

Solar active building facades

Smart Green Tower becomes an energy producer

03SBE0005A

03SBE0005B

Kurztitel: Smart Green Tower

Ausführende Stelle: Freie Liegenschaftsverwaltung GmbH

Förderinitiative: Solares Bauen

Laufzeit: 10/2017 bis 09/2020

Bewilligte Summe: 966.407 €

Förderkennzeichen: 03SBE0005A

Topics:

Construction of individual buildings, Building operation & automation, Decentralised energy generation, Energy storage, Operational management & energy management, Solar power, Modelling & simulation, Planning & design, Optimisation of operations, Monitoring & balancing, Exergy optimisation

Innovation:

By linking an energy management system with intelligent operational management strategies, energy flows in the building are optimised and the integration of the building into smart district concepts is made possible.

Keywords: Facade Grid convenience Plus-energy Sector linkage

Kurztitel: SMART GREEN TOWER

Ausführende Stelle: Fraunhofer-Institut für Solare Energiesysteme (ISE)

Förderinitiative: Solares Bauen

Laufzeit: 10/2017 bis 12/2020

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Construction of individual buildings, Building operation & automation, Decentralised energy generation, Energy storage, Operational management & energy management, Solar power, Modelling & simulation, Planning & design, Optimisation of operations, Monitoring & balancing, Exergy optimisation

Innovation:

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Quintessence

- Glass/glass photovoltaic modules form the outer building envelope
- Photovoltaic modules are also used for shading
- Energy storage based on lithium-ion battery enables high power supply and grid stabilization
- Energy management controls the operation of the battery
- Scientific monitoring should analyse the components used and derive possible optimisation potential

The Smart Green Tower is being built in the city of Freiburg. The 51 m high residential and commercial building will have a building envelope made of photovoltaic modules. Depending on the solar radiation, more energy is generated via the photovoltaic system than can be directly consumed. To use the excess electricity, the planners rely on flexible internal energy storage using lithium-ion batteries. This system can also be made available to other renewable energy producers and users.

Project context

In the Smart Green Tower, an innovative energy supply with a high proportion of regeneratively generated electricity for own use is to be demonstrated. The goal of a climate-neutral building is achieved in particular through the use of solar radiation falling on the building envelope and the grid-bound supply of heat on the basis of renewable energies.

This approach is accompanied by the integration of a highly efficient battery storage in the megawatt range in order to increase own consumption and at the same time compensate for peak loads. This relieves the power grid and improves grid stability.

Research focus

The goals of scientific support are the identification of optimization potentials and their technical and economic evaluation. The work includes the simulation-based investigation and optimized design of the power and heat supply concept including a PV battery system and a detailed yield forecast. In particular, shading and partial shading effects for the facade modules as well as the room climate and visual comfort are taken into account. The simulation-based investigation and optimisation of operational management strategies, the development of a cross-discipline energy management system and detailed monitoring of all relevant energy flows are investigated over a period of one year.

Concept

Building concept

The photovoltaic facade serves both to generate energy and to provide shade. The project partners are developing a multifunctional façade solution with integrated PV sun protection slats. Special wiring concepts and performance optimizers are to ensure efficient operation even if the modules are partially shaded. The facade construction with integrated PV slats is matched to the heat and cooling supply of the rooms behind it in such a way that optimum thermal and visual comfort is achieved. In order to save costs in the construction of the façade, the aim is to create a lightweight facade. One goal of the project is to show that the direct substitution of building elements makes sustainable construction economical.

Energy concept

The goal is a climate-neutral building. The energy generated by the PV facade of the high-rise building will produce more electricity than can be directly consumed when exposed to high levels of solar radiation. For this reason, flexible energy storage is planned. This should have the ability to integrate further renewable energy producers and users. In this way, the Smart Green Tower serves as an "energy manager".

The lithium-ion storage facility in the building is to serve as a link between decentralized regenerative energy generation plants and the distribution grid. If the energy demand is very high, energy from the Smart Green Tower's storage facilities can be used. The supply of energy from your own battery thus smoothes out peak loads. The supply grid is relieved and grid stability improved.

Performance and optimisation

The Smart Green Tower is still under construction.

After commissioning, comprehensive monitoring is planned to verify the simulation-based data.

Project data

Building data

Owner, investor, operator	Green Tower Freiburg GmbH
User	Various tenants
Building type	High-rise residential building with tenants and commercial units
Construction	2017
Start of planning	2011
Completion	2019
Inauguration	2020
Measures	
Gross floor area (according to DIN 277)	25718 m ²
Gross volume	79767 m ³
Useful area AN (according to EnEV)	13.818 m ²
Heated net floor area (for non-residential buildings, based on DIN 277)	10364 m ²
Heated living space (for residential buildings, according to 2nd calculation ordinance)	3454 m ²
Jobs (or pupils or similar personal data)	380 Personen

Contacts for the project

Project partner research

 Fraunhofer-Institut für Solare Energiesysteme ISE

Last Update: 5. April 2018