SMART WINDOWS

Impacts throughout a building's life

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Buildings contribute a large fraction of global electricity and heat consumption, and so policies are being introduced to improve their energy performance, including through technological innovations. For example, integrating photovoltaic (PV) panels to the envelope of a building could provide electricity for self-consumption, reducing the burden on the electric grid. Now, Francesco Fiorito and colleagues in Italy and Australia argue for a broadband vision in deciding how to design energy-efficient buildings — a vision that should include the environmental impacts of the chosen technologies during their production and throughout the life of the building itself.

A traditional polycrystalline silicon PV system, integrated into the building façade, is compared to photovoltachromic windows, which generate electricity and modulate light ingress into the building, thereby changing the building's energy demand for artificial lighting, cooling and heating. The researchers calculate the net energy demand of two model commercial buildings equipped with either of these technologies in three locations: Egypt, Italy and the UK. They then compare the environmental impacts of both building-integrated technologies for various building lifetimes, including the PV system production, the building electricity consumption and the country energy mix. The study considers current laboratory-scale fabrication processes for the smart windows and industrial processes for the silicon PV system. The environmental impact of the smart windows is smaller than that of the traditional PV systems, both for the production phase and for the operation phase, due to the beneficial effects of the smart windows on electricity demand for heating, cooling and lighting. The reduction of the environmental impact is largest in Egypt, thanks to the reduction in cooling demand.

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