

The energy markets from a small scale consumer perspective: the CRETA experience

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Abstract—When small consumers, like local authorities, try to approach the electricity world too often they face problems rather than great opportunities. Purchasing electricity in the liberalized market, trying to adhere to energy savings projects or planning new renewable energy plants are great initiatives but often with low probability of concrete realization. For this reason, the Power System Research Group of the University of Calabria has founded CRETA, a coalition of local authorities and small companies, sharing its manifold expertise in energy field. CRETA is a non-profit organization with the mission of mobilizing, educating, informing and allowing its members to change the way they use and think about energy. CRETA works together and for its members, carrying on many projects, some concerning energy purchase in the liberalized market, energy savings in road lighting and renewable plants planning. In the paper, final results and business plans of the main CRETA activities are made available.

I. INTRODUCTION

AGENDA 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, governments, and major groups in every area in which human impacts on the environment. Agenda 21, the Rio Declaration on Environment and Development and the Statement of principles for the Sustainable Management of Forests were adopted by more than 178 Governments at the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil, June 3-14 1992. The full implementation of Agenda 21, the Programme for Further Implementation of Agenda 21 and the Commitments to the Rio principles were strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa from 26 August to 4 September 2002. Official

Because so many of the problems and solutions being addressed by Agenda 21 have their roots in local activities, the

participation and cooperation of local authorities seems to be a determining factor in fulfilling Agenda 21 objectives. Indeed, local authorities, such as municipalities, construct, operate and maintain economic, social and environmental infrastructures, oversee planning processes, establish local environmental policies and regulations and assist in implementing national and sub-national environmental policies. As level of governance closest to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development. Representatives of associations of local authorities are thus encouraged to establish processes to increase the exchange of information, experience and mutual technical assistance among local authorities themselves [1]. To remark the importance of local initiatives, the European Commission has also promoted the “Mayors agreement”, an innovative initiative to involve citizens in the fight against the planet warming, so encouraging virtuous energy consumption habits [2].

However, local initiatives are often discouraged by bureaucratic complexities and diffuse scarce technical skills. At the same time, the days of cheap energy for Europe seem to be over. Increasing fuel import dependence and higher energy prices are faced by all EU members. EU Member States have thus to act now, together, to deliver sustainable, secure and competitive energy. To achieve this goal a lot of European directives have been delivered in the last years, regarding electricity and gas market [3, 4], renewable sources promotion [5] and energy savings [6, 7]. The impact of these directives has been great on common people though, on small consumers, like local authorities, their application have often yielded financial and social difficulties than opportunities and benefits. Indeed, despite Agenda 21 lays down that local authorities play a leading role in the energy and environmental scenario, nonetheless they sometimes suffer the superimposed rules coming from the European directives, feeling not able to apply them and therefore damping the initial enthusiasms.

Starting from the above considerations, the Power System Research Group of the University of Calabria has founded a coalition of local authorities (in the remainder municipalities) and small companies, offering them its manifold expertise in energy fields in order to achieve the Agenda 21 prescriptions. The name of the coalition is Consorzio Regionale per

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l'Energia e la Tutela Ambientale (CRETA) (in English Regional Consortium for Energy and Environment Safety). CRETA is a non-profit organization, mainly operating in Calabria, a south Italy region, though some municipalities from other Italian regions are also joining. The mission of CRETA is to mobilize, educate, inform and allow its members to change the way they use and think about energy. CRETA's focus is indeed bottom-up, working with its members to identify their individual energy needs and carrying on projects concerning: collective energy purchase in the liberalized market; global service for road lighting systems; wind farms installation, sharing the profits coming from the energy production with municipalities and citizens; solar photovoltaic plants; biomass plants; solar thermal plants.

In the paper, CRETA presentation is first provided, followed by a detailed discussion of the main CRETA projects in progress, highlighting their relating social and economic benefits.

II. CRETA'S PRESENTATION

CRETA was established in 2005 by five Calabrian municipalities, Falerna, Nocera Terinese, Pianopoli, Parghelia and Stefanaceni and one private company, the "Turismo e Sviluppo S.p.A.". Currently, it numbers twenty-one municipalities and six private companies, all from Calabria, though others from Molise are also joining the coalition. Fig. 1 highlights the two regions of Italy, Calabria and Molise, where CRETA current and potential members are mainly located, while Fig. 2 and Fig. 3 provide a zoom on such two regions.



Fig. 1. Italy and its regions



Fig. 2. CRETA current members in Calabria

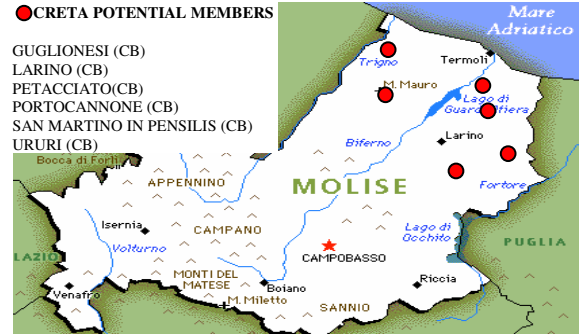


Fig. 3. CRETA potential members in Molise

CRETA acts as an Energy Service Company (ESCO) for its members, suggesting them opportune activities to save energy and reduce their overall management costs. The success of CRETA is mainly due to the expertise of its Technical and Scientific Board (TSB), currently made up of five experts in energy fields, nominated by the Department of Electronic, Computer and System Science of the Faculty of Engineering of the University of Calabria. The TSB is the body supporting all CRETA initiatives, which CRETA members can adhere to with no expense, rather having benefits. Indeed TSB and municipalities share the economic and social benefits deriving from all the projects, being municipalities involved in the projects themselves and not suffering them. In the following sections three main projects CRETA TSB is working on are discussed in detail, with attention focused on how they are carried on, which difficulties have been experienced and which final/preventive results have been reported/expected.

III. CRETA PROJECTS IN PROGRESS

In this section, a detailed description of the first three projects carried on by CRETA is provided. Each subsection has been divided into an introduction to the specific project, a consequent report of all the real boundary conditions, advantages and obstacles encountered in carrying on it and a final analysis of the benefits, often not only merely economic.

A. Electric Energy procurement

CRETA purchases electricity in the liberalized electricity market on the behalf of its members and shares with them the consequent economic and social benefits. The strength of CRETA is to be a unique "customer", made up of a group of small municipalities and of small and medium companies to which the electricity supplier reserves different treatments with respect to those of a consumer buying electricity alone. As far as the electricity purchase, CRETA develops a manifold activity:

- it draws up all the documents of a unique call for tenders for the whole consortium, so avoiding onerous stand alone calls for tenders, as many as the number of the municipalities members of CRETA (municipalities have to make a call for tender in spite of signing a direct contract, being them public authorities);
- it selects the most advantageous supplier by means of a European public procedure;
- it supervises the correct invoicing of its members;

- it proposes energy saving solutions, following a preventive analysis of the historical invoicing (power factor correction, reduction of the contractual power, correct application of the rate of taxation, etc...), there where necessary.

The determination of the most advantageous supplier is not merely based on the exploitation of the banal criterion of the "lowest price", being conversely based on the application of the economically most advantageous offer. According to transparent criteria, each offer component of the potential supplier is weighted, concurring at the determination of a final "score". The supplier winning the call for tenders has the highest score and, since December 2005, CRETA has been providing by EDISON ENERGIA, an Italian-registered company with equity, listed for trading on the stock market.

Starting from a result of a final analysis conducted over 20 months of supply (from December 2005 to July 2007), by considering only 11 members, having had a 7% and a 5% discounts on a component of the electricity price and having been 0.002 c€/kWh and 0.0005 c€/kWh the financial contributes to CRETA, for "Other Uses" and "road lighting" respectively, CRETA forecasts to save 1 200 000 € by the end of 2009 for electricity purchase in the liberalized market, accepting the concrete hypothesis that it will number almost 200 members. The savings might then be invested by each member in sustainable development activities thus further satisfying AGENDA 21 prescriptions.

However, besides the financial aspects, also a balance has to be drawn of the difficulties met and the relating solutions adopted in the activity of electricity purchasing. With regard to this, we would like to highlight first the difficulties for those municipalities which for choice or for missed knowledge, have independently entered the energy market, without making use of existing consumers coalitions, like CRETA, which could support them when switching the ex monopolistic supplier, ENEL.

It is worth to remember that after the unbundling of the generation, transmission and distribution services, previously managed centrally by ENEL, the authority responsible for the distribution service in Calabria is still ENEL DISTRIBUZIONE. Its responsibility also embeds the electricity consumption measuring service, needed to impute the right invoice to each customer according to its effective rather than expected consumption, whose frequency is variable in function of the voltage supply level (low/medium/high voltage).

Therefore, even if a consumer switches his supplier, he still owes the distribution operator the fees for the energy transport. Recently, because of its many consumption points, when a municipality decides to switch the previous supplier in favor of a more advantageous one, it often happens that the municipality faces natural, even though onerous, transient problems of settlement, often attributable:

- to the new supplier, due to mistakes of wrong classification (low instead of medium voltage, wrong tax rate, etc) if compared with the historical data communicated by the previous supplier (often ENEL);
- to the distributor (ENEL DISTRIBUZIONE), due to wrong

communications to the new supplier or rare energy consumption measurements;

- to the inadequacy or inexistence of successive controls by the municipality to detect likely anomalies in the invoices produced by the new supplier, consisting in excessive and unsustainable economic adjustments, often due to missed consumption measurements.

For this last reason, many cases of suits against the new suppliers have been brought by as many municipalities, new entries of the liberalized market. Disastrous economic and financial results have then been reported for the management of the electricity supply service by many municipalities. They indeed believed in obtaining some savings by changing supplier, but had not been enough prudent to understand preventively that the greatest problem would have been managing the relation with the supplier itself. Naturally, the CRETA supply relation with EDISON ENERGIA SPA has not been free from the above cited arrangement problems but, simultaneously, CRETA members have been supported and protected by the supervision and control activity of the TSB, in the respect of the contract terms and of the spirit that promoted all the initiatives carried on together.

As an example, the authors want to signal the case of a municipality that received an invoice on July 2007 containing relevant adjustments pertaining its consumption during 2006. It was the case of a medium voltage contract the municipality has and, according to directives of the Italian Electricity and Gas Authority (AEEG), it should have had the consumptions measure (and not the forecast) every month, without any reserve of adjusting. Thanks to careful and scrupulous controls and contacts with the AEEG, EDISON and ENEL DISTRIBUZIONE by the TSB, the mistake causing the wrong invoice has been detected and the invoice has been corrected.

Such problems could discourage a municipality to purchase electricity in the liberalized market, nonetheless since the first of July 2007 this has been mandatory in order to avoid extra electricity costs. In fact, since the first of July 2007, any electricity customer, even domestic, has been having the possibility of choosing his supplier independently. For this reason, for those customers having neither competences nor skills to choose by themselves, the AEEG established two services, guaranteeing power supply according to different economical conditions:

- a. the "greater protection" service, pertaining domestic customers, small companies and municipalities with less than 50 employees and an yearly turnover less than or equal to 10 million euro.
- b. the "protection" service, pertaining all final customers being not in possession of the requirements for the "greater protection" service, and having not chosen a supplier on the liberalized market or, further, any customer owning, at least, one consumption point supplied in medium voltage. The energy prices applied by the various local distributors for the "protection" service have recorded increases of about 20%.

From this last considerations, it is mandatory that each municipality, particularly those interested by the "protection" service, urgently procures a power supply in the liberalized market at more advantageous conditions.

Joining CRETA a municipality can avoid the extra expense due to the aforesaid AEEG services. Nonetheless the contract has been now renewed for the maximum number of years (three years according to the terms of the contract), thus the TSB is now writing all the documents of a new call for tenders to select the next electricity supplier from 2009 on. The idea is to invite to tender one energy price per consumers class (civil, road lighting, low/medium voltage, with different or flat tariffs in function of the hours of the day) following an index trend, like in the current contract. All the participants may propose their own index, based on their own fuels basket, so being guaranteed to have their own margins of profit preserved, but according to expected trends of a given number of fuels prices given by CRETA. This modality should provide CRETA with a certain number of different tenders, but founded on a unique common base: an equal expected fuels prices trend. Of course, any member of CRETA may or not benefit from the results of the call for tenders, being free of eventually acting by himself, but with all the consequences inherent this choice.

B. The Global service project for road lighting

Energy Service Companies (ESCOs) are a recent concrete example of support in the realization of energy saving projects. As far as their activities for a municipality, they first analyze the municipality electricity and gas consumptions, then deciding where to intervene to save energy. As to how they intervene to save energy, ESCOs apply rules for the standardization of plants and make use of new technologies in the management of the plants themselves, in order to reduce the cost of the "energy invoice" and drastically decreasing the maintenance cost thanks to preventive logics rather than repairing actions in case of need. Once the investment is quantified, the ESCOs *modus operandi* is usually based on the Financing Through Third (FTT), i.e. the whole investment is supported by a third company, which recoups it by recouping the savings of the municipality. When the company investment is totally recouped, the municipality will fully keep its own savings, being also owner of a totally modernized plant. Though everything seems working, the municipality faces not trivial problems such as how to select an ESCo, how to evaluate if an energy-saving project is well done or if a particular kind of contract is advantageous.

CRETA TSB supports the municipality overcoming the three aforesaid problems having drawn up a Global Service project for road lighting besides still working on one for district heating. As first step, CRETA has defined the best contract clauses for a municipality and selected the best ESCo financing the project by means of a unique public European call for tenders for all its members. What is important is that all these operations have been without any expense for each municipality, valid for all the municipalities members, but not binding. The public European call for tenders has been published on the Official Journals of the European Union (OJEU) and of the Italian Republic (GU), on date 06/07/2007. The ESCo that awarded the agreement with CRETA has been ALFANO SPA (in the remainder ALFANO), which has undertaken to finance the initiative, recouping its investment by the municipality savings. On the other hand, each

municipality adhering to the agreement undertakes to pay to ALFANO the expected annual amount to cover the electrical invoices for road lighting and buildings belonging to the municipality (in the remainder "private buildings"), with a 3% applied discount. The agreement thus allows the municipality to:

1. perform energy saving;
2. have routine and planned-preventive maintenance: savings from the avoided expense can then be invested in other activities;
3. standardize road lighting plants;
4. make technological and functional modernization of road lighting plants;
5. realize new plants installation for a 4% of the contract amount multiplied by the term of the contract (30 years) within the first two years after signing the contract.

As to the last point, if the municipality intends to extend its plants more than how it is indicated in 5. (with the related planning and works direction included in the price) it will pay a fixed price decided by the regional authorities, with a reduction, as indicated in the economic offer of the tender procedure.

Conversely, ALFANO saves money:

- by the regulation of the light flow on each lamp;
- turning off exceeding lamps, especially present in particular plants like artistic illumination plants, with many lamps on each lamppost;
- supplying electricity, since it buys it at a lower cost than the one previously paid by the municipality;
- in the standardizations of the plants: the more the plants are obsolete the higher is its margin.

As an example, let us consider a real case of a municipality of 5000 inhabitants, with different quarters and some near shore residences, spending an average of 100 000 €/year for the electricity invoice of road lighting and roughly 30 000 €/year for routine maintenance. Through the Global Service project, the municipality is going to spend only 100 000 €/year, covering with it:

- the electricity supply for road lighting and private buildings;
- the routine and planned-preventive maintenance of road lighting plants;
- the technological and functional modernization of the road lighting plants;
- new road lighting plants for 120.000 € within the first two years after signing the contract;

Among benefits, it has to be underlined also the convenience to commit all the services related to the Global Service project to a single company, either from a managerial or organizational and economic viewpoint. The success of the initiative is however due to the CRETA TSB support, who performs all the administrative functions, supervising and monitoring the Global service activity performed by the awarded company as well. The last two activities are carried on by CRETA thanks to a modern innovative system fully exploiting the standard Internet technology and financed by ALFANO with a 5% of the contract amount per year (5000 €/year as to the example above).

C. The wind farm project

For its particular geographical position and orography of its territory, Calabria is among the most favorite regions for the establishment of plants fed by renewable energy sources (RESP, renewable energy source plants). In particular, as to wind generation, for the 80% of its extension, Calabria presents sites with high wind, i.e. with wind speed exceeding 6 m/s, so offering ideal conditions for wind farms establishment. But the energy problem is now becoming a business too often in the hands of people who don't care the welfare of all. Indeed, many municipalities are currently visited by dozens of promoters who promise "some euro" per year and no more benefits in exchange for authorizations to build wind farms in their territories. Accepting these proposals, at a first sight attractive, for a handful of euro means surrendering a valuable resource not as widespread in Italy as it is in our region: the wind!

As an example, let us consider that a 2 MW wind tower, working for an average of 2000 hours per year, can produce an income more or less equal to 700 000 € per year, compared with an investment of 2 to 2.5 Million € and a payback time so short that it is difficult to find investors that are not available to finance any project. So the main question is why should municipalities undersell also wind in exchange for a handful of euro? The CRETA wind farm project is a concrete answer to the aforesaid question, planning to establish a 200 MW plant distributed in the territories of the most windy CRETA municipalities. The project has been concretized through the establishment of a company, the CRETA Energie Speciali Srl (in the remainder CRETA ES), aimed at the realization of plants fed by renewable energy sources and in particular of wind farms. CRETA ES is an academic Spin-Off, result of a research activity conducted by the Power System Research Group of the University of Calabria. CRETA ES is participated for a 5% by academics, a 30% by CRETA, thus by its members and for the remaining 65% by a private company. The initiative is therefore open to citizens, enabling a strong and positive fallout on the territory, also in terms of sharing of the profits coming from the energy production. In particular, the municipalities that will host wind farms on their territory will be awarded with four different incomes:

1. A *una tantum* quota (a maximum of 10 000 € per MW authorized and installed), according to the wind farm size and the "quality" of the potential territory, i.e. viability, access and distance from the interconnection, easiness in laying cables.
2. Annual revenues, commensurate to the output plant and to the power installed on the municipality territory.
3. Annual income deriving from the possibility of a further wind power installation with prevailing property of both the municipality and CRETA, in the remainder "private plant". This offer component represents a strength of the project, being absolutely not present in other offers.
4. Incomes due to CRETA membership, for its participation to the CRETA ES, divided among members according to rules laid down in a special regulation document. Also this component is clearly not present in other offers.

For clarity sake, a deeper detail has to be given about the above four offer components. The first component allows each municipality i) to become partner of a new company, realizing the "private plant" without any expense; ii) to show citizens the economic benefits after signing the agreement; iii) to have an economic recognition justifying the environmental impact of the plant. The second component aims at choosing only the most productive territories, instead of occupying also those where production would be less remunerative, significantly increasing the economic and social value of the municipality activities. As to the third component, CRETA ES recognizes to the municipality the possibility of establishing and managing a further partially private plant, for a minimum of 1 MW and a maximum of the 10% of the installed capacity in its territory. Therefore the municipality is directly involved in the production of wealth, sharing it also with CRETA. The financial feasibility of each private plant is indeed assured by the establishment of a new company, according to the following share: 35% the municipality, 35% CRETA, 30% the private company.

As last observation, with reference to the fourth offer component, deriving from the participation of CRETA to CRETA ES, it safeguards those municipalities who, less fortunate, do not have the primary resource, the wind. Basically a mechanism of solidarity starts among municipalities, they have or not wind either, procuring sums of money that can be invested in further renewable sources plants or energy saving activities. All the benefits deriving from the overall offer thus demonstrate how signing agreements in favor of unknown promoters of individual private companies definitely doesn't generate the same benefits produced by CRETA.

As an example, supposing an overall 200 MW plant, distributed in 10 plants of 20 MW each, 10 private plants of 2 MW and 20 members in CRETA, Table III and Table IV provide the incomes of a generic municipality hosting both a 20 MW and a 2 MW plants, for 2000 equivalent hours of operation, considering 7 €cent/kWh and 11 €cent/kWh as average prices of energy and Green Certificates, respectively.

TABLE III
INCOMES FROM THE PRODUCTION OF A 2MW PRIVATE PLANT, IN €

Variables	Amount
Average investment cost	2 600 000
Annual total energy production, in kWh	4 000 000
Annual revenues from energy sale first 12 years	720 000
Annual revenues from energy sale next years	280 000
Annual average profit	210 000
To Municipality (35%)	73 500
To CRETA (35%)	73 500
To Private company (30%)	63 000

TABLE IV
INCOMES FROM THE PRODUCTION OF A 20MW PLANT, IN €

Variables	Amount
Average investment cost	260 000 000
Annual total Energy production, in kWh	40 000 000
Annual revenues from energy sale first 12 years	7 200 000
Annual revenues from energy sale next years	2 800 000
Annual average profit	2 100 000
To Municipality	31 500
To CRETA (30%)	630 000
To private company and University (65%+5%)	1 470 000

From Table IV, the Municipality gains € 31 500 thanks to the installation of a 20 MW plant in its territory, since it is member of CRETA, having equally divided the CRETA incomes among CRETA members (€ 630 000/20). To this quota, thanks to the fourth offer component, the municipality gains also the quota deriving from the remaining nine 20 MW plants and 10 private plants equal to € 320250 ($€630000 \cdot 9/20 + €735000/20$), as provided in Table V, resuming the municipality annual overall incomes. The annual revenues from the 20 MW plant production are estimated as a 3% of the annual revenues from energy sale ($3\% \cdot € 7\,200\,000$), according to the hypothesis on the 2000 equivalent hours of production.

TABLE V
MUNICIPALITY ANNUAL OVERALL INCOMES, IN €

Variables	Amount
Annual revenues from the 20 MW plant production	216 000
Annual revenues from the 2 MW plant production	73 500
Annual revenues from CRETA profit sharing	351 750
Tot.	641 250

Besides the four offer components, the CRETA wind farm project is innovative also for the further chance given to the private landowners allowing to build a plant on their territory. As an example, assuming the same prices for energy and green certificates, Table VI summarizes the overall incomes for a landowner hosting a 20 MW plant working for 2000 equivalent hours.

TABLE VI
LANDOWNER OVERALL INCOMES, IN €

Variables	Amount
<i>Una tantum</i>	10 000
Annual revenues due to building lease for a 20 MW plant	60 000
Annual incomes from the 1 MW plant production	105 000

The *una tantum* quota is at least € 5000 and at most €10000, depending on the same conditions in point 1. of the offer to municipalities. The annual revenues due to building lease is equal to 3000€/MW authorized and installed. Like municipalities, also landowners can establish a further wind plant but for a maximum of 1 MW, with prevailing property of both the landowner and CRETA.

Finally, the last but not least, the CRETA ES private partner will support also the scientific research for the renewable energy source plants development activity, providing research funds by means of contracts agreements for a total amount of 360 000 €. Moreover, for the development of the project, CRETA ES further recognizes to the CRETA a contribution of 20 000 €/MW authorized and installed.

IV. ACKNOWLEDGMENT

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