

***Intergenerational Social Perceptions of the Energy Context as Based for Designing Educational Structures That Promote Sustainability and High Social Participation***

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The Barcelona Conference on Education 2024  
Official Conference Proceedings

**Abstract**

To support the Sustainable Development Goals (SDGs) proposed by the United Nations, several important aspects are required, among which the active participation of society in initiatives and project development can be highlighted. In particular, the social perception of the energy sector can be understood as the social opinion related to the acceptance, appropriation, and social trust regarding the actions developed by the private and public sectors in the energy framework. Given the above, a quantitative and exploratory study has been carried out on the intergenerational social perception of the energy context, to obtain results that will allow the identification of starting points for improving the formal, informal, and non-formal structure of social education on sustainability (particularly concerning the energy sector and energy poverty) for different segments of the population, namely the Centennials, Millennials, Generation X and Baby Boomers. An important result to highlight is that the public opinion of citizens belonging to the Centennial Generation is extremely representative. Meanwhile, the opinions of previous generations, such as Generation Millennials, Generation X, and Generation Baby Boomers, have less influence on public opinion. Finally, this research also addresses the challenges and opportunities regarding the development of interdisciplinary educational projects to improve the energy indicators of the region considering the intergenerational aspects.

Keywords: Community & Society, Education, Sustainability & Society, Social Justice, Development & Political Movements

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## Introduction

The generation, transmission, and distribution of electrical energy are undoubtedly vital to various important aspects of society's development. In general, the creation of jobs in certain sectors of the manufacturing industry requires a public and/or private service of constant and high-quality electrical energy. In the healthcare sector, for example, electrical energy is crucial, as medical equipment needs to be constantly running due to vaccines need to be almost frozen. For these reasons, there are many technological advances in the energy sector, from those based on conventional energy sources (e.g. coal, natural gas) to those based on renewable energy sources (e.g. wind, solar, etc.) (Kaygusuz, 2012; Khan et al., 2020).

However, in addition to the technological challenges, the energy sector also faces social barriers. These challenges are related to society's trust in energy projects, people's emotional and cultural appropriation, and other aspects that include social opinion on energy sector developments. In fact, there have been social problems related to energy projects around the world, most of them based on disagreements and/or misinformation (see Figure 1) (Cuppen, 2018; Ibar-Alonso et al., 2022).



Figure 1: Rally of People Due to Social Problems

Source: <https://freerangestock.com/sample/108370/large-group-of-people-holding-signs-in-a-protest.jpg>  
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Therefore, it is important to approach the relationship between energy sector projects and society's perspectives from a non-technical point of view, i.e. socio-demographic aspects should be taken into account in all locations to communicate the best way to inform about energy sector projects, their advantages, disadvantages, risks and their management (Schmidt and Weigt, 2015). A particular aspect of this approach is the different generations that make up a society. That is, people of different ages who, due to various factors, have different opinions and perspectives on a unique event, in this case, energy sector projects and their management (Grossmann, 2019; Radtke & Ohlhorst, 2021). In this manner, this investigation considers social perception from aspects related to the energy sector, including the following age categories: 1) Gen-Z, also called Centennials (1995–2009), 2) Gen-Y, Millennials (1980–1994), 3) Gen-X (1965–1979), and lastly, 4) Baby boomers gen, Gen-BB (1946–1964).



Figure 2: Adult Education Programs

Source: [https://live.staticflickr.com/3308/3546874366\\_5edd55f72e\\_c.jpg](https://live.staticflickr.com/3308/3546874366_5edd55f72e_c.jpg)  
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The last point allows us to define the starting point for the creation of a formal, informal, and non-formal educational organization aimed at a specific market segment defined by the age generations already mentioned, intending to share with all people all aspects related to the management and projects of the energy sector located in their locality (see Figure 2). In addition, what has been mentioned above is framed on the novel educational frameworks promoting the participation of cities concerning the Sustainable Development Goals (SDGs) proposed by the United Nations (Elice et al., 2023; Melnic & Botez, 2014).

In this way, we've proposed various questions to continue the research, such as, what is the level of trust that citizens of different generations have in the management of public and private projects in the energy sector? Are there any patterns of behavior between generations in terms of the trust placed in the private and public sectors? And, what are the educational proposals to initiate a social change in terms of trust in energy sector projects?

## Methodology

This research has been developed taking into account the analytical questions mentioned above. A tool (survey) has been created with 14 single and multiple-answer questions on society's trust in renewable energy projects, energy sector management, and energy poverty. In the case of this research, only the questions relating to trust in society are relevant. This tool also includes 3 questions about demographic information, such as gender, age, and highest school grade obtained. The survey of this research was carried out in the first half of 2023 in the municipality of Ensenada, México, on 402 people through different digital platforms. It's important to mention that the tool was formulated, revised, and verified by 6 people directly involved in the energy sector, all specialized in renewable energy. Following the application of the research survey, the data were analyzed as a whole, and different results were obtained from the questions and objectives of the research. In this case, this document only shows the research findings related to the intergenerational social perceptions of the energy context as a basis for designing educational structures that promote sustainability and high social participation.

## Results and Analysis

Table 1 shows the demographic information from people's responses. It can be seen that Z Gen people represent 72.39% of the respondents, while BB Gen represents only 1.24%. The percentages of X and Y Gen are 10.70% and 15.67%. It's important to note that the fifth column of Table 1 represents the percentage of each generation based on a government census from the National Institute of Statistics and Geography (INEGI in Spanish), which indicates a potential limitation that will be addressed in the limitations section.

Table 1: Age

<b>Generations</b>	<b>Age range</b>	<b>Amount</b>	<b>%</b>	<b>% INEGI</b>
Z, Centennials (1995–2009)	14 - 28	291	72.39	33.57
Y, Millennials (1980–1994)	29 - 43	63	15.67	29.33
X(1965–1979)	44 - 58	43	10.70	22.96
BB (1946–1964)	59 - 77	5	1.24	14.14
		<b>402</b>	<b>100.00</b>	

Concerning the question of trust in the private sector to manage energy resources (Who do you trust most to manage energy production in Mexico?), Table 2 shows the main results. It can be seen that 36.07% of the total population belonging to Generation Z trusts the private sector to manage the energy sector. This means that 72.50% of the total population of Generation Z trusts the private sector. In addition, 27.5% of people belonging to Generation Z do not trust the private sector. On the other hand, Generation BB is the population group that trusts the private sector the least.

Table 2: Distribution of Generations That Trust More in the Private Sector

<b>Generations</b>	<b>% Sample</b>	<b>% Population</b>
Z, Centennials (1995–2009)	72.50	36.07
Y, Millennials (1980–1994)	14.00	6.97
X(1965–1979)	12.00	5.97
BB (1946–1964)	1.50	0.75

Table 3 shows the distribution of the population in terms of trust in the public sector, i.e. the government sector for the aspect of energy production. In particular, we can see a trend similar to that of Table 2, where of all the people who trust the government, 70.83% belong to Generation Z, 15.28% to Generation Y, 12.50% to Generation X and, finally, 1.39% to Generation BB.

Table 3: Distribution of the Generations That Trust the Public Sector or Government the Most

<b>Generations</b>	<b>% Sample</b>	<b>% Population</b>
Z, Centennials (1995–2009)	70.83	12.69
Y, Millennials (1980–1994)	15.28	2.74
X(1965–1979)	12.50	2.24
BB (1946–1964)	1.39	0.25

Finally, Table 4 shows the results of those who trust both sectors (public and private) to take care of the production of electrical energy. In particular, Table 4 shows the same trend in responses as Tables 2 and 3.

Table 4: Distribution of Generations That Trust the Private and Public Sectors in the Same Way

<b>Generations</b>	<b>% Sample</b>	<b>% Population</b>
Z, Centennials (1995–2009)	73.08	23.63
Y, Millennials (1980–1994)	18.46	5.97
X(1965–1979)	7.69	2.49
BB (1946–1964)	0.77	0.25

In this way, research finding 1 can be established, which is that 5 out of 10 citizens of the municipality of Ensenada, Baja California, trust the private sector more to be responsible for generating electrical energy in Mexico. Research finding 2 is that 2 out of 10 citizens trust government agencies more for the same purpose. Research Finding 3 is that 3 out of 10 citizens say they trust more efficient cooperation between the private sector and government agencies to manage the energy sector.

Finally, an important aspect to highlight is that (research finding 4) the public opinion of citizens belonging to the Centennial Generation is extremely influential. On the other hand, the opinions of previous generations, such as the Millennials, Generation X, and Baby Boomers have less influence on public opinion. For example, 72.5% of those who said that they trust the private sector more to be responsible for the country's electricity production belong to the Centennial Generation.

## **Designing Educational Structures on Sustainability**

### ***Formal Structure***

In general, formal education or formal learning has certain characteristics, such as 1) learning goals are set through linear progressions according to a pedagogical plan along with a formal study plan, 2) education has to be consciously planned, taking into account both the educator and the learner, 3) in terms of place, said the educational structure should take place in formal learning centers, where students' assistance can be required. 4) the knowledge gained is measured by numerical scores, 5) perhaps the most important feature is that the learning process doesn't have to be social, which means that students can choose to learn in solitude. In this way, once the formal education structure is established, and taking into account the results and discussions of this research work, face-to-face, and online learning activities have to promote sustainability and high social participation related to energy sector projects, such (see Figure 3):

1. Private companies in the energy sector could work with educational institutions to create accessible and affordable courses, certificates, and other activities for people related to sustainable development, energy projects, and social participation.
2. Private companies in the energy sector can independently create formal education programs, including social awareness and responsibility, involving citizens in energy and sustainability-related projects.

3. The public sector and all levels of government, in coordination with the private sector and educational institutions, can establish formal training programs.
4. The public sector, with all levels of government bodies, within the scheme of the various secretaries related to education, economic issues, innovation, environment, etc., can create formal educational programs.



Figure 3: Face-to-Face Education Programs

Source: [https://live.staticflickr.com/8118/15588661820\\_d7f74ebb8a\\_b.jpg](https://live.staticflickr.com/8118/15588661820_d7f74ebb8a_b.jpg)  
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### ***Informal Structure***

In this type of teaching, the learning part is not as structured and is supported by indirect teaching activities. Learning as such doesn't necessarily have to be intentional, and the student may not even realize that he/she is learning. As for the learner's motivation, it may be intrinsic and not obvious to others. In addition, learning can take place at any time and in any place. In this kind of learning, knowledge isn't recognized or measured by numerical scores, but cognitive, emotional, social, and behavioral elements are the aspects considered. In summary, informal structured education is autonomous, experimental, flexible, and contextualized. In this way, having clarified the informal structured education and remembering the results and discussions of this research work, the following initiative is proposed to promote sustainability and high social participation concerning energy sector-related projects.

1. Forums, conversations, and online communities are designed to match the characteristics of X, Y, and BB Gens. These alternatives are unplanned. In general, public and private sector companies need to organize and collaborate to promote in a smarter way and with strategies this type of activities related to informal learning structure.
2. Websites, books, and other resources specifically designed for X, Y, and BB generations. In this sense, there is still much to be done in terms of asynchronous education via digital platforms.

### ***Non-Formal Structure***

This structure may be more complex to define as it has some features in common with both the informal and formal structures. All the characteristics mentioned above are optional in the

non-formal structure, that is, they aren't mandatory. Learning has a voluntary dimension and is promoted through indirect teaching behavior. As in formal and non-formal learning, learning can be recognized or measured through qualifications. Therefore, non-formal and informal learning is more difficult to calculate clearly than formal learning. Concerning the latter, activities to promote sustainability and citizen participation in energy projects can be established in the non-formal structure, although these activities could be similar to those proposed for the informal structure.

### **Conclusions, Limitations, Implications, and Future Tasks**

This research work approached the social perception and social approval regarding energy projects from the public and private sectors. The results of the surveys made it possible to identify different research findings related to the social perceptions of different generations. This will allow the definition of possible educational proposals to improve social acceptance regarding energy projects. All the above-mentioned proposals should be justified considering the Centennials, Millennials, X, and Baby Boomers generations. Therefore, prior market and anthropological research is necessary to guarantee the success of the educational programs.

However, it is important to mention some limitations regarding this research project and, more precisely, the results. First of all, there is a methodological limitation, which means that although the information on the population is provided by a government institution (INEGI), the application of the instrument doesn't take into account the generational distribution of the population. This may lead to a bias in the results towards certain types of generations, such as centenarians. Another limitation relates to geographical location. If this instrument were applied in other places in the state of Baja California, or in other states of Mexico, well, in other countries, it wouldn't be able to guarantee similar results, because it depends very much on the context and the history in which the energy projects are applied. In this particular case, the Municipality of Ensenada, where the project was tested, there is already an established relationship on energy projects between the public and private sectors, nationally and internationally.

In general, this research has important applications. In terms of educational applications, the research results and findings can be the starting point for designing educational programs, taking into account the different structures mentioned above. The previous theme and the results of the research also have potential social implications, since the information to the different generations can be taken into account to design educational programs, thanks to which it is possible that the positioning of the energy projects becomes stronger in terms of social respect. Along the same line, if the expectations of social and educational impacts are met, there can be important implications in the field of companies related to energy projects, i.e. the competitiveness between them will be strengthened. Finally, the results presented can be important for the public sector, as they can be a starting point for political implications with legal regulations before, during, and after the planning and execution of energy projects in specific locations.

Lastly, in terms of future research, it's important to note that, due to the limitations of the current research, the results do not seek to generalize in any context. Considering the latter, it's necessary to take measures to improve the methodology of applying the tool according to the socio-demographic contexts in each place. Nevertheless, the preliminary results of this research can be used as a starting point for other interdisciplinary indicators that may need the results.

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