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RESEARCH ARTICLE



Hydropower: renewable and contributing to sustainable development? A critical analysis from the Mazar-Dudas project (Ecuador)

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ABSTRACT

The energy transition has provided a framework for designing and implementing renewable energy policies in a growing number of countries in recent years. The discourse from both international energy organisations and national governments around these renewable energy policies highlights its -supposed- sustainable nature. However, much evidence shows that the “renewable” component of these energy policies and the impact on local communities’ sustainable development are much smaller than what is claimed in their discourse. This paper analyses the Mazar-Dudas hydropower project (Ecuador) case study, which is officially classified as a small renewable energy project (21 MW) with presumable low environmental impact and significant positive effects on sustainability of local communities. Although, the sustainability associated with hydropower production is one of the most controversial aspects of this energy production technology. Based on interviews with relevant actors and the subsequent thematic content analysis, the results highlight that the environmental impact is perceived as significant, contrary to what it is said in the official discourse. Additionally, the benefit-sharing scheme’s effects of this hydropower project are far below expectations.

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Introduction

Energy transitions: sustainable and renewable?

The energy transition has provided the framework for designing and implementing renewable energy policies in a growing number of countries in recent years. Behind them are organisations such as the United Nations (e.g. through the 2015 Paris Agreement), European Union, national agencies, and governments. Moreover, the energy transition framework is well reflected in the Sustainable Development Goals (SDG) of the 2030 Agenda (UN 2015). The SDG framework proposes a response to the mainstream of the “climate emergency” (Swyngedouw 2010) and focuses the attention on energy as a factor directly linked to climate change (UN 2015). In this regard, the organisations and institutions mentioned above recommend the achievement of the SDGs as a guiding framework for the transition pathways towards clean and sustainable energy (UN 2021).

The discourse around this global development framework, often repeated by many policymakers, highlights its inclusive, sustainable, and egalitarian nature, which many identify with the phrase “leaving no one behind.” However, critical research contests this global agenda for representing a Neoliberal Development Project that emphasises economic growth as a necessary condition for

achieving the SDGs. Weber is especially critical and conclusive in his analysis, noting that “... the SDG framework is deeply aligned with the rules and regulations of key international development institutions, such as the World Trade Organisation (WTO) and its highly contentious policies...” (2017, 2). In this context, we have “a development agenda that fundamentally privileges commercial interests by (re)framing development more broadly in terms of the market episteme” (Weber 2017, 3).

Indeed, these priorities are a highly concerning issue within the global development agenda, mainly due to redistribution and ecological implications of the prominence of economic growth (Weber 2017). The failure to address these fundamental socio-ecological and egalitarian issues distances the SDG framework from a truly inclusive, sustainable and renewable policy instrument, despite its rhetoric suggesting otherwise (Levenda, Behrsin, and Disano 2021).

Furthermore, several authors in the energy social science research and, in particular, in the critical renewability field highlight the current energy transitions, and their associated policies, as not always as sustainable and renewable as they are said to be. Some even emphasise the neoliberal philosophy under which renewable energy transitions occur (Batel 2020). This becomes evident, for instance, in the neoliberalisation of climate policy by extending the use of markets to address climate and energy issues (Vlachou and Pantelias 2021). On this matter, Swyngedown (2010) warned about the populism behind many of the policies on climate change, which are mainly benefiting large corporations, against both individual operators and local communities, as highlighted by Silva and Sareen (2020).

Together with the mentioned supranational organisations, large energy companies are significant players in shaping SDG objectives and, therefore, in renewable energy transitions and their policies (Scheyvens, Banks, and Hughes 2016). In this way, for many large companies, the renewable energy transition and the fight against climate change represent, first and foremost, new business opportunities and increasing profits, often masking their claimed commitment to the ultimate goals of the energy transition. In this regard, renewable energy power plants (and also carbon capture and emission reduction mechanisms) theoretically aim to mitigate climate change; however, they frequently represent one additional opportunity for business rather than a real solution to the climate crisis (Duarte, Boelens, and Yacoub 2015).

Additionally, despite the rhetoric of “leaving no one behind,” the SDG framework, specifically SDG 7, does not consider the energy justice implications of renewable energy in the nearby communities. On this matter, critical research on people’s responses to renewable energy technologies addresses the related discrimination, injustices, and inequalities (e.g. adverse effects on local communities) derived from renewable energy projects (Batel 2020). In a similar path, Levenda, Behrsin, and Disano (2021) highlight renewable energy’s negative environmental and social justice impacts. In this respect, from its frequent top-down planning and business perspective (where to set up infrastructure, which resources to exploit, the size of the development), through its construction and operation, renewable energy projects are not, per se, genuinely egalitarian nor sustainable forms of energy production. Therefore, SDG 7 fails in not considering three important energy justice issues.

First, similar to conventional forms of energy production, the physically unequal allocation of renewable energy production also leads to an unequal distribution of burdens and benefits (Jenkins et al. 2016), such as environmental inequalities (Heffron, McCauley, and Sovacool 2015), which are frequently the most important. These inequalities are of particular concern because of their role in creating further exclusions and imbalances, often in socio-economically disadvantaged areas inhabited by ethnic minorities (McCauley et al. 2019).

Second, it is known that in the areas where renewable energy infrastructures are built, local communities’ rights, values, or views are frequently ignored or not respected (Pastor, Sadd, and Hipp 2001; Schlosberg 2003; Levenda, Behrsin, and Disano 2021), or their social, cultural, ethnic or gender backgrounds are not recognised (Heffron, McCauley, and Sovacool 2015).

Third, renewable energy developments often ignore participatory and inclusive decision-making processes (Bullard 2005; Walker 2009; Jenkins et al. 2016), which are essential at the local level (LaBelle 2017). In this vein, renewable energy generation does not precisely incorporate the

demands and needs of local communities or new conceptions and roles of and for those communities. On the contrary, research in this field has shown how the relationship between political actors and local communities tends towards consensus building as a solution to promote renewable energy developments (Batel 2020). However, these consensus are not based on democratic processes but on asymmetric power relations that eliminate potential conflicts (Kropp 2018).

Having this in mind, SDG 7's lack of the energy justice perspective can be certainly detrimental within the global development agenda. Consequently, the 2030 Agenda would leave the most vulnerable behind if SDG 7 framework and practice do not consider energy justice implications. Therefore, in Hope's words (2021), it would reveal how the environment and (local) development assemble in an uneasy union within sustainable development discourse.

Hydropower and -un-sustainable development

The sustainability associated with hydropower production (power plants, the environment in the surrounding areas and reservoirs, local communities) is one of the most controversial aspects of this energy production technology. On the one hand, international organisations and governments intend to demonstrate that hydropower facilities do not seriously affect environmental sustainability. However, on the other hand, environmental organisations, local actors, and much of the scientific community highlight many examples where environmental and social sustainability are indeed seriously affected. This context raises the great debate on whether hydropower production can or should be considered renewable (and thus, according to its defenders, "sustainable").

Therefore, many international organisations directly consider hydropower a renewable energy source (IRENA 2021), arguing that its development is essential for the energy transition. Many governments base on this consideration to count hydropower as a significant part of their targets to reduce greenhouse gas emissions and fulfil their ambitious renewable energy targets. However, in many parts of the world, there is an agreement that "large hydropower facilities" should not be considered as part of renewable energy (IRN 2003; Gunkel 2009; Hudson 2017) nor as low-emission energy (Räsänen et al. 2018; Elagib and Basheer 2021), therefore should not be counted in energy transition targets towards renewable energy. In this respect, many countries consider only energy produced in small hydropower facilities as renewable. The question is where the boundaries of large and small facilities reside. In this sense, there are no agreed classifications regarding the size of the facility (Egré and Milewski 2002). However, hydropower plants less than 20 MW are usually considered small facilities (therefore, "more sustainable") (IRENA 2012), although indeed some countries only consider those of less than 10 MW (IPCC 2011).

Additionally, a related argument used by international organisations refers to the idea that run-of-river hydropower plants are more sustainable because they have little or no storage capacity and are more likely to be small facilities (IRENA 2012). However, there are many examples of large capacity run-of-river hydropower plants. For example, some authors stress that these facilities are clean and green since their operations do not alter nearby terrestrial or aquatic ecosystems (Kong et al. 2015), nor emit greenhouse gases or other harmful gases (Varun and Bhat 2012). Therefore, from their view, this type of facility would not generate serious unsustainability problems.

Nonetheless, in the face of the general consideration of hydropower as renewable and the idea of its low impact on environmental and social sustainability, environmental groups, local actors, and a large part of the scientific community, among others, are particularly critical of these postulates (Zanotti 2015); (Blake and Barney 2018) (Shah et al. 2021). In this regard, different studies point out adverse effects on local ecosystems, such as alterations to landscapes, changes in land use, landslides, and erosion processes, not only from large hydropower plants but also medium and small-sized (Kaygusuz 2009); (Pang et al. 2015); (Zhang, Xu, and Li 2015); (Kumar et al. 2021). Furthermore, large dams have also been highlighted concerning social unsustainability, with very negative social impacts (e.g. displacement of local communities, restrictions on farming). As a result, dam construction is often strongly contested by local communities, whose well-being is undermined, while distant

urban territories are the primary beneficiaries (Randell and Klein 2021). On this matter, hydropower has been deeply questioned for not advancing in a substantial change in the energy model, nor in the modes of production and consumption (Duarte, Boelens, and Yacoub 2015), and for not being environmentally, socially, and even economically sustainable, at least for the local communities (Zhang and Xu 2015; Sayan 2017).

Taking all this into account, responsible companies often establish mechanisms to alleviate and compensate local communities for these negative impacts on their environmental, social, and economic sustainability through various mechanisms. An international overview of them, and the case from Ecuador, are analysed below.

Compensating unsustainability from hydropower? Community benefit-sharing schemes

Acquainted with the problems of unsustainability arising from a significant part of the hydropower developments, international organisations and public agencies have taken up and promoted community benefit-sharing schemes. However, in their discourse, they do not explicitly acknowledge the unsustainability of such energy generation developments. On the contrary, they do so in a possibilistic sense and take credit for taking the initiative to implement hydropower projects in a sustainable manner (Wang 2012). For example, the World Bank's guide to implementing local benefit sharing in hydropower projects defines it as "systematic efforts by project proponents to sustainably benefit local communities affected by hydropower investments" (Wang 2012, 4; IHA 2019). In this sense, a benefit-sharing scheme, theoretically, involves a "sustainability intervention" that goes beyond replacing or enhancing lost assets (Schulz and Skinner 2022).

The motivation underlying these benefit-sharing schemes resides in the fact that the developers and the electricity consumers mainly gain the direct benefits from hydropower plants at the cost of relocation, resettlement, or environmental degradation of affected local communities (Wichelns 2014). Therefore, in line with the discourse of international organisations, benefit-sharing programmes aim to improve livelihoods in the vicinity of hydropower projects (Balasubramanya et al. 2014) and promote local development in municipalities (Égré, Roquet, and Durocher 2007) with a focus on making an additional and positive long-term development impact (Schulz and Skinner 2022). Therefore, such programmes theoretically should strongly connect the energy company and the local community (Paiva and Mateus 2017).

Following those official discourses, developers, municipalities, and other organisations have designed various schemes to share part of the benefits generated by hydropower operation with local communities. Nevertheless, benefit-sharing schemes may vary depending on the social, economic, and political contexts and even on power relations between companies and local communities (Kerr, Johnson, and Weir 2017). For example, shared benefits might use monetary mechanisms, resulting in tangible and immediate benefits for local residents (direct payments, discount on electricity rates, community development funds, etc.). However, they can also use non-monetary mechanisms for local communities (benefits in kind, improving infrastructures and local services, promoting local economic sectors, employment creation, etc.).

In theory, benefit-sharing programmes aim to improve the living conditions of people affected by hydropower projects. In practice, however, these schemes tend to show limited results. According to Suhardiman et al. (2014), the design and implementation of benefit-sharing schemes reflect a limited perspective on the potential benefits of hydropower development for affected households and communities. In contrast, the objectives of developers and governments have priority over the objectives and needs of the intended beneficiaries of these schemes. In this line, experiences in the global south show how benefit sharing programmes have been implemented actually as a way to smooth project building and operation when there is strong public opposition to hydropower (Balasubramanya et al. 2014).

In addition, different studies highlight the ineffectiveness of benefit-sharing systems. Lebel et al. (2014) describe how benefit-sharing measures to promote people's livelihoods do not always reflect

the needs of affected people and their communities. Balasubramanya et al. (2014) emphasise distributional inequalities due to benefit-sharing criteria that benefit both affected and unaffected territories from hydropower developments. Therefore, revenue sharing is unlikely to favour equitable development substantially and does not represent a substantial source of income for affected communities. Another frequent problem is the delay in obtaining and allocating funds for programme implementation (Lebel et al. 2014; Men et al. 2014). As a result, benefit-sharing programmes do not always improve people's quality of life or local development processes (Paiva and Mateus 2017).

Ecuadorian energy policy largely follows the discourses of international organisations (it goes along with the idea that it is necessary to contribute to the sustainability of local territories and communities affected by hydropower or other energies through different mechanisms). There are two main features of the Ecuadorian local community compensation scheme. First, electricity companies share part of their benefits with local communities by implementing Territorial Development Plans (TDP) in the corresponding project-affected areas. TDPs reflect the orientation of this benefit-sharing scheme to an intended place-based development and the concentration of the revenues in the area directly affected by the hydropower facility. Additionally, in theory, the TDP design come from a participatory process in which the local inhabitants should decide how to improve the living conditions of local communities. As a result, greater effectiveness, equity, and democracy could be expected from this share-benefit programme.

Second, the budget for implementing the PDTs is managed directly by the electricity generation firms, mainly public companies. This feature might seem positive from their direct involvement in local development processes and their significant theoretical proximity to the interests of people living in the project-affected areas. However, the effects of a company's involvement with such great power in the region (generally isolated and impoverished rural areas) could distort the relationships with the local actors. Furthermore, company management of TDPs might be an instrument for centralising local development or even political patronage.

Accordingly, the PDT benefit-sharing scheme preserves the logic of power asymmetry between the actors who have the dominant interest in hydropower development and those who suffer the social and environmental impacts. Therefore, it reveals the unsustainability of the benefit-sharing scheme and the gap between the official discourse and the results, which are far from those desired and publicly declared.

Case study, hypothesis, methodology and sources

Case study: the Mazar-Dudas hydropower project (Ecuador) and place-based development

Governments of Ecuador have promoted the growing participation of renewable energy as part of its National Energy Plan (SENPLADES 2009; 2013). The Mazar-Dudas project is a small hydropower project¹ with 21 MW, made up of three run-of-the-river power plants (Alazán, San Antonio and Dudas). The direct area of influence is made up of four of the eight rural communities in the municipality of Azogues (parishes of Rivera, Pindilig, Taday and Luis Cordero) in the Cañar province. They represent 84% of the municipal area (just over 1,000 km²), even though only 13% of the population (GAD AZOGUES 2015); (STPE 2017) (Figure 1).

The MDHP stands in a mountainous area with low population density and communication difficulties. Its economy is based on primary production (more than 2/3 of the working population), with family and subsistence farming, which is barely technical and offers low income. The resulting poverty indicators are particularly high (75% of the population, over 60% of the national average) (INEC 2010). From the environmental point of view, the unplanned advance of the agricultural frontier is a matter of much concern (Cuesta and Villagómez 2017). Notwithstanding, this area has much agribusiness or tourism development potential (ecological and recreation) in the economic domain.



Figure 1. Location of the study area (municipality of Azogues, Ecuador). Source: The authors.

The TDP aims to “drive a participative TDP with the population in the Mazar-Dudas project’s area of influence by reinforcing local capacities, conserving watersheds, and supporting social and economic well-being” (“As of December 12, 2020, CELEC EP listed on its website the information of Mazar-Dudas TDP”). To do so, the company reserves a specific budget and also manages supplementary financing (cooperation agreements with other organisations, frequently for certain works and projects).

Hypothesis, objectives, methodology and sources

This research focuses on analysing the effects deriving from a small run-of-the-river hydropower project, which were expected to be positive based on government official discourse. The interest of the case study is firstly based on it exemplifying the energy transition towards renewable energy and its theoretically explicit link with (local) sustainable development. Secondly, interest lies in the compulsory implementation of a benefit-sharing scheme through intended place-based development projects (TDP) that aims to improve the living conditions of communities in the influence area of the hydropower project.

Following the official discourse and the expectations of local communities, the research hypothesis is that this hydropower project and the TDP have positive and revitalising effects on local SD. To this end, two specific objectives are set out: identify the effects of the MDHP-TDP on sustainability in the area of influence and study the way in which the benefits and implications of the MDHP-TDP can be locally distributed in energy justice terms.

The present research involves a double analytical framework, the three SD dimensions and their interrelations (del Río and Burguillo 2008; UN 2015), and the energy justice one (Lacey-Barnacle, Robison, and Foulds 2020). In relation to the latter, it would be interesting to detect the main gaps for distributing the benefits and negative effects of the MDHP-TDP in the area of influence; identify which social and economic groups are more affected; and explore mechanisms by means of which decisions about the TDP have been made (Jenkins et al. 2016); (Villavicencio and Mauger 2018).

The research follows the case study methodological approach and includes a thematic content analysis of the interviews with local stakeholders. Thematic content analysis provides a useful and flexible method for analysing qualitative data (Brown and Clarke 2006). This approach is suitable for analysing how stakeholders value the MDHP-TDP and its effects, interests, incentives, and strategies, as well as its mutual relations and interactions (Rosso et al. 2014; Mendieta and Esparcia 2018).

In order to identify the key stakeholders and themes, in line with Alonso (2004), emphasis was placed on exchange and articulation processes among local groups of interest, the involved supra-local organisations and the company promoting the MDHP. The stakeholder's system includes the municipal area (beyond the four most affected local communities) and the provincial area. Although three types of stakeholders have been defined, namely public-institutional, social, and economic, this research focuses on the public-institutional ones because representatives of local communities and those non-local directly in charge of implementing public policies herein converge. These stakeholders are linked with the energy policy, leadership in promoting the MDHP-TDP, putting into practice TDP actions, coordinating the actions of public interventions in the territory or, above all, they are representatives of the local communities (Table 1).

Data collection was carried out by holding personal semi-structured interviews (the first months of 2018) with a representative sample (almost 3/4 of all stakeholders). Those not interviewed were due to difficult physical access or because they indicated that they were unable to offer any relevant information. The interview focused, first, on the effects that the MDHP had, using questions about consequences on SD in the territory, improvements to the population's quality of life, the most relevant (positive and negative) effects on the economic, environmental, and social areas, and the benefited or harmed communities and social groups by the MDHP. Second, on questions about the TDP, its objectives, appropriateness and relevance, its design (participation mechanisms, different stakeholders and organisations' level of implication, poorly represented groups), and the analysis of the results (their actions and relevance, territorial concentration, if objectives had been fulfilled or not, the extent to which actions had been performed, etc.). And third, on the effects on SD (from environmental, economic, and social points of view, the most benefited or harmed communities or groups, requirements not met, etc.). Data processing was done with the MAXQDA software by defining the three theme dimensions, seven codes and 42 subcodes, and later coding text segments and analysing the relation of the themes dealt with by stakeholders (Mendieta and Esparcia 2018).

Results: significant progress but below expectations of local communities

Forecasts and the current situation

The new MDHP (21 MW) would contribute to national electricity production with 125.3 GWh/year of clean energy, reduce CO₂ emissions by 60,000 tons/year, and save the State approximately 7 million

Table 1. The public-institutional stakeholders' system in the area of influence and the number of interviews held.

Interest Group	Organisation	Description	Code	No.
Energy policy	Ministry of Electricity and Renewable Energy	Guidelines to implement TDPs.	PE01-PE02	2
Promoting MDHP-TDP	CELEC EP	Operates the MDHP and promotes the TDP and implements it.	P01	1
Implementing TDP actions	CELEC EP		101-105	2
	Decentralised Autonomous Governments (DAG), municipal and provincial.	Local administration (municipal and provincial).		2
	Azogue Electric Company	Power company (electricity distribution and commercialisation)		1
Coordination in the territory	The DAG in the area of influence	Local administration (rural parishes).	C01-	1
	Government Delegations in the area of influence	Public organisations in the rural parishes area that coordinate the central government's actions in the parish.	C05	4
Representatives of local communities	Parish Councils in the area of influence	Government organisation of the rural parish made up of members.	E01-E08	7
	Azogue Municipal Council	The legislative body of the municipality is made up of the Mayor and councillors.		1
Number of interviews				21

Source: The authors (according to MDHP-TDP exploratory study and fieldwork).

euros/year. The government managed to have the project recognised internationally as a Clean Development Mechanism, and it was registered as such in the United Nations.

Despite these forecasts, at the end of 2021 the project was still at 87%², and only the Alazán Power Plant was fully operating (6 MW, 30% of the foreseen power). The main reasons for these delays were problems with the contract signed with the construction company, which would be solved during 2022.

Local effects were expected in the form of direct and indirect employment, mainly related to the works of this power plant, and to socio-economic development and environmental protection actions for the area of influence, which mainly were channelled through the TDP. The intervention areas are shown in Figure 2. While, regarding the created jobs, 77% were direct employment, of which half involved qualified employment.

Contribution of both the MDHP and TDP to the territory's sustainability: high expectations, limited outcomes

The stakeholders' thematic content analysis allowed us to assess to what extent they perceived the relevance of each sustainability dimension, and what valuation or overall position they had in relation to the contribution of the MDHP-TDP in the territory (Table 2 and Figure 3). The outcomes revealed that most stakeholders were well aware of the environmental and economic issues, but somewhat less aware of social sustainability:

Both flora and fauna have been the most affected by the clearance work done for the power transmission line and by moving earth for pipelines. Most of the vegetation, crops, and non-native forest species, like pine or eucalyptus, disappeared during earth moving works. For forested areas, clearances were done for the transmission line ... some fruit trees have been lost. (I01).

The population's high level of awareness about environmental issues is understandable bearing in mind that the MDHP's area of influence is an ecosystem considered an environmental asset because of its location in the National Sangay Park's absorption area. The study area also forms part of the Paute Hydropower Project's area of influence, which is considerably larger than the MDHP. So, the fact that the MDHP is a small-power plant and, consequently, respects the natural environment more (Kong et al. 2015), did not avoid many local stakeholders' negative evaluations.

Local stakeholders stressed the negative externalities and environmental impacts of this power project: deforestation due to civil engineering works (which have affected protective and non-native exotic forests); landslides and overflowing watercourses (*ravines*) (which have also stopped

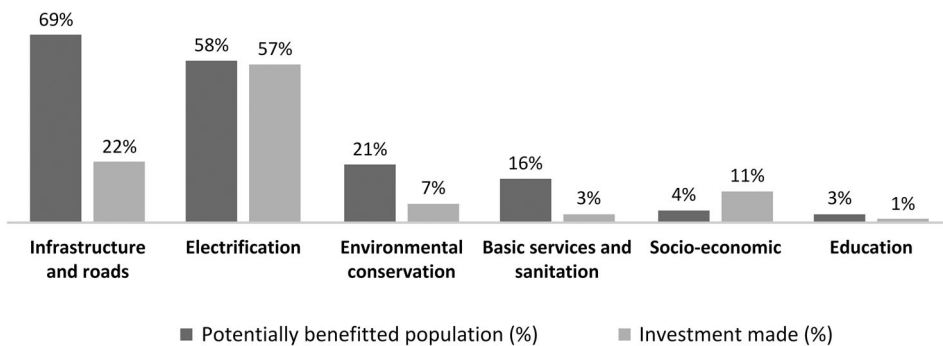


Figure 2. Territorial Development Plan (TDP): fields of operation and distribution of benefited population and investment (*). (*) Potentially benefited population as a percentage of the total population in the area of influence (PRPNP 2010–2020) and investment made as the percentage of the total investment (1.5 million euros). Source: The authors (in line with [“As of December 12, 2020, CELEC EP listed on its website the investments in territorial development for MDHP”]).

Table 2. Perceived Contribution of both the MDHP and TDP to the sustainability in the area of influence.

Dimension of sustainability	Stakeholders dealing with the dimension as a % (*)	Evaluation	
		Positive	Negative
Environmental	86%	30%	70%
Economic	76%	88%	12%
Social	19%	100%	0%

(*): As each stakeholder can deal with the different sustainability dimensions, the total percentage sums more than 100%. Source: The authors (according to MDHP-TDP fieldwork).

the building works for long periods of time, consequently with delays); and generally, altered landscapes (and, hence, a worse environmental quality in this mountainous area):

Wherever [transmission] lines pass, they affect the way all parishes look. When we walk around the eastern parishes, we’ve seen the number of cables, pylons ... it’s no longer the living nature that we lived before. I think there are four high-tension lines here in the Luis Cordero Parish; so, the panorama is different, it’s an attack on the landscape (E02).

Although the expected benefits were less than those forecast, part of the interviewed stakeholders stressed positive environmental sustainability aspects, such as conserving and recovering native vegetation, protecting water sources, or awareness-raising and environmental education actions. They especially stressed the slowing down of the advance of the agricultural frontier, which in this area has negative environmental effects (the removal of native vegetation, fewer water sources, increased erosion, ravines overflowing more frequently):

Environmental education has been given in education centres ... A reforestation project was also undertaken in the area of influence by planting native trees from this same area, and despite considerable earth moving works, CELEC has attempted to leave things as they were at the beginning (C04).

Yes, plenty of these actions and activities have been performed, like educating the population to stop the agricultural frontier from advancing; slowing down the effect on water sources and civil works to compensate for any effects (I05).

Many stakeholders voiced the positive contribution of both the MDHP and TDP to the economic sustainability of local communities by building and improving road infrastructures (with positive effects on tourism and for transporting farm produce), and promoting different economic activities locally, with consequent effects on job creation and improved household income:

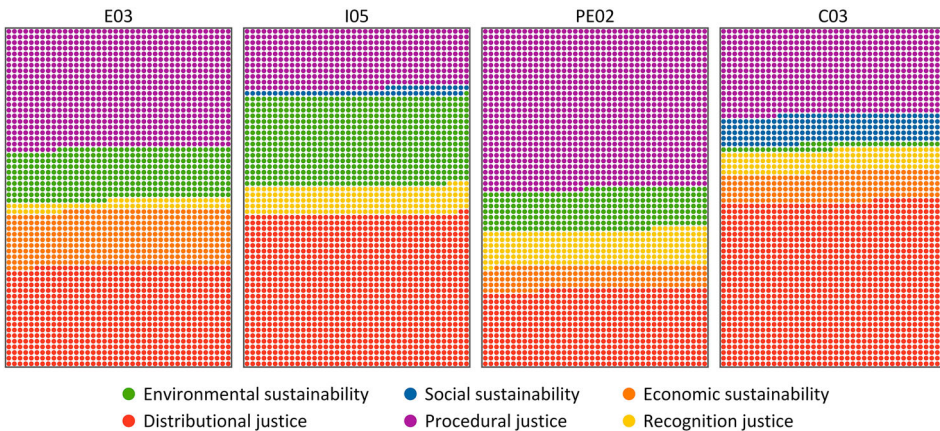


Figure 3. Relevance (in terms of length) of thematic contents of some interviews. Source: The authors (with the coding of interviews from MDHP-TDP fieldwork in the MAXQDA Analytics Pro 2020 software.) For type of stakeholder (E, I, PE, C) see Table 1.

Thinking positively, the MDHP has supported us by creating jobs, and building infrastructures not only in the Rivera Parish, but also in the four eastern parishes. So, investments have been made, not as high as they should have been (...) (E04).

The arrival of temporary workers, who were employed to build the MDHP, was another positive effect because of the higher demand to rent homes, and the rendered user assets and services. This motivated the creation or development of several local businesses (mostly in the local Rivera community), and a street market of local products was set up (in the local Taday community). All this meant promoting short distribution chains and the increase of farmers' income:

This has positively affected the parish because technicians have come to work on the construction [of the hydropower project]. This has increased the sales of local produce and local shops. It has also affected house rentals. It has positively affected some sources of employment, particularly unqualified labour. So, it has economically helped families in the parish to a certain extent (C01).

Vehicle traffic increased during the building works. Restaurants and shops had more customers. (...) The MDHP has also helped to move the economy more because people have sold at least one piece of candy, water, [since] they have driven their vehicles around, stopped and bought things (E02).

The creation of local direct and indirect employment was the second positive effect. Its impact was, however, almost more apparent than real because local stakeholders' evaluations were based on their expectations, and not on obtained outcomes:

I think that the fundamental objective should have been sources of employment and giving priority to the people living in the parish, so local residents would work on the hydropower project in the long term (C04).

Certainly, local employment was mainly unqualified and contracted mainly on a temporary basis (mostly when the power plant was being built). Nevertheless, the percentage of the local labour (21.5%) as opposed to that from elsewhere (78.5%), was striking ("As of December 12, 2020, CELEC EP listed on its website the employment created by MDHP"), especially as local labour is mostly unqualified (INEC 2010), as was pointed out by a local stakeholder:

Logically, jobs were created when construction was underway. We had serious problems with this. The inhabitants here were not contracted ... (E02).

Local stakeholders' expectations of the MDHP and TDP's economic effects were very high (hence their positive evaluations), especially considering the initial situation of local communities, characterised by high unemployment and poverty rates. However, neither the MDHP works nor the TDP actions proved to be a significant additional and stable source of income because of the incapacity to generate and drive sufficient activities to attract and settle the population in this area, particularly women and youths.

Finally, on the social dimension, the low proportion of local stakeholders who included it in their discourse was striking, although they were all well aware of its importance. Here we should stress these stakeholders' interest in the active implication of some local population segments in participative processes. These stakeholders were aware of the limitations and stressed that they had at least managed to reinforce associationism in the territory and, consequently, this led to more cohesion in and between local communities:

There was no type of associations before because there was no need to form them. A change has taken place in the parish. We realised it was necessary to form these associations and to make them work to benefit the parish and the association itself ... The presence of CELEC and the building of the hydropower plant were advantages because they were forgotten parishes before, but each one played its role. Now we are sister parishes (C03).

The energy justice derived from the MDHP and TDP

The benefits and implications of both the MDHP and the TDP locally can also be analysed from the energy justice perspective and its three basic tenets: distributional, recognition and procedural

(McCauley et al. 2013). This approach made visible those cases in which the MDHP-TDP had been able to ensure making energy justice, and (perhaps more importantly) exploring where the main deficits were, recognising the affected sectors and developing mechanisms to avoid them (Jenkins et al. 2016).

Unequal distribution of benefits and damage

Most local stakeholders recognised that the strongest negative effects concentrated in the MDHP's area of influence, mainly the environmental effects derived from the building works of the three power plants and power transmission lines (installing pylons and transmission power lines). These impacts were more serious because some of these processes were practically irreversible:

Evidently because civil works, the landscape changed, which was irreversible in some cases until the project ended. This was the case of the transmission lines and aqueducts, and these structures stand alongside rivers. These irreversible effects are affecting the landscape. This is something we cannot ignore. (I01).

Many farmers were negatively affected by the loss of farmland, by their agro-productive capacity being affected and by them being limited to use new lands for crop-growing (to protect sensitive areas, especially high up in mountains). The effect was lower productive capacity and less income:

Evidently, these lands were taken from farmers to be given to the State. So, farmers lost these lands and could not sow. This area was covered by large cornfields (C01).

Other benefited groups, such as the owners of those lands sold at much higher prices than their actual agricultural value. This extra income from expropriation has also been indicated in other studies (del Río and Burguillo 2008). In this context, the actions performed due to the MDHP and by means of the TDP were particularly relevant for cushioning these negative effects, and for correcting or compensating, as much as possible, unequal land distribution. Most of the local stakeholders recognised that these actions had beneficial effects for the area of influence. However, a high proportion of them (45%) pointed out that the positive effects had not been fairly distributed among local communities, and they perceived a tendency of the resulting actions (infrastructures, aid for productive investments, etc.) concentrating in those communities nearer the hydropower plants.

This distribution neither corresponded to each local community's actual requirements nor contributed to correct imbalances of local capacities. Nor did it promote high social capital where it was most needed. This would mostly explain why some communities had managed and put to better use the resources that derived from the TDP than others. So, the fact that part of the aid benefited the most vulnerable groups, but the indirect effects also fell short of expectations in relation to, for instance, local job creation of a temporary and unqualified kind (Figure 2), was recognised.

Delays in setting up compensations: increase of injustices, poverty and imbalances

The MDHP's area of influence is relatively isolated from urban centres. Its population is mostly indigenous and has been traditionally overlooked and marginalised. This is why the community benefits received from the MDHP-TDP were so important. Local stakeholders generally recognised that their needs have begun to be addressed. However, they perceived that the rights of local communities were not being sufficiently recognised or, at least, those of some groups or workers linked with particularly affected activities.

This injustice can be stated of many farming families, for whom the works and measures related to the MDHP had led to social exclusion and even poverty, resulting from the combination of the prolonged delay in paying compensations, not earning alternative income, and not being able to buy other lands. Such is the case of families whose small or poorly productive farmlands were expropriated or those who owned farms in recently protected areas. Payments of compensations helped to relieve this situation, even though structural problems persisted.

Another negatively affected group was made up of small entrepreneurs or businesspeople linked with the incipient tourism activity (based on the beautiful landscapes in mountainous areas). Although these activities were not as important as farming activities, the economy of the affected families also worsened. In this respect, some local stakeholders perceived certain injustices in the way aid was distributed, such as that to reinforce production (in the form of delivering farming supplies), which would more benefit some communities, but harm others (e.g. Rivera), and without actually knowing the criteria set to assign this aid:

I've seen CELEC grant a productive project to a certain community, and we had no idea about this. So, I think there should be more coordination, no matter what the party line is (E06).

Finally, injustices were also perceived with respect to the unemployed or the underemployed population, mainly young people. They lived up to the expectation of gaining access to job posts, at least unqualified jobs, but the outcomes indicated that local job contracts were well below the expected numbers. This population segment feels marginalised by the company.

Insufficiently participative and inclusive decision-making processes and institutional stakeholders' preponderant role

The importance of participative processes is an excellent indicator of procedural injustices (Tabi and Wüstenhagen 2017). They were herein used to analyse the extent to which the local communities participated in defining and performing the actions set out in the TDP. The local stakeholders mostly criticised the participative processes because they should have helped the local communities and their representatives to actively participate in defining the actions to be performed.

The community does not only need to know the plan by means of proper socialisation. People must also participate in devising the plan because they know the real requirements involved (E01).

The outcomes highlighted those participative processes actually existed. Nevertheless, it is stressed that they were mostly evaluated as purely formal (75% of stakeholders), which were restricted to the information supplied by the company or, if applicable, to act only as socialisation spaces for the local people and did not help to channel their hopes about possible actions. Both local and external stakeholders agreed about that:

It is necessary to meet absolutely all the needs because some were not considered by means of socialisation with local people. So, the true requirements that this community is concerned about remain unknown (E05).

At Hidroazogues [CELEC], a proposal was made to reach out to the community. It was difficult, but work was done. Although there has been participation, it is not institutionalised because there should be representatives from the area to control projects and to monitor territorial development (I04).

What can be concluded is that local communities played a very small part in devising the TDP, which contrasts with the strong sense of community and the high levels of social cohesion. This deficit was corrected only partly with the representative key stakeholders from local communities being present in these participative processes (as pointed out by 71% of the interviewed stakeholders), who recognised that they did not play a particularly relevant role. Likewise, a high proportion of interviewees perceived that representatives of local communities did not even have the chance to adequately participate (29%), which is very significant.

The presence of local communities, or their representatives, in true participation processes was not a purely theoretical matter, but one that clearly influenced specific works. According to many stakeholders, this deficit would explain why some of the population's requirements were not sufficiently considered when actions were defined. These requirements were mainly educational and involved gaining access to drinking water and sewer infrastructures.

The presence of, or the active role played by, local stakeholders, was another relevant factor in the phase when TDP actions were performed. In fact, sometimes the problem lay in the assumed participation actually limiting the institutional stakeholders involved and, logically, the local community

and the remaining stakeholders practically remained outside the decision-making processes. Not even did the presence of farmers and some business stakeholders result in any particularly relevant participation.

The serious consequence of this mostly institutional presence was that it neither led to the integral execution of the foreseen actions nor did these actions actually cover local communities' requirements (as highlighted by deficits in production diversification actions, cutting the farming commercialisation chain, improving agricultural and fishing technologies, etc.).

Local stakeholders' role differed depending on their power position in the institutional structure. Three kinds of stakeholders stand out. One formed by the government delegates from each local community or parish, who acted as coordinators of actions. Another is formed by the local administration in these local communities or parishes, acting as an alliance with the power company (CELEC EP) and playing a leading role in implementing the TDP. Finally, there are the presidents of "communities", local leaders who clearly influenced citizen organisation structures, but whose role in relation to the performed works was more limited. Other stakeholders played a less important role, such as municipal governments (despite them having much more power than the governments of parishes), or were virtually absent, which could be stated of the Ministries of Agriculture and Livestock and Education.

Discussion

The international literature emphasises that hydropower projects can have significant and multidimensional effects on rural settings and, in order to analyse them, they have to be related to a much broader context of their contribution to the different sustainability types (Tahseen and Karney 2017). To this approach, which is quite a long-standing one in the literature, energy justice needs to be added because it is a more modern and very suitable approach to value effects on local communities.

Ecuadorian energy policy is theoretically framed within this double approach, SD and energy justice. In fact, the analysis of official documents, from the Ecuadorian Constitution, the National Plan for Good Living, or the Territorial Development Plans, highlight a theoretical commitment to SD and energy justice for local communities in general, and in particular where energy projects are implemented.

Part of the international literature highlights the trend that the size of power generation projects tends to directly condition their greater or lesser environmental sustainability (IRENA 2012); (Nautiyal and Goel 2020). According to this literature, the MDHP, which is a small hydropower project, would therefore contribute to minimise negative landscape/environmental impacts. However, the results show that, at least from the point of view of local stakeholders, not all negative impacts on the sustainability of local communities are not sufficiently or adequately mitigated or compensated. Similar cases are also reported in the literature (Tahseen and Karney 2017). In this case, the negative perspective of local actors is reinforced by the presence of several large hydropower plants in the vicinity, which obviously have major impacts on the natural environment and landscapes. Studies of similar cases also highlight the presence of such major negative impacts (Frantál, Pasqualetti, and Van Der Horst 2014).

Large-scale conflicts have not yet been identified in the MDHP, possibly due to the fact that only one of the three foreseen power plants have been completed and put into operation. However, some dissatisfaction can already be detected among the local actors and population.

The literature emphasises that small projects usually involve the participation of the local population (Klimpt et al. 2002; Carrera and Mack 2010; Sparkes 2014), have positive effects on social cohesion (Morimoto 2013; Delicado, Figueiredo, and Silva 2016; Osti 2016) and stimulate a certain degree of associationism (del Río and Burguillo 2008). In our case study, there has indeed been a certain level of participation by the local population. However, this is globally assessed as unsatisfactory, partly because it has been controlled by certain stakeholders (power elites). In turn, associative activities

in the local communities and cooperation between the different parishes have been practically non-existent.

One matter that very much worries local communities is its impact on both local economy and employment (economic sustainability). The international literature underlines two important aspects. The first one is that hydropower projects tend to significantly impact local employment, particularly in the building stage, although employment is mostly temporary and unqualified (Moreno and López 2008). With Mazar-Dudas, both temporary and unqualified work concur, but the effects on local employment hardly concur because the building company, which was external, made use of its own employees. The second aspect stressed by the international literature is the extra-local nature of more qualified and stable employment, which is also centred in the operation/maintenance phase (Reddy et al. 2006). These trends also feature in our case study. This low impact on local employment in the MDHP limited the multiplying effects, e.g. production diversity (del Río and Burguillo 2008) and innovation capacity when building and operating these infrastructures (Carrera and Mack 2010).

If the effects of the MDHP are less than those expected (in both the local communities and that indicated in the international bibliography), then the TDP, as a compulsory local development and place-based scheme, should become particularly relevant. Generally speaking, theoretically, TDPs address better roadway infrastructures, community/education equipment, rural electrification, and basic services and sanitation. Of course, Not all TDPs act in the same way in all domains. While the TDP herein acted more towards community equipment and electrification, the TDP of the Villonaco Wind Farm addresses roadway infrastructure and school equipment (Mendieta and Esparcia 2020). Actions performed in the education domain tend to be considerably present in schemes of community benefits linked with renewable energy (Munday, Bristow, and Cowell 2011; Rudolph, Haggett, and Aitken 2015). However, this is something that local stakeholders miss in the TDP associated with the MDHP.

The effects that the TDP has on the productive sector are still, from the local stakeholders' perspective, a pending matter. One fundamental objective was to increase job opportunities and improve family income. However, apart from some isolated aid, it cannot be stated that these aims have been met, at least not significantly so the agricultural sector has not been reinforced (training, technical counselling, innovation, diversification, productivity, fair trade, etc.); diversification towards other sectors like tourism or agribusiness have not been sufficiently stimulated; nor has the development and reinforcement of the local productive fabric been stimulated (e.g. both small business and social economy in the commerce sector and local services).

Distributional justice is a theme that has been discussed in the literature about renewable energy projects for a very long time (Batel 2020); (Levenda, Behrsin, and Disano 2021). The starting point lies in the fact that while the profits made from energy production tend to be widely distributed, negative effects concentrate wherever energy is produced. Besides, these areas never receive enough compensations and community profits (Walker 2009); (Jenkins et al. 2016). At Mazar-Dudas, these negative effects (deforestation, landslides, and overflowing ravines, altered landscape, poor agro-productive capacity in the area, etc.) are found despite the small size of the hydropower project. These effects require public policies to offer a fairer deal to the most affected lands (Eames and Hunt 2013), a task that would be expected of TDPs. Nonetheless, as the international bibliography points out, these schemes frequently (which is also the case in the MDHP and its area of influence) offer more benefits to better organised communities, those with more resources and capacities (Park 2012); (Catney 2014), and/or where local elites are more and better networked with external elites (hydropower company or other government bodies). All these elements converge in our case study.

Although no problems related to the recognition-based tenet local communities appear in the present case study (as set out by [(Sovacool y Dworkin 2015; Schlosberg 2003; Bullard 2005)]), MDHP is a good example of unsatisfactory participative processes, which have been characterised mainly as informative. Even though these processes led to some suggestions, the local community did not actively and formally participate in defining and prioritising actions. Moreover, some

strategic stakeholders were not present in these processes held for the design and efficient implementation of the TDP and were both public (the Ministries of Agriculture and Livestock and Education, and even part of the local administration) and private (local businesses) stakeholders.

In this context, the commitment of public decision-makers with this compensation scheme is questionable taking into account the resources that have actually been allocated to this TDP. Certainly, despite the law foreseeing using 30% of the profits made with the MDHP, the actual figure is well below than expected. The given reason is that the project is only producing barely one-third of its installed capacity. To correct these imbalances, a Regulation of the Law (February 2020) was proposed, which included the objective of setting up a common fund for all TDPs so that they all have access to fair financing. However, by early 2022 the Regulation has not yet been implemented, nor is there any certainty that these imbalances in the distribution and availability of funds for TDP will be fully addressed in the coming years.

Conclusions

This article raises the initial question of whether energy generation projects are compatible with sustainable local development. The discourse of both international organisations linked to hydropower generation and many governments emphasises that, in most cases, hydropower can be considered renewable and, consequently, contributes to sustainability objectives. In this respect, they stress that these projects are environmentally friendly, economically sustainable through job creation, and socially sustainable through participatory processes and cooperation between stakeholders fostered in local communities.

However, as much of the international literature highlights, such a rather lax consideration of renewable would be highly questionable. On the one hand, most projects' economic impact is often much lower than expected. On the other, in most cases, the contribution to participatory processes is far from responding effectively to the official speeches and statements.

The case study of the PHMD in the municipality of Azogues (Ecuador) is another example of the limited or questionable sustainability of hydroelectric projects. Thus, although it is a small facility (6 MW in operation, out of a total of 21 MW), from the perspective of the local population, the adverse environmental effects are already evident, such as landslides, deforestation, landscape degradation, etc. Similarly, from an economic perspective, only temporary low-skilled employment has been generated locally, mainly during the construction stage. In addition, there has been a loss of agricultural land (which has contributed to impoverishment, given that farmers have not received timely compensation or alternatives to farm in other lands). Furthermore, the local productive structure has not developed as much as expected. Instead, the only found evidence is a small stimulus to local commerce, which has not led to the consolidation of a wide range of services to cover the needs of the power plant. Therefore, coming back to the research hypothesis previously stated, it can be said that, according to the obtained results, neither the PHMD, nor the TDP linked to it, are implying a significant improvement in the SD of the local communities, contrary to what the official discourse has been defending.

Due to the sustainability issues related to hydropower, benefit-sharing programmes have been implemented in several countries to benefit households directly affected by hydropower installations. For example, in Ecuador, the benefit-sharing programme contemplated by current legislation has been implemented through Territorial Development Plans (Planes de Desarrollo Territorial). Through this instrument, the (mainly public) companies developing hydropower projects would invest in a variety of sectors to improve livelihoods of local communities, such as civil infrastructure, educational and health facilities, as well as promoting the development of various productive sectors (mainly supporting commercial and agricultural activities). Therefore, the planning of the TDP should derive from participatory processes within the local communities to identify local needs and prioritise actions to be implemented. However, this instrument non-explicitly aims to increase the local acceptance of energy projects and prevent any possible local opposition.

The PDC benefit-sharing scheme has been implemented in Ecuador for a decade. The case study of the Mazar-Dudas hydropower plant highlights two relevant aspects. Firstly, the announcement of the PDT, and the promised investments to promote the local community's development, raised high expectations and even favourable attitudes towards installing the hydroelectric power plant. Secondly, the Mazar-Dudas TDP contribution to triple sustainability has not been achieved sufficiently and is still far from expected. As a result, the implementation of the PDT has led to frustration and disappointment among the local population, given the poor results, far from the original promises, despite the government's theoretically good intentions. Other Ecuadorian case studies, though referring to a wind power plant, present similar results (Mendieta and Esparcia 2020).

The disappointment of the local communities centres on several aspects. First, the available budget has been insufficient (with no possibility of being corrected in the coming years) and far below what is needed to carry out all the planned actions. Second, as a result, not all the planned infrastructure and facilities have been built, nor has the local economy (especially in the service, agribusiness, and tourism sectors) been stimulated. Third, participatory processes have been weak and often controlled by local elites, with the result that the local community does not fully identify with the prioritisation of implemented actions. Finally, in general, local people perceive that the effects and burdens they suffer are not justified, as long as the hydropower project is not complete, therefore is not operating at its total capacity.

Finally, as for the role of the PDT as a compensation and energy justice scheme, there is still plenty of margins left for improvement in both distributional and procedural justice. Reasons can be found again in the delays of operation and profitability of the MDHP, which limited available resources to distribute among the affected communities. Additionally, the institutional approach for the planning and setup of the PDT fails to respond to the local communities' real needs. A turnover in this procedural justice issue could be only possible if adequate participation mechanisms are implemented. Therefore, running a development plan that best responds more to local communities' requirements can also prove fundamental since those development plans can empower communities to become active participants in the planning process.

Notes

1. MDHP is one of the eight hydropower projects that have been promoted in this direction since 2009 by the public company Electric Corporation of Ecuador (CELEC EP).
2. The building works, which began in 2012, stopped in 2015.

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