest, to manage workers, sell harvest or even land), children welfare and entitles in many cases important decisions at the administrative positions in her surrounding community. Educating women in the benefits and use of renewable energy and providing the appropriate power to take decisions for the community could improve the potential to switch to this type of energy [82].¹

limited or no
empowerment

full / attained

partial

T. Community organization.

The degree of commitment someone who belongs to a traditional rural community in Mixteca is high. The organization of community work is a link that keeps rural society integrated; it is not only an economic reason, but a well-recognized social bond whose meaning is as important as family relationships, festivities and religious rituals. This means that each member of the community contributes to the community benefit in several ways. This is also the basis of a cooperative system through which new projects can be undertaken for the benefit of the entire community [74].¹

poor
community
organization

limited to
labour

support
includes
economic
contribution

¹ References listed on main document.



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