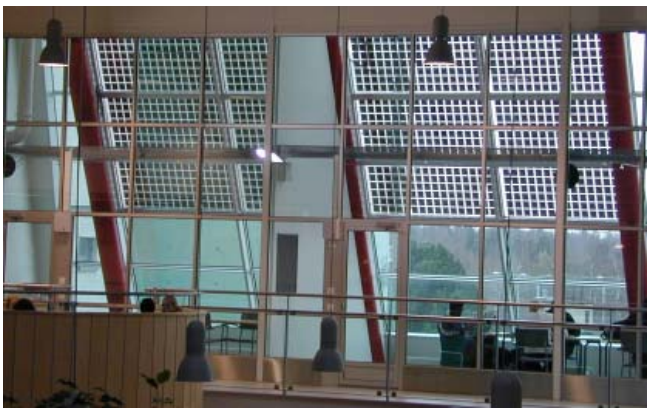

Naps Solar Glazing systems offer a reliable and attractive way to produce energy at the point of consumption.

Naps Solar Glazing (NSG) Systems

Naps Solar Glazing (NSG) systems for buildings make it possible to combine clean electricity production with the coverage of building areas such as glazed roofs, facades (single or double skin), atria, sunshades, balconies, etc. At the heart of these systems are Naps GG type solar electric laminates, which combine weather protection with electricity production, and can also provide functions such as shading, daylighting and visual protection.

The GG laminates may include an insulating window unit with almost any type of glass package in the inner side, like a safety laminate or bullet-proof glass. The laminates offer the possibility of tailoring the light transmission to a desired level by adjusting the gaps between the solar cells. In this way shading and light transmission can be optimized.

Naps Solar Glazing products, a result of Naps extensive expertise in solar electricity, are for the discerning customer who wants to take advantage of clean solar electricity in a simple package, designed for easy and simple installation. The laminates are installed using standard glazing methods, as they are compatible with most facade and glazed atria profile systems. The only additional requirement during their installation is the electrical cabling.

Naps Solar Glazing can produce a significant fraction of a building's annual electricity need. In some countries excess solar electricity can be sold to the electricity network at an attractive price, so users can obtain a financial pay pack in addition to saving on electricity purchases. In some other countries, a grant can be obtained for part of the cost of the system.

NSG systems are cleaner

Naps Solar Glazing generates clean electricity whenever there is daylight and feeds it into the building electricity supply. NSG systems are unique in that they can be mounted on buildings to produce electricity at the point of demand without any adverse environmental effects (no noise, no moving parts, no exhaust gases and no dangerous by-products).

Our solar cells are made using either very energy-efficient or low carbon dioxide emission processes. This means that the time for NSG systems to displace as much carbon dioxide emission as went into their total manufacture is often considerably less than that for other silicon-based photovoltaic systems.

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NAPS Power of Light

System components

An NSG system comprises the multifunctional solar electric building elements, cables, array connection boxes with lightning protection and circuit breaker(s) and inverters to convert the dc solar electricity into ac electricity, which is fed into the house's standard electrical supply. The inverters can transmit data to a PC or data logger if the owner wants to monitor the performance, and large visual displays can also be provided.

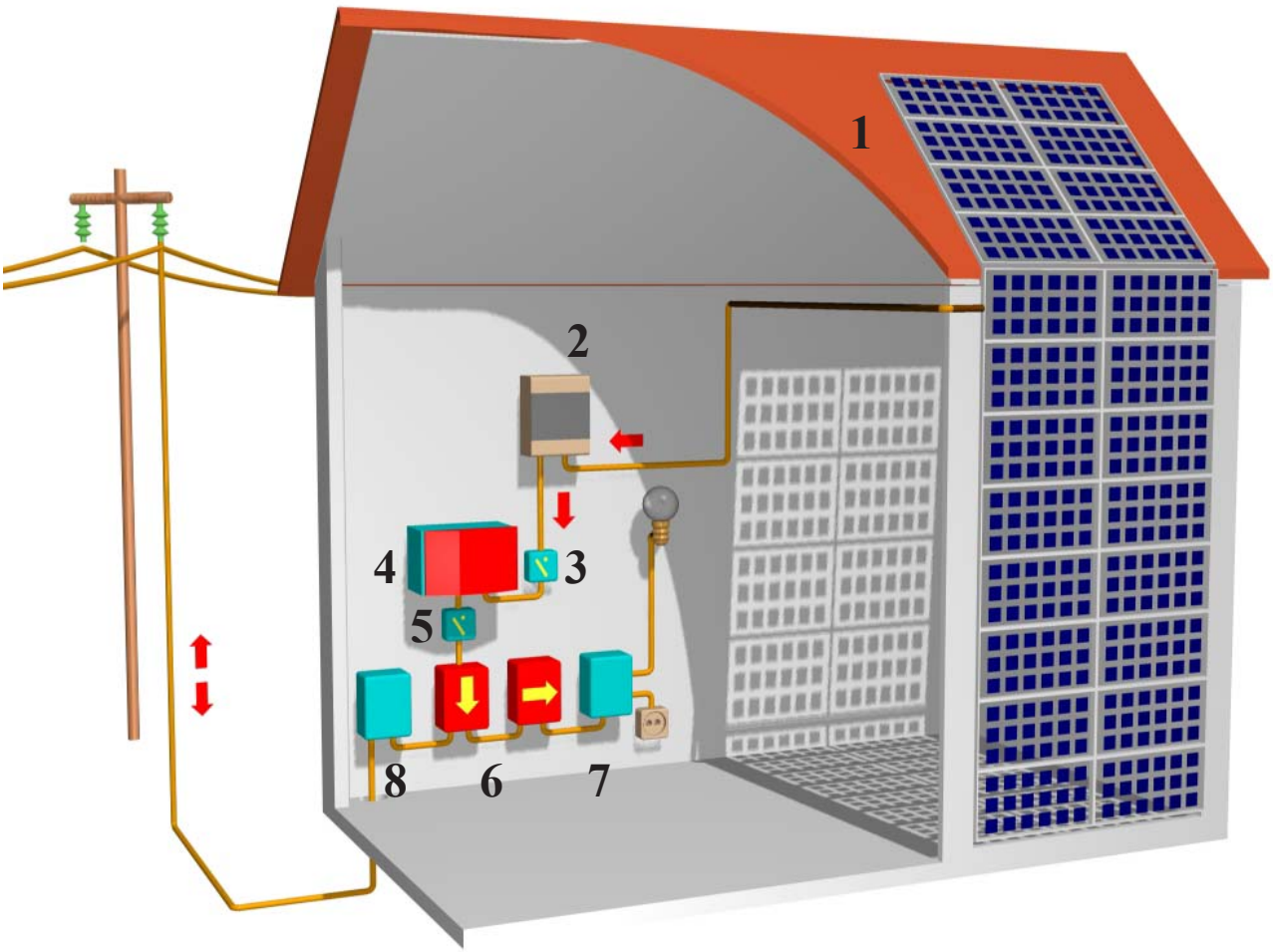
Modular construction

NSG systems are split into two or more electrical subsystems which feed into the ac electricity supply independently. Because of this modularity, NSG systems can be designed efficiently for any size of installation. The electricity-producing glazing elements themselves are custom-designed for each installation.

Added value with multifunctionality

The most economic applications for NSG systems are where high cost building surfaces can be replaced with solar electric elements which can also offer additional benefits. Office and commercial buildings are typical of such cases. The avoided cost can be substantial, e.g. in expensive facade systems, where the cost of "mirror" or darkened glass approaches the cost of the GG laminates. The laminates can also perform additional functions such as:

- Cutting the peak power demand of the building.
- Providing overhead glazing with light transmission control (shadings, preventing overheating, daylighting).
- Providing sunshading over conventional windows.
- Providing visual protection / privacy (balcony wall).
- Giving an attractive "high tech" appearance combined with ecological aspects to promote a positive image.



General schematic of a solar electric building system and the main components :
1 Solar array, 2 Array box (string fuses, blocking diodes, lightning protection), 3 DC switch (not needed in all countries), 4 Inverter, 5 a.c. switch (optional), 6 Energy counters, 7 Electrical distribution box (with fuses), 8 Building electricity supply.

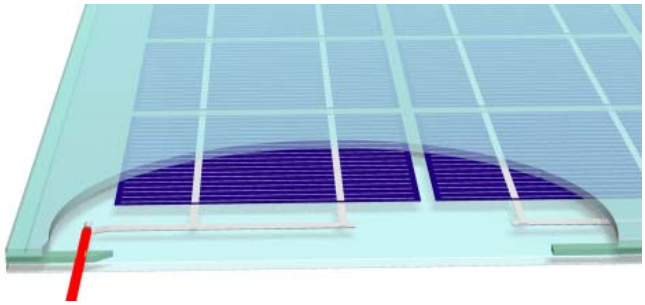
(a.c. connection and metering details may vary slightly in different countries)

(larger systems will have more than one inverter and a three phase connection instead of single phase connection)

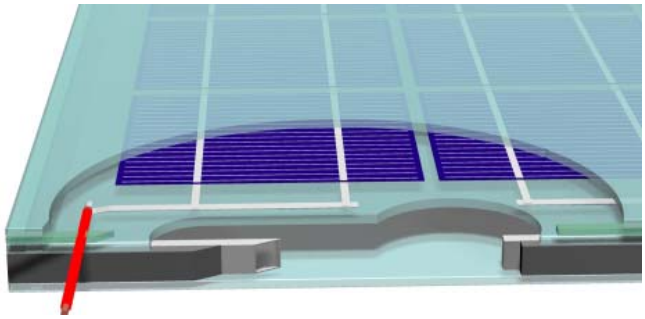
Naps GG elements

Naps GG elements are made using the highest standards of construction. Once installed, they will provide a reliable source of clean electricity for decades.

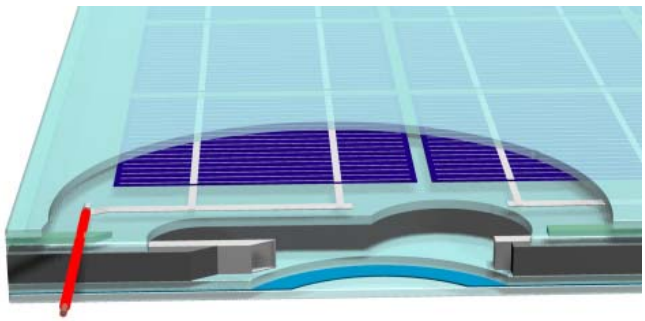
The solar cells are encapsulated between heat-strengthened glasses with high performance transparent resin to ensure a long lifetime. Almost any type of glass unit can be integrated on the back side of the glass laminate. The glass thicknesess required depend on element size, support method and mechanical loads.



The basic GG solar laminates are most suitable for cold facades over a wall, double skin facades, greenhouses and sunshades.



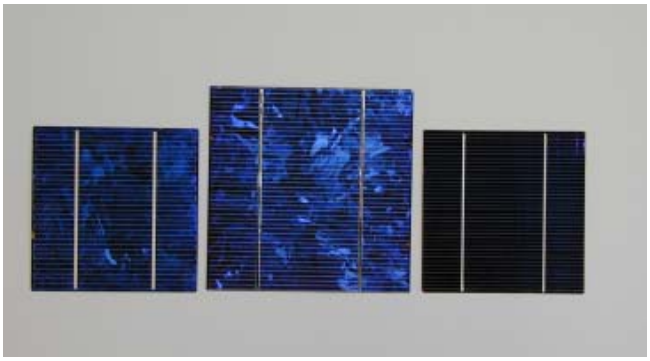
For a warm facade, an insulating glass unit with a U-value down to 1.1 W/m^{2}K can be integrated on the inner side of the laminate. This may be air- or argon-filled.



Many applications require added security. Almost any type of glass can be integrated on the inner side of the basic laminate or insulating glass unit. This can be laminated security glass for overhead applications or even a bullet-proof security glass.

Cell types

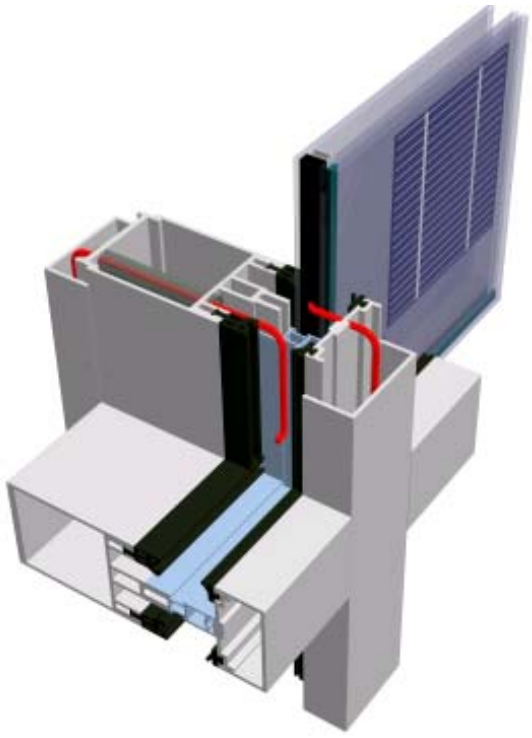
The GG type solar elements can be made from several different types of solar cells. The most common cell sizes are 125 mm x 125 mm and 150 mm x 150 mm. Main cell colours are dark blue and light blue. Other colours are available on request.



Mounting methods

GG elements can be used with most standard aluminium or steel building profile systems. If required, e.g. for double skin facades, integral mounting holes can be provided in the glass away from the active cell area. Supporting of the elements can be two sided, four sided or pin point. The mechanical support given by the mounting structure is taken into account when designing the glass thickness.

Cabling of the elements can be conducted inside the mounting profiles in the case of laminates or insulating window types. The elements normally have cables exiting from the edge. For basic laminates it is also possible to have rear-mounted cable junction boxes.



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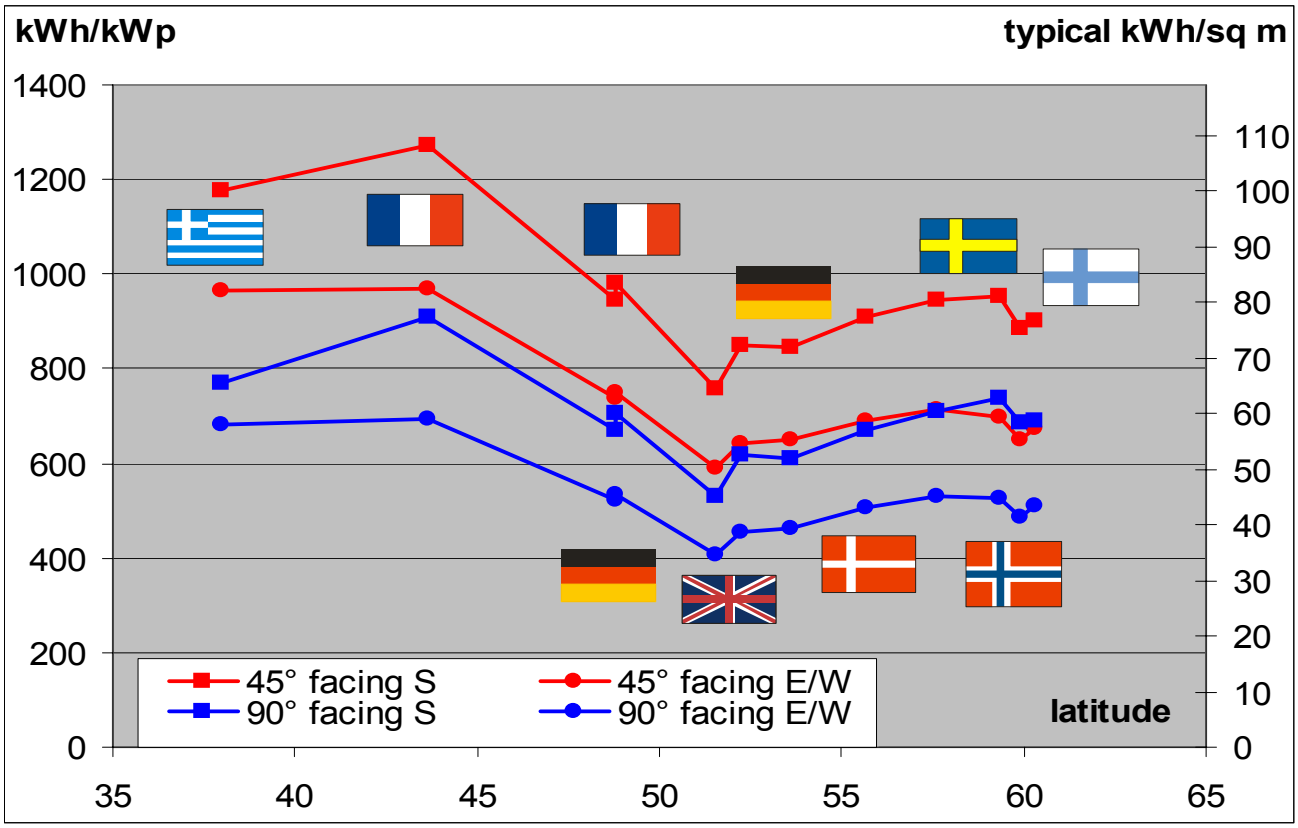
Typical system performance in Europe



Average annual performance range of NSG systems in Europe

Annual kWh per sq m depends on the exact spacing of cells within the glazing element. Typical kWh/sq m values shown in the above graph are for 85 Wp per sq m. This corresponds to approximately 30% of the element area being clear and light transmitting.

These performance figures are carefully calculated for average sunlight availability in various typical locations in Greece, France, Germany, UK, Denmark and the southern parts of Sweden, Norway and Finland.

The calculations include all losses due to operating temperature, inverter losses, etc, plus reasonable allowances for module soiling and module operating mismatch. Calculations do not include losses for below average sunshine, shadows or other factors. Shadows and the reduction of daylight availability will result in lower output than illustrated.

The effect of the tilt angle in the range 30-45° on annual performance is minor (+/-3% at most). The effect of facing 45° off due South is also quite minor (5-10% less annual electricity production).

	ac kWh / kWp
90° facing S	531 - 908
90° facing E/W	408 - 695
45° facing S	756 - 1273
45° facing E/W	590 - 971

Avoided CO_2 emissions

Avoided CO_2 emissions for an unshaded south-facing NSG system mounted at a tilt of 30-45° are in the range of 0.64 to 1.08 tonnes CO_2 equivalent per kWp per year, assuming that 'average emission' fossil fuel electricity is replaced. For south-facing NSG systems mounted on a vertical wall, the avoided emissions are about 70% of the above. If 'world average electricity' is replaced, the above figures should be multiplied by approximately 70%.

The CO_2 payback time for an unshaded south-facing NSG system mounted at a tilt of 30-45° is in the range of 2 to 7 years, again assuming that 'average emission' fossil fuel electricity is replaced. The lower figure is for the case where the silicon processing uses mostly hydroelectricity (actual range 2.4-4 years, depending on location). For south-facing NSG systems mounted on a vertical wall, the CO_2 payback time is about 40% longer, due to the lower annual electricity production.

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