УДК 514.18:628.921/922(083.75)

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BUILDING INTEGRATED PHOTOVOLTAICS WITH THERMAL INSULATION AND MECHANICAL VENTILATION IN ROME – ITALY

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One of the most promising renewable energy photovoltaic a technology is photovoltaic is introduced. Photovoltaic's (BIPV) is an alternative technology for producing electricity on the end use stage, directly from the sun, in order to decrease energy dependency and reduction of GHG emissions by the buildings. In this article, realization of BIPV work in Roma city is analyzed and realized by Eutecna Energia, Italy.

Actuality of the theme. The idea was replacing the old roof with a new BIPV roof, using aluminum and thin roof photovoltaic film, thermal insulation placed at the roof of the beam and mechanical ventilation. The building was covered by a roof in asbestos.

Fig.1. Roof in abestos

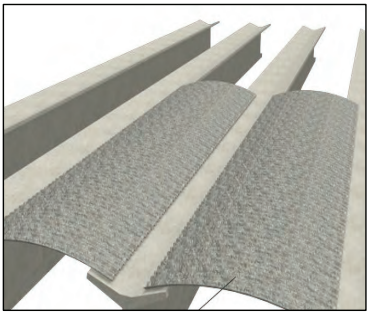


Fig.2. Details of roof

The building envelope has always been considered a key element to guarantee indoor comfort and energy efficiency. In the past the main aim was the improvement of its thermal properties.Nowadays the envelope has to perform like a skin showing an active behaviour in order to fulfill different requirements under different boundary conditions. This turning point needs new solutions and new concept where the integration between building envelope and building services become very strict and unavoidable. The building envelope is not a barrier but a membrane that lives, dinamic, adaptive to different necessities. The ventilation of the "active roof" with ventilators and temperature/umidity sensors can be controlled. An intelligent control activate the ventilators when boundary conditions happen.

Summer heat, trapped in the zone between roof and thermal insulation , creates a furnace effect, heating ceiling insulation, which then conducts heat through to the

ceiling, and this heat is then radiated downward to persons and objects in the area below.Thermal insulation reduce and postpone by 10-12 hours the heat flow between the roof and the building indoor. Ventilation permits, during the day, to remove direcly the hot air between the roof and the thermal insulation .During the night ventilation permit to realise free cooling and remove all the heat absorbed by the structures of the building during the day[4].The double effect of insulation and ventilation permit to save energy necessary to realise indoor comfort conditions for people.

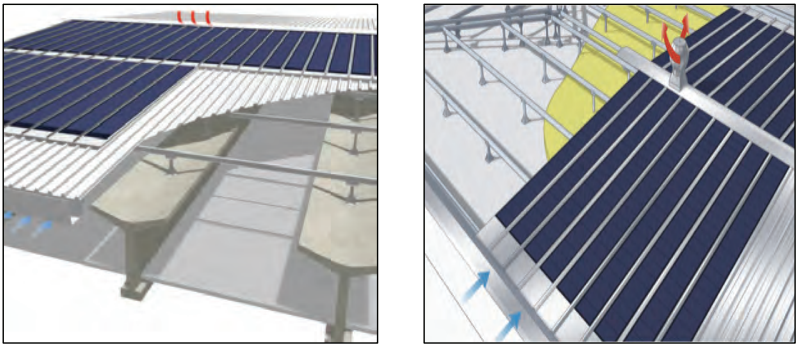


Fig.3. Render of BIPV, thermal insulation and active ventilation

Fig.4. BIPV Element : alluminium and thin film

Fig.5. Mounting fase

Fig.6. Final fase

Fig.7. Realization of BIPV, thermal insulation and active ventilation

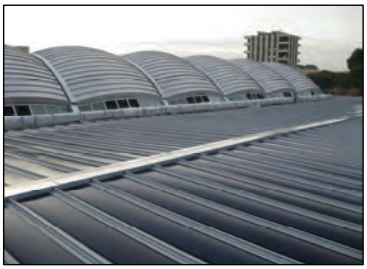
Energy has been produced by Photovoltaic system in the project

description	unit	amount
Area of the roof	m^2	2.300
Power of photovoltaic system	kWp	99,6
Electricity production per year	kWh	125.000
Saved CO2 emissions per year	kg	60.793

Analysis of the main researches. There are many types of photovoltaic roofing products compliment many different roofing materials including asphalt shingles, standing seam metal roofing and slate or concrete tiles. BIPV roofing is designed in order to serve to functions: As a roofing material[1)] and as an electrical device to produce electricity[2)].

PV systems moderately sized, works on small scale producing limit amount of energy. At the same time, it can produce during daylight hours and supplies house entirely with completely electricity demand. PV system is accessed to utility system [5]. Most BIPV systems in residential are used in conjunction with utility-supplied power. In addition to the PV-active roofing, an inverter, located near the electrical panel, converts the PV produced electricity into utility compatible alternating current (AC) electricity for the home. PV systems that utilize battery storage can produce electricity for the home even when the utility power is disconnected or when the sun

is not shining. Utility-provided electricity is used when the house demand is greater than can be supplied by the photovoltaic roofing.



"Eutecna Energia" different realizations in corporation with "Elleemme"

Fig.8. BIPV in Roma – kWp 31,00 Fig.9. BIPV in Roma -kWp 49,10

The scientific novelty of the research The main purpose of the article is achieving Building Integrated Photovoltaics (BIPV) in order to integrate of photovoltaics (PV) with the building envelope.

Practical value of the theme. The PV modules serve the dual function of building skin—replacing conventional building envelope materials—and power generator. By avoiding the cost of conventional materials, the incremental cost of photovoltaic is reduced and its life-cycle cost is improved. That is, BIPV systems often have lower overall costs than PV systems requiring separate, dedicated, mounting systems [4].Thin-film products typically incorporate very thin layers of photovoltaic active material placed on a glass superstrate or a metal substrate using vacuum-deposition manufacturing techniques [5].Once installed, BIPV components not only protect the home from storms and rainy weather but produce free electricity for use in the home. The residential industry most often uses building-integrated photovoltaic roofing products; however PV systems can also be integrated into façade materials, awnings, and covered walkways [4].

Further improvement BIPV has been complied with all criteria and standards: The module has been designed to be installed as roofing tiles. The roof also must meet the durable and resistant wind requirements. Besides that it must prevent the accumulation of dirt, as well as, it should be walk able. In addition, it should be allowed to maintain when needed.

Profiled sheet is possible to be made in Roma, combining solar generation system using roof integrated photovoltaic with architectural design to creating stunning buildings view. The solar laminates are flexible and extremely durable. Another benefit is the energy efficiency [4]. Passive solar design and BIPV are also criteria to LEED [6], BREEAM [7] certifications.

Conlcusion. Building-integrated photovoltaic's (BIPV) are photovoltaic materials that are used to replace conventional building materials in details of the building envelope such as roof, skylights or facades. The advantage of integrated photovoltaic over more common non-integrated systems is that the initial cost can be

compensated by reducing the investment expenses needed to allocate the funds to building materials and the labor of BIPV modules. These kinds of advantages make BIPV one of the fastest growing segments of photovoltaic industry. Applying to passive design concept (thermal insulation) and smart building (mechanical ventilation controlled by sensors), energy can be saved to maintain indoor comfort.

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СТВОРЕННЯ ІНТЕГРОВАНИХ ФОТОЕЛЕКТРИЧНИХ СИСТЕМ З ТЕРМОІЗОЛЯЦІЄЮ ТА МЕХАНІЧНОЮ ВЕНТИЛЯЦІЄЮ У РИМІ, ІТАЛІЯ

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Інтегровані фотоелектричні системи (BIPV) – це альтернативна технологія для вироблення електроенергії на стадії кінцевого отримання сонячної енергії, за допомогою чого можливе зменшення енергозалежності будівельних об’єктів та скорочення викидів парникового газу в атмосферу. У даній статті аналізується використання BIPV-технологій компанією Eutecna Energia у Римі, Італія.

СОЗДАНИЕ ИНТЕГРИРОВАННЫХ ФОТОЭЛЕКТРИЧЕСКИХ СИСТЕМ С ТЕРМОИЗОЛЯЦИЕЙ И МЕХАНИЧЕСКОЙ ВЕНТИЛЯЦИЕЙ В РИМЕ, ИТАЛИЯ

Интегрированные фотоэлектрические системы (BIPV)- это альтернативная технология для выработки электричества на стадии конечного использования солнечной энергии, с помощью чего можно уменьшить энергозависимость строительных объектов и сократить выбросы парникового газа в атмосферу. В данной статье анализируется использование BIPV-технологий комапанией Eutecna Energia в Риме, Италия.