Frodeparken

IEA PVPS

Introduzione

Frodeparken is located close to the railway station and is one of the ‘entrance buildings’ that are visible on entering the city of Uppsala by train from Stockholm. On the curved façade 1,181 BIPV modules are integrated. The total building process started in 2006, when the architect suggested the use of BIPV, and was finalized in 2014. Lars Hedström (Solkompaniet) was hired as a consultant and investigated the design of the facade together with Mats Egelius (White arkitekter) and Uppsalahem. Åsa Reinsson (Uppsalahem) was project manager and in board that made the investment decision.

Source: Successful Building Integration of Photovoltaics – A Collection of International Projects

Integrazione estetica

The curved façade fits the surroundings and the black surface of the thin-film modules is not obviously PV to the non-expert eye. In addition, a few customized modules, which are not electrically connected, were needed to fill the whole façade with modules. (Mats Egelius - White arkitekter, Åsa Reinsson – Uppsalahem, Lars Hedström - Solkompaniet).

Integrazione energetica

The PV electricity is used only for building functions and is not used by the households in the building. The annual electricity generation is around 70,000 kWh. 43% of the PV electricity is self-consumed, which corresponds to 28% of the total annual demand for the building functions, and the rest is fed into the external electric grid.

Integrazione tecnologica

The building is constructed with a concrete façade on which the PV modules were installed with a mounting system from the German company U-kon. Metal hooks were fastened with rivets to the module frame and the module was than hang onto vertical bars attached to the building structure.

The curved façade was a challenge for the installation. Thin-film modules were chosen because of their smaller size than standard silicon modules, offering greater flexibility for the construction, so that standard modules could be used, lowering the cost of the façade. A tolerance of 10 mm in height for mounting 14 modules was needed. (Mats Egelius - White arkitekter, Åsa Reinsson – Uppsalahem, Lars Hedström - Solkompaniet).

Processo decisionale

The idea of a BIPV façade on this building was raised by White arkitekter when they were hired for the town-planning process of the area. A glass façade was an alternative to a BIPV façade far into the design process. Uppsalahem wanted something that stood out. It was also an owner directive by politicians on the board of the city-owned Uppsalahem to promote renewable energy. The main reasons for the project were profiling and to enhance PV competence within the company.

The original design was made with blue silicon cells and customized modules but during the design process, it evolved to black standard-sized thin-film modules with frames. Uppsala is a university city with outstanding research in thin-film solar cells. The CIGS thin-film technology used was originally researched and developed in Uppsala. This was one of the reasons why it was chosen to replace the blue silicon cells by black CIGS. (Mats Egelius - White arkitekter, Åsa Reinsson – Uppsalahem, Lars Hedström -Solkompaniet).

Lessons learnt

The architect Mats Egelius was a key person in the process. He was the person who introduced the idea of a PV façade. He was hired as a city planner already when the restructuring of the neighborhood next to the train station was planned. It would be a new entrance to the city and the current building would be a symbol of innovation and sustainability. When black modules were suggested instead of blue, it was said that a building permit was not going to be allowed for a black façade. However, Mats had a large mock-up built and prepared detailed written material, much more accessible than normal, since he and Uppsalahem wanted this to be built. In the discussions with the Uppsala municipality about the building permit, Mats also borrowed a black module to demonstrate it. He managed to convince the officials to give a permit for the black façade.

One crucial success factor was that BIPV was included very early in the process and integrated into the design. It would have been much more difficult to include BIPV if the idea had come at a later stage. The PR value became higher than expected, including media attention, visits by politicians, and other study visits at both national and international levels. The curved façade in Frodeparken made the installation more difficult than if the façade had been a straight façade. The building owner Uppsalahem is very pleased with the BIPV façade. Even though Uppsalahem has not made a similar façade installation since this one, they now consider PV on roofs in every project and plan buildings to accommodate PV installations on roofs in the future. For instance, they plan the position of other installations on the roof such that they would not prevent PV installations from being added in the future.

Of the 350,000 € total investment, the share for the PV contractor part was 280,000 € and the rest was for sheet metalwork, connections and internal costs. The PV module share of the PV contractor cost was 32%. The installation work represented a large share of the cost, since it was more complex than a standard installation on a roof. In the first investment decision, the PV façade was not included. It was added in an extra decision, in a meeting regarding the building permit and budget in 2010. Until then, an alternative glass façade had been discussed. An investment subsidy of 120,000 € was granted for the PV installation. However, this was not vital for the decision to install PV, since the decision was taken before the subsidy was granted and the subsidy was considered as a bonus. If a glass façade had been chosen instead, the façade cost had been about 250,000 – 300,000 €, similar to the PV façade cost. Taking the investment subsidy into account, the cost for the PV façade became lower than for a glass façade. In addition, it is believed that the PV installation increases the value of the building. Additional income is obtained from electricity certificates, with a value of 0.01 €/ kWh early in 2018, and from tax deductions for excess electricity fed into the grid, maximized to 1,800 €/year per company. The tax deduction was introduced in 2015 and had no influence on the investment decision.

DATI EDIFICIO

Tipologia progetto	nuova costruzione
Destinazione d'uso	residenziale
Indirizzo edificio	Stationsgatan 52, Uppsala, Svezia

Sistemi BIPV

DATI SISTEMA BIPV

Sistema architettonico	facciata ventilata
Anno integrazione BIPV	2014
Active material	film sottile CIGS
Trasparenza modulo	opaco
Tecnologia modulo	vetro-vetro, FV non riconoscibile, modulo standard
Potenza sistema [kWp]	100
Area sistema [m²]	898
Dimensioni modulo [mm]	1196 x 636
Orientamento moduli	da sud-ovest a sud-est
Inclinazione moduli [°]	90
Produzione FV annuale [kWh]	70000

COSTI SISTEMA BIPV

Stakeholders

Progettista principale

White arkitekter

Progettista sistema BIPV

Lars Hedström (Solkompaniet)

Produttore componenti BIPV

Solibro GmbH (Solid State Solar)
Sonnenallee 32, Bitterfeld-Wolfen, Germany
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https://www.solibro-solar.com/

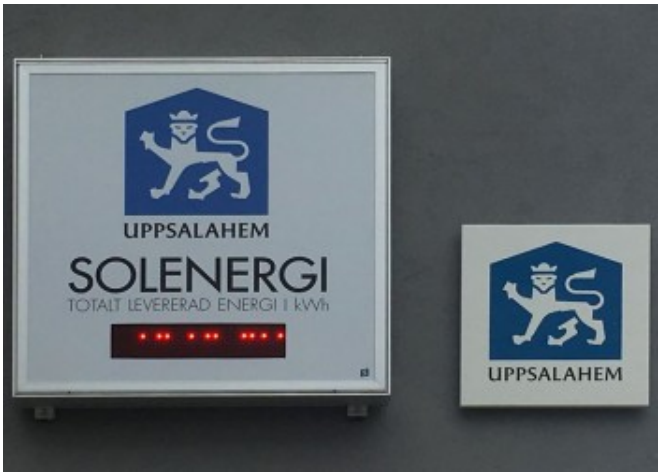
Next to the train station and the city centre © White arkitekter

PV modules start above ground floor level © White arkitekter

The installation was made with a scissor lift © Solkompaniet

Evolvement of the BIPV façade. (1) Original design in building permit © White arkitekter

(2) Revised design with thin-film modules © White arkitekter



Display on the façade © BEAR-iD

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