

The integration of photovoltaics systems in architecture

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Edmond Becquerel (1820-1891) discovered the photovoltaic effect in the 1839 when he presented at the Academic of the Science in Paris his “Memory of electric effects produces through the solar radiation”.

The first application of photovoltaic system was in the 1954 in the space.

The photovoltaic effect is generated from the interaction of solar radiation and the semiconductor materials.

Today the semiconductor used to produces the photovoltaics cells, the unit of a photovoltaic system, is the silicon.

There are different kinds of photovoltaics cells: traditional cells are monocrystalline and polycrystalline cells, new generation cells are tandem cells, amorphous silicon cells and thins film.



When we connected more cells we obtain the photovoltaic module, the commercial unit of a photovoltaic system.

To complete a photovoltaic system there are electric, electronic and mechanics components like inverter, battery and mounting structures.

We distinguish transparent modules, opaque modules and thin film modules flexible and rigid.

The applications in architecture are:

- Independent applications;
- Placed upon applications;
- Integrated applications.

For architects who want to project a photovoltaic system it is necessary to know the market of photovoltaic technology; so we did a market research for the main photovoltaic modules producers in the world.

For every producer we did a corporate profile and a description about the main modules produced for every corporate.

From this study it is important to underline that the trend is to produce integrated modules like the photovoltaic tiles produced by Pilkington or the photovoltaic brise-soleil produced by Saint-gobain.

The integration is the solution to render the photovoltaic technology competitive on the market compared to the traditional sources to produce electric energy.

The advantages with the use of an integrated photovoltaic system are:

- The energy is produced where it will be used;
- It will be occupied space already used for other reasons, like facade or roofs;
- There is an energy conservation for the mounting structures;
- It is possible to use the thermal energy dispersed from the modules (in the applications on the airy facade).

To expand the market of photovoltaic modules to create a market of photovoltaic modules in Italy there is the "10000 photovoltaic roofs" that through incentives wants to increase the demand of photovoltaic modules.

We have studied the integration of photovoltaic system on a case history: the Olympic Village for Turin 2006.



The object of this project was to define integrated solutions for the roof and for the facades to realise a photovoltaic system grid connected, able to satisfy the energetic demand of the Olympic Village.

To do this it has been used the software PVSYST 3.0; this software has been used also to define the energetic demand after the Olympic games for other uses of the area: college for students or residential complex.

For every case we have obtained real economic and energetic results.

In fact the cost is 900-1100 £/kWh.

From this case we can say that the integration of photovoltaics system is the solution to render this a competitive technology if in the economic analysis we consider energetic and environment benefits.

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