Wuppertal Institute
for Climate, Environment
and Energy

ECOINNOVATION

Topics Online „Eco-Innovation" presents cutting-edge and fascinating best practices for increased resource productivity. In the tradition of „Factor Four" they show what is possible, present obstacles and how green lead markets can emerge.

Best Practice

Functional Integration:

››› The Resource-Efficient Building Envelope

Buildings are resource-intensive. E.g. in Germany, up to 40% of the total final energy consumption are caused by the operation of buildings.

Furthermore, construction waste (incl. road construction waste) accounts for more than half of the total German waste accumulation.

Up-to-date technologies can help to realize energy savings of up to 80%. The **building envelope**, i.e. facade and roof, is of particular importance: It serves as interface between the internal and external environment and thus has major impact on material and thermal flows. Current research aims at integrating various functions constructionally and architecturally into the building envelope without using more material due to increasing thickness.

Future building materials and facade systems are thus multi-functional: innovative glazing and thermal insulation systems protect from heat and cold, absorb sound, produce and save solar energy and control supply of daylight and fresh air - all at the same time. New technologies like adaptive facades, vacuum insulated panels (VIP), phase change materials (PCM) and building-integrated photovoltaics (BIPV) save costs, preserve resources and open up innovative fields in architectural design.

The functional and aesthetic building integration will play a major role in the future. Both the energetic and material optimisation of the building envelope as a functional and creative element must be the ambitious aim.

Sustainability-effects

ECOLOGY

Thin layers and the replacing of constructive building elements save resources. Vacuum insulated panels are five to ten times thinner than conventional insulating materials, yet achieving the same thermal performance.

Using superinsulating transparent wall panels saves energy for heating, cooling and electric light and thus reduces emissions. Often, solar building elements can be replaced and re-used, leading to waste and production energy savings.

- ✓ Resource consumption
- ✓ Energy consumption
- ✓ Emissions
- ✓ Waste

ECONOMY

When using multifunctional modules, conventional building elements can be replaced – this saves costs. Photovoltaic cells reduce the electricity bill or are profitable due to feed-in tariffs.

The innovative technologies and concepts have very good prospects on export markets. On the domestic market, small and medium-sized businesses and trade can benefit from increasing renovation actions. Using local renewable energy sources reduces dependency on foreign energy sources, and the effects of price fluctuations in international energy markets decline.

- ✓ Costs
- ✓ Export options
- ✓ Jobs and markets
- ✓ Reduced import dependency

SOCIAL

Thermal insulating materials in the building envelope reduce heating by day during the summer and serve as solar stoves during the winter, producing a warm and even radiant heat. They improve the thermal cosiness and living comfort in the building.

Photovoltaics and solar heat as creative elements combine energy supply with a pleasant appearance and a positive image. Multifunctional building elements open the door to various creative, innovative and resource-efficient designs and reflect the owner's consciousness of ecological matters.

- ✓ Health
- ✓ Living comfort
- ✓ Positive image

Obstacles and drawbacks

Individual building elements are by now widely tested and implemented. However much research and further development is needed in order to realise efficient comprehensive solutions at reduced costs. Various types of buildings have specific demands and thus require intensive information, coordination and cooperation of all involved parties (architects, owners, trade). Hence up to now individual solutions are prevailing which constrains prefabrication and cost reductions. In many cases restrictive building regulations hinder innovative designs.

High initial costs and information deficits deter owners from using energy and resource efficient technologies when renovating. Furthermore, owners are often confused and overwhelmed with inconsistent and complicated responsibilities, various funding programmes and lack of liability of (energy) consultancies. Due to the high dynamics in this innovative field insecurities arise with regard to current standards and how long they will be up-to-date.

Potential

More than 70% of all possible energetic renovations in old buildings from 1989 to 2006 have not been undertaken yet (Germany). Currently owners invest mainly in insulation measures due to increasing requirements for old and new buildings (EU Energy Performance of Buildings Directive, passive house standard, zero energy buildings) and extensive funding programmes.

There is particular high potential in the prefabrication of large-area multifunctional modules and lightweight construction using innovative materials. Reduced insecurities and costs can lead to mass production and further lower production costs. In the long term it could even be possible to locally produce hydrogen - and thus replace fossil fuels.

Policy recommendations

Funding programmes should be simple and clear and provide not only good loan terms but grants and tax abatements. They could be based on few main indicators – primary energy requirement and total material requirements – and hence increase transparency and allow to pick the most effective and efficient measures. It makes sense to support major pilot projects that realise energy and resource efficient solutions for buildings of different type and age. Economic incentives like taxation of construction materials would be appropriate.

Extended technology support programmes should focus on premium products in order to defend the technological leadership and high level of innovation – e.g. through an „innovation bonus" in a Renewable Energy Sources Act.

Education and training of qualified consultants is indispensable – they need to have the whole building in mind and integrate technical solutions and the respective funding programmes. Evaluating periodically their consultations ensures a higher quality.

In the long term, buildings should also be assessed with regard to their resource consumption. It should be aimed at integrating these aspects into the certificate of organisations such as the German Sustainable Building Council (DGNB) and the energy performance certificate.

Links and contacts

Further information and examples:

Renewable Energy Research Association
mipsHAUS Institute
Fraunhofer Institute for Solar Energy Systems ISE
Bundesverband Solarwirtschaft
Association for Transparent Insulation (FVTWD e.V.)
Stadttor Düsseldorf
Akademie Mont Cenis, Herne

Manufacturers and suppliers (examples):

gap-solar GmbH	www.gap-solar.at
GLASSX AG	www.glassx.ch
Prokuwa Kunststoff GmbH	www.prokulit.de
SCHOTT AG	www.schott.com

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