

# Energy communities

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**Abstract.** Energy communities are associations of producers and consumers of energy set up to reduce the dependence on fossil fuels and optimise the use of energy for the advantage of the members. This paper presents an experiment being implemented in the territory around the town of Pinerolo in western Piedmont. Encouraging results are reported.

## 1 Foreword

An energy community may involve various types of organisation, but all somehow interested in using energy. Its members may be private individuals, firms, or public administrations, but energy is the connecting motivation for all. There are well known examples: cooperatives of energy producers exist throughout Europe for commercial purposes, including in Italy; there are also cooperatives of consumers interested in buying energy under the best possible market conditions; and finally, there are associations doing both jobs. There are currently a number of real energy communities in Italy as part of a special list of “historic cooperatives”, where “historic” denotes that they were founded long ago (sometimes even a century ago) in specific areas of the country where commercial operators did not provide electricity. Those entities survived various legislative changes during the 20<sup>th</sup> century, always keeping their special status. Excepting the “historic cooperatives”, it has not so far in Italy been allowed to exchange energy between different non-contiguous energy users. The situation is now changing:

- An Italian law (n. 221/2015) has introduced the ability for local administrations to establish Oil Free Zones, including experiments in various ways to attain independence from fossil fuels [1];
- A law in the Piedmont region (12/2018) explicitly permits energy communities to be founded, in the Piedmont territory, whose members may be companies, private citizens or municipalities [2].
- In December 2018 a directive was issued by the European Union (L 328) committing member states to allowing and supporting the formation of communities of producers and consumers of energy, removing legislative and economic obstacles to the functioning and life of such communities [3]; the member states are required to adopt the directive into their national legislation by 2021.

Under this new positive legislative background, a process has begun in the area surrounding the town of Pinerolo (Western Piedmont), to set up a real energy community.

## 2 The Pinerolo Energy Community

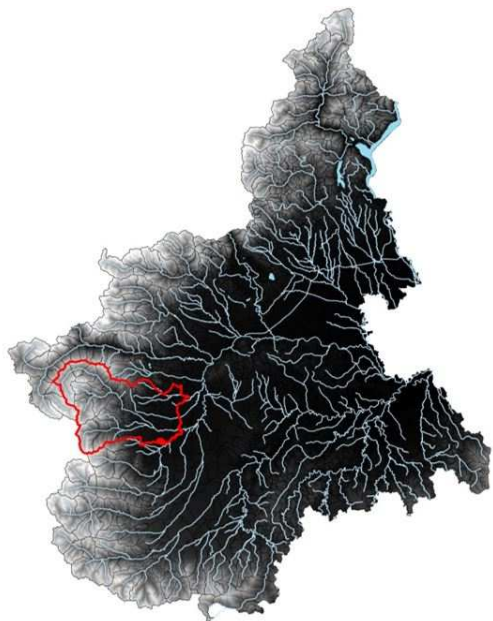
### 2.1 Territory

The potential extent of the Pinerolo Energy Community is shown in Figure 1. The borders of the relevant area are indicated by the red line. The darkest colour is used for the lowest lands (the lowest is 72m above sea level; the highest is 4,628m a.s.l.). The map gives also an idea of the proportion of the maximum surface of the Community (1,348 km<sup>2</sup>) and the area of the whole region (25,387 km<sup>2</sup>): the former is approximately 5.3% of the latter. There are 149,249 potentially affected inhabitants: 3.4% of the total Piedmontese population (4,353,916).

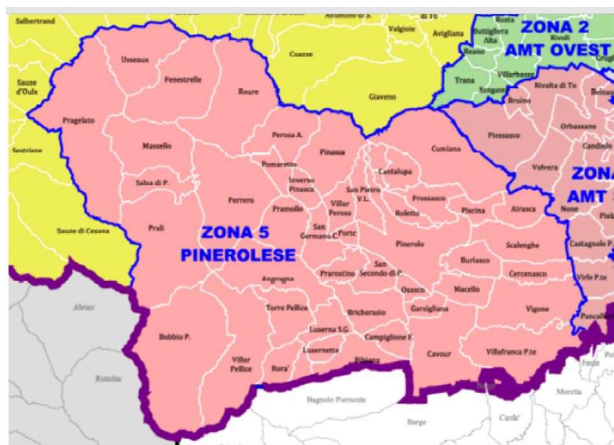
The area considered includes 45 municipalities, which, altogether, comprise the administratively defined “Zone 5” of the Metropolitan Area of Turin. The distribution of the above municipalities may be seen in Figure 2. Most of the area is mountainous and includes a number of Alpine valleys. The future community will be rather different from the existing historic cooperatives, both because the extension and the population are an order of magnitude bigger, and because the land and potential members are much more varied.

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**Fig. 1** Location of the future Pinerolo Energy Community within the Piedmont region.



**Fig. 2** The future Energy Community coincides with Zone 5 of the Metropolitan Area of Turin. White lines show the administrative borders within Zone 5.

## 2.2 Prospective members of the Community

The core of the future community and, at present, the promoting entity, is the CPE (Consorzio Pinerolo Energia) consortium. CPE was originally born to provide the municipalities of the Pinerolo area with electric energy conveniently acquired on the energy market. Various constraints imposed by national regulations on the way that public administrations must procure their energy have *de facto* frustrated the original purpose of the consortium. It has survived but changed its goal: now the main purpose is to stimulate and facilitate collaboration and synergies among firms and companies in the Pinerolo area. At present CPE includes more than 70 companies working in various fields, from mechanics to food, from cement to tertiary services and more. The seat and centre of CPE is ACEA Pinerolese Industriale (API); which interestingly belongs to 47 municipalities of the area: 45 comprise Zone 5, and the other two are

conterminous. Municipalities have not disappeared from CPE, but they are there, without direct responsibility, as “supporting partners”; the same is true for the Politecnico di Torino (Turin Technical University) which of course is also a public institution, subject to the same kind of restrictions as the municipalities. The latter are also present through API in any case.

## 3 Preliminary activities

### 3.1 Institutional front

On April 16, 2019, five months after the Science and the Future 2 conference, the first Italian Oil Free Zone (compliant with the national 221/15 law) was established. The founding members were 25 municipalities of the Pinerolo area, including the main town. This was just the start, since other administrations are following the same route and it is reasonably expected that within a few months the rest of Zone 5 will join in. The memorandum that all municipalities have at hand establishes that when a new partner approves it without changes, it immediately becomes a member of the OFZ.

The OFZ is the legal container where it is possible to test solutions to reduce dependence on fossil fuels. The first announced experimentation, in this case, was the foundation of an energy community, within the borders of the OFZ, and as a pilot project.

### 3.2 Energy plan

A working group from the Department of Energy of the Politecnico is performing preliminary research for drawing an energy plan for the future community. So far, data on energy demand and production have been recovered from the main industries that are part of CPE. A similar investigation is under way for municipalities, although this is slower due to bureaucracy and the internal structural weaknesses of public institutions.

The preliminary results of the study demonstrate the need and opportunity for reducing the importance of fossil fuels: the sample that has been examined produces approximately 9.95% of its energy consumption. 73.72% of the internal production is destined for consumption by the producers themselves and 34.71% is from renewables. There is room for important improvements.

### 3.3 Legal aspects

A legal team is working on the most appropriate design for the future community: shall it be a society? A consortium? A cooperative? Something else?

If we want to preserve a role for municipalities, in addition to establishing the OFZ, the most appropriate institutional set-up appears to be the cooperative: it is indeed the most flexible type of association and the only one where public institutions are allowed to be members together with private partners. In all other cases,

according to current Italian laws, the aggregations must be either entirely private or entirely public.

The legal team is also charged with drafting the statute of the future cooperative, defining the reciprocal obligations of the members and an appropriate internal organisation.

### **3.4 Economy**

Of course, a reliable business plan must also be prepared. The community should have a positive balance sheet and, although regional law poses as a condition for its recognition that it be no-profit, its capacity to support itself is an essential requirement to ensure the long life of the institution.

The task of drawing up a business plan will be accomplished in collaboration with LINKS, which is a non-profit foundation owned 50-50 by Politecnico and Compagnia di San Paolo (which is a banking foundation). The main purpose of LINKS is to promote 'innovative projects for a sustainable future'; for this reason it is, from the very beginning, committed to help in finding possible investors to support specific projects within the framework of the energy community.

## **4 Open problems**

### **4.1 Technical aspects**

The initial operation of the community is planned to be essentially virtual, via virtual net metering (VNM). In practice the partners would continue to pour the energy they produce into the connecting network when production is in excess of their requirements, and take it from the network when they need to. Access to real time electronic counters, however, suggests that when one partner is injecting energy and another is collecting it, the latter is the energy that the former is providing (electrons always follow the shortest path). Rather than resorting to the external market, the economic balance could then be defined as an internal transaction between partners of the community. Of course one the cost of the physical network needs to be taken into account, which generally does not belong to the community and in any case has maintenance and operation costs. The whole scheme would have to be convenient for all partners, proving able to produce energy from local renewables at a lower cost with respect to the external market, and negotiating, with the owner or manager of the physical net, the economic counterpart of the reduction in transport and delivery costs (lower transmission losses).

Of course VNM cannot be the only long term approach to the operation of the community. Investments are needed in order to enhance and diversify the self-production capacity of the whole group. The corresponding policy cannot rely on production technologies only, but must also develop energy saving and efficient use of energy techniques. Last but not least there is the problem of diffused energy storage. The vehicle to car storage strategy is being considered by the promoter group. The Pinerolo area has an interesting

fleet of public vehicles, including school buses and service vehicles for the municipalities. That fleet, which is now entirely based on conventional fuel engines, could be turned into a set of electric vehicles and at the same time a dedicated bi-directional power supply network be provided in order to allow the batteries of the vehicles to work both in the usual way and also by providing a diffuse storage facility for the whole group of users.

In all cases the technological frame of everything will be a smart grid.

### **4.2 Bureaucracy and regulation**

Technical and technological problems are in a sense an easy matter, when compared with problems of bureaucracy and regulation. Despite the presence of a regional law allowing for the foundation of energy communities, there is not yet a corresponding consistent regulatory framework at the national scale. Energy communities as such do not yet appear in the tables and guidelines of the main Italian regulation authorities. The latter are GSE (Gestore dei Servizi Energetici) and ARERA (Autorità di Regolazione per Energia, Reti e Ambiente). The main problem appears to be the exchange of energy between different subjects located in different places. The quality of the associated producer and/or associated consumer of energy is not a problem, but the difficulty arises from the need for the role of a distributor of energy. The latter function is granted to a selected set of qualified operators who either own the physical local distribution network or are allowed to manage and use a network belonging to someone else.

In order to discuss the issues of the associated distribution function, the promoters of the future Pinerolo Area Community have already established communication channels with RSE (Ricerca sul Sistema Energetico: a public company controlled by GSE) and with ARERA.

Such contact has identified a strategy to allow the start of a real energy community even in the absence of a single national regulatory framework, and while waiting it to be defined or even helping its definition. The approach could be as follows:

- Define the institution of the community as a pilot project to be realised in the area of the newly established Oil Free Zone, devoted to the experimentation of solutions to reduce local dependence on fossil fuels;
- Attribute the status of associated producer of energy to the nascent community; as the group has the appropriate requirements, since, starting from ACEA Pinerolese, a number of partners are able to produce energy for commercial purposes;
- Recognise the new organisation as an associate consumer, which is permitted by the present regulations for a plurality of users willing to jointly procure energy on the market;
- Entrust the task of distributing the jointly produced energy for the final users, who are part of the same group, to one of the members of the association, which already has the requisite and the official recognition of

being an authorised distributor; for example, a firm belonging to the ACEA Pinerolese group: ACEA Pinerolese Energia (APE).

The most complicated task is to find a way to allow the municipalities to benefit from the same possibilities as companies and private citizens. One option is to do so not directly but through ACEA Pinerolese, which is their exclusive property: this would be a form of in-house procurement. Another way, especially suitable for mountain municipalities, requires extending an ability that towns with fewer than 20,000 inhabitants already have (together with the Ministry of Defence): the permission to exchange energy between different public buildings, even if they are not contiguous. This option could be extended from administrations to the citizens of the given municipality who agree to be members of the energy community. In this case it is not enough to simply interpret existing regulations appropriately, but it is necessary to extend them: consent of ARERA is needed. This issue has not yet been resolved, but if the privilege is extended to a limited area in a mountain environment, and for a pilot project, then success is reasonably expected.

One further delicate problem remains, involving the system charges which are now paid by energy consumers, not directly reflecting costs related to transport and the delivery of energy. Part of these charges are indeed a form of taxation, that the state allocates to various energy-related purposes. The structure of these charges should be revised, better distinguishing costs from taxes and also considering the opportunity to facilitate the formation of new energy communities, as required by the EU directive. This issue is of course political: the debate is open.

## 5 Conclusion

We have presented here the preliminary initiatives and work in the Pinerolo area, for an energy community intended to be a forerunner of similar experiences diffused all over Italy. The first evaluations on the basis of the data collected in the territory involved are encouraging, and municipalities and private companies are both taking the experiment seriously. It must be stressed here that, apart from the details of the local implementation of the project, the experiment is in fact starting a sort of revolution in the way of thinking about energy and organising its production and distribution. Energy is no longer seen as merchandise to be sold on the market for the maximum profit of specialised operators. Energy is instead conceived as a fundamental asset that is part of primary rights of a community, which is entitled to procure it directly on its own. Diffused production and consumption is also the way to achieve more stable and safer networks, and it is especially fitting for the use of renewables. So far the only aspect strictly related to energy has been mentioned, but Energy Communities can be much more. They may lend the opportunity to start a different approach to the way a community manages social relations, local services and even economy: common

responsibility, collaboration and mutual exchange of skills and resources are called in and stimulated.

Returning to the global change, Energy communities are part of a trend that humanity will have to follow if we want to cope with the 50% reduction and more in the release of CO<sub>2</sub> into the atmosphere before 2030, which is required by the need to keep the impact of ongoing climate change under the threshold of affordability.

Unfortunately, the perception of this very role of future energy communities is also the reason why we may expect the culture of business as usual and short term vested interests in the current energy market to interpose obstacles and hitches to implementation.

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