

## **Sun light boosted Solar PV integrated in building façade**

The invention is located in the technical sectors of renewable energies, specifically photovoltaic solar energy, energetic efficiency and integration of energy generation in the enveloping of buildings or urban or street elements (BIPV). Prior art The majority of urban and street elements, such as for example street lamps, bus stops, parking meters, motorway toll booths, charging facilities, kiosks and advertising sites, amongst others, need electricity supply to feed the various electric and/or electronic devices thereof, such as lighting, chargers, advertising or informative screens, etc. Although generally, said elements are connected to the network, it is increasingly more common for them to incorporate an electricity generation system, normally solar photovoltaic, and even a storage system which can allow autonomy.

There are a multitude of examples of urban elements with photovoltaic technology incorporated. One example of solar street lamps is provided by Chong and Kong in the patent, WO/2014/126453, Wang and Wang (patent ON 101009071 A), Hao et al. (patent ON 101781939 A), or Freitas et al. (patent US 2014/0080406 A1) can be named as an example of bus stops; solar kiosks are also found, such as for example that proposed by Hixson and Creswell in the patent, US 2013/0033222 A1. Many of these can even be applied to assembly systems for solar modules, as Depaw proposes in the patent EP 2 369 266 A2. It is also usual for said systems to be able to incorporate intelligent management devices, as Freitas et al. propose in the patent already mentioned.

One element common to all these is the difficulty of combining the urban or street element with the photovoltaic solar module, both aesthetically and technically. Given that for the most part, standard, commercially available, photovoltaic modules are provided, the modules are an element external to the urban or street element. This involves orientations and inclinations which break the aesthetic of the element, even sometimes not allowing the integration CA 02961287 2017-03-14 thereof in accordance with the urban environments.

Although there are architectonic integration solutions, these are generally energetically inefficient and also have a higher cost.

The examination of the prior art reports that a significant improvement both in the performance as well as in the aesthetic of the urban and street elements, which generate energy, would be to achieve the architectonic integration of the solar module at low cost. The present invention proposes to use the versatility of the holographic solar concentration (HSC) modules with the urban and street elements. The HSC modules have, amongst other elements, a hologram and solar cells, and the hologram always directs the light towards these solar cells, whatever the orientation of the module.

There exist various versions of HSC modules developed by the applicant, such as for example the 3rd generation in the patent US20080257400 from Mignon and Han, in which a flat HSC module is presented; the 4th generation with a tridimensional module with a concentration factor between 3 and 10x in the patent ESP 201331199 from Cab o et al.; or the document "Modular system for solar concentration without tracking by means of combining conventional optics and holographic optical elements (HOES)" from Rodriguez et al. and pending patenting, which presents the 5th generation, a flat HSC module capable of reaching concentration factors from 10x and which separates the optics from the generation part. All these HSC modules can act independently or architectonically integrated, and at a lower cost than that of the conventional flat solar modules, which can even reach 0.25 euros per watt peak. The versatility of these HSC modules is translated into the form and orientation which they can adopt, since the hologram which they integrate, allows the light from the sun to be captured at a multitude of orientations, without tracking, with high efficiency. Thus, they can be adapted to various forms (straight, curved, round, etc.) and orientations (horizontal, vertical, north, south, east and/or west)