
CONFERENCE
OMAINTEC
2024
EXHIBITION
THE 21ST INTERNATIONAL
OPERATIONS & MAINTENANCE
CONFERENCE IN THE ARAB COUNTRIES
Energy Sustainability
and Renewable Energy
Communities
How to create an almost completely autonomous system
from an energy point of view
#OmaintecConf
An Initiative by
OMAINTEC
المجلس العربي للتشغيل والصيانة
Arab Operations & Maintenance Council
Organized by
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مجموعة أكزيكون الدولية

Introduction

Renewable Energy Communities :

- one of the tools for the **energy transition**
- tackle the **reduction of traditional natural resources**
- contain **the impact of human activities** on the environment and climate.
- **domain of activity** of the Energy Communities
- **opportunities for implementation** given by the technologies currently available
- **exemplary case of application** accompanied by data collected over several years.

Introduction

Renewable Energy Communities

- ***Prosumer*** is a possible fusion of the roles of producer and consumer.
  - the prosumer possible by **technological discoveries**
  - the growth of **user participation**
  - **boundary between production and consumption** activities indistinct.
- European Union encourages the establishment of Energy Communities.
- Switzerland has adapted by promulgating similar laws on the matter.

What is an energy community?

An energy community consists of an association among:

- owners of residential homes,
- commercial companies,
- local public administrations, and
- small/medium enterprises

who decide to join forces with the aim of producing, exchanging and consuming energy from renewable sources on a local scale.

The aim is to create a decentralized network in which the active and conscious participation of every citizen is required.

Community members are engaged in the various stages of energy production, consumption and exchange, promoting sustainable energy management, within a new energy model.

Renewable energy communities ensure a reduction in energy waste and promote the sharing of a fundamental good at a competitive price.

Their diffusion makes it possible to meet the energy needs of the population and to propose new socio-economic models focused on sustainability and circularity, without resorting to the use of fossil fuels.

How to create an energy community?

The first step to be taken is the establishment of a legal entity among the future members of the community, whether they are

- individuals,
- small or medium-sized enterprises,
- local or regional authorities
- local public administrations.

The next step is to identify the area where to install the production plant(s), which must be close to consumers.

Examples

A SME or a Public Administration can install a photovoltaic system, respectively on its production plant or school, and share the energy produced and fed into the grid with the citizens of the Municipality who have decided to be part of the community.

You can form neighbourhood communities, agricultural communities, village communities, and so on.

The facility does not necessarily have to be owned by the community: it can be made available by only one or more of the participating members or even by a third party.

Where production exceeds consumption, the community is granted only the economic value of the energy for the surplus energy, without further benefits.

This energy can also be stored in storage systems to be used when renewable sources are not usable or when the need arises, for example to cope with peaks in demand.

What are the starting requirements?

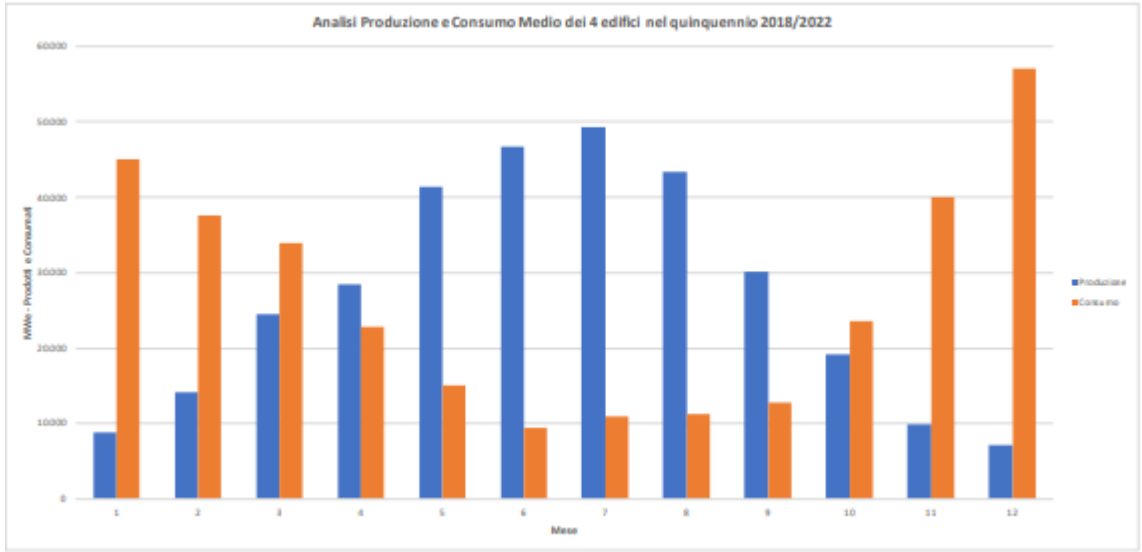
First of all, it is necessary to have the measurement of consumption under control for the different sectors:

- Residential;
- Commercial;
- Industrial;
- Infrastructure.

Mixed systems are those that could give greater results due to the complementarity of times:

- people live in the apartments preferably from evening to morning;
- factories produce mainly from morning to night, 5 days a week;
- shopping centers receive the largest number of customers on weekends, when factories do not produce;
- infrastructures have different distributions of consumption (and production) depending on the type of services (public buildings, energy, transport, health, security, environment, etc.)

Example of photovoltaic energy production and consumption in an energy community in southern Switzerland.



What are the energy sources?

The main sources of energy through which it is possible to produce electricity, thermal energy or directly mechanical energy are:

- Fossil fuels;
- Nuclear energy;
- Hydroelectric power;
- Solar energy;
- Wind power;
- Geothermal energy;
- Magnetic energy;
- Tidal energy;
- Collected energy.

Depending on the location of the production and consumption systems, renewable energy sources are normally as follows:

- the sun,
- the wind,
- water and geothermal resources,
- the tides,
- the motion of the waves,
- biomass, i.e., the transformation of plant products or inorganic and organic waste into electricity.

Other systems are being studied but do not currently have large-scale application.

What are the ways of storing energy?

Storage batteries

From traditional lead-acid batteries, to new lithium-ion batteries, to other dissolved salt forms.

In the prosumer model, there could be a development with the advent of electric cars and therefore exploit the charging system of the car batteries for traction and discharge of the same for residential operation.

Batteries are currently expensive and unreliable: their service life often does not exceed 2 years of service.

Complementary to batteries, supercapacitors could be used. These would be better used to cope with consumption peaks limited to a few minutes.

Potential energy

The most widely used criterion in Europe is transformation into potential energy, in particular by pumping water into reservoirs in the mountains.

Similar systems are being developed using other systems such as the case of Energy Vault in Tianying (PRC).

Production of bio-fuels

Instead of producing hydrogen, an alternative could be the production of bio-fuels. In this case, an interesting application could be given by the environmental sector, such as,

- the treatment of wastewater from civil plants;
- the processing of organic products derived from the agro-industrial sector;
- the recovery of wood chips and mowed.

What are the ways of storing energy?

Hydrogen

The conversion of energy into hydrogen by hydrolysis of water, or other molecules containing hydrogen, is arousing much interest.

This has received applications especially in the transport sector where there are applications in fuel cells or direct combustion in endothermic engines. In such cases, the objective is mainly the production of electrical or mechanical energy, while the thermal factor must be eliminated.

For residential applications, thermal energy could in turn be used for heating or cooling via absorption systems.

Hydrogen is a light gas and, in order to contain volumes, accumulation could be achieved either by compressing it or by verifying the applicability of metal hydride systems.

The compression can be increased to 700 and up to 2000 bar: this would lead to problems in applications in residential or frequent-intensive areas.

In contrast, metal hydride storage is much less dangerous but currently too expensive for marketable applications.

Example of Zero Energy Building

It is a residential building located in southern Switzerland, with a position particularly favorable due to:

- mainly southern exposure and number of hours of sunshine per year;

- presence of a lake at a very short distance;

- availability of the property to invest.

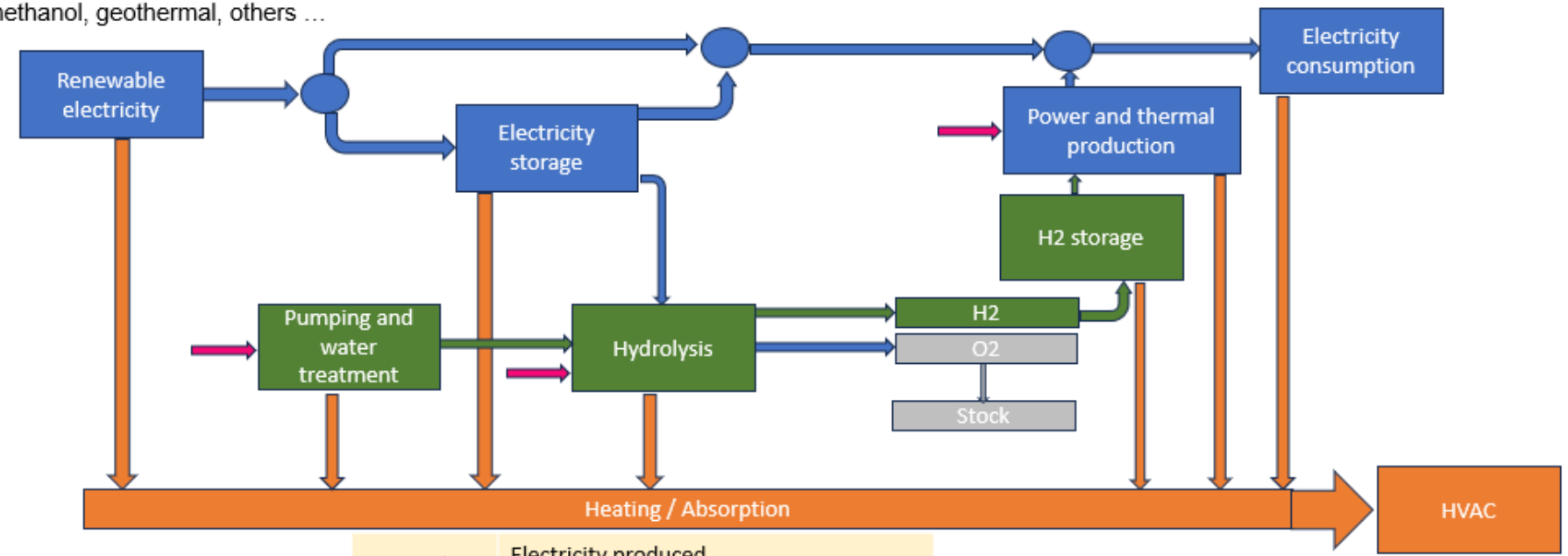
The basis of the project is the complete autonomy of the system from an energy point of view, as regards domestic, condominium and ancillary utilities, such as for example vehicle recharging.

Example of Zero Energy Building

Photovoltaic, wind, hydroelectric, wood chips, bio-methane, bio-methanol, geothermal, others …

Energy sustainability

VSM model for energy autonomous building



→	Electricity produced
→	Water / H2
→	O2
→	Electrical service (from the electricity grid or from renewable sources)
→	Thermal recovery

Note: only concentrated losses are considered and losses distributed over the lines (electrical and fluidic) are excluded.

Case history: Consumption data in a residential complex in southern Switzerland

The idea of the project is to establish a framework for using flexibility in a residential neighborhood from heterogeneous devices and a pilot study for integration of green hydrogen production, storage and use to allow for a all year round of renewable energy.
Characteristics of the Energy Community are:

- Electric vehicle chargers (mono and bi-directional);
- Flexibility with electric appliances, in particular white goods;
- Foster user engagement & participation with financial incentives backed by platform through micro-payments;
- Smart contracts with micro-payments within energy community;
- Demonstration of user engagement through reward mechanisms for flexibility provisions;
- Demonstration of flexibility forecasting & valorization for mixed resources: bi-directional EV, appliances, on-site battery

Case history: Consumption data in a residential complex in southern Switzerland

User Requirements Specifications

- Statistics of energy consumption during the hours of the day, the days of the week, the weeks of the year;
- Statistics of the intensity and duration of sunlight during the day and on different days of the year;
- Influence of shading from trees or other buildings;
- Availability of other renewable energy sources in adjacent areas (wind, geothermal, biofuels, hydraulic reservoirs, etc.);
- Constraints on the installation of battery systems or storage tanks or other installations;
- Incidence of extreme weather events (wind speed [(1)], lightning, hail size and speed [(2)], snow load) [(3)],;
- Effects of air pollution and need for washing photovoltaic panels;
- Architectural and landscape constraints;
- Spending budget and expected return on investment.

Notes

In Europe, insurance companies require:

(1) the structure to withstand 160 km/h winds;

(2) the PV panels resist hail of 50 mm diameter at speeds of 80 km/h;

(3) the snow load can reach 1.5 m in mountain areas.

Case history: Consumption data in a residential complex in southern Switzerland

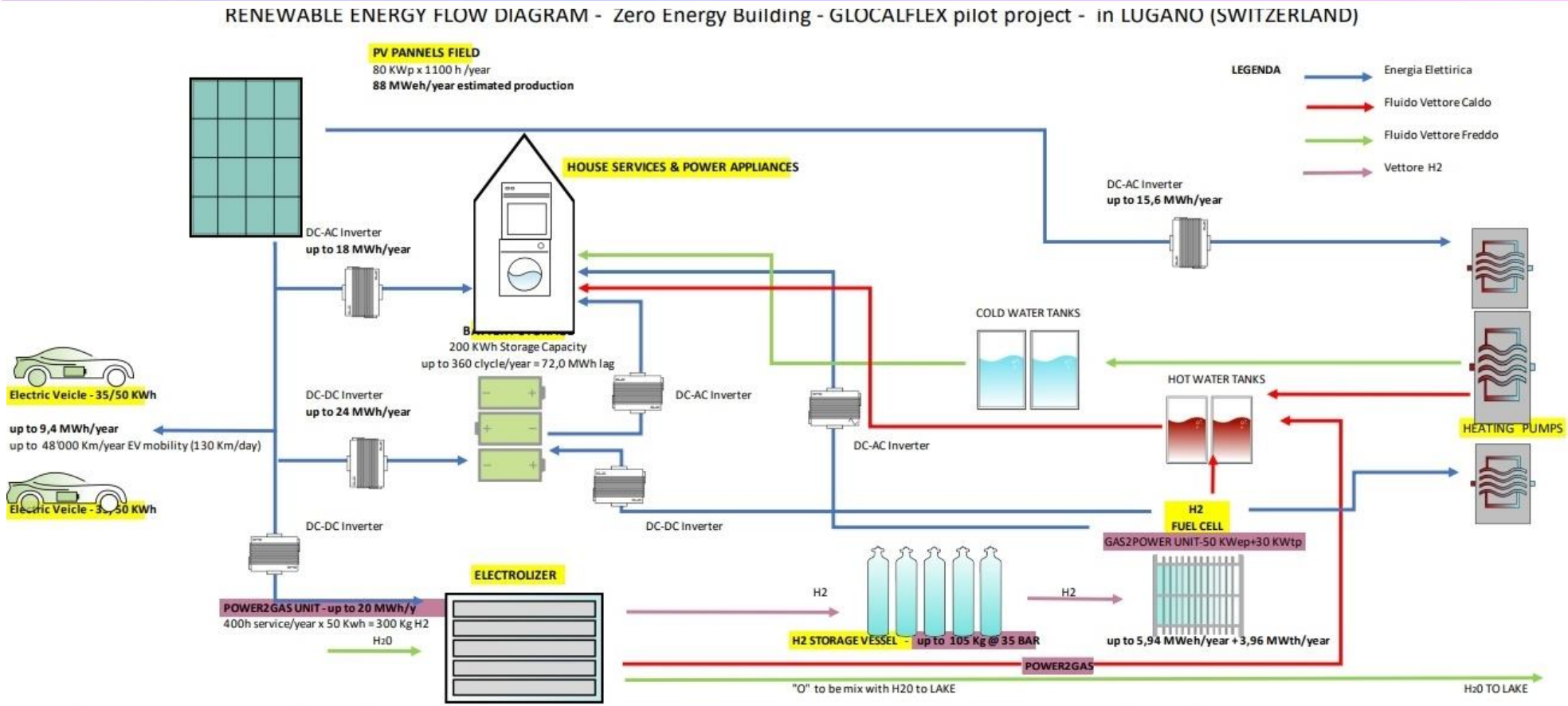
Functional Specifications

- Renewable energy production system (if photovoltaic panels, type based on the URS);
- Support carpentry;
- Inverters;
- Voltage transformers;
- Power lines and cabins;
- Excess energy storage systems;
- Monitoring and reporting systems.

Objectives, constraints and incentives

- Decarbonisation;
- Sustainability;
- Public financing;
- Tax incentives;
- Etc.

Case history: Consumption data in a residential complex in southern Switzerland



Anno 2024	Investments in CHF	Ammortization n°/year	Prod Kwh/Y	CHF/KWh
FV	64.000	25	88000	0,029
Batteries	80.000	8	26540	0,377
H2 System	360.000	25	5940	2,424

KWh
88000
Production

EVERGREEN®
SUSTAINABLE ENGINEERING

Real-time Self Consumption
Delayed Self Consumption

Anno 2030	Investments in CHF	Ammortization n°/year	Prod Kwh/Y	CHF/KWh
FV	48.000	25	88000	0,022
Batteries	60.000	10	26540	0,226
H2 System	200.000	25	5940	1,347

Questions and Answers

This presentation was written in collaboration with

engineer Giuseppe Macario by EVERGREEN SWISS and

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If you are interested in learning more, you can contact me at:

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THANK YOU!

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