

Advantages of building integration of PV-systems

There are a number of advantages combined with use of a building surface for production of electricity by photovoltaic modules (PV), which can be supplied to the electricity supply network that has already been installed in the building. Then the produced solar electricity is first used directly in the building and a possible excess of electricity can be supplied to the electricity supply system.

In connection with new building and rehabilitation projects considerable savings can be obtained, both as regards materials and installation, by integration of PV-modules in the ordinary façade or roof surfaces on a building. If a standard building integrated PV-system is installed it can in some case be possible to obtain a lower price of PV-modules than the price of only the PV-modules, as the possible savings of façade or roof surfaces can be considerable.

New examinations show e.g. that on office blocks, where the façade surface often is very expensive, electricity from PV-modules will within a few years be a competitor to ordinary electricity from the electricity supply system.

In office buildings does the electricity production from the PV-modules often follow the variations in the electricity demand. By installation of building integrated PV-modules it is also easier to utilise the production of both electricity and heat from the PV-modules. This can increase the total utilisation of the solar energy from the building integrated PV-modules. The electricity production from the PV-modules can in some cases also be increased because these are cooled, e.g. by heating of ventilation air in connection with a solar wall with built-in PV-modules.

PV-modules can on a long view also operate together with natural gas fired local combined heat and power systems on a beneficial way for the society. The heat demand during the summer is not very large and it sets a limit for a combined heat and power production in this period. Electricity production by PV-modules increases the local electricity production, also resulting in a reduced heat loss. Electricity from PV-modules does not compete with utilisation of solar heating for hot water.

Figure 2.6.3. Examples of integration of PV-modules in the Hedebygade block at Vesterbro in Copenhagen (a) is amorphous PV-modules from Fortum in Finland installed on the window parapet, (b) is PV-modules integrated around a window and (c) is PV-modules integrated in connection with a solar wall façade.

Economy for building integrated PV-modules with a combined electricity and heat utilisation

The calculated value of the annual savings by crystalline building integrated PV-modules is shown in figure 2.16 and 2.17. Calculations for both façade and roof integration of PV-modules have been made of the savings just by electricity from the PV-modules and also where the PV-modules at the same time preheat the ventilation air, which can also increase the output from the PV-modules. The calculations are based a price of electricity from PV-module that in principle is the same the usual electricity price.

Figure 2.18 shows the economy of the PV-modules mentioned in figure 2.16 and 2.17 based on the price of installed modules by large orders, both regarding roof integration and in new or renovated facades. The figure shows that for PV-systems with a combined electricity and heat utilisation the simple pay-back time will be 29-37 years at the moment, while it will be 14-16 years with a 40% reduction of the price of the PV-modules, which is expected within the next 5 years. The calculations do also include maintenance costs of 1% of the additional investments. With amorphous PV-modules you can at best get a pay-back time of only 7 years.

	South facing 45° roof with crystalline PV-modules ¹⁾	South facing façade with crystalline PV-modules ²⁾		South facing façade with amorphous PV-modules ³⁾
1. Price of installed building integrated PV-modules including converter and electricity installation (DKK/m ²)	4000	4000	4000	2400
2. Total price including design and façade insulation (DKK/m ²)	4400	5050	5350 ₄₎	3360
3. Price of usual solution with insulation and ordinary covering, including design (DKK/m ²)	500	1440	2350	1440
4. Additional expenses for solution with PV-modules (2-3) (DKK/m ²)	3900	3610	3000	1920
5. Simple pay-back time (4/(saving – 1% of the additional investments and maintenance)) (years)	29	37	29	24
6. Total price with a 40% price reduction (DKK/m ²)	2640	3289	4125	2016
7. Additional expenses for PV-modules with a 40% reduction of the price (6-3) (DKK/m ²)	2140	1849	1775	576
8. Simple pay-back time (7(saving – 1% of the additional investments)) (years)	14	16	15	7

Figure 2.18. Economy of building integrated PV-modules with a combined electricity and heat utilisation. All prices are 1999 prices by large orders.

1) Annual saving: 175 DKK/m² from both PV-modules and preheating of ventilation air exclusive maintenance of 1% of the additional investments.

2) Annual saving: 133 DKK/m² from both PV-modules and preheating of ventilation air exclusive maintenance of 1% of the additional investments.

3) Annual saving: 27 DKK/m² from electricity from PV-modules and 54 DKK/m² from heat utilisation from the PV-modules.