The path towards energy transition

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Urban planning and Smart City are strictly interrelated concepts towards a sustainable vision. The article illustrates the example of the Lyon Confluence district, Europe's largest regeneration project where Hikari, the first positive energy block realized in France, is located

The previous, first number of the column *Cosa succede in città* (i.e. What's up in town) has highlighted the central role of the multidimensional and integrated vision which characterises the developing process of a Smart City. The concept of Smart City assumed by the EU consists of six different dimensions: Economy, Mobility, Environment, People, Life, Governance.

A similar level of sophistication requires smart policies, in order to face all of the challenges posed by the rapid growth of a city.

In fact, over decades to come, cities will become the elective living places of humankind; therefore, new rules and models of social organization must be implemented, based on strict sustainable practices. Reducing energy consumption represents one of the main targets, since 80% of global primary consumption occurs in urban areas. The Future Energy Expo in Astana represents a step forward on the path towards energy transition, a significant matter for both the public at large and experts in the field.

What is clear now is that giving up on the use of fossil fuels for energy production will not be enough: we need to intervene on the demand side, consuming less and better. This goal can be achieved by rethinking the relational models to disseminate information, creating a virtuous circle between consumers and producers based on the exchange of data flows and transparent criteria. Raising awareness over consumption, tariffs and services provided is a fundamental requirement to reach the energy paradigm shift. From this new kind of relational models, new figures are emerging on the energy market: for example, the *prosumer*, associated with a large-scale penetration of renewable energies. New forms of self-production are

likely to impact the current "centralized "model of energy production and distribution.
A new citizenship model, based on awareness raising and on the request for deeper involvement, is strongly recommended at European level, to "empower citizens to produce, consume, store or trade their own renewable energy either individually or collectively, to take energy-saving measures, to become active participants in the energy market through consumer choice, and to allow them the possibility of safely and confidently participating in demand response;... in this context, a practical common understanding of the definition of 'prosumers' should be agreed at EU level, through a participative process guided by the Commission" (Resolution of the European Parliament, P8_TA(2016)0234)
The diffusion of Smart Grid technologies goes in that direction, allowing the enhancement of consumers' awareness upon consumption and expenditure. Setting this path became possible due to the progress made in domotics: smart metering, wireless networks are just two examples of possible two-way communication between the meter and the central system. Even nowadays, experiences and best practices in the field can be found widely: citizens can already install in their houses devices with wide range of advanced built-in features, such as advanced power measurement and management capabilities, including the ability to remotely turn power on or off, read usage information from a meter, detect a service outage, and so on.
For what concerns urban planning, a careful consideration over the crisis of the current developing models leads to the adoption of a sustainable approach, which has a significant impact on the process of decision-making by stakeholders, who will shape the future urban landscape. Since the Eighties, an environmentally-oriented project planning has taken the lead: at the beginning, it interested small areas, quartiers and peri urban areas, eco-villages or eco-districts.
One of the milestones in this process consisted in the realization of the "Aalborg Charter" in 1994. It was an international initiative approved by the participants in the first European Conference on Sustainable Cities & Towns in Aalborg, Denmark. It was inspired by the Rio Earth Summit's Local Agenda 21 plan, and was developed to contribute to the European Union's Environmental Action Programme, 'Towards Sustainability'.
The initiative allowed to adopt guidelines to promote ur-

Eco district examples

Hammarby Sjöstad is one of the biggest urban development project in Sweden. Located in Stockholm, the Hammarby model describes the environmental solutions used for energy, waste, water & wastewater.
By around 2018 Hammarby Sjöstad is expected to have approximately 11,500 apartments for just over 26,000 residents, and a total of around 36,000 people living and working within the area.
Orestad is a developing city area located south of Copenhagen, Denmark.
Since the beginning, Ørestad was meant to be a sustainable city district. The urban planning focused on developing mobility infrastructure. The subway is considered the backbone of public transport, a system that also includes Railway, Airport Bridge and good bicycle lanes minimizing private car transport. The City adopted a parking strategy so that commercial and private users can share the available parking spaces.
Linz, an Austrian town is considered as a SolarCity, an energy-saving living district which ensures living space to about 4,000 people. It is an outstanding project which combines both social and environmental sustainability; it resulted from the close collaboration between architects and municipalities. SolarCity has managed to provide high class living comfort using the standard investments required in public housing, harmonising consumption, production and use of energy.
Ekoviikki, in Helsinki, is the largest sustainable building development in Finland. There, a range of environmental and energy concepts are demonstrated and it has paved the way to new planning approaches for sustainable suburbs.
Eco-criteria were set by external consultants mostly in order to maintain the area's high ecological profile: reduction of pollutants (CO_2, sidewater, site debris caused by construction, domestic waste, eco-labels); use of natural resources (reduced fossil fuels, multi-purpose use of space); Healthiness (indoor climate, moisture risk control, noise, the wind-free and sunny qualities of the site, alternative floor plans); Biodiversity (plant choices and habitat types, storm water); Nutrition (plants, soil).

ban, sustainable regeneration, defining new practices for territorial planning to mitigate the adverse effects of climate change. Those principles intended both to enhance environmental protection and human health and to integrate economic growth with social justice.
Many experiences, especially in Northern Europe, have been developed since 2000: all of them conjugate urban development with sustainable models in order to minimize energy consumption and waste production whilst maximizing the value of resources saving and recycling.
Among the most significative experiences which conjugate urban project planning, energy and environment, an initiative carried out by the city of Lyon is worth mentioning, an important project providing for recovery and urban regeneration of abandoned industrial areas.
The experience concerns the Lyon Confluence district that should become the flagship district in terms of energy efficiency mainly thanks to planning of positive-energy eco-district.
The Lyon Confluence district covers a total area of 150 hectares in the very heart of Lyon, where the rivers Rhone and Saone meet.
The interaction between public and private is one of the strengths of the intervention, addressing political-administrative issues and providing innovative technological solution.
Grand Lyon selected SPL Lyon Confluence (a local public redevelopment company) to design, realize, and promote the Lyon Confluence urban development project.

The residential development, with the construction of positive-energy buildings, allows to increase energy efficiency incorporating renewable energy, the main core of the energy project. Thanks to the massive use of cutting-edge IT technology installed in smart buildings, users should be able to control their energy consumption, and manage and analyse data collected by a Community Energy Management System.
Hikari, namely "light" in Japanese, is the name of the first positive energy block realized in France.
As a combination of needs and resources, the block is composed of three buildings, a mix of housing, offices,

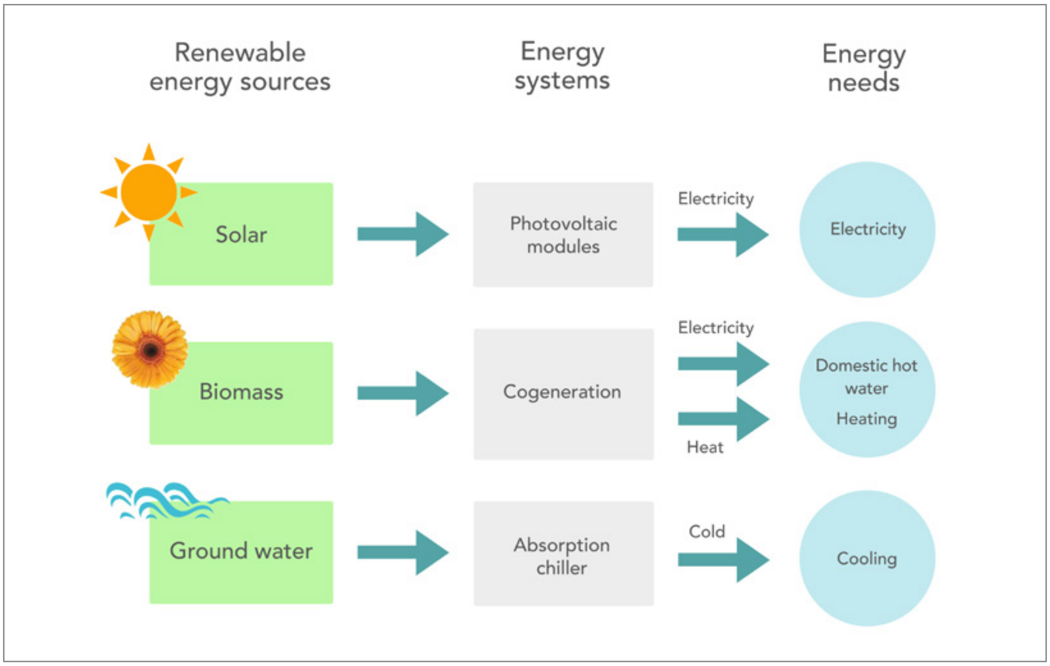

Fig 1 Hikari energy system design

and retail outlets, interconnected and with energy interchange according to the needs of each building.
The excess in energy production is stored and the surplus can be used for housing or offices according to their different needs during the day or night time.
Inaugurated in September 2016, Hikari focuses on renewable energy systems capable of ensuring on-site production of the energy supply necessary to operate the building.
Hikari consumes 50% less energy than the standard targets provided for in current thermal regulations and produces an amount of energy higher than what is consumed.
The project has been realized by Kengo Kuma, considered as one of the most innovative architects on the global panorama thanks to his expertise; he often uses technological advancements to meet the challenge posed by unexpected building materials, such as stone, wood, paper, or membranes.
The project meets the environmental and energy targets set by a specific commission created by the local authority. It combines a wide series of technological and planning solutions, related to both dimensions of energy consumption and production.
The target energy performance and the primary energy factors are based on a feasibility study that has been included in the environmental guidelines used for the international contest that selected Kuma's project.
The architect worked on both the design of the building and technological solutions in order to optimize energy consumption. He focused on the enhancement of lightning and natural ventilation systems, integrated with smart systems able to monitor the habits of the inhabitants, minimizing losses and optimizing energy management.
The energy requirements are met through the combined use of renewable energy sources, solar, biomass and hydro. Its core of 12,000 m^2 consists of three buildings, named after the three cardinal points they point to: Higashi ("East"), 5,263 m^2 of offices distributed on 7 floors, Minami ("south"), 3,400 m^2 split in 32 residential units, and Nishi ("west"), 2,246 m^2 of offices on five floors: on its roof, four urban villas have been realized. Additionally, there are 1,000 m^2 available for commercial uses, parking, and green areas overlooking the edge of the new dock.
Kuma's idea consists in improving natural lighting: as he explained during an interview:
"The architectural line we adopted led us to make deep openings in the façades in order to provide as much natural light as possible, cutting down the need for artificial

lighting and improving visual comfort."

The large glazing areas of office places and the cutting in each façade based on the sun path respond to a visual function, they want to create a sort of link between the inner and the outer space of the building.

Higashi building has a natural ventilation system in order to cool down the building. Lateral inlets favor fresh air circulation while two chimneys in the middle generate an airflow to let the heated air out.

Technological solutions are used to produce energy, to supply electricity, heating and cooling to the building. Three types of renewable energy sources available on site have been used: solar, biomass and groundwater. These sources power 3 main energy systems, solar PV modules, a combined heat power (CHP) system and an absorption chiller. Figure 1 shows the energy systems corresponding to the energy needs.

The photovoltaic system was installed on the rooftop of the 3 buildings and on the facades of MINAMI building corresponding to dwellings. The glazing areas have been used to insert photovoltaic cells that are visible from the street and from inside the flat.

In addition to photovoltaics modules, electricity is provided by a cogeneration system. A 75 kW CHP unit, powered by rapeseed oil that is stored in a 90 m^3 tank covers heat and domestic hot water needs for HIKARI building.

The cooling necessary to office places is generated by an absorption chiller, which uses heat from ground water and from the CHP.

In order to avoid discontinuity of energy production Hikari block can rely on an 8-hour heat storage made of 65 m^3 of water and is also equipped with cooling storage and power storage systems. The power storage system uses a hybrid battery (lead/acid and L-ion) with a capacity of 100 kWh.

All energy systems are managed through BEMS, the Building Energy Management System, that monitors and controls the energy performance of Hikari. More than 10,000 sensors collect information about temperature, CO_2 and humidity, in order to optimise the indoor comfort of users.

BEMS is connected with HEMS, Home Energy Management System, made of a set of devices located in every dwelling – smart water meter, control panel, PC tablet – which provide the inhabitants with energy feedback on energy saving targets.

Inspired by the Smart City approach, the Lyon Confluence project can be considered an interesting example of integrated urban planning in which the high performance of the building is crucial to achieving sustainability targets, particularly as far as the optimization of water resources and energy saving.