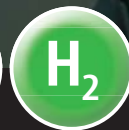




**SUSTAINABLE BUILDINGS**

**THE H<sub>2</sub>YDROGEM® PROJECT**



## HOTEL SAN ROCCO, THE FIRST CERTIFIED SUSTAINABLE BUILDING

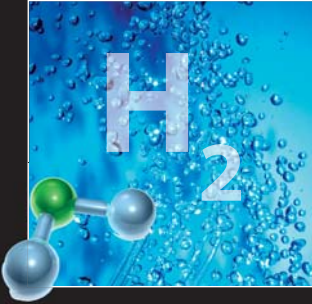
Hotel San Rocco of Orta San Giulio (NO) was the first building to be ever awarded the certification of “Sustainable Building” by ICIM. It was an important acknowledgement of the valid redevelopment of the complex of ancient buildings that make up the hotel structure. To guarantee the highest environment friendliness, technical solutions privileging sustainability were massively implemented: therefore the project focused on the research of highest energy efficiency and exploitation of renewable energies, with a specific concern on high comfort and functionality levels. Furthermore the result of the certification procedure highlighted that the merely energy-related aspects were integrated with an unrestrained vision of the building-system finding the proper balance between the needs in the social, ecological and construction field.



## INNOVATION AND SUSTAINABILITY WITH H<sub>2</sub>hydroGEM®

The sustainability certification was awarded to a large extent thanks to the innovative catalytic burner H<sub>2</sub>hydrogem®, a result of the Giacomini R&D activity. H<sub>2</sub>hydrogem® allows a cycle of thermal energy production with “zero emissions”, since for its operation it uses only hydrogen, produced with renewable sources, and air taken in the atmosphere. Through a catalytic reaction – therefore without flame - H<sub>2</sub>hydrogem® produces the heat necessary to heat the zones of Villa Gippini, the baroque jewel incorporated in the Hotel San Rocco. The only other product of catalytic combustion is steam that can be released in the atmosphere without risks. No CO<sub>2</sub> is released, and no No<sub>x</sub> either: a totally “zero emission” cycle. All this thanks to hydrogen, a clean and revolutionary energy vector, with barely no restrictions in availability, which will help in the future releasing the world from dependency on fossil fuels, with huge benefits for planet’s environment and climate.

# ZERO EMISSION CYCLE FOR THE HEATING OF VILLA GIPPINI



## HYDROGEN, THE NEXT GENERATION ENERGY VECTOR.

Hydrogen does not occur free in nature. But its availability is close to unlimited: wherever there is water, there is also hydrogen. Together with oxygen, as a matter of fact, hydrogen forms the molecule of water, the most widespread compound on earth. Contrary to fossil fuels, hydrogen is an energy vector free from carbon in its composition. In the process of energy production it is a great advantage: thanks to this, the combustion is totally free from emissions of CO<sub>2</sub>, the greenhouse gas.



## FROM WATER AND ELECTRICAL POWER HYDROGEN ANYWHERE.

Electrolysis allows producing hydrogen with a process that can be implemented wherever water and electrical power are available. In the electrolyzer the water molecule is broken down in its two constituting elements: hydrogen and oxygen.

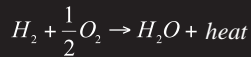


The produced hydrogen is sent to the catalytic burner directly or through an intermediate storage, whereas oxygen can be released in the atmosphere.

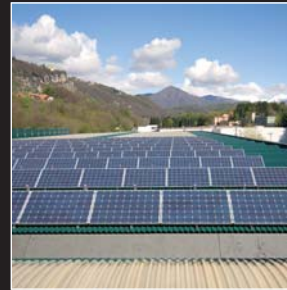


## THE H<sub>2</sub> HYDROGEN®, CATALYTIC BURNER, AT THE CORE OF THE CLEAN CYCLE

In the burner a catalytic reaction (therefore without flame) combines oxygen and hydrogen, producing exclusively heat and water in the form of steam.



Heat produced is taken by a heat exchanger embedded in the burner and sent to the heating system circuits. Thanks to low temperatures typical of the reaction (300-350°C), no nitrogen oxides are produced (NOx). The reaction does not produce CO<sub>2</sub> either, due to the absence of carbon in the reacting elements.



## RENEWABLE SOURCES ARE THE UNDERPINNING OF CLEAN ELECTRICAL ENERGY.

Electrical energy required for an actual “zero emission” cycle should be produced with renewable sources. The position of a building can be a huge restriction for the use of renewable sources: it occurs with historical centers of towns and hamlets. However electrical energy produced, for example, by a photovoltaic field and sent into the distribution network can be sampled anywhere to supply the electrolyzer, separating the production place from the one of energy use.



## COMFORT AND SUSTAINABILITY: THE HEATING OF VILLA GIPPINI.

Heat produced by the catalytic burner is used for the underfloor system of Villa Gippini, the baroque jewel incorporated in Hotel San Rocco. The 10 rooms, the presidential suite with arcade and the other areas are heated with a “zero emission” cycle, a result of the Giacomini research, fully conceived and manufactured in Italy. The best demonstration of high comfort and full environmental sustainability coming together.

# RENEWABLE ENERGIES

SOLAR IRRADIATION



PHOTOVOLTAIC FIELD

WIND



WIND ENERGY FIELD

WATER



HYDROELECTRICAL POWER

ELECTRICAL ENERGY



ELECTRICAL ENERGY



ELECTRICAL ENERGY



# ELECTRICAL ENERGY DISTRIBUTION NETWORK

ELECTRICAL ENERGY



ELECTROLYZER

OXYGEN [O<sub>2</sub>] FOR OTHER PURPOSES



HYDROGEN (H<sub>2</sub>)



H<sub>2</sub>



STORAGE SYSTEM

AIR FROM THE ATMOSPHERE



HUMID AIR IN THE ATMOSPHERE

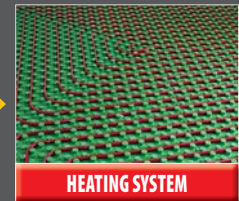


H<sub>2</sub>DROGEM®

H<sub>2</sub>



HEAT



HEATING SYSTEM

# THERMAL ENERGY PRODUCTION PROCESS

# FINAL USES

# GIACOMINI



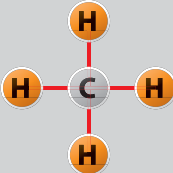
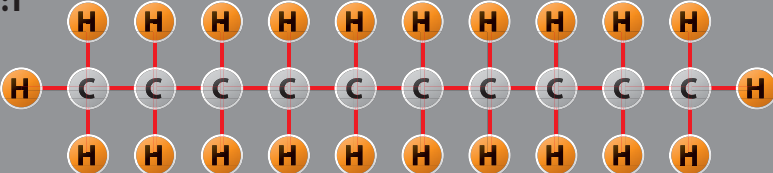
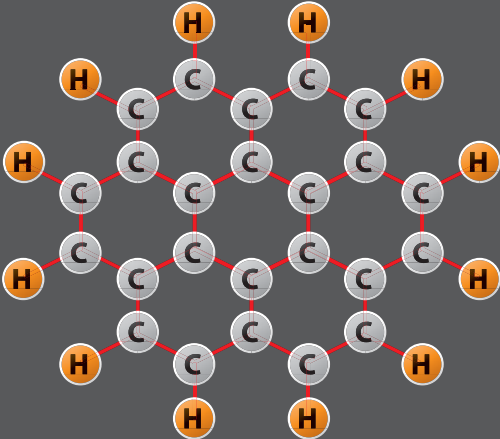
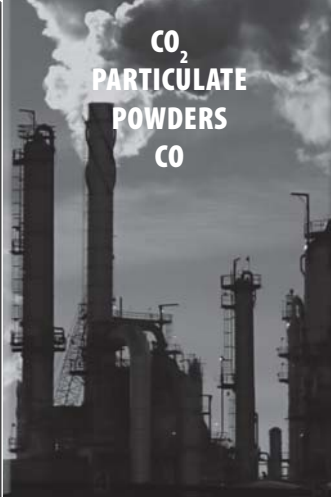
## CATALYTIC BURNER H<sub>2</sub>YDROGEM®



H<sub>2</sub>ydrogem® is the result of Giacomini R&D activity aimed at creating a “zero emission” cycle for the production of thermal energy. For its operation, H<sub>2</sub>ydrogem® uses a catalytic reaction and therefore is without flame. It is composed of one or more channels, independent, supplied with gaseous hydrogen and atmospheric air. In each channel a catalyzer allows hydrogen and oxygen to combine in a molecule of water, simultaneously releasing heat. Heat produced by the reaction is removed by a heat exchanger embedded in the burner; water temperature is between 35 e 40°C, ideal to feed heating systems such as radiant floor wall or ceiling panels. The absence of carbon in reagents determines a reaction without co<sub>2</sub> emissions; low combustion temperature (300-350°C) avoids the formation of NOx. The only other product of the reaction is simple steam that can be released in the atmosphere without risks.

### MAIN FEATURES:

- **catalytic combustion without flame.**
- **power modulation with independent channels.**
- **versions with 1, 2, 3 or 6 channels.**
- **maximum power thermal 35 kW (version with 6 channels).**
- **incorporated heat exchanger for heating circuit.**
- **water emission in the form of steam.**
- **no emission of NOx thanks to low combustion temperature (300-350°C).**
- **no emission of CO<sub>2</sub> thanks to the use of hydrogen, energy vector free from carbon in its molecule.**
- **PATENT PENDING.**

COMPONENTS OF THE MOLECULE	MAIN COMBUSTION EMISSIONS
<p><b>HYDROGEN (CASSENTE)</b></p> 	 <p><b>H<sub>2</sub>O</b></p>
<p><b>NATURAL GAS (METHANE)</b> H:C=4:1</p> 	<p><b>CO<sub>2</sub></b> <b>CO</b></p>
<p><b>OIL</b> H:C=2:1</p> 	<p><b>CO<sub>2</sub></b> <b>PARTICULATE</b> <b>CO</b></p>
<p><b>CARBON</b> H:C=0,5:1</p> 	<p><b>CO<sub>2</sub></b> <b>PARTICULATE</b> <b>POWDERS</b> <b>CO</b></p> 

# HYDROGEN

Hydrogen ( $H_2$ ) is the energy vector used by the Giacomini catalytic burner. The hydrogen atom is the simplest of all: it is composed of a nucleus with just one peripheral electron. Thus it is the lightest substance known and also largely widespread: 55% of cosmic matter is composed precisely of hydrogen. In nature, however, it does not occur free, unless exceptionally: instead it is present in organic substances, and mainly in water. As a matter of fact the name that was assigned to this element in 1783, seventeen years after its discovery, means precisely "water generator". Today technologies related to hydrogen are thoroughly investigated, an energy vector close to unlimited availability. Associated with renewable energy sources, in the next future these technologies could release the world from dependency on fossil fuels with beneficial effects on the environmental and on the climate of planet earth.



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