Brynseng Primary School

IEA-PVPS Task 15

Aesthetic integration

The school is designed for 840 pupils in year 1-7. It is a newbuild of around 11600 m2 net area and six floors, with a large multiuse sportshall at the upper level. The school is built on an old industrial site near the Alna river, with a train and tube station close to the front entrance. The PV is integrated in the south-facing facade on the back of the building, covering 37 % of the school facade area. It is visible from afar, which gives it a demonstration value. Pupils and teachers can follow the power production and consumption in the building, which also gives a pedagogical dimension. A uniform 'non-technical' BIPV facade has been achieved using all-black modules and fastening brackets. All module formats were adapted to the facade to give a holistic architectural impression.

Energy integration

As there is no clear regulation in Norway for the definition of nZEB, it was decided that the building should use 70 % less energy than the existing technical standard (TEK10), with net delivered energy below 40 kWh/m2/yr. To achieve this, a range of energy solutions were implemented including natural lighting, heat pump and 20 energy wells drilled 250 m deep into the ground. The energy consumption for heating and hot water is covered 90% by the heat pump/ground well system, whereas the PV system covers 25% of the electrical consumption. The estimated annual PV production is 105 MWh (633 kWh/kWp). When the school is in use, all PV electricity is consumed. When it is empty during weekends or vacations, power is exported to the grid within the 'plus-customer' limit of 100 kW. Overall self-consumption is expected to be 80-100 %.

Technology integration

The modules are of the type ISSOL CENIT220-6112, tailor-made in 26 different sizes adapted to the facade area. The frameless modules consist of standard black mono-crystalline silicon solar cells with black-painted metal wires and busbars, and 4 mm building-approved safety glass at the front and back. The modules are mounted as aired cladding with waterproof insulation at the back, which will dry out in case of moisture intrusion. The BIPV facade fastening method was especially developed for the project by ISSOL and installed by Staticus. They used standard but deeper brackets for facade glass mounting, fastened to the battens of the climate wall, with PV panels hooked onto the brackets. The DC cabling outside is hidden behind the BIPV modules. Inverters are placed inside, distributed in several electrical rooms to reduce DC cable lengths.

Decision making

The initiative to apply a PV system to the building was taken by the owner Undervisningsbygg Oslo KF, a property company owned by Oslo municipality with the responsibility to build and maintain school buildings in Oslo. The order was placed by the Education Department of Oslo municipality, who willl also be the rental user of the building. The final decision was made when financial support from the 'Energy efficient buildings' program at the public financer Enova was approved in autumn 2014.

Lesson learnt

BIPV is still new in Norway, which became apparent during the tender process. There were few reference systems and none of the suppliers had experience with a total delivery of integrated solar cells in facade. The BIPV system was added late in the pre-project, and as a consequence the architect was not able to make all desired adjustments. After the BIPV facade was included, the building was redesigned to place a sportshall on the top of the building which gives some shading on the facade. The main obstacles of this project were costs and unclear regulations. A lot of own effort was used for the coordination and clarification of fastening system specifications and fire safety regulations. The local fire brigade did not have previous knowledge about PV systems, but were happy to receive information and perform an inspection. Important lessons learned include ensuring that the projecting company has sufficient competency, defining regulations and requirements early in the process, knowing who should do the mounting and electrical works, and using clear evaluation criteria for the testing, instrumentation and commissioning of the system. New BIPV projects are now being planned without financial support. This would not have been possible without the knowledge and competency built in this pilot project. The use of standard modules instead of customized sizes and a more efficient process will substantially reduce costs. New offers show that half the cost is possible. The lessons learned are transferred to new projects through the national programme «Futurebuilt» and the research project «Building integrated photovoltaics for Norway».

PROJECT DATA

Project type	New construction
Building function	Public
Integration system	Opaque cold façade
Location	Brynsengfaret 10, 0667 Oslo, Norway

BIPV SYSTEM DATA

Module type	Custom made modules
Solar technology	Monocrystalline Silicum
Nominal power [kWp]	166
System size [m²]	1,046
Module size [mm]	26 different, from 400x664 to 2,760x980
Orientation	south
Tilt [°]	90

BIPV SYSTEM COSTS

Total cost [€]	828,000
€/m²	792
€/kWp	5,000

PRODUCER DATA

Producer	Issol

Address	Rue du Progrés 18, Dison, Belgium
Contact	-
Web	http://issol.eu

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1. BIPV façade at Brynseng © Undervisningsbygg Oslo KF
2. Red coloured elements were added by the architect to break up the black façade © Undervisningsbygg Oslo KF
3. Mounting of the BIPV façade modules © Lavenergiprogrammet
4. Environmental advisor and technical project manager © Undervisningsbygg Oslo KF
5. Black mounting brackets and modules give the façade a uniform appearance © Lavenergiprogrammet
6. Details of BIPV module with mounting frame © Sean Erik Foss (IFE)
7. Front entrance of Brynseng school © Undervisningsbygg Oslo KF