Energy
National Research Programmes 70 and 71

Project

ACTIVE INTERFACES - Holistic strategy for PV adapted solutions embracing the key technological issues.

Maximum electricity generation in a minimum of space

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It would already be possible to integrate photovoltaic modules directly in roof tiles or facade elements – and yet this solution is rarely applied. Which factors will help the new technology to break through?

A plain Jane? Far from it – photovoltaic modules are integrated in the facade of this multi-family dwelling in Zurich.
Source: O. Wavre / LAST / EPFL

At a glance

- Colour-printed photovoltaic modules represent an attractive solution in urban renovation projects, especially due to their visual impact.
- Photovoltaic modules with a lower weight than conventional products are also boosting their acceptance and increasing their usability on roofs and facades.
- Building-integrated photovoltaics (BiPV) could become an important source of energy production in Energy Strategy 2050.

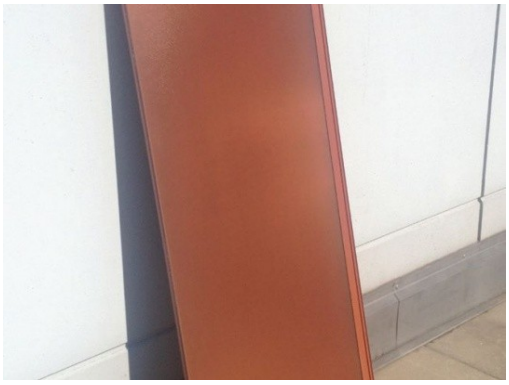
Space is at a premium in Switzerland. If free land was to be used to achieve the Energy Strategy 2050 objective of generating 20 % of energy via photovoltaic installations, conflicts would quickly arise with the agricultural sector, while concerns with respect to forest areas, wild animals and the leisure needs of Switzerland's citizens would also come to the fore.

Photovoltaic systems must therefore be placed on buildings. While there is sufficient space in Switzerland to this end, it will not be enough to simply equip the roofs of new buildings with photovoltaic modules. The roofs of renovated buildings as well as their facades must also be utilised for electricity production.

The technology required for building-integrated photovoltaics (BiPV) is actually already available. It is therefore now possible to integrate photovoltaic modules in roof tiles or facade elements. Nevertheless, such systems are almost nowhere to be found. Many building owners are put off by the higher investment costs, while architects are not convinced of the aesthetics of BiPV products – or have not yet come into contact with solutions that convince them.

White and cool

But such solutions are already available. For example, researchers from the Swiss Center for Electronics and Microtechnology (CSEM) in Neuchâtel, in cooperation with the industrial partners ISSOL and Userhuus, have developed a terracotta roof tile with integrated photovoltaic modules for application on building roofs. This product could be used, in particular, in architecturally or historically sensitive areas such as old-town centres. The tiles comprise a high-performance photovoltaic module that is embedded between two glass plates. Using a special procedure, the upper glass plate is printed with a terracotta look. This sandwich structure guarantees a high mechanical resistance.



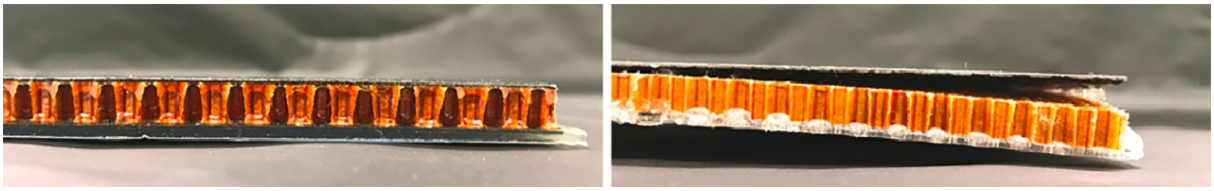
A solar module with a terracotta look.
issol.ch

Photovoltaic modules that are integrated in facades also have a good chance of market success. In dense conurbations, in particular, there is often more space available on facades than there is on roofs. Thanks to new colouring techniques and substrate types, it is possible to produce BiPV facade modules in many different colours. The colour white is especially promising for high-grade architectural buildings. In cooperation with the start-up company Solaxess, the CSEM has developed a white photovoltaic module that is now available on the market and can be installed with facade-specific assembly techniques. A further advantage of white modules is that they reduce the building temperature by approximately 10 degrees Celsius – meaning that less energy is required to keep the indoor climate at a pleasant level.

White photovoltaic modules on a building facade can be integrated almost seamlessly into the architectural design. Solaxess

Powerful lightweights

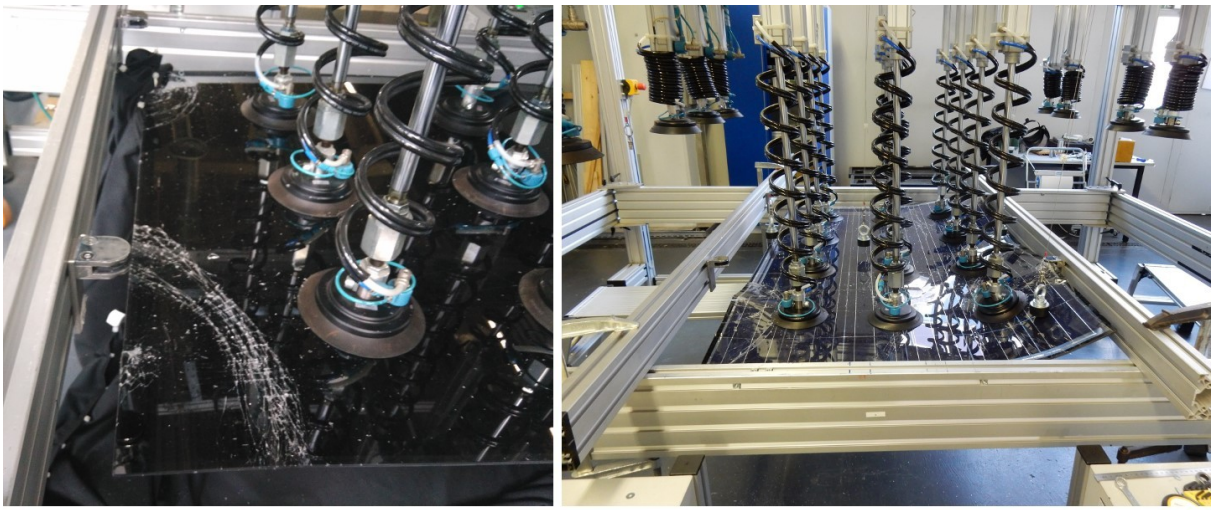
The weight of photovoltaic modules is often a problem, especially during the renovation and upgrading of older buildings. Conventional modules frequently have a weight of more than 15 kilograms per square metre. The load limit of older roof constructions is therefore quickly reached. Researchers from EPFL Neuchâtel have found a solution. The replacement of the glass or foil backing layer in conventional photovoltaic modules with a composite sandwich structure allows for weight to be saved without sacrificing the good mechanical stability and durability properties of the panels. The substitution of the front glass plate with a transparent polymer film also saves weight: at just over six kilograms per square metre, the new photovoltaic module of the Lausanne research group is now almost only half the weight of conventional products.



What counts is the adhesive: only with the right glue can a lightweight composite structure survive thermal and mechanical stress. activeinterfaces.ch

The researchers subjected their construction to several customary industry tests – ultimately

the lightweight photovoltaic modules need to be able to withstand wind, hail, ice and heat just as well as heavy conventional modules. Initial results indicate that the lightweight construction can pass even the most demanding of industry qualification tests. The next step will now be to increase the size of the lightweight solar panels.



Mechanical load test for photovoltaic modules in the laboratory. SUPSI

The issue with durability

Will the innovative BiPV modules hold up just as long as conventional panels? This question isn't so easy to answer. Simulating the conditions of the next 25 or 30 years – this is currently the usual timeframe for which manufacturers of photovoltaic modules provide a performance guarantee – in the laboratory is virtually impossible. However, there are methods that have a predictive power. At the University of Applied Sciences and Arts of Southern Switzerland (SUPSI), researchers tested BiPV modules in various test scenarios. Focus was placed on UV and weather resistance. In climatic chambers and special testing facilities, the researchers therefore conducted accelerated stress tests. Typically, the modules were exposed to rapid changes of temperature, voltage, mechanical loads, moisture and vibration.

Produkte aus diesem Projekt

- Unsichtbare Solarmodule
  Date of publication: 01.01.18
- Glass-free lightweight PV building elements: solutions to minimize weight and maximize durability
  Date of publication: 01.01.18
- Potentiel solaire des territoires urbains: vers de nouveaux paradigmes?
  Date of publication: 01.01.18
- Quantitative Evaluation of BIPV Visual Impact in Building Retrofits Using Saliency Models
  Date of publication: 01.01.18
- Photovoltaïque et gestion de l'énergie: un aperçu des activités au CSEM-PV-center.
  Date of publication: 01.01.18
- Architecture solaire: du dévelopement technologique aux matériaux de construction.
  Date of publication: 01.01.18
- The Bearable Lightness of Solar Modules*part1
  Date of publication: 01.01.18
- The Bearable Lightness of Solar Modules Part II
  Date of publication: 01.01.18
- Novel designs and materials for durable PV modules: applications on the ground, in cities and in the air
  Date of publication: 01.01.18
- Innovation und Multifunktionalität: was bietet der BIPV-Markt heute?
  Date of publication: 01.01.18
- Perspektiven der Solarentwicklung in Gebäuden
  Date of publication: 01.01.18
- Nouvelles solutions photovoltaïques pour l'environnement construit: technologies, prix et acceptation
  Date of publication: 01.01.18
- Reliability of PV modules and long-term performance prediction
  Date of publication: 01.01.18
- Building and se!lement
  Date of publication: 01.01.18
- New approaches for BIPV elements: from thin film terra-cotta to crystalline white modules
  Date of publication: 01.01.18
- Gebäudeintegrierte Photovoltaik als Bauprodukt: Können Normen helfen oder nur bremsen?
  Date of publication: 01.01.18

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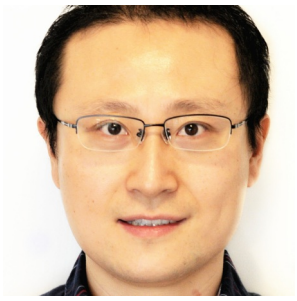

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