Leaf House is the first energetically independent building in Italy; a place to exchange thoughts on the subject of ecological sustainability and the home of the “Leaf (Life Energy And Future) Community”. The project was implemented by the Loccioni Group together with a network of companies. The Leaf House is a building with six residential units that is operated using only clean energies and does entirely without CO₂ emissions. What makes this model experiment special is the proof that ecology and modern living comfort do not have to contradict one another. Intelligent building automation by Beckhoff provides the basis for this.

Beckhoff building automation in CO₂-neutral house

Living in harmony with nature

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Efficient energy management with the latest technical standards

With a photovoltaic system for generating electricity and solar panels for heating the tap water as well as supplementing heating, the solar energy of the south-facing building is utilized in the best possible way. In addition, there is an air treatment system that serves well-being in the interior – with constant control of temperature, humidity and carbon dioxide in the rooms. A system for the reclamation and treatment of rain water, which is collected in a tank under the garden, is used for sanitary areas and for watering. The energy efficiency of the building goes into great detail: from the use of electrical devices and household appliances with low consumptions of electricity and water to lighting systems in which sources of light are used that radiate very little heat. Loccioni chose Beckhoff as its technology partner in particular for the realization of the energy-saving system. Loccioni found the desired components in the extensive range of products from Beckhoff without any custom manufacturing being necessary. With its special function blocks, the TwinCAT Building Library additionally offers comprehensive solutions that are tailored to the specific requirements of building automation. In this way, it was possible to implement all of the building functions in Leaf House on a software basis.

Embedded PC for control, Control Panel as operating unit

The entire Ethernet-based building control consists of seven CX1020 Embedded PCs and two BK9000 Ethernet Couplers. Built-in Control Panels with 15-inch TFT displays and DVI/USB interface are used as user interfaces. The panels can be installed up to 50 meters away from the PC and serve the monitoring of room functions. The data points are connected via Beckhoff Bus Terminals. The KL3403 power measurement terminal acquires all relevant electrical data from the mains supply; the comprehensive network analysis provides the basis for efficient energy management. The KL6401 LON Bus Terminal integrates the air conditioning unit with LON interface into the control system. The KM2774 modules control the sun shades. The KM2604 relay modules serve the automatic separation of loads and allow appliances with a high current consumption to be connected directly to the mains supply. Analog I/O terminals and thermocouple terminals offer the basis for the control of heating and air conditioning.
The wide range of I/O components for the control of various lighting scenarios as well as for room control also makes it possible to acquire data that has an influence on energy consumption and the well-being of the inhabitants, such as the control of external window shutters, protection against ‘prying eyes’ from outside, the movement of doors and windows, and also the correlation of climate conditions from indoors and outdoors. There are many different ways to optimize energy consumption, whether by integration of window contacts in the heating controller or by lowering of set room temperatures at night or when the inhabitants are absent. The PC-based technology enables remote diagnosis, maintenance and monitoring. It is therefore the ideal platform with which to ensure the monitoring of energy and consumption data as demanded by Loccioni.

**Shaping the future with the technology of today**

Leaf House is already carbon-neutral today, i.e. the energy is obtained completely from renewable energies, so that there are no CO₂ emissions. It is a residential building, but at the same time it is also a laboratory for new technologies for the efficient use of clean energy and a place for “environmental education” that wants to make a contribution to forms of living aimed at the future of our Earth.

**Loccioni Group** The Leaf Community, the “community of clean energy” was conceived by the Loccioni Group. It has concerned itself for forty years with the development of solutions in the fields of automation, quality measurement and assurance, and network infrastructure. As a technology integrator, planner and builder, Loccioni has invested in the community in order to develop trend-setting forms of living. Clean energy and maximum integration should bridge the chasm between man and nature instead of further intensifying the conflict.