UsersTCP

Global Observatory on Peer-to-Peer Energy Trading

Nice Méridia - France

Benoit Couraud, Yann Rozier, Erwin Franquet, *2024*

Key facts

Location (town + country)	Nice - France
Duration (start/end dates)	*January 2024 - no end date*
Funding source	*self funded*
Project lead (organisation)	*Université Côte d'Azur*
Project partners	*Chambre de Commerce et d'Industrie, Habitat06, Meridia Smart Energie, Palazzo, Université Côte d'Azur*
No. of participants	*5*
Case study type	*{Demonstration}.*

Table of Contents

Case study statistics

Parameter	As designed	As built
No. of participants	5	5
Generation (kWp)	700	700
Storage (kWh)	1400	1400
Unit price ($/kWh)	dynamic	tbd
Project cost ($)	-	self-funded

Summary of case

The Nice Méridia energy community consists of a collective self-consumption project that gathers 5 original members with solar PV generation, electrochemical storage and electric vehicles. The project allows consumers and storage assets to consume exports from other community members. Self-consumption quantities are assessed every 30 minutes on an ex-post basis (at the end of each month) by the Distribution System Operator through smart meters, and locally consumed electricity is removed from the utility bill of the community members. Then, for each time slot of the previous month, a local energy market is implemented to determine the price and energy quantities exchanged. This market proposes a dynamic tariff that corresponds to the output of a double auction in which prosumers and consumers communicate their aggregator and supplier’s prices. Finally, the Nice méridia energy community has also implemented moral values that are implemented in the local

energy communities through a priority that is given to some members of the community to purchase electricity.

Impact highlights

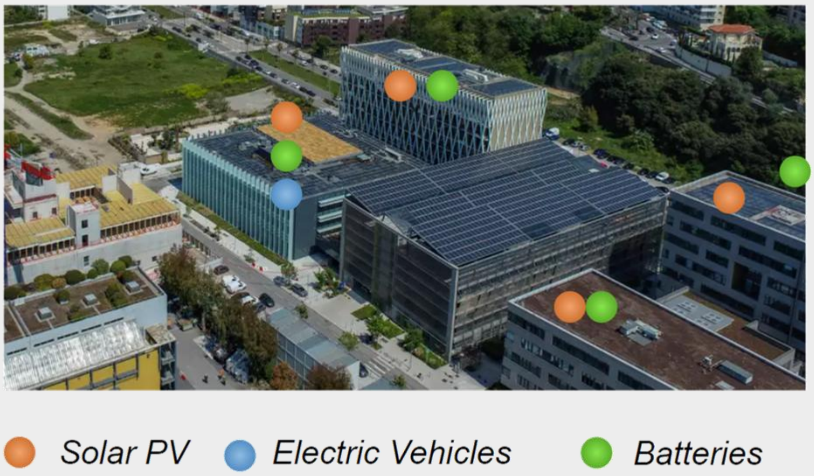
- Increase in the renewable energy self-consumption rate within the neighbourhood.
- Reduction of energy bills of the consumers through access to cheaper energy within the energy community at times when they consume while other members are exporting electricity.
- Increase of prosumers revenues through the selling of energy to other community members at a higher price than what is proposed by their aggregator.
- Integration of social and economic moral values that give prior access to cheap energy to some community members.

Project aims and objectives

- **What problem(s) does the case study aim to resolve?** This case study aims to enable access to cheaper energy to the community members and to increase the revenues of the community prosumers. It also aims to create a real energy community that gathers around shared moral values that define their relationship to energy.
- **What were the social objectives (if any)?** Social objectives aimed to give prior access to cheap electricity to members that are in need, such as members exposed to energy poverty. Indeed, the community members included tertiary and residential buildings. The latter were given priority to have access to cheaper energy.
- **What were the environmental objectives (if any)?** The energy community increases its self-consumption rate, and thus increases its consumption of renewable energy.
- **To what degree were participants actively involved in design or operation?** In this use case, the 5 main members of the community worked together on the establishment of the community, by working together on the legal aspects, the moral values and the local energy market. At the beginning of the project, members gathered every month to define the principles of the energy community and participate together in events that promote the project.

- **Was participation financially or socially incentivised or both?** There was no financial or social incentive apart from the gains of buying and selling electricity within the community at a cheaper / higher price than their aggregator/supplier proposed respectively.
- **What degree of demand response flexibility was provided?** At the current stage of the project, flexibility is not implemented. However, with the integration of new members, and especially new prosumers, flexibility will be achieved through batteries owned by the members of the community when real-time monitoring of exports will show that the community consumes its solar production within the current time slot of 30 minutes.
- **Provide images of, and participant quotes from the case study.**

Yann Rozier, Climate & Transition Project Manager at the University Côte d'Azur: "This energy community allows the community members to engage together and to think about the way we can better consume electricity together. It allows us to implement moral values that define us and that enables residentials to benefit from cheaper energy produced by tertiary buildings, especially during week-ends when there are no tertiary activities. We hope this energy community is developing as an example that can be replicated in other places in France, and maybe abroad.



Description of case

Market value proposition and key activities

The market value proposition of the Nice Méridia energy community consists in a standard access to cheaper energy to the consumers, and to a greater revenue to the prosumers. The main activities in this use case consist in:

1. Monitoring of local consumption and production in real-time that is then gathered on a 30 minutes basis and provided by the DSO to the community coordinator on the first day of the following month.
2. Communication to the community coordinator by every member of their energy import and export prices for the previous month.
3. The community coordinator runs the local energy market (based on double auction optimisation) to define, for each 30 minutes time slot, the price and energy quantities that are rewarded with local energy self-consumption.
4. The locally consumed energy quantities are sent to the DSO before the 7th of the month. The DSO will then remove these quantities from the members' monitoring sent to their supplier.
5. The community coordinator collects payment from the community consumers that got rewarded with energy within the considered month, and proceeds to the payment to prosumers. Payments are equal to the sum over the whole month on each time slot of 30 minutes of the product between the market clearing price for the considered time slot and the energy quantities determined during the market clearing for this same time slot.

Financing/funding (who contributed funding and under what terms)

The Nice Méridia energy community is currently building on existing assets that were already owned by the community members. As a result, there is no further funding required for assets purchase. However, the development of the market platform, legal and technical actions was financed directly by the active public and the industrial members of the community that appointed engineers to work on the project. It was done on a voluntary basis.

Legal structure (co-operative; partnership; social enterprise; etc)

The project has started as a partnership and is still operating on this legal structure. However, a legal team has been appointed to assess what would be the most appropriate structure to meet the requirements of the community, and could evolve toward a co-operative, a social enterprise, or simply an REC (Renewable Energy Community) structure.

Stakeholders/project partners involved (organogram)

The Nice Méridia project was instigated by the Metropole Nice Côte d'Azur that appointed the company Meridia Smart Energie to coordinate the energy community. The university Côte d'Azur has undertaken the economic studies and market setup to enable a fair access to local energy, while CCI Nice Côte d'Azur has managed the legal aspects of the community, along with the reflections for shared moral values within the community. Finally, a residential building and a mixed residential and tertiary building complete the members of the community.

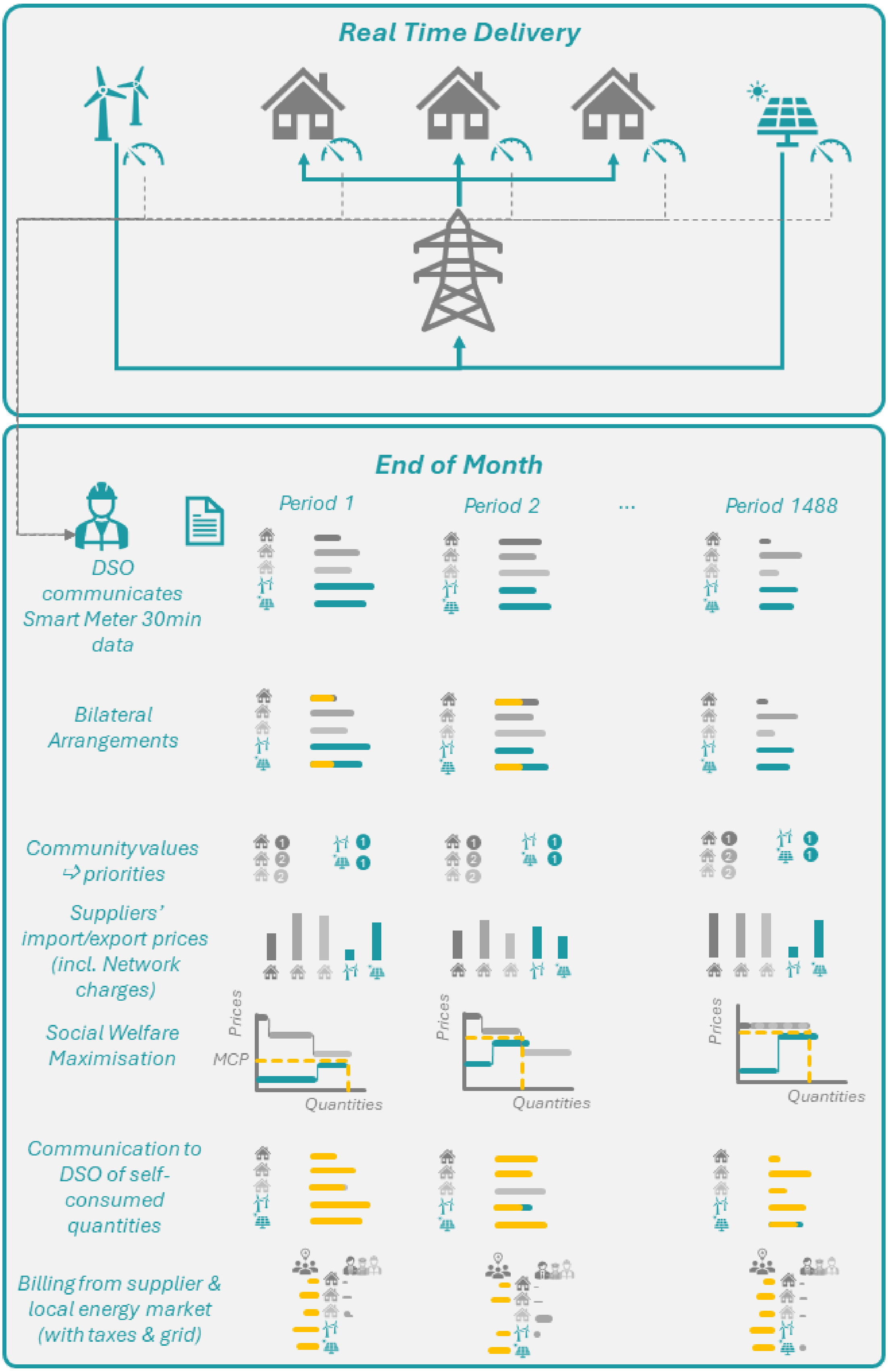
L'ELECTRICITE EN RESEAU

Participant types and characteristics:
Participants to the Nice Meridia energy community include an industrial (Meridia Smart Energie), two public bodies including the Chambre des Commerces et Industries and the university Côte d'Azur, and two homeowners' associations. The energy community was initiated by Nice Metropolis, and enedis, the French DSO, is enabling this energy community by proposing the smart monitoring and the communication with the suppliers.

Participant recruitment methods, incentives and protection:
Participants were recruited on a volunteering basis within the neighbourhood. As a result, they were not paid, and participated in this energy community to share the same vision on energy. Of course, it is mandatory to ensure that no member of the community (today or in the future) loses money compared to the business as usual with Feed In Tariff.

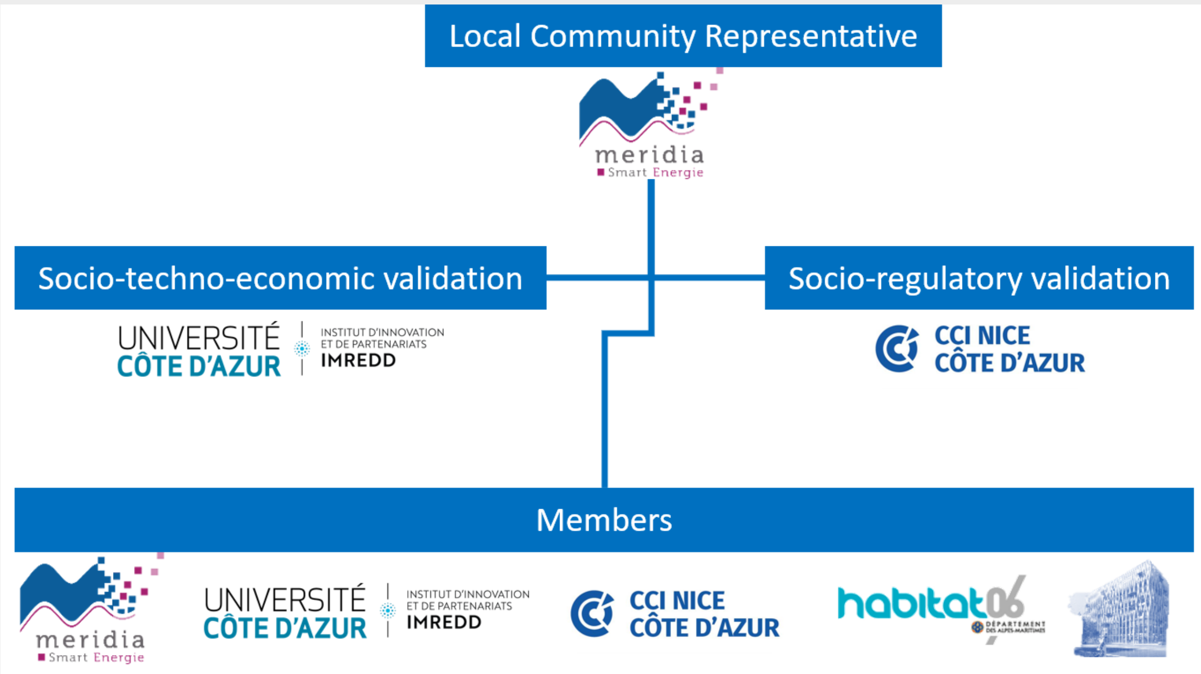
Case study functional requirements.

- **Regulatory structure and requirements (beyond compliance with existing law)**: The current regulation in France allows collective self-consumption and internal local energy markets. However, the main requirements that had to be met consist in allowing institutional members to have multiple suppliers. Indeed, institutional members had a specific contract with their energy supplier that might not be compatible with this local energy market in which members buy and sell energy to the community, that is represented by a third party (Meridia Smart Energie). Also, Meridia Smart Energie proposed to supply energy that was stored in their battery, which was a potential point of conflict with existing suppliers' contracts compared with the case where electricity inside the community is only supplied with PV. Therefore, although it is perfectly allowed for residentials in the current legal set up, this energy community had to ensure that institutional members with specific electricity contracts were also allowed to have multiple suppliers.
- Stakeholder requirements (trial design requirements): Stakeholders only requested to not lose money, and to participate in an energy community that reflects their shared moral values in the priorities for accessing local energy.
- Technical architecture (representation of assets: generation; storage; control; load types (electric vehicles (EVs); heating, ventilation and air conditioning (HVAC); small and medium-sized enterprises (SMEs); etc): The architecture and workflow of the energy community is presented in the figure below:


Real Time Delivery
End of Month
Period 1
Period 2
...
Period 1488
DSO communicates Smart Meter 30min data
Bilateral Arrangements
Community values
→ priorities
Suppliers' import/export prices (incl. Network charges)
Social Welfare Maximisation
Prices
MCP
Quantities
Communication to DSO of self-consumed quantities
Billing from supplier & local energy market (with taxes & grid)

The workflow of this energy community is as follows:
First, there is no demand response nor flexibility program. Which means that people produce and consume as they normally do during the real-time operations. Then, at the end of the month, the DSO provides the energy quantities consumed and produced by each member for each of the 1488 30 minute time slots of the month. Then starts the local energy market (post delivery) to determine who self-consumed the exports from the other members. This local energy market can be broken down in several stages:

1. Bilateral trading is done between peers, to determine the quantities that are traded directly from one member to another. This answers the requirement that some might have when they own 2 buildings within the same community and want one building to take advantage of the exportations from the other one.
2. Then, we identify priorities among members. In this community, priority of access to cheap energy is given to the social housing members. Priority could also be given among producers, but this was not implemented.
3. Members are asked to submit a time series with the price they pay their suppliers for energy consumption for every 30 minutes time slot of the previous month and the price they get for their exportations again for every 30 minutes interval of the previous month.
4. Then, a market clearing mechanism is implemented. This market mechanism is subjected to change every month or so. But in a nutshell, it consists in a social welfare maximisation where members' prices have been biased based on the priorities. A member that has priority will show at the top left of the 'price/quantities' graph. The optimization results in some members not having energy because their price is not compatible with the prices from the other members. The final price (market clearing price) should also ensure that it is not above the price requested by a priority consumer, in which case the market is run again without integrating this member's priority.
5. The energy quantities exchanged within the community for all the 30 minute time slots of the previous month are then communicated to the DSO within the first 7 days of the current month.
6. The DSO then removes these quantities from the energy consumption measurement sent to the members' suppliers, and specifies the network charges to add in their bill relative to the locally consumed energy.
7. Finally, members pay their supplier's bill, including normal network charges for the energy coming from outside the community, and reduced network charges for the energy consumed locally, and on the other side, members pay the community representative for energy and taxes that correspond to what was consumed locally, whereas the community representatives remunerates back the producers with the same price minus a fee.



   - **Data architecture (including data ontology/standards where used)**: An API is provided by the DSO through their platform. Within the community, a dedicated platform has been set up to retrieve the energy quantities, the bilateral trades, the import and export prices, to clear the market and communicate the energy quantities agreed within the community. The billing system is also included in this platform..
   - **Financial model (representation of financial flows and markets)**: The financial model and market was presented above. Although it is based on social welfare maximization, it can be adapted to reflect several constraints and to maximize the energy quantities exchanged instead of the welfare. .
- **Geographical scale**: This project members are within a perimeter with a maximum diameter of 2km.
- **Governance structure (organogram)**: a data governance was implemented in order to ensure collaborative validation of economics and legal aspects of the community. The adopted organogram is as follows:

  Meridia Smart Energie is the legal entity that represents the energy community, whereas CCI validates all the legal decisions and ensure compliance with current regulations, while University Côte d'Azur provides the algorithms, woks on the integration of moral values inside these algorithms, and validates the computation provided by the legal entity.
- **Electricity network ownership (public or private)**: The electricity network is owned by the Metropole of Nice, but operated by the main French DSO: Enedis..

- **Management of changes in case study over time (i.e. participants leaving; assets failing; data losses; etc)** : The integration of new participants is done as it arises, as the legal framework allows it. All services and data are stored with redundant storage (at the DSO and local scale).

Key takeaways

The legal framework and the role of the DSO (monitoring, communication to suppliers) has allowed the set up of a very advanced energy community with a local energy market.

This energy community shares common moral values that are reflected within energy distribution algorithms implemented locally.

Outcomes and achievements

What outcomes are anticipated from the pilot? This pilot aims to showcase the possibility to have an advanced local energy community within the current legal framework in France. This will also result in a bill reduction for the consumers, and an increase in revenues for the producers. This energy community aims to pave the way for future energy communities with local energy markets.
What outcomes were delivered by the pilot? At this stage, the pilot is still on-going. Algorithms have been designed, members have actively engaged in the community, and financial trades will happen shortly..

What was the primary goal of the project?*

☐ **Grid integration** - e.g. management of grid constraints; balancing of demand and supply; promote/include distributed energy resources (DER) generation; optimisation of energy behaviour to benefit system; aggregation of participant energy loads.

☐ **Environmental benefits** - e.g. promote or include renewable energy (RES) generation.

☒ **Empowering individuals** - e.g. participants have greater control over preferences; self-sufficiency (autarky); autonomy.

☐ **Local benefits** - e.g. improvement to local economy (job creation etc); independence from other regions; community as focal point for engagement; shared benefits across the community.

☒ **Creating market value** - e.g. economic incentives for participants; access wholesale, balancing and ancillary service markets.

Were there any secondary goals of the project? (please tick as many as apply) *

☐ **Grid integration** - same description as above

☐ **Environmental benefits** - same description as above

☐ **Empowering individuals** - same description as above

☒ **Local benefits** - same description as above

☐ **Creating market value** - same description as above

☒ If other, please give a brief description: demonstration of the capabilities that arise from the right legal framework.

Obstacles encountered when conducting the pilot

Several obstacles were encountered during this pilot. First of all, the question of trust arised as members were hesitating to trust the institution that proposed to build the energy community. Indeed, in the context of 2022 when the project started, energy prices had increased considerably, and trust between consumers and energy companies was broken. To solve this issue, the University Côte d'Azur proposed to run simulations on several weeks of operation of the community to demonstrate that all members had economic interests in joining the community, even if the community responsible also had economic revenues. These simulations were run on time series with 30 min time intervals with imports and exports from all members, and aimed to determine the energy quantities that were exchanged at each timeslot to compute the bills reduction and revenues increase for each member. The process of the energy community (communication with the DSO, market clearing, etc…) was also detailed and explained carefully to all the members of the community in order to highlight that it was transparent for members and that all the burden (technical and administrative) was taken by the community leader.
The second obstacle was a legal one. Indeed, although the framework for energy communities is well in place in France, it is clear how to implement it for residential users. However, with organisations that have a dedicated energy contract with their supplier, it is unclear if they can buy energy from another supplier like a neighbour. As a result, legal studies were requested to sort out this issue and determine the procedure and strategy to enable public institutions to have multiple suppliers despite their current energy contracts.
Other obstacles were less critical, and included:

- The type of legal vehicle that should be adopted by the energy community (association, SPV, …)
- The possibility to integrate batteries in the energy community, and its impact on the qualification of the energy community, between a simple collective self-consumption community, a REC (Renewable Energy Community) and a CEC (Citizen Energy Community)
- The method to determine the electricity price inside a community. Although this is a critical topic (as members do not want to buy energy in a community at a higher price than what is proposed by their own supplier), it was quickly addressed by the university researchers.

Key learnings for other pilots

If you were repeating the pilot project: what would you have done differently, what are your key lessons learned and key takeaways?
The key lessons learned are about trust. An energy community cannot be successful if trust is not the backbone of the initiative. Therefore, it is strongly recommended to gain the trust of the members when proposing to join an energy community. This can be done by showing examples, by being transparent and by proposing simulations that demonstrate the benefits and difficulties that will arise from the energy community. Second, it was experienced that members want to build a community that actually represents their own values. As a result, an energy community should be built for and by the members, based on local considerations

and specificities, and it is therefore necessary to propose economic mechanisms (such as market clearing algorithms or energy dispatch approaches) that reflect these values, such as giving priority to low income or fuel poor members. Finally, regular communication should be proposed to the community members. This enables them to feel involved in the community, and to trust the directions that are taken and to prevent any disagreements.

Recommendations for policymakers

Please fill in the table below, by including recommendations for policymakers based on your experience of conducting the pilot (in particular obstacles encountered).

What?	Who?	Why- Example from case study?	How?	When?
Smart Meter	Grid regulator and DNOs	The fact that the smart metering infrastructure was owned by the DSO enabled this local energy market.	By imposing the grid operator to have the dedicated infrastructure and smart meters rollout	
DSO and Supplier data access	DSO and suppliers	In this project, the accessibility of data with high granularity (30 minutes) enables a local energy market with dynamic pricing.	By enforcing API access to data.	
Network charges calculation and billing from the suppliers	DSO, suppliers and grid regulator	The grid regulator must compute the reduced network charges that apply to local energy so it is correctly billed.	By enforcing the DSO to assess and compute the network charges and the suppliers to bill accordingly	
Energy taxes calculation and billing from the suppliers	Suppliers and grid regulator	The grid regulator must compute the taxes that apply to local energy so it is correctly billed.	By enforcing the suppliers to bill these taxes	

References

SOURCES

B. Couraud et al., "Collecting French Smart Meter Data for Residential Flexibility," 2023 IEEE PES Innovative Smart Grid Technologies Europe (ISGT EUROPE), Grenoble, France, 2023, pp. 1-5, doi: 10.1109/ISGTEUROPE56780.2023.10408704.

Enedis, « Modalités de mise en oeuvre d'une opération d'autoconsommation collective », Enedis OPE-CF_07E v6, 2023

Enedis, "Tarifs d'Utilisation des Réseaux Publics de Distribution d'Électricité"

Enedis, "Autoconsommation, guide pédagogique"

FURTHER INFORMATION

Contact Dr Benoit Couraud at benoit.couraud@univ-cotedazur.fr, Yann.rozier@univ-cotedazur.fr, Pr. Erwin Franquet erwin.franquet@univ-cotedazur.fr, Ludovic ASSO CCI