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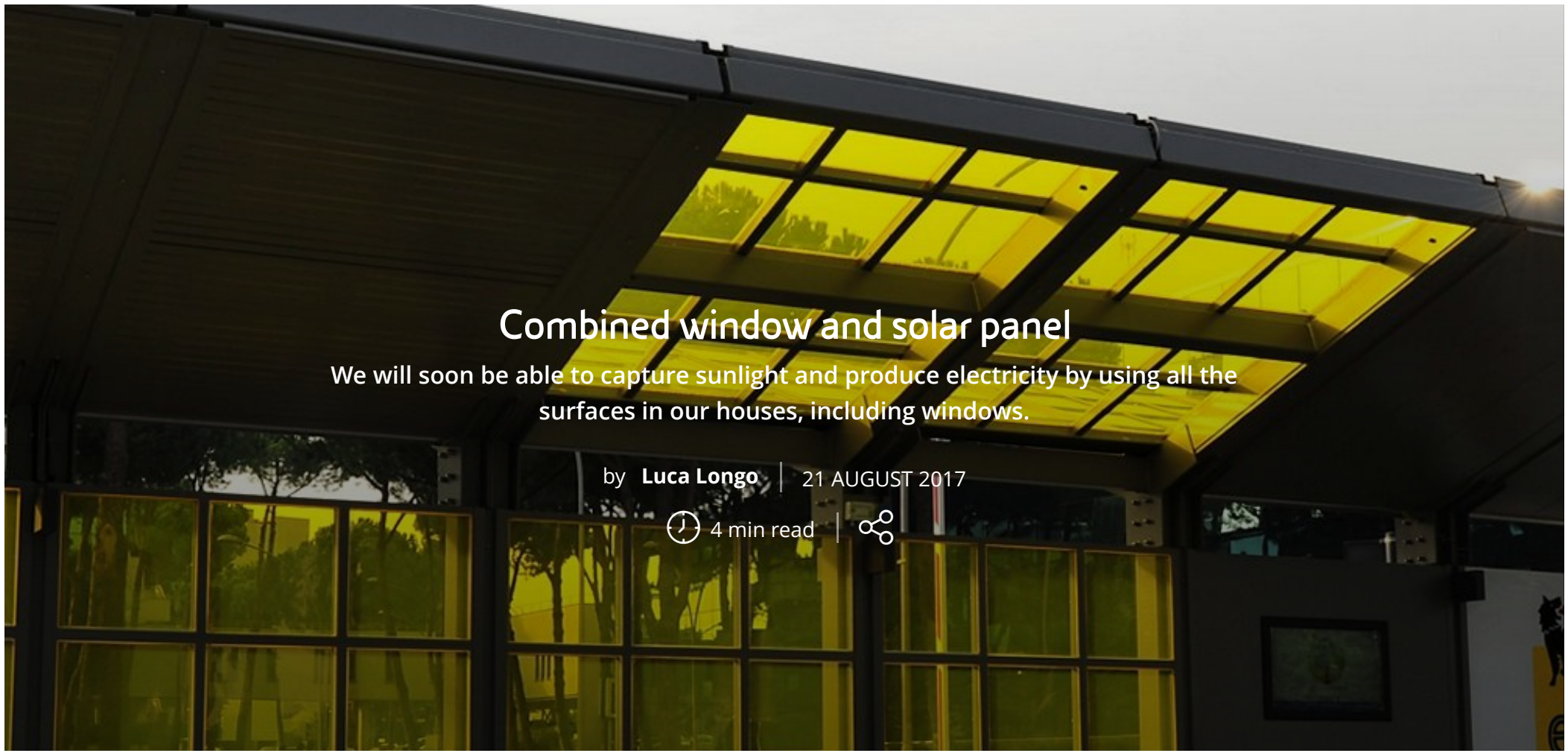


Combined window and solar panel

We will soon be able to capture sunlight and produce electricity by using all the surfaces in our houses, including windows.

by **Luca Longo** | 21 AUGUST 2017

4 min read |

Clear as glass

Perhaps the one place we would never have thought to place solar panels is the windows in our houses. But silicon solar cells are not the only way to turn sunlight into electricity.

We have written in the past about organic solar modules; organic photovoltaics (OPV) are light and flexible and can therefore be installed in places a traditional panel would never fit. But OPV are not the only alternative to silicon.

At various cutting-edge research centres they are perfecting a completely new technology: **luminescent solar concentrators** (LSCs).

The challenge is to create surfaces that can produce energy from sunlight but remain transparent.

So, special luminescent dyes have been invented that can capture photons from the sun and re-emit them in a different wavelength (and therefore a different colour). These dyes are placed inside glass panes or, what is better, inside highly transparent plastics like polycarbonate or plexiglass, used for spectacles and visors on motorbike helmets.

This creates transparent panes of glass in different colours, which can absorb sunlight at a certain wavelength and relative colour. The trick is that the light re-emitted by these dyes is mostly trapped in the pane and channelled to its slender edges.

It is the same principle by which fibre-optic waves are guided, but in their case, the direction of the signal is linear. With these panes, on the other hand, the energy of sunlight is channelled to the two parts of the LSC pane.

Researched in Novara, tested in Rome

When the light arrives at the edges of the pane, it is intercepted by a series of solar cells stuck to its frame. Thus the window remains transparent but the solar cells along the frame pick up concentrated light and turn it into electricity.

For many years at Eni's Renewable Energy and Environmental R&D Centre in Novara, we have been studying LSCs and have invented a hundred new luminescent dyes. The first photovoltaic shelter was created there in 2012, and installed on Via Laurentina, in Rome. It consists of 192 panels, 50 cm wide, and recharges electric bikes parked in the charging station below it. The shelter is essentially an open-air laboratory for testing new materials and engineering solutions developed by Eni at Novara.

The next step was designing and building the **Smart Windows**, photovoltaic windows to replace traditional ones. At Eni's sites in Novara and San Donato Milanese, we have already installed some photovoltaic windows based on LSCs. Energy produced by the panes on the high part of the window help feed a cluster of sensors, which record the temperature and luminosity, inside and outside, and other environmental parameters, then control a series of electric blinds (powered by the same LSCs) to optimise light and temperature in the room. There is also a USB port attached if you need to recharge your phone with the sun's rays!

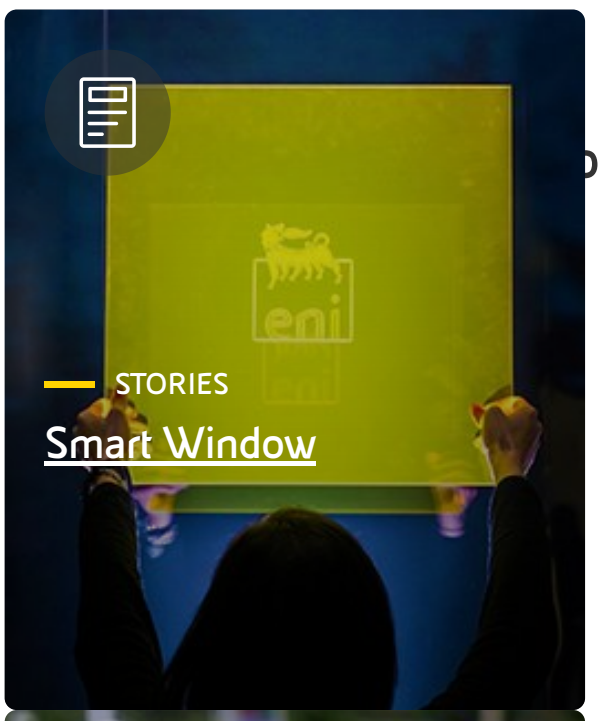
This technology has a range of applications. At Eni's Renewable Energy and Environmental R&D Centre, in collaboration with road sign companies, we have come up with billboards that power themselves and light up at night with energy from LSCs. We are also studying how to apply LSCs to sound barriers separating high-speed railways and roads from buildings. The initial studies indicate that a strip of LSC windows, in the place of the walls that currently form many barriers, could – with the help of batteries, perhaps the flow batteries Eni is researching – light up stretches of road at night.

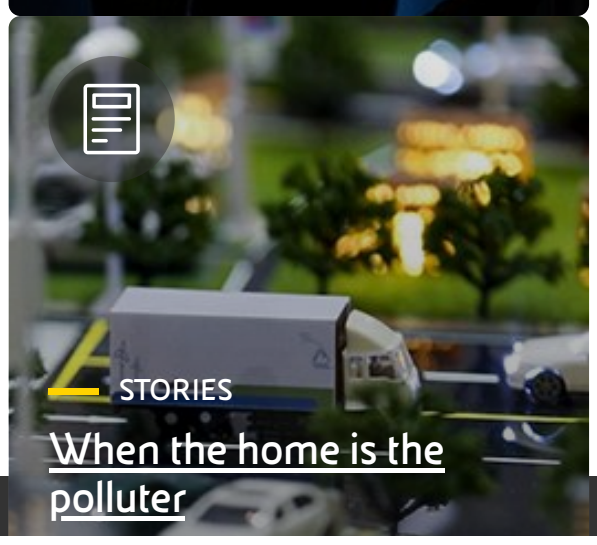
Photovoltaic greenhouse

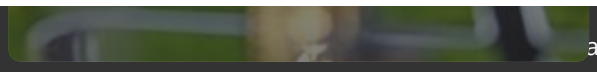
But you ain't heard nothing yet. At Eni's research centre in Novara they have the first prototype for a photovoltaic, LSC-powered greenhouse. It is not well known, but plants do not actually use all of the sun's light for photosynthesis. They only absorb the part of the solar spectrum corresponding to red and blue-violet light. The rest of the light (yellow and green radiation) they reflect, hence why leaves are green.

At Novara we have also invented fluorescent dyes that capture light in the yellow region of the spectrum and re-emit it as red, the perfect colour for plants. The preliminary studies show that the LSCs protect plants from solar radiation they do not use and help them grow.

Meanwhile, Eni's research goes on. We hope that this study will lead to a world that is not only cleaner and more efficient, but also more colourful!







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