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# **The effectiveness and efficiency of local governance in the energy transition: the case of the Queyras region (French Alps), a case study.**

## **Abstract**

Reducing carbon-based energy consumption involves both switching to the production of renewable energy (RE), such as hydro, solar, wind and wood heating, and becoming more frugal or reducing consumption overall. Reducing energy consumption is only possible if we adapt and change our consumption patterns. At the local level, however, the development of renewable energy is hampered by cumbersome procedures and opposition. This article looks at how projects are developed and managed. Most of these projects are the responsibility of public or private bodies that are too far removed from the problems of the areas where the infrastructure is to be built. However, the scientific literature shows that there is a link between the effectiveness and efficiency of mixed use and that the most sought after practices are linked to social, economic and political objectives. In the Queyras region of the French Alps, interviews with 22 stakeholders, processed using Hyperbase © semantic software, show that local governance of the energy transition is effective and efficient in technical, economic, social and political terms. The move towards greater sobriety and a change in energy consumption patterns is reflected in the involvement of citizens in governance processes.

## **Key words**

Energy transition; Energy communities; Energy democracy; Local governance

## **Highlights**

- Technical, economic and social effectiveness and efficiency of local government
- Making local government look good especially to local stakeholders
- The need for mixed rather than unilateral engagement strategies
- The growth in renewable energy is a shift in the empowerment of citizens
- A new governmentality consists of governance based on citizen participation

## 1. Introduction

Reducing carbon-based energy consumption requires a shift towards green energy production (hydropower, solar, wind, wood heating) and greater sobriety (Adams and Acheampong, 2019; Cutore et al., 2023; Shobande et al., 2023). Because of its complexity and safety issues, nuclear power generation is only undertaken by public and private, national and multinational bodies, with chains of decision-making and technical processes that result in long lead times to respond to the climate emergency. Green energy production infrastructures are growing rapidly in developed countries, especially in Europe (Devine-Wright, 2019; Busch et al., 2023; Radtke and Wurster, 2023). They are technically simpler and less costly than other forms of energy production, such as nuclear power. And they have far less impact on the environment and human health. Paradoxically, in some countries, such as France, the development of renewable energy is slow (it takes three times less time to build a wind farm in Germany than in France) and increasingly faces local opposition (Smalskys et al., 2020; Salak et al., 2022; Shobande et al., 2023). Shouldn't we be looking at the conditions under which projects are developed and the way they are managed, which is essentially the responsibility of public or private bodies that are too far removed from the issues at stake in the areas where the infrastructure is to be built? As several authors have pointed out, the scientific literature shows that there is a link between effectiveness and efficiency, and that the most frequently cited procedures are linked to social, economic and political objectives (Ford et al., 2021; Del Rio and Kiefer, 2023; Dudka et al., 2023; Fell et al., 2023; Romero-Jordan et al., 2023).

Furthermore, sobriety, i.e. reducing energy consumption, can only be achieved if there is flexibility (Couraud et al., 2023; Valkering et al., 2023), i.e. the ability to adapt and change consumption patterns. For Valkering et al. (2023), flexibility has implications for the efficiency and effectiveness of the energy transition. The technical and scientific issues surrounding austerity and flexibility cannot be separated from socio-economic and socio-political issues (Hoppe et al., 2015). The emergence of autonomous processes deserves to be explored as a source of innovative solutions that meet the real expectations of local residents and stakeholders, who are developing new forms of organisation and even new processes as part of the energy transition (Smalskys et al., 2020; Soutar et al., 2022; Dudka et al., 2023; Ryder et al., 2023; Valkering et al., 2023). Local governance is agreed as a goal for local development, as adopted

by the United Nations Development Programme (UNDP, 2016). *“Local governance refers to the whole range of interactions between players at the sub-national level, ranging from local governments, to private sector, civil society and community-based organisations. It is the combined set of institutions, systems and processes, at the sub-national level, through which local authorities interact with and provide services to citizens, groups, and local communities and through which the latter articulate their needs”* (UNDP, 2016, p.10).

Local governance seems to be a prerequisite for the development of green energy in particular (Devine-Wright, 2019). As stated by Valkering and al. (2023), "the increasing degree of decentralisation of energy infrastructure implies an increasing degree of local supply of energy production". For Ryder et al. (2023) and McNaught (2024), collaborative processes may be the way to facilitate the approach and management of the complexity of multiple objectives related to the diversity of stakeholders. This flexibility cannot ignore the issue of fuel poverty, and addressing it requires local knowledge of the people living in the area (Couraud et al., 2023; Dudka et al., 2023; Moon et al., 2023). The shift in production towards low-carbon energy and the change in consumption patterns raise questions about the territorial level of governance. Local and collaborative governance seems to be more efficient, and with the study of an exemplary area, our study attempts to show how local governance (Wyse and Hoicka 2019) is proving effective technically, in terms of project management, and in terms of economic, social, environmental and political (in terms of democracy) impacts on the area (Devine-Wright, 2019).

In order to answer the scientific question posed, this article consists of the following four parts: a description of the materials and methods used or constructed for the research, a presentation of the results, their discussion and a conclusion.

## **2. Materials and methods**

### **2.1 Study area**

In order to assess the effectiveness of the transition to other forms of energy production and to greater sobriety, it is necessary to analyse the components of an area. To answer this question, we have chosen the Queyras, a mountainous region in the French Hautes-Alpes (Fig. 1), because it is an example of

innovation and diversity in the production of green energy. For this type of sparsely populated and widely dispersed area, the challenge of energy transition is twofold: the local development of green, non-carbon (in the sense of fossil carbon) energy and the fight against fuel poverty.

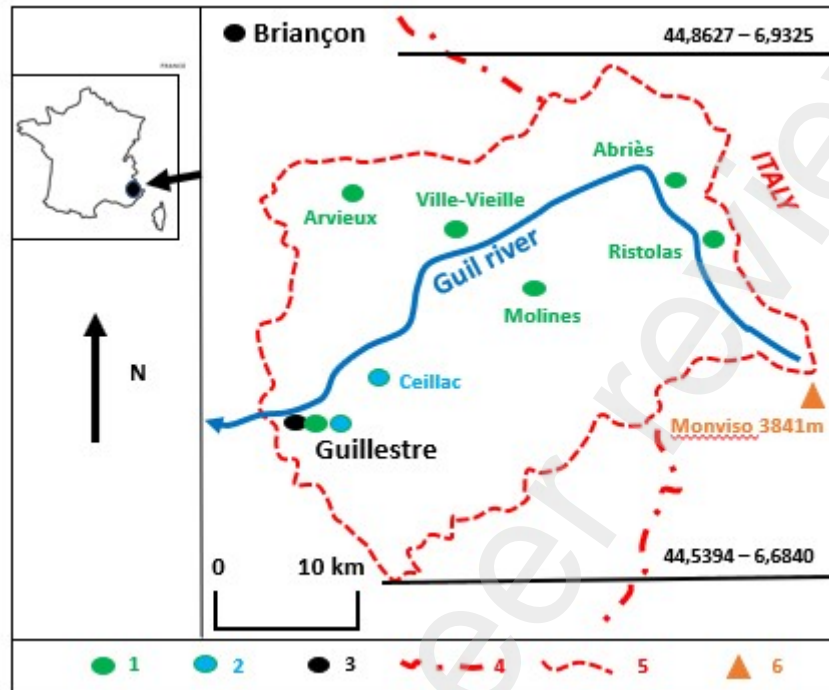


Figure 1: Location map (caption: 1 Wood boiler and heating network; 2 Micro hydropower plant; 1 and 2 villages; 3 towns; 4 French-Italian borders; 5 boundaries of the area studied - nature park and community of municipalities- ; 6 summit)

This area is made up of the catchment area of a tributary of the Durance, the river that drains all the southern Alps from the Italian border. This river, the Guil, rises from ridges over 3000 metres high. The end of the basin is dominated by Monviso. The mountainous character of the area is strongly influenced by the local geomorphology, with steep mountainsides dominating the rare alluvial plains of the Guil river. The villages are mainly located on these river axes. Warm and dry in summer, the valley is one of the snowiest in the southern Alps. The high ridges are still home to rock glaciers. The landscape is dominated by forests, mainly larch (*Larix decidua* Mill.). High above the forests are alpine meadows. These are areas used for grazing. They are managed by landowner associations. Administratively, it belongs to the Queyras Regional Natural Park, which is part of the Monviso Biosphere Reserve, a

UNESCO site. The area is made up of 10 municipalities with a total population of 8,200. Tourism is the main activity, with ski resorts and summer tourism (hiking, canyoning, etc.).

Agriculture is omnipresent in the landscape. Although it does not employ many people, it is the mainstay of the local economy, and livestock products are exported. The area is used by transhumant herds from the lower areas of Provence. The forest is exploited for its wood, mainly for carpentry and furniture, but most of the processing takes place outside the area. These activities are complemented by small-scale and industrial processing of local products. Although the region's economy is still dependent on the outside world for income from tourism and the export of agricultural and craft products, local stakeholders are working to develop activities that promote self-sufficiency by shifting agricultural and food production. The recently formed agricultural cooperative is buying up agricultural land to enable farmers to settle in the area and devote their activities to production to meet the needs of the local population.

## 2.2. data collection

The data collected is based on the study of databases and the analysis of administrative and territorial structures. The analysis is based on data provided by various French public institutions (INSEE, National Institute for Statistics and Economic Studies, <https://www.insee.fr>, ADEME, French Agency for Ecological Transition, <https://www.ademe.fr/>, Département des Hautes-Alpes, <https://www.hautes-alpes.fr/>, Queyras Regional Nature Park, <https://www.pnr-queyras.fr/>, Communauté Guillestrois Queyras, <https://www.ccguillestroisqueyras.fr/>). Socio-economic data and data on energy production and consumption are taken from databases or reports, in particular the climate-energy diagnosis of the Queyras Regional Nature Park (Parc Régional Naturel du Queyras, 2021).

## 2.3. survey and processing

By studying the data, we were able to define a sample of relevant stakeholders. Those who responded positively were interviewed. The recorded material was processed in several ways (Assuma et al., 2024), as shown in Figure 2. The aim was to process qualitative data from the raw material constituted by the interviews (Toro et al., 2013).

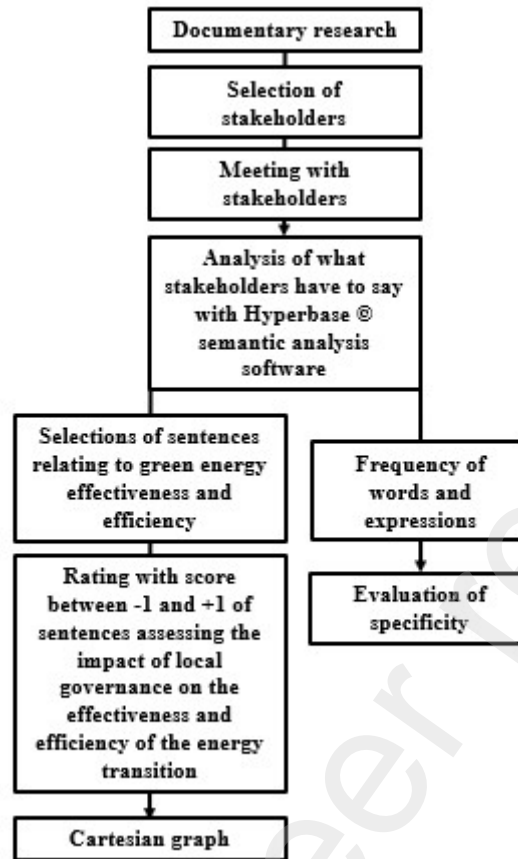


Figure 2: Data, statistical corpus and interviews and their analysis methods

The approach (Figure 2) was to conduct interviews with 22 stakeholders selected from the data analysis above. The interviews were then transcribed and analysed using Hyperbase© semantic software (Brunet, 2011; Brunet, 2012). The governance analysis concerns the methods and choices used by local stakeholders (public and private) to decide to create green energy production and distribution infrastructures, as well as the methods used to manage, market and use the revenues generated by these infrastructures. We carried out a survey based on interviews (about one hour each) with twenty-two stakeholders (Table 1) from outside (A in the tables) and inside (B in the tables) the Queyras area. Each stakeholder is concerned with energy issues or the impact of infrastructure. Table 1 shows the diversity of the stakeholders selected by the authors of this survey.

Table 1: List of stakeholders interviewed (A: stakeholders from outside the Queyras region; B: stakeholders from within the region)

<i>Stakeholders</i>	<i>Spatial level</i>	<i>Political and administrative structure and Public institution</i>	<i>Association, private company</i>
A	National	ADEME : French Agency for Ecological Transition (Technician)	
A		ONF, French National Forest Office (District manager)	
A		Water agency (Technician)	
A	Regional	DREAL, Regional directorate for the environment, planning and housing (one person)	
A			Association for the protection of nature
A			Company manager
A	Departmental	DDTM, Direction Départementale du Territoire et de la Mer (technician)	
A			Association of Forest Communities (two persons)
A		Joint Syndicate of ski resorts (Technician)	
A		Joint Energy Syndicate (Director)	
A		Public institution of Grand Briançonnais (President)	
A			
B	Local	Community of municipalities (President)	
B		Regional Nature Park (two persons)	
B		Manager of the Guillestre micro power station for the Guillestrois-Queyras community of municipalities	
B		Head of wood-fired heating systems and heating networks for the Guillestrois-Queyras community of municipalities	
B			ENERGUIL, photovoltaic electricity production cooperative (President)
B		Municipalities (two mayors)	
B		A social Welfare Centre Manager	
B			A local resident and a farmer
B			
B			

Respondents were asked: "Do you think that local governance of the energy transition is more effective than governance from outside the area? First, we defined what we meant by the term 'local governance', based on the definition used by the United Nations Development Programme (UNDP, 2016). Where appropriate, we asked for details of the type of energy generation facilities, the project sponsors and the current managers. We asked what they thought about the effectiveness and efficiency of local governance from a technical, economic, social, environmental and political perspective. These comments were recorded and then transcribed into files that were analysed using Hyperbase© semantic processing software. The Hyperbase© software can be used to calculate the frequency of words and



phrases. It can also be used to assess specificity, i.e. the likelihood of having a type of word in relation to the word being studied.

These analyses make it possible to identify how stakeholders rate the effectiveness and efficiency of local government positively or negatively (Laumann, 2020; Salak et al., 2022). The interview data were transformed into a series of sentences, which were then written down. Coding is used in social and psychological sciences (Yun-Chen Chan and Mazzocco, 2021). In particular, several studies have used the Q method. The Q method (operant subjectivity) is essentially an exploratory research method. It is used to identify people's different opinions about a social phenomenon or situation. It allows us to understand and describe subjective viewpoint profiles in relation to a set of ideas (Zabala et al., 2018; Zawilinska et al., 2023). The Q method makes it possible to evaluate the statements made by stakeholders on the basis of certain parameters: for example, it assigns scores from 0 to 5 and allows the data to be processed statistically. The method proposed here is based on an approach in which researchers assign a score from -1 to +1 to the different expressions used by stakeholders, depending on the parameters related to the effectiveness of local governance (De Luca et al., 2020; Pech et al., 2021). Scores are given to stakeholders' statements for each issue related to the effectiveness and efficiency of the transition to green energy: technical, economic, environmental, social and political. The score ranges from -1 to +1 being significant: +1 corresponds to a score that is very favourable to local governance; -1 is the score that corresponds to an assessment by a local stakeholder that is unfavourable to local governance. The score can vary according to the intrinsic effectiveness of the issue. The scores allow us to analyse the distribution of local stakeholders' assessments of these positive or negative aspects of the governance of green energy infrastructure. Green energy is energy that does not contain fossil carbon. It includes wind power, photovoltaic panels and hydropower. Wood heating systems are also part of the renewable energy mix: they are based on the use of living wood, which is subject to the living cycle (growth = absorption of carbon from the atmosphere; death and decomposition = release of absorbed carbon into the atmosphere). This carbon has nothing to do with fossil carbon. It is part of the living carbon cycle. All the more so when local communities plant trees to compensate for the cutting of firewood.

### 3. Results

3.1. A high level of equipment and the social and economic efficiency of local government decisions

As can be seen from Table 2, in this type of low-density, widely dispersed area, the challenge of energy transition is twofold: the local development of green, non-carbon energy with a view to energy self-sufficiency, and the fight against fuel poverty.

Table 2: Energy consumption in the Queyras region as a percentage of total consumption (source: Regional Natural Park)

<i>Types of consumption by type of energy</i>		<i>Types of consumption by sector</i>	
Wood energy	10%	Residential	37%
Electricity	27%	Tourist and commercial activities	16%
Other renewable energies	4%	Agriculture	1%
Petroleum products	59%	Industry	2%
		Road transport	44%

The results of the analysis of socio-economic data taken from databases or reports provided by various French public institutions (INSEE, National Institute for Statistics and Economic Studies, ADEME, French Agency for Ecological Transition, Département des Hautes-Alpes, Queyras Regional Nature Park, Community of municipalities of Guillestrois Queyras) and the analysis of the opinions of local stakeholders demonstrate the effectiveness and efficiency of local governance in the energy transition for this area.

This effectiveness and efficiency can be measured first and foremost by the extent to which green energy production facilities are equipped. Table 3 shows a variety of equipment and functions.

Table 3: Impact of local governance on the efficiency and effectiveness of local green energy production: types of energy production facilities in the Queyras region

<i>Type of unit</i>	<i>Type of energy</i>
1 methanisation unit (lactoserum = 1 million litres/year)	Local heating (local activities: school, administration, shops, residences)
8 municipal wood-fired heating systems	
6 wood-fired and biomass heating networks	
35 photovoltaic roof coverings	Low voltage = local self-consumption
9 photothermal systems on roofs	
2 pico hydroelectric power stations	
3 hydroelectric micro-power stations	Medium voltage = sale to the national grid of Electricité de France compagny

This effectiveness and efficiency is the result of a choice of local governance, as demonstrated in other French regions by Dudka et al (2023). Local stakeholders, elected representatives and residents, have initiated and supported projects, developed administrative structures and have control over the management of facilities. As shown in Table 4, local stakeholders are diverse and provide complementary structures, whether public or private, such as the ENERGUIL cooperative, which offers, installs and manages photovoltaic systems on the roofs of public or private buildings.

Table 4 : local stakeholders in charge of green infrastructure governance in the Queyras region

<i>Status of the public or private establishment</i>	<i>Governance type</i>
Municipality	Project
Communauty of municipalities	Project and technical, administrative, financial and commercial management
ENERGUIL cooperative	Project and technical, administrative, financial and commercial management
Nature Park of Queyras	Project assistance

The ENERGUIL cooperative was created locally. It is the result of an initiative by local stakeholders, institutional stakeholders such as the Regional Natural Park and the municipalities, and private stakeholders, in particular local residents. It is a cooperative society based on membership, with all members having equal voting rights, regardless of the size of their capital contribution. The board of directors is elected and manages the cooperative. As one of the stakeholders interviewed put it: "Local participation gives citizens a sense of responsibility. We have rights, but we also have responsibilities. Concerted efforts and co-governance, especially for the cooperative, have an impact on citizen participation (Bauwens et al., 2020; Ford et al., 2021; Herbes et al., 2021). Local stakeholders recognise that local democracy has been strengthened, which does not prevent conflict but helps to build consensus.

As observed in many cases of local systems implementation (Ford et al., 2021), this efficiency in governance has an impact on the dynamics of initiatives, projects and outcomes. It also has a socio-economic impact. Local electricity production exceeds local consumption. Local management ensures control and stability of heating and electricity prices. The price of heating from networks connected to communal wood-fired heating systems is half the average cost in France, which is constantly rising due to the increase in the price of heating oil and electricity. These lower costs help to combat social insecurity (Punt et al., 2021). The efficient management of local green energy production facilities (photovoltaic and hydroelectric) generates income for private entities and for the cooperative. This enriches the structures and the members of the cooperative, who receive dividends. In addition, the income generated is reinvested locally. In Ville-Vieille, a central commune in the region, the local authority has provided a building for a group of craftsmen (wood, cheese, confectionery). This building is surrounded by two others, the headquarters of the region's tourist office and a large facility that markets the region's products. Nearby is a sawmill. It sells its waste to the wood-fired boiler that supplies the three buildings, which are covered by photovoltaic roofs. The system functions as an industrial ecosystem serving the whole area (Talandier and Donsimoni, 2022). The cooperative system strengthens the circular economy (Ziegler et al., 2023).

### 3.2. Making local government look good, especially to local stakeholders

The Hyperbase © software is used to calculate the frequency of words and phrases. The words "energy", "territory", "local" and "projects" are the most frequent. They are also related to many other words. Some words, such as "territory", have a high frequency of occurrence and correspond to other words. The Hyperbase © software calculates the specificity. The specificity is the probability of having a type of word in relation to the word being studied. In linguistics ( Frawley, 1992). Specificity is a semantic feature that distinguishes between entities that are unique in their relations in a given context. It corresponds to a rate of probability of occurrence of one word in relation to another. Table 5 shows the strongest specificities in the whole of the actors' statements processed with the Hyperbase © software.

Table 5: table of specific features of the main words used by the stakeholders questioned in the survey in relation to the word "territory".

<i>Word related to "territory"</i>	<i>Specificity</i>
Relevant	3,81
Companies	3,2
Sector	2,82
Scale	2,8
Energy	2,48
Stakeholders	2,23
Projects	2,03
Local authority	2,81

The transformations associated with these choices of local governance give the local area an important role in the development of new social relations. By taking into account the ways in which organisations construct their actions, we can examine the place of the territory as a space for expression and interaction, with a focus on the local scale. The themes are grouped into two categories of effectiveness: technical and economic effectiveness, which concerns the direct effectiveness of local government choices in the energy transition; and social, environmental and political effectiveness, which reflects the

effects induced by these choices. Table 5 shows the average ratings attributed to stakeholder phrases in two categories: technical and economic effectiveness and efficiency, and social, environmental and political effectiveness and efficiency. These values are represented in the Cartesian graph in Figure 3.

Table 6: Average of the scores awarded for the two categories assessing effectiveness: X = assessment of the technical and economic effectiveness of local governance; Y = assessment of the political, social and environmental effectiveness of local governance; A: stakeholders from outside the area; B: stakeholders from within the area.

	X	Y
A1	0,6	0,8
A2	0,6	0,89
A3	0,8	-0,19
A4	-0,53	-0,64
A5	-0,87	-0,82
A6	-0,81	-0,75
A7	-0,77	-0,75
A8	-0,9	-0,39
A9	-0,87	-0,92
A10	-0,79	-0,815
A11	0,5	0,6
A12	0,5	0,92
B1	0,86	0,95
B2	0,46	0,95
B3	0,88	0,2
B4	0,61	0,42
B5	0,53	-0,23
B6	0,77	-0,41
B7	0,54	-0,8
B8	-0,62	0,21
B9	0,5	0,5
B10	0,5	0,88

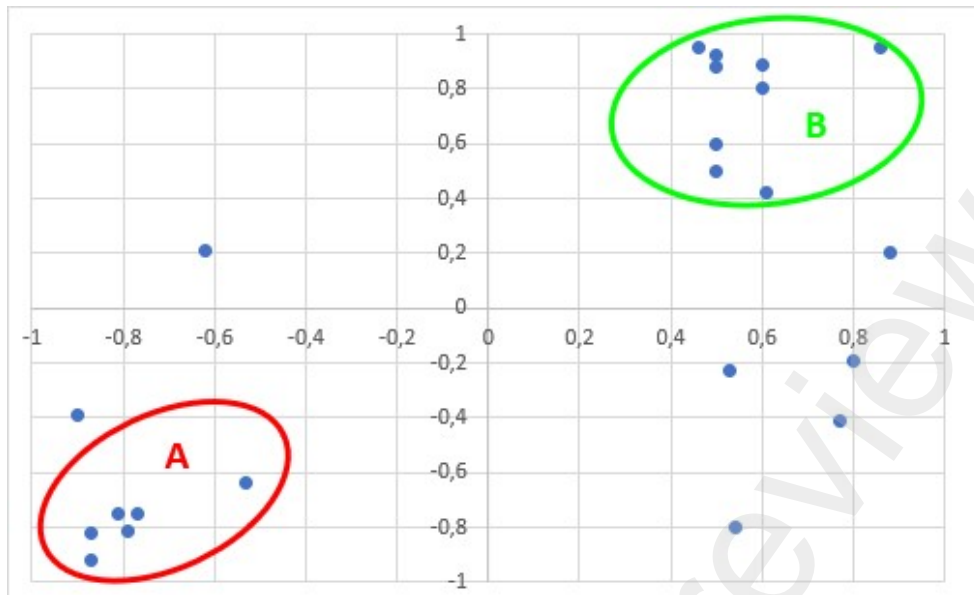


Figure 3: Cartesian graph representing the cloud of scores in Table 6. Red circle and A: actors from outside the region; green circle and B: actors from within the region; the two axes correspond to columns X and Y in Table 6.

With an  $r$  (Pearson coefficient) of 0.673374844774968, the relationship is quite significant. On the Cartesian graph, the two axes therefore correspond to the values attributed by the stakeholders studied to the assessment of the effectiveness and efficiency of local governance of the energy transition. In the red circle, stakeholders with a negative or sceptical view of this governance are mainly stakeholders from outside the local area: 58% of stakeholders from outside the area have a totally negative assessment. Conversely, stakeholders with a positive view of the impact of local governance on the energy transition are mainly from within the area.

#### 4. Discussion

The use of stakeholder assessments is a legitimate and effective means of evaluating various environmental initiatives and policies (Toro et al., 2013; Baird et al., 2017; Pernice et al., 2023). The qualitative data from the interviews show the effectiveness and efficiency of the projects run by local stakeholders. In Queyras, this effectiveness and efficiency correspond to the importance of infrastructures for the production of renewable energy from local resources: solar radiation, wood and river water. They also correspond to the impact of these facilities and heating networks in the fight

against fuel poverty. The region and its inhabitants are enriched by the income generated by local energy. The economic impact is reflected in the development of craft, tourism and commercial activities. The transfer of energy sources reduces dependence on fossil fuels and some costly forms of transport. As a number of stakeholders have noted, local people have a direct interest in the facilities and contribute to reducing their energy consumption. This responsibility stems from their involvement in governance structures, particularly the cooperative (Bauwens et al., 2020). As stated by Baird et al. (2021): "the level of stakeholder engagement may influence perceptions of outcomes, with greater frequency of engagement leading to more positive perceptions". As argued by Wyse and Hoicka (2019), "community energy" can be an opportunity for transition and can create "additional benefits for local communities". Local governance also has an impact on the fight against fuel poverty. Heat distributed through heating networks supplied by wood-fired boilers is controlled by the local public institution, the community of municipalities, which in France is made up of municipalities with democratically elected leaders. Although management must be balanced and profitable, this public heating service offers low prices. Part of the electricity produced in the area is supplied by the local cooperative, which also ensures low prices. Local governance leads to public acceptance and adaptability to the energy transition and greater flexibility, as has been demonstrated in other areas (Couraud et al., 2023).

Renewable infrastructure projects face opposition from associations and interest groups that oppose the construction of micro-hydropower plants on mountain streams. An analysis of the statements of the respondents shows that this opposition comes mainly from outside the area. In Figure 3, confidence in the effectiveness of local governance is higher among local stakeholders than among external stakeholders.

The efforts of these local stakeholders are undermined by the continuation of the ski tourism model. Tourist infrastructures consume a lot of energy, especially electricity. Climate change requires the use of snow cannons to produce snow for ski slopes. This energy is imported from outside the region. The trend in the number of winter tourists shows that this activity is becoming increasingly uncertain, even for sectors in the inner Alps. Investments tend to be made by companies and public institutions from outside the region. This development model is at odds with a development model based on year-round



tourism, based on nature and driven by the people who live in the region. The future depends on political choices that will be constrained by changing climatic conditions and the economics of industrial tourism.

## **5. Conclusion and policy implications**

This work is based on the evaluation of the effectiveness and efficiency of local energy transition governance by local stakeholders. They are rated positive because they are effective in producing positive results in financial, social and environmental terms. They are considered efficient because they have a positive impact on the implementation of the projects, especially in terms of citizen participation and acceptance of the projects (Ford et al., 2021 ; Maldet et al., 2023 ; Nguyen and Batel, 2023). It is often an invitation to think globally or in an integrated way about governance issues: thinking about the energy transition with the other aspects of the ecological transition, improving local democratic life, combating insecurity, etc.

This choice of an integrated approach (Cockburn et al., 2019) is also a scientific issue related to the complexity of territories. The analysis of the case study suggests that an integrated approach to governance issues is the most effective (Gitelman et al., 2023). Considering the relocation of agricultural and food production reduces dependency and mobility (Kebrowski et al., 2019) and therefore energy costs. In the Queyras region, Terres en Guil, an agricultural cooperative, aims to buy land to enable new farmers to set up and produce horticultural products for local consumption. Energy production infrastructure is helping to improve the efficiency of this project (Walker et al., 2021). For some authors, including Johnston et al. (2018) and Sueur et al. (2021), the local projects and actions of a community of stakeholders generate social capital that can increase the effectiveness and efficiency of the area. This social capital corresponds to the sharing of knowledge, the exchange of food and services, and solidarity in case of illness or accident (Sueur et al, 2021). Innovation is the result of an interactive process that integrates concepts and approaches from different fields.

The circular economy (Bellemare et al., 2022; Maldet et al., 2023) promotes the transformation of waste into resources. It reduces transport costs. It is a source of innovation (Caprian et al., 2023): for example, it maximises synergies and reduces dependence on markets outside the region (Xie et al., 2023; Honeybun-Arnolda et al., 2024).

When it comes to energy, public support makes it easier for public authorities to implement projects that make room for boiler rooms, heating networks and photovoltaic panels. Local environmental and energy governance is accompanied by territorial stewardship, with an integrated approach to relations, including with the natural components of the territory (Mathevet et al., 2018; Baird et al., 2021). It also goes hand in hand with the desire to promote local social solidarity: the fight against fuel poverty can be seen in the context of food and medical insecurity. These issues are closely linked to mobility and access to services, especially health services (Sueur et al., 2021). This management of the territory requires integrated and participatory governance (Gooding et al., 2023; Honeybun-Arnolda et al., 2024). All residents are responsible for and initiators of the management and governance of the area in which they live (Smalskys et al., 2020; Maldet et al., 2023). Research shows that for individuals, relational values are often stronger than individualistic values (Arias-Arevalo et al., 2017; Gooding et al., 2023). Therefore, as stated by Peçanha-Enqvist et al. (2018), stewardship can be seen as a conceptual tool that enables collaboration and dialogue between different stakeholders, while allowing for differences in use and perception (Nguyen and Batel, 2023). We could ask ourselves what concepts, knowledge and skills will enable us to imagine the transition: not to determine it in advance, but to be able to choose it. Choosing it undoubtedly means having it chosen by those who live it at each territorial level. At the local level, it is therefore up to the local actors and inhabitants, as well as the actors chosen or elected by these inhabitants, to take temporary responsibility for policies and strategies. This is also the analysis of Raymond et al. (2010), who conclude that there is no optimal solution: each solution must integrate different types of knowledge linked to a variety of parameters. It is therefore necessarily complex and requires local contingencies to be taken into account (Bauwens et al., 2022).

In energy, for example, the goal may be to achieve a Renewable Energy Community (Herbes et al., 2021; Dudka et al., 2023), which is a recognised entity in Europe: « According to the definition of the Directive 2018/2001, a Renewable Energy Community (REC) is a legal entity “based on open and voluntary participation with the primary purpose of providing economic, environmental or social community benefits for its members, stakeholders and for the areas where it operates” (Cutore et al., 2023; Gooding et al., 2023). The importance that people attach to ecosystems and ecosystem services has been identified as a critical dimension of sustainable management of social-ecological systems

(Ostrom 2009). However, the study of values and other human cognitions has been poorly addressed in research on social-ecological systems and environmental management. As De Stefano et al. (2017): “Management of socio-ecological systems is characterized by uncertainty, complexity and incommensurability of perspectives of the different actors involved. In the face of these challenges, science and technology alone cannot hope to provide an adequate diagnosis of the problem or design adequate solutions that are effective in different socio-political settings”. Based on an analysis of the Spanish region of Donana, De Stefano et al. (2017), like other authors (Haatanen et al., 2014; Gaitan et al., 2023; Honeybun-Arnolda et al., 2024), show that moving towards collaborative systems and an integrated approach to territorial issues is an effective and efficient strategy. An integrated approach to ecological management of the energy transition means taking into account the rational use of wood resources from local forests, water resources and biodiversity (Haatanen et al., 2014; Broeck, 2019). Our results show that all engagement behaviours are positively influenced by more than one type of perceived value. This suggests the need for mixed, rather than unilateral, engagement strategies that promote multiple types of perceived value.

As numerous research studies have shown, this article concludes that local governance of the energy transition is effective and efficient across a range of technical, economic, social, political and environmental issues (Hoppe et al., 2015; Walker et al., 2021; Fell et al., 2023). However, the question remains as to the appropriate scale at which this model can be replicated (Dymitrow, 2020 ; Boffardi et al., 2021). One of the conditions for its sustainability and repeatability is that it should not be predetermined or theorised, but that it should be decided and chosen by each territorial level and, within each territory, by the people who live there. It is up to the local population and the actors they have elected to take temporary responsibility for the policies and strategies to implement this energy transition (Boffardi et al., 2021; Walker et al., 2021; Gooding et al., 2023). The re-territorialisation and management of energy by the 'commons' seems to be a source of effectiveness and efficiency in achieving the energy transition.

Finally, contrary to what Wang et al. (2018) claim, democracy works in favour of the ecological transition, especially as sustainable development strategies are supposed to incorporate governance objectives that promote democratic principles (Smalskys et al., 2020; Honeybun-Arnolda et al., 2024).

The energy transition has been shown to be more effective when it is politically supported by democratic governance processes and when local actors take the initiative to achieve this energy transition (Walker et al., 2021; Dudka et al., 2023; Nguyen and Batel, 2023), including taking into account local cultural specificities (Datta et al., 2022). The growth of renewables and the road to energy transition will be followed by energy democracy (Aalbers and Sehested, 2018 ; Szulecki, 2018; Adams et al., 2019; Beauchamp and Walsh, 2021; Ejsing et al. 2023; Szulecki and Overland, 2020). As stated by Busch et al. (2023), the growth of renewable energy is also a shift in the "empowerment of citizens". Nguyen and Batel (2023) speak of a new governmentality that consists of governance based on citizen participation. And this form of government is local, even if, as we have shown here, it contradicts movements and pressure groups from outside the area. The present study has some limitations, which we acknowledge and which provide opportunities for future research on the relevant scale of what can be called the local level and the effectiveness of the exercise of local governance (Hoppe et al., 2015; Walker et al., 2021; Ejsing et al., 2023 ; Radke and Wurster, 2023; Honeybun-Arnolda et al., 2024).

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Figures captions

Figure 1: Location map (caption: 1 Wood boiler and heating network; 2 Micro hydropower plant; 1 and 2 villages; 3 towns; 4 French-Italian border; 5 boundaries of the area studied - nature park and community of municipalities- ; 6 summit)

Figure 2: Data, statistical corpus and interviews and their analysis methods

Figure 3: Cartesian graph representing the cloud of scores in Table 6. Red circle and A: actors from outside the region; green circle and B: actors from within the region; the two axes correspond to columns X and Y in Table 6.

## Tables captions

Table 1: List of stakeholders interviewed (A: stakeholders from outside the Queyras region; B: stakeholders from within the region)

Table 2: Energy consumption in the Queyras region as a percentage of total consumption (source: Regional Natural Park)

Table 3: Impact of local governance on the efficiency and effectiveness of local green energy production: types of energy production facilities in the Queyras region

Table 4 : local stakeholders in charge of green infrastructure governance in the Queyras region

Table 5: table of specific features of the main words used by the stakeholders questioned in the survey in relation to the word "territory".

Table 6: Average of the scores awarded for the two categories assessing effectiveness: X = assessment of the technical and economic effectiveness of local governance; Y = assessment of the political, social and environmental effectiveness of local governance; A: stakeholders from outside the area; B: stakeholders from within the area.

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## **The effectiveness and efficiency of local governance in the energy transition: the case of the Queyras region (French Alps), a case study.**

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### **Abstract**

Reducing carbon-based energy consumption involves both switching to the production of renewable energy (RE), such as hydro, solar, wind and wood heating, and becoming more frugal or reducing consumption overall. Reducing energy consumption is only possible if we adapt and change our consumption patterns. At the local level, however, the development of renewable energy is hampered by cumbersome procedures and opposition. This article looks at how projects are developed and managed. Most of these projects are the responsibility of public or private bodies that are too far removed from the problems of the areas where the infrastructure is to be built. However, the scientific literature shows that there is a link between the effectiveness and efficiency of mixed use and that the most sought after practices are linked to social, economic and political objectives. In the Queyras region of the French Alps, interviews with 22 stakeholders, processed using Hyperbase © semantic software, show that local governance of the energy transition is effective and efficient in technical, economic, social and political terms. The move towards greater sobriety and a change in energy consumption patterns is reflected in the involvement of citizens in governance processes.

### **Key words**



Energy transition; Energy communities; Energy democracy; Local governance

### **Highlights**

- Technical, economic and social effectiveness and efficiency of local government
- Making local government look good especially to local stakeholders
- The need for mixed rather than unilateral engagement strategies
- The growth in renewable energy is a shift in the empowerment of citizens
- A new governmentality consists of governance based on citizen participation