SOCIAL ACCEPTABILITY OF ENERGY PROJECTS UNDER THE BUSINESS MODEL LENS

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1. Introduction.

Producing carbon-neutral energy is, together with energy sufficiency and energy efficiency, one of the three pillars of the energy transition. The energy transition is not only the use of clean energy and the creation of efficient technologies (1) but also the need to take into account the environmental and social implications.

As some countries struggle with achieving their renewable energy targets (2), the renewable energy transition is also characterized by the challenge of legitimizing a rapid implementation of technological infrastructures at different social scales. Regarding the social aspect, the energy transition implies paying attention to both the interests of stakeholders directly involved in energy projects and those who are indirectly affected by their implementation (e.g., communities or individuals), the so called negative externalities.

The energy transition faces several obstacles, for instance, the business operations risks or the lack of political and industrial support needed for speeding it up (e.g., 3). However, low communities' acceptability, which can risk the implementation of the project and incur significant additional costs (4), is considered one of the most important. Understanding the root causes of the low acceptance of energy projects and what can be done to improve it is key to designing their business models enabling the renewable energy transition (5).

According to some authors (6), acceptability is an ambiguous concept and there is not a clear distinction between it and other associated terms (e.g., public acceptance). Extensive research has been done on factors that facilitate or hinder the social acceptability of energy projects. However, the fact that its results are diverse and its conclusions are not uniform reveals the complexity of the subject. A perspective helping to have an overarching comprehension of what is important to facilitate the social acceptability of energy projects is needed. By employing the business model tool, this article aims to fill this gap. As the business model helps companies to identify critical aspects to consider when creating value, we think it is a useful lens to have this helicopter view.

Through a literature review, we provide an answer to the following research question: What are the distinctive factors of a business model for the acceptability of energy projects?

We discovered multiple factors related to the social acceptability of energy projects, identified the most studied ones, and found that some of them are clustered within a multilevel acceptability analysis scheme. However, the main contribution of this paper is to show distinctive acceptability factors of energy projects through a business model framework. The Business Model for Acceptability (BMfA) presented in this paper is a draft based on the literature that we further conceptualize as our research project evolves. This business model for acceptability is the first step of a more complex process helping us to explore the acceptability problems of new renewable energy infrastructures.

The rest of the paper is organized as follows. Section 2 includes the theoretical framework. Section 3 explains the method we followed. Section 4 shows the results and discusses them. Section 5 presents what we call a business model for the acceptability of energy projects. Finally, Section 6 briefly concludes our findings and presents a research agenda.

2. Theoretical framework.

2.1. The Business Model

The business model is a concept that emerged to highlight the importance of the relationship between business and technology. While in 1957 the concept was used for designing business games, later in 1960 it was used to show how communication and information technologies (e.g. internet, which was emergent those days), should be taught to business and management students (7). According to some authors, the fact that many articles began to use the business model concept in 1990 is related to the boom of the dot com era and the emergence of technology-based companies occurring by then (7,8).

To some extent, this situation anticipated the versatility of using the business model in a variety of domains. For instance, business models are constantly employed in strategy, managerial decisions, and information systems areas (9,10). Articles that coined the concept several years ago did not provide details of the concept, but the business model is vividly discussed nowadays.

Some authors argue that its versatility also consists in what the business model is used for (e.g., 10,11). Several functions have been attributed to the business model and they have been used to characterize it. It is said that the business model is about modeling a process, it concerns a strategic management tool or an abstract description of the companies' architecture (13).

According to some authors (14), business models articulate the logic and provide data and other evidence demonstrating how a company creates and delivers value to customers. It also outlines the architecture of revenues, costs, and profits associated with the company delivering that value. However, the business model has been heterogeneously characterized. Table 1 describes some of the many business model definitions that have been formulated.

References	Definitions
(15)	The business model is the logic of how a company proposes customer value and exhibits the configuration of a company for a specific opportunity.
(16)	The business model reveals the relationships between the actors that participate in a company.
(17)	Business models concern a representation of a firm's core logic and strategic decisions in a value system for generating and capturing value.
(18)	The business model is an interconnected and interdependent group of activities explaining how a company's stakeholders do business together.
(19)	Business models specify the business actors and their roles, let to understand the benefits they produce, and how the firm gets revenues

Table 1. Sample of Business Model definitions.

Although definitions may be different, there are a couple of common elements in them. The business model is a representation of a complex system of stakeholders, their activities, and the values they produce.

Examining business model activities represents one of several approaches business model research has focused on. More specifically, through this approach, researchers try to identify or develop constituent elements of business models (see 19 for more details). Constituent elements are evoked differently in the literature, for example, components, elements, or building blocks.

2.1.1. Value Proposition, Delivery, and Capture.

Some scientific works compile studies aiming to identify business model components. For example, Shafer and colleagues (17) discovered more than forty components through a literature review. However, later works

highlight that more than one hundred components have been used to explain a value creation process during the evolution of the business model research (21).

Business model components are a subject of debate in the literature. Recently, some authors aimed to clarify their meaning. Components cluster stakeholder activities producing values and are the most evident building blocks for portraying and explaining the value process in business models (22). Despite the large diversity of components in the literature, most of the recent studies have widely accepted an integrative framework for value creation analysis.

This framework is grounded on the work of Richardson (23) and consists of Value Proposition, Value Delivery, and Value Capture. Like many others, this framework uses the value concept to represent the activities performed in a business model. This is explained by an inherent relationship between value and business models since it is very often employed for defining and representing them (24). Each value component in Richardson's framework has been defined as follows:

a) Value Proposition: The value proposition represents the benefits designed for the stakeholders of the model for which a payment or other value exchange is necessary (25). This concept implies a value embedded in a product or service (26). Such a value offers a solution to a customer's problem or needs (27).

b) Value Creation and Delivery: The value delivery system consists of how the company delivers the value proposition to the customer and is the source of its competitive advantage (23). This component includes resources, capabilities, inter-organizational networks, and their main activities to create and deliver value (28).

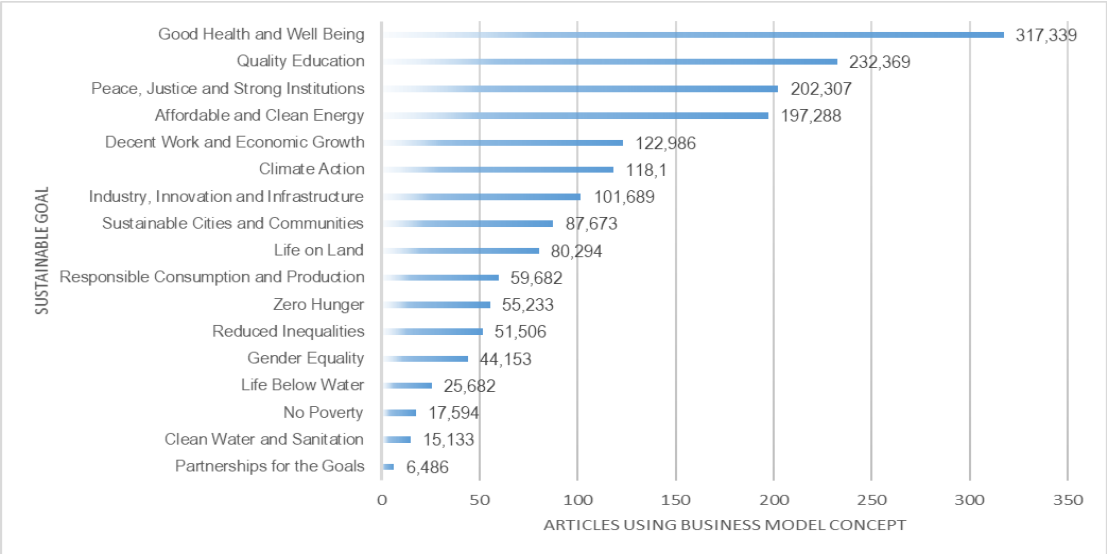
c) Value Capture: The value capture component explains how the company monetizes the value proposition and details the costs to create and deliver it (29). According to some authors, value capture is not only about making profits but also about other benefits resulting from collaborating with stakeholders (30).

Recently, a new version of the business model is discussed in the literature. This is known as a sustainable business model. To conceptualize this recent model, the value remains an important element. The type of value sustainable business models produce is not only economic but also social and environmental and is known as sustainable value (31). Despite the evolution of value and business models, value proposition, delivery, and capture are still employed but in a sustainable version, for instance, sustainable value proposal (see 32). The fact that the three components remain theoretically helpful for explaining both the economic and sustainable models, positions them as the most appropriate way to examine the benefits created by stakeholders' collaborations.

2.1.2. The business model in the energy sector, latest applications.

We searched for academic papers on Dimensions[1], a database useful for exploring the field where a topic is addressed in academic papers, to identify to what extent the business model concept is employed in papers dealing with the energy sector associated with sustainability. The result shows that the business model is largely employed within the seventeen goals for sustainable development but the number of academic articles employing a business model perspective to study the energy sector (as a sustainable development goal) is ranked fourth. Figure 1 shows our findings.

[1] Dimensions web page: https://app.dimensions.ai



Source: Modified from https://app.dimensions.ai.
Original version Exported: May 23rd, 2023.
Criteria used in the search: 'business AND model' in full data.
Classification: Sustainable Development Goals.

Figure 1. Use of the Business Model tool in the energy sector and sustainable development goals.

One example of how the business model tool has been recently employed in the energy sector is the article written by Vernay et. al (33). By employing the Value Proposition, Value Delivery, and Value Capture components, this work explains how energy communities contribute to the ongoing neutral-carbon energy transition in France.

This work demonstrates how useful the business model is to detect important aspects of the energy sector. In addition to identifying the economic and non-economic values produced for the business model stakeholders, this paper shows how useful the business model perspective is to identify important aspects of the energy sector.

We assume that social acceptability, a necessary condition of the energy transition (34), can be understood through the use of the business model tool. Therefore, it is crucial to understand what social acceptability is, what its fundamentals are, and how it is connected to the business model.

2.2. Acceptability, the meaning.

Acceptability is a concept that has often been compared and confused with others (6). To name a few, acceptability is compared to the technological risk of technology concept (35), public support, or social support (36). Acceptability is also considered a synonym for social license to operate (37). Although different, acceptability is usually confused with acceptance (38).

When acceptability and acceptance are compared, the concept can include different nuances such as social acceptance (39), community acceptance, local social acceptance, or local acceptance (40). However, acceptability and acceptance are not the same but are part of a more complex adoption process of technologies (41). Table 2 provides some definitions of acceptability and shows some conflicts of definitions and how complex the topic is.

Reference	Acceptability/Acceptance definition
(42)	Based on other work, this author states that "social acceptance… (is)… the acceptation or mere toleration of a new technology, while… acceptability… (is) a reflection on a new technology that takes into account the issues that emerge from its introduction." (p. 2)
(41)	"Acceptance corresponds to judgments, attitudes and behavioral reactions of potential users towards a product after they have tried it." (p. 252)
(43)	"Acceptability the extent to which products and services offered by a firm meet or exceed the expectations of customers. It has two dimensions: functional acceptability and psychological acceptability." (p. 5)
(40)	Local acceptance refers… "to public attitudes of the local community and social acceptance when the scope includes the broader society." (p. 329)
(36)	Acceptance is… "the respondents' attitudes including their behavioral responses after the introduction of a measure and acceptability as the prospective judgment to be introduced in the future." (p. 2)
(44)	"As far as the acceptability of wind energy projects is concerned for instance, the extant literature highlights the concept of "attachment to place", which designates an emotional and symbolic bond uniting individual with the place in which they live." (p. 4)
(6)	Acceptability is… "a favorable or positive response (including attitude, intention, behavior and -where appropriate- use) relating to proposed or in situ technology or social-technical system by members of a given social unit (country or region, community or town and household, organization)" (p. 2)

Table 2. Sample of definitions from the literature review.

Social acceptability involves an evaluative reflection by stakeholders (e.g., inhabitants, policymakers, consumers, investors) considering perceptions of issues, benefits, and risks emerging from a renewable energy project implementation (38). Acceptance is the final stakeholders' behavior concerning the project implementation (e.g., acceptation, tolerance, or rejection). Therefore, acceptability is more complex and relevant because it implies stakeholders' attitudes and perceptions as to what is proposed by developers at the infrastructural social, and environmental levels.

In this interpretation, attitudes define acceptability. Attitudes are an evaluative judgment not only toward the introduction of an energy technology but also toward possible behaviors in response to the technology, for instance, protesting against the technology implemented in communities (resisting) or proclaiming its advantages (acceptance in a supporting mode) (45).

Several theoretical perspectives are used to explain and define the acceptability of energy projects. Some examples are technology implementation (6), innovation theory (46) business models and entrepreneurship (47), or community ownership (48). However, since acceptability has much to do with attitudes, public perception, and public opinion (49), theoretical frameworks based on psychology and other social sciences are also common (50). Despite this diversity of approaches, definitions of acceptability have been found mainly in solar (e.g., 51) and wind energy technologies (e.g. 37,52).

3. Methods.

The identification of factors for acceptability in the energy sector was carried out through a literature review. We followed four steps to analyze scientific articles and reports:

Planning the review: Our plan considered examining papers dealing with the definition and analysis of acceptability and discussing the relationship between acceptability and BMs in the energy sector.

Conducting the review: In order to retrieve articles, we launched different search strings in two major repositories of scientific articles, Science Direct and Google Scholar. The concepts "acceptability", "acceptance", "analysis" and "business model" were used in multiple combinations. We also use "hydrogen"

and “biomethane” to collect papers discussing the acceptability of those technologies since they may be contexts where we would seek case studies to deploy our conceptual framework.

The combination of words is shown in Table 2. Journal articles written in English between 2010 and 2023 were the main search rules in the title and abstract.

	Search strings in Google Scholar and Science Direct
1	energy AND acceptability AND "business model"
2	energy AND acceptance AND "business model"
3	hydrogen AND acceptability AND "business model"
4	biomethane AND acceptability AND "business model"
5	"acceptability measurement" AND energy
6	acceptability OR acceptance OR measurement OR analysis
7	acceptability AND analysis AND business
8	"acceptability OR acceptance analysis" AND business

Table 2. Description of search strings for gathering papers from Google Scholar and Science Direct databases.

We retrieved 124 and 42 articles from Google Scholar and Science Direct respectively. Later, we removed repeated articles in and between both databases and we scanned the title and abstract to select 142 documents. We then analyzed those items in depth to obtain our final sample. The criteria for inclusion of articles in our sample were to select papers presenting some of the following aspects:

a) Definition of acceptability in the energy sector
b) How acceptability is being analyzed in the energy sector
c) Indicators to measure or study acceptability in energy projects
d) Arguments on how and why acceptability is related to the concept of the business model

After following these steps, we selected 42 papers. As we analyzed those documents, we realized that some articles were cited because they offered important notions of acceptability not only in the energy sector but also in other fields. So, we decided to include them. Thus, the final corpus of articles included in our review was 52.

Analysis: We used a conventional and inductive analysis for selected documents by reading and highlighting text defining acceptability, arguing links with the BMs, or discussing other relevant insights. We also employed an online text mining software (Voyant Tools[2]) to reveal the most frequent factors of acceptability from our paper corpus, results of this analysis are exhibited in section 4.2.

4. Results and discussion.

4.1. Descriptive results.

We found that the issue of social acceptability is frequently discussed in the following journals: Renewable and Sustainable Energy Reviews, Energy Policy, Energy, Sustainability and Society, Journal of Cleaner Production, Sustainability, and Technological Forecasting and Social Change. The largest number of articles published in the search period was concentrated in the year 2022, they were 9. The methodological approach used by the analyzed articles is diverse, however, theoretical reviews and case studies to understand acceptability in energy projects stand out.

[2] https://voyant-tools.org

4.2. Thematic results.

In this section, we summarize the thematic findings in 3 axes: definition of acceptability and contexts where it is studied, disclosure of the most commonly used acceptability factors for its analysis, and how acceptability is related to the business model.

Factors to study acceptability of energy projects.

Multiple factors can foster or limit acceptability. Different authors mention the conservation of nature, improving community participation, increasing transparency about the processes of implementing energy technologies and their benefits, encouraging community ownership, increasing the participation of community authorities, identifying key actors in the communities or outside the community for the promotion of energy projects, improving ways to negotiate with the communities, consulting stakeholders' opinions participating in the projects, promoting social innovation, reducing social and environmental risks during the different stages of energy projects, improving communication with stakeholders participating in the projects, improving the knowledge of the community as to the energy technology employed or improve communication through the provision of adequate and real information to the public, are factors that can improve the acceptability of energy projects (see 37,38,42,50,51,53–56). Other authors argue that if they are not taken into account by project developers or other stakeholders of the energy projects, they can trigger the community not to be in favor of the implementation and manifest certain resistance (45). However, acceptability (positive or negative) obtained by taking into account these factors (or not) is not consistent.

Although various factors are used to examine the social acceptability of energy projects, we aimed to detect the most frequent. After an in-depth reading of the selected articles, we constructed a summary of acceptability factors in a separate file. Eventually, we used this file to run a text-mining analysis to identify the most frequently studied factors in the literature. Figure 2 shows the results of this analysis in a word cloud display.

Source: Voyant Tools webpage. Data provided by authors.

Figure 2. Text-mining result of acceptability factors summary.

Figure 2 portrays twenty five words. The largest words located in the center represent the most frequent in our acceptability factors file.

We contrasted this result with the insights that we understood during the reading (some of them listed at the beginning of this section). We highlight that some words are acceptability factors perse, such as *information, benefits, participation, knowledge, communication, justice, and trust.* Some others do not have a special meaning as isolated words (*perceived, benefits, values, risk, social, economic, environmental, technologies*) but interpreted them as part of a group, they can reveal important aspects for the acceptability of energy projects. For example, to get acceptability of energy projects:

(i) The *perceived benefits, values, and risks* by the communities are important aspects to pay attention to (either *social, economic,* or *environmental*) (see 50 as an example). The most particular example is the word *environmental* which can also imply both the environmental risk that affects opposition and the environmental care that triggers acceptance of energy projects (see 57)

(ii) Project developers have to pay attention to how information about energy *technologies* is provided to communities (see 58,59 as examples).

Particularly, we distinguished that some words (*socio, community, market, acceptance, distributional, procedural, justice, and trust*) in this word cloud are part of an umbrella scheme grouping them and representing an analysis of acceptability at different levels.

The multilevel analysis consists of *socio-political*, *community*, and *market acceptance* (39). Socio-political acceptability is the attitude that society at large has about an energy project, community acceptability concentrates on the attitudes of community members where projects are implemented and market acceptability involves the attitudes of consumers, investors, and the firm in charge of the implementation (60). Among these levels, a consensus is found in the literature showing that community acceptability elements (procedural justice, distributional justice, and trust) play a crucial role in determining the social acceptability of energy projects (59).

On the one hand, procedural justice is about ensuring a fair decision-making process that allows all stakeholders to participate when energy projects are carried out. Procedures matter, especially to citizens; fair participatory processes produce fair outcomes for them. Some principles of procedural justice are to provide adequate information (technology, benefits, impacts, and risks) to stakeholders and to enable them to voice opinions (61). On the other hand, distributional justice consists of clarifying how benefits and costs of projects are distributed, it also implies examining how they are perceived by residents. Some benefits (values) in this sort of justice are not only economic but also goods and services, climate protection, reduction of energy costs, local employment, or tourist attractiveness (62). Finally, trust is to rely on the actions and verbal communication of the project stakeholders.

Acceptability and business models

We found that few papers have addressed the relationship between energy projects' acceptability and business models. What some works investigate is to identify the values delivered by energy projects. One example is the work of Mihailova et. al (63) which explores the creation of sustainable value by citizens and stakeholders of an energy community. Although these authors emphasize that collaboration among various stakeholders could lead not only to energy self-sufficiency of communities but also to greater public and social acceptability, the work does not elaborate on how the business model could lead to greater acceptability.

In order to advance the renewable energy transition, we believe it is important to describe what a business model aimed at generating acceptability looks like. To this end, it is important to review where the business model and acceptability converge.

Van der Waal et. al (42) provide notions letting us confirm a connection between business model and acceptability. They argue that one way to achieve acceptability for wind projects is to use a value-based perspective. Energy projects can be considered as entities producing economic, social, and environmental values for a complex system of stakeholders, that is to say, they can be treated as business models per se. The motivation for different stakeholders to participate in energy projects is the value they will obtain.

To improve acceptability, what these authors propose is to:

(i) Identify the values involved in energy projects;
(ii) Identify the values desired by each stakeholder;
(iii) How does each stakeholder try to insert values into projects;
(iv) How value conflicts are solved (negotiated/modulated) if interests between one stakeholder and another do not match in energy projects.

Considering that value is inherently related to the business model (22), we believe that these procedures are a matter of business model analysis. Hence, to get acceptability, project developers must show a high-value

sensitivity to be able to identify crucial activities and economic, social, or environmental values for stakeholders and incorporate them into the design of an energy project business model. We propose that combining the business model tool with the acceptability elements is a conceptual step to understanding what is distinctive about a Business Model for Acceptability.

5. A conceptual Business Model for Acceptability (BMfA) of energy projects.

The elements of community acceptability and some important and frequent factors discussed in the literature were combined with the business model components to tentatively show specificities needed for an energy project business model. Table 3 introduces the conceptual and preliminary BMfA.

This BMfA is the first step in our reflection on what are the main problems of the acceptability of energy projects. It is a draft that we envisage using to identify more distinctive characteristics of energy projects needing a license to operate. Therefore, this theoretical result (Business Model for Acceptability) will help us empirically explore the acceptability of renewable energy infrastructures.

	What acceptability literature says	Impact on the distinctive characteristic of the BM
Value Proposition	- Several actors have a perception/ attitude/ about projects that need a license to operate. - Value associated with a project depends on the type of technology, the consequences on nature and the environment, and health and safety hazards. Potential positive effect influence risk acceptability. - Need to develop value inclusive-design	Need to consider a **plurality of value** (both direct and indirect stakeholders) Defining **the perimeter is a strategic** decision (whose value matters?)
	-Public perception, knowledge about risks or perceived usefulness, and misinformation depend on the perceived legitimacy of the technology and public trust in the energy sector. → This reveals the need to organize information campaigns and to familiarise people with the technology. -Personal values are also an important determining factor for acceptability. People fear detrimental effects on human health, biodiversity loss, landscape degradation, and negative impacts on tourism and property prices. -Employment, age, and level of education can influence acceptability.	It is both about the **value created and value destroyed** (when the value destroyed hides value creation – the objective is to reverse this).
	Policymakers at local, regional, and national levels impose legal constraints on projects.	The perimeter (whose value to include) may be **both chosen and imposed** upon; it may also **change during the lifetime** of the project.
	People expect the conservation of nature and local community promotion.	Value has a **spatial dimension** (locally embedded)
	Local stakeholders may have demands regarding the scale of the project.	
Value delivery	The need for procedural justice via community participation from the start of the project is important to create more widely shared value conceptualizations and enable embedding in design. It is useful to create a space for constructive conflicts of value and where public risks perception can be acknowledged and addressed (providing information is not a substitute for addressing concerns and decisions needs to be correctable if information changes. Participative tools may help. All stakeholders should have a voice (a risk that opponents have a stronger voice than those in favor, especially if they are well organized).	Important activities in the value chain are **before obtaining the license to operate** and imply involving/giving a voice to the local community. The focal firms need to **tone value sensitivity**.
	Perception of a few organized actors can block a project even if the local community at large welcomes it.	The focal firm needs to build the **capacity to counteract small groups of** actors that can harm projects.
	Need to build trust and good relations with the community. In a participative planning context, the help of a neutral mediator or even supportive intermediaries can help.	Necessary to **identify bottleneck actors** that can act as trustees and help with **value transmission**
	Need for transparent communication in the life cycle of the project about project risks, complexity, and benefits.	**Communication capabilities** are among the core capabilities needed
	Local authorities facilitate different things for supporting projects (collaborative planning, consultation, and improving the collaboration of local citizens). They can also contribute to a sense of pride regarding renewable energy projects by local participants.	**Local authorities are bottleneck actors**
Value capture	Need for distributional justice which implies fair sharing of benefits and burdens of the project without giving the impression to bribe the community. These can take the form of compensation or benefit sharing. Economic benefits for the community appear as the main factor.	The necessity to include tailored compensation can make the **revenue model hard to predict** with accuracy
	Need for procedural justice.	**Long delays** in value capture.
	Giving local inhabitants the possibility to invest in the project either through crowdfunding or community ownership (literature review results suggest preference for participation that does not require active involvement)	A **hybrid model** combining market and community logic

Table 3. Specificities of a Business Model for Acceptability of energy projects.

6. Conclusions and future research agenda.

Our results allowed us to clarify the meaning of acceptability and its implications. We presented a summarized list of factors affecting the social acceptability of energy projects. We also presented the most frequent factors, and we presented some arguments as to how they might be part of a broader scheme for acceptability analysis.

We articulate our literature findings to introduce a Business Model for Acceptability (BMfA) of energy projects. This conceptual result is a draft, and it will help us to identify more distinctive characteristics of energy projects needing a license to operate.

By employing it, we envisage following the next research agenda aimed to understand what the main problems of the acceptability of energy projects are:

1. To identify acceptability problems from case studies to make a typology based on different dimensions:

   a) Generic problems. Identify acceptability problems, which represent minimum conditions to be fulfilled in energy projects and are common to numerous of them.
   b) Emerging problems: Identify acceptability issues that arise as the project is implemented over time and are difficult for stakeholders to anticipate.
   c) Specific problems: Identify specific acceptability issues associated with the nature of the project (e.g., wind, biogas, photovoltaic) or who is the project holder (e.g., community, authority, or company).

2. To evaluate the criticality of acceptability problems (generic or specific). In this way, we will identify the necessary and sufficient conditions for acceptability but which, if they are not met, would cause the energy project to fail.

3. The final procedure in our research agenda is to define, for each case analyzed, public policies or business recommendations that allow us to mitigate acceptability problems according to their type (generic, specific, or critical). We envisage formulating public policy recommendations on regulation, subsidy, or communication rules. As for business recommendations, we envisage producing negotiation and communication rules that follow a specific order.

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