Sapa Building System

Sapa Solar BIPV

* The acronym BIPV (Building Integrated Photovoltaics) refers to systems and concepts in which photovoltaics, as well as having the function of producing electricity, also takes on the role of building element. It's a state-of-the-art technology that allows the integration of photovoltaic cells into architectural building systems.
As a member of the Orkla group, Sapa Building System’s involvement along the supply chain of the PV industry assures the highest possible standards to its BIPV solutions.
As a provider of market leading architectural solutions, Sapa Building System’s drive for constant innovation has lead to the development of state-of-the-art integrated energy technology.

Sapa Building System: a solar player
Sapa Building System is one of Europe’s largest suppliers of aluminium building systems and is part of a large international group that operates around the world, with interests in profile extrusion and heat transfer. Sapa Building System aims to be the preferred European provider of environmentally sustainable and energy-efficient aluminium building solutions.

As part of the Orkla group, Sapa Building System offers a vertically integrated solution throughout the photovoltaic supply chain. From silicon, through cell and module manufacturing, Sapa Building System provides the complete photovoltaic system for the building envelope.

This includes:
• project consulting
• engineering and design
• complete PV and aluminium product range
• fabrication and installation network
• after sales services

Our global presence together with our local network of fabricators and specialist subcontractors ensures efficient project management close to our customers, in all geographical areas.

Moreover, Sapa is able to implement these Building Integrated Photovoltaics in many of its market leading product groups like facades, curtain walling, glazed roofs, conservatories and windows.

Advice, assistance and solution providing are never far away no matter where your project is. Sapa Building System is active in more than 20 countries in Europe and Asia.

BIPV and the SBS product groups
BIPV can be implemented in many of Sapa Building System’s market leading product groups.
the solar promise
The challenge for a new age

At a first glance, reserves of traditional prime energy sources appear comfortably large compared to global annual consumption.

Overestimating these reserves would be a mistake. According to recent figures, mankind will only last
- 3 years on uranium (nuclear energy)
- 20 years on gas
- 30 years on oil
- 60 years on coal
The reason is quite obvious: while fossil fuels are getting exhausted at an alarming pace, global energy consumption keeps increasing.

Taking climate and geopolitical issues into account, it is imperative that we shift the thinking pattern and focus on renewable energy that doesn't put our planet at risk.

Annual energy demand vs. available global energy

The solar energy that is currently available exceeds the annual energy demand by 400 times. The potential for solar energy exceeds the demand by 10,000 times.

source: IEA, World Energy Council, own estimates
While fossil fuels are being exhausted at an alarming pace, global energy consumption continues to increase. The solution, however, has always been around. We only need to connect our grid to the sun.

Reach out for the sun

To induce safe, sustainable energy, we only need to connect our power supply grids to the sun. The sun has been the source of life on Earth since the very beginning of its existence. Yet still the majority of its power is wasted.

For the next 4-5 billion years the sun will provide the earth with almost unlimited energy. Theoretically speaking, if we could capture solar energy without loss, the global annual energy need would be captured in less than 1.5 hours. More than half of the sun’s energy is radiated back to space. By not using such a vast energy source, we are wasting power every second.

Research tells us that annual global energy needs can be covered about 400 times by conventional solar cell technology available off the shelf today.

In Europe every square metre of land receives approximately 1200 kWh of energy per year. This is an equivalent of 100 liters of gasoline per m². On a larger scale there is an abundant supply of solar energy in the regions where 85-90% of global population lives.

Estimated growth of global energy consumption

<table>
<thead>
<tr>
<th>Energy Consumption TODAY</th>
<th>Energy consumption 2100 applying new energy saving technologies</th>
<th>Energy consumption 2100 not applying new energy saving technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4 X</td>
<td></td>
<td>5-6 X</td>
</tr>
</tbody>
</table>

Global energy consumption is increasing with 2.6% per year. By 2100 the demand for energy will have grown by 3-4 fold assuming we apply new energy saving technologies. And by 5-6 times if not.

Annual global irradiation

The annual amount of solar energy, expressed in kWh/m²

source: based on Thomas Huld and Marcel Suri PVGIS © European Communities, 2001-2007

Sun hours for European Cities/year

<table>
<thead>
<tr>
<th>City</th>
<th>Country</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lisboa</td>
<td>Portugal</td>
<td>1,860 h</td>
</tr>
<tr>
<td>Roma</td>
<td>Italy</td>
<td>1,687 h</td>
</tr>
<tr>
<td>Istanbul</td>
<td>Turkey</td>
<td>1,454 h</td>
</tr>
<tr>
<td>Geneva</td>
<td>Switzerland</td>
<td>1,394 h</td>
</tr>
<tr>
<td>Paris</td>
<td>France</td>
<td>1,265 h</td>
</tr>
<tr>
<td>Warsaw</td>
<td>Poland</td>
<td>1,159 h</td>
</tr>
<tr>
<td>Berlin</td>
<td>Germany</td>
<td>1,146 h</td>
</tr>
<tr>
<td>Stockholm</td>
<td>Sweden</td>
<td>1,137 h</td>
</tr>
<tr>
<td>London</td>
<td>UK</td>
<td>1,131 h</td>
</tr>
<tr>
<td>Brussels</td>
<td>Belgium</td>
<td>1,084 h</td>
</tr>
<tr>
<td>Oslo</td>
<td>Norway</td>
<td>1,015 h</td>
</tr>
</tbody>
</table>
PV, a promising solution
With over 40% of worldwide electricity usage, buildings can be considered as the largest consumers of energy. Therefore architects, consultants, developers, maincontractors and investors are increasingly opting for renewable energy produced in this environmentally responsible way as we aim towards passive energy buildings. Photovoltaic technology is a promising solution transforming solar radiation into electricity connected to the grid for mass usage.

With PV modules, buildings gain considerable added value, which makes every investment in this technology worthwhile. They also upgrade the value of renovation projects for existing buildings.

The exemplary path by the German Advisory Council on Global Change (WBGU) estimates a major reduction in the use of fossil energy by the year 2100 and a substantial development and expansion of new renewable energy sources, notably solar.

source: WBGU
Solar energy and photovoltaics in particular are amongst the most promising solutions to future energy problems.

**BIPV, a great opportunity**

In order to protect the Earth, governments worldwide are increasing efforts to reduce harmful emissions by stimulating and subsidising the use of renewable energy sources. Europe especially is taking serious measures, thus creating massive opportunities for investors and companies to incorporate state-of-the-art solar technology into their energy systems.

Europe has committed to severely reduce CO\textsubscript{2} emission with a 20% target of renewable energy by 2020. Supported by extensive research programs, cutting edge technology and industry commitment, the mass usage of photovoltaic and solar thermal energy seems no longer a pipe dream.

Today, many governments worldwide have an extended offer of subsidies to compensate the investment the implementation of BIPV technology requires. Since each region has its specific regulations and subsidiary systems, Sapa Building System consultants can and will research the best opportunities for each particular project.

**A bright future with BIPV**

The generation costs of PV electricity from grid-connected systems are currently relatively expensive compared to traditional networks. By 2010-2015, however, these costs will have been halved and, by 2030, generation costs will be less than the current household electricity price. After 2030, costs will decrease further aided by breakthrough technology.
Photons (01) are captured by photovoltaic cells (02) and converted into electrical current (03-04). Using an inverter (05) the electricity can be linked to the grid (06).
Photovoltaics: a cutting edge technology.

How does a photovoltaic cell work?
PV cells work according to a basic physical phenomenon called ‘photoelectric effect’.

01. When the energy of photons hitting a semiconductor plate is high enough (light has the right colour), it can be absorbed by electrons on the surface of the semiconductor plate exposed to such radiation.

02. The absorption of additional energy enables the (negatively charged) electrons to free themselves from their atoms. The electrons become mobile, and the space which is left behind is filled by another electron from a deeper part of the semiconductor.

03. As a consequence, one side of the wafer has a higher concentration of electrons than the other, which creates voltage between the two sides. Joining the two sides with an electrical wire enables the electrons to flow to the other side of the wafer – which is electrical current.

What factors influence the performance of PV?
The most important factors for the electrical output are the positioning, orientation, geographical latitude and the shadowing of the PV panel. The impact on the performance due to different positioning is shown below.

Each specific project will be simulated thoroughly regarding to orientation of the PV panels according to the position of the sun, thus guaranteeing the largest possible return-on-investment.
Multi-applicable solutions for all market segments:
Sapa Solar designs photovoltaic solutions adapted to
the requirements of every kind of building:

- **Landmark buildings:**
  - banks
  - headquarters
  - governmental
  - hotels
  - hospital
  - universities

- **Residential sector:**
  - apartments
  - condominiums

- **Industrial sector:**
  - warehouses
  - factories

- **Retail sector:**
  - shopping mall
  - shopping centers

- **Agricultural sector:**
  - Greenhouses

- **Sports & Leisure**
  - Airports
  - Train stations...
Building integrated photovoltaics: new ways to improve building performance with attractive design.

What are Building Integrated Photovoltaics?
While standard PV solutions are often used in residential or solar-farm applications, BiPV provides the architect with completely new possibilities to incorporate solar technology into buildings. PV systems and architecture can now be combined into one harmonious mixture of design, ecology and economy.

Our building integrated photovoltaic modules create a world of possibilities. The wide variety of elegant forms, colours and optical structures of cells, glass and profiles enables creativity and a modern approach to architectural design. It allows specifiers to deliver an energy-efficient, innovative and prestigious project and to set new architectural standards for the future by combining elegance with functionality. PV modules can be incorporated into the building vertically, horizontally or at an angle.

The modules can be tailor-made in accordance with dimensions and customer wishes. A selection of cells and positioning can be adapted according to project design specifics: Transparency, Light control, Module design, Shading, Dimension.

PV solar installations for 2007 in MWp

<table>
<thead>
<tr>
<th>Country</th>
<th>Photovoltaic capacity installed during the year 2007 (in MWp)</th>
<th>Cumulated photovoltaic capacity in 2007 (in MWp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>1,328,000</td>
<td>4,364,000</td>
</tr>
<tr>
<td>Spain</td>
<td>640,000</td>
<td>758,000</td>
</tr>
<tr>
<td>Austria</td>
<td>179,000</td>
<td>208,020</td>
</tr>
<tr>
<td>Italy</td>
<td>90,000</td>
<td>147,900</td>
</tr>
<tr>
<td>France</td>
<td>50,000</td>
<td>82,690</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>1,000</td>
<td>52,230</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>0,040</td>
<td>23,600</td>
</tr>
<tr>
<td>Portugal</td>
<td>12,000</td>
<td>15,466</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2,750</td>
<td>13,630</td>
</tr>
<tr>
<td>Greece</td>
<td>3,000</td>
<td>9,894</td>
</tr>
<tr>
<td>Belgium</td>
<td>2,000</td>
<td>6,161</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>3,500</td>
<td>4,271</td>
</tr>
<tr>
<td>Sweden</td>
<td>650</td>
<td>4,867</td>
</tr>
<tr>
<td>Finland</td>
<td>64</td>
<td>4,066</td>
</tr>
<tr>
<td>Denmark</td>
<td>230</td>
<td>2,880</td>
</tr>
<tr>
<td>Cyprus</td>
<td>520</td>
<td>0,976</td>
</tr>
<tr>
<td>Slovenia</td>
<td>183</td>
<td>0,363</td>
</tr>
<tr>
<td>Poland</td>
<td>114</td>
<td>431</td>
</tr>
<tr>
<td>Ireland</td>
<td>n.a.</td>
<td>300</td>
</tr>
<tr>
<td>Cyprus</td>
<td>520</td>
<td>976</td>
</tr>
</tbody>
</table>

source: EurObserv’ER 2007
the sapa solar solutions
**Polycrystalline** cells are produced by pouring hot, liquid silicon into square molds or casts. The silicon is cooled to form solid blocks, which are sliced like single-crystalline silicon. The obtained mass is cut into rectangular rods which are sliced into thin wafers, forming a ‘patchwork quilt’ of single-crystalline silicon molecules. Since this technology is the best known and relatively cost-effective, polycrystalline cells remain the most commonly used.

**Monocrystalline** cells are created in a similar process as mentioned above but the ingots are manufactured according to the very complicated Czochralski process. The ingots have the same, strictly desired crystal orientation through their whole length. The shape of the cross section of an ingot is circular. Since it is a waste of surface to use round cells beside each other, a rectangular like shape is cut out of the ingot’s cross section. The corners are left round because it would be too expensive to throw out the obsolete material after cutting out a full square from the inside of a circle cross section.

**Thin-film technology** cells are printed on glass in many thin layers, thus forming the desired modules. Manufacturing them requires less material than producing crystalline cells because no cutting is needed. In addition they only require laminating on one side since they are “glued” to a glass pane on the other side during the production process.

<table>
<thead>
<tr>
<th>PV cell types and their efficiency</th>
<th>DIMENSIONS</th>
<th>EFFICIENCY</th>
<th>Wpeak/m²</th>
<th>Wpeak/cell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POLYCRYSTALLINE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>156x156</td>
<td>16%</td>
<td>120</td>
<td>1.46 - 3.85</td>
<td></td>
</tr>
<tr>
<td>125x125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MONOCRYSTALLINE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>156x156</td>
<td>18%</td>
<td>130</td>
<td>2.60 - 4.02</td>
<td></td>
</tr>
<tr>
<td>125x125</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MONOCRYSTALLINE – HIGH EFFICIENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>125x125</td>
<td>22%</td>
<td>155</td>
<td>2.90 - 3.11</td>
<td></td>
</tr>
<tr>
<td><strong>MONOCRYSTALLINE - SEMITRANSPARENT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>125x125</td>
<td>17%</td>
<td>105</td>
<td>1.90 - 2.20</td>
<td></td>
</tr>
<tr>
<td><strong>aSi (AMORPHOUS SILICONE) THIN FILM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>576x976</td>
<td>5%</td>
<td>50</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td><strong>aSi THIN FILM 10% OR 20% OPACITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>576x976</td>
<td>4%</td>
<td>40-45</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>
Sapa solar PV cells: a wide array of choices that can be combined and connected to suit every possible project requirement.

<table>
<thead>
<tr>
<th>Possible combinations cell-type and cell distances</th>
</tr>
</thead>
<tbody>
<tr>
<td>aSi THIN FILM</td>
</tr>
<tr>
<td>10% TRANSPARENCY</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POWER W/M²</th>
<th>TRANSPARENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>20</td>
<td>5%</td>
</tr>
<tr>
<td>40</td>
<td>10%</td>
</tr>
<tr>
<td>60</td>
<td>15%</td>
</tr>
<tr>
<td>80</td>
<td>20%</td>
</tr>
<tr>
<td>100</td>
<td>25%</td>
</tr>
<tr>
<td>120</td>
<td>30%</td>
</tr>
<tr>
<td>140</td>
<td>35%</td>
</tr>
<tr>
<td>160</td>
<td>40%</td>
</tr>
<tr>
<td>180</td>
<td>45%</td>
</tr>
</tbody>
</table>

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power W/m²  
transparency
Sapa Solar PV modules: single cells are connected to form a photovoltaic module.

Tailor-made solutions
Sapa Solar’s solutions are all tailor-made to fit specific project requirements.

Opaque panels
Incorporation of opaque, crystalline high performance sun panels in the facade allows coverage of the building structure and concrete walls. Insulation behind the opaque panels ensures the necessary thermal barrier. Both see-through and opaque panels can be combined in the same facade.

See-through panels
Transparent crystalline photovoltaic panels, in combination with Sapa’s aluminium profiles, can easily be integrated in facades and roofs. See-through panels are available in a large range of applications, dimensions, shapes, colours and transparency. The photovoltaic cells are embedded between two glass sheets. The panels can also be thermally insulated, laminated and tempered for security reasons. By adjusting the distance between cells, it is possible to regulate the light transmittance and the shade effect inside the building.

Thin-film technology
Thin-film modules are recommended for applications in dim light and indirect sunlight. The thin-film panel exists as both opaque and see-through.
Different BIPV possibilities

- **DOUBLE SHEET, SEE-THROUGH WITH SAFETY INTERNAL GLASS**
  - noble gas for superior insulation

- **TRIPLE SHEET, SEE-THROUGH WITH SAFETY INTERNAL GLASS**

- **DOUBLE SHEET, SEE-THROUGH**

- **TRIPLE SHEET, SEE-THROUGH**

- **SINGLE SHEET, OPAQUE**
  - non transparent PVB foil

- **SINGLE SHEET, OPAQUE**

Legend:
- glass
- low iron toughened glass
- noble gas
- spacer
- solar cell
- low emission coating
- PVB foil
- tedlar foil
The construction of the modules is adapted according to its integration in the building.

Sapa Solar’s BIPV solutions provide architects and constructors with custom made systems and components that generate a considerable added value to each passive building project.

PVB-technology (Poly-Vinyl-Butyral)
For all glass/glass PV modules, Sapa Solar uses the certified and glass industry-approved PVB technology. This laminated safety glass offers both architects and building constructors many additional possibilities and advantages regarding safety and performance.

- High tensile strength and load carrying capacity
- The PVB-film in between the glass layers ensures the integrity of broken units
- Extensive life cycle
- Excellent acoustic performance
- Different module layers

Panel size and characteristics
Sapa Solar tailor-made modules can be manufactured in almost any size with a maximum of 2.4 m length x 5.1 m height

Insulation
Triple glazing provides improved thermal insulation performance.
Typical grid connection of the Sapa solar modules

- 49 x Sapa Solar modules
  - roof 360W
  - 45° → 0°
  - 7 x inverters
  - 2.7 kW

- 24 x Sapa Solar modules
  - curtain walling 365W
  - 90° → 0°
  - 2 x inverters
  - 4.2 kW

- METER

- THE GRID
Sapa Solar BIPV: bringing the power of the sun into your grid.

As an operator of a grid-connected photovoltaic system, solar power generated is fed into the public electricity grid using a separate export meter. Every kWh (kilowatt hour) produced can be paid for according to the applicable legislation of your country.

The inverter
PV modules generate DC current. The most important function of the inverter is to convert DC current into AC current. Additionally, it ensures that the PV modules are functioning optimally and achieve the highest possible yield. It monitors all functions and switches the system off if, for instance, there is a power failure in the public grid. Inverters are offered in a wide range of power classes. The number and the power of the inverters depend on the size of the generator.

The export meter
The export meter indicates how much electricity is provided to the grid. The device is completely independent of the import meter.
A turn key solution for your entire project
Supported by Sapa Building System’s extensive ex-pertise and know-how, we provide a complete package with a wide range of services: we investigate which subsidy regulations apply to the project and ensure that national building regulations are met in every detail. Sapa Building System supports with design and engineering for utility connections, cabling plans, electronic, static and thermal calculations. For the installation, our extensive network of experienced installers and builders provides full assistance. For the delivery of BIPV components we cooperate with prominent partners in the building industry.
Sapa Solar provides a turnkey solution for your entire solar project. A complete photovoltaic package combining engineering, extensive support and continuous advice.

Sapa’s architectural aluminium building systems are developed in close cooperation with architects and other specifiers and are adapted to meet the latest building regulations.

At Sapa Solar, we drive the entire design process by using our technical expertise and experience: from the very first dialogue with the client, through conceptual drawings, the development of high quality photovoltaic systems that are easy to manufacture and simple to install.

Support

- Engineering study, curtain walling structure, static calculation, design, drawings
- Photovoltaic study, module proposal, output calculation, electrical data, investment calculation
- Project budget envelope, timetable estimation, qualified installer recommendation

BIPV project installation

- Supply of all hardware, profiles, modules and electrics
- Engineering, installation support, site management, administrative assistance
- Qualified installer network combining expertise in facade and electronics

BIPV Product and Output Warranties

PV modules:

- 5 years product warranty
- 10 years > 90% of the minimum peak power
- 20 years > 80% of the minimum peak power
- Production monitoring

Inverter and connectors warranties:

- 5 years product warranty
- according to the manufacturer conditions
architectural integration
The eye-shaped curtain wall of the hospital hall has a 500 m² surface area and over 18,000 polycrystalline cells that produce 31,122 kWh a year.

architect: VK STUDIO Architects, Planners & Designers
In order to maximise the output of the 45° angle curtain wall, special glass-glass modules were made with custom connected cells that fit the hospital’s eye-shaped public hall.

OLV hospital
Aalst, Belgium
For years, O.L.V.-Ziekenhuis in Aalst has been one of the best hospitals in the world for researching and curing cardiovascular conditions. The hospital wanted its facilities to reflect its prominent role. Ever since 2005, Sapa has contributed to the creation of a new, state-of-the-art campus, of which BiPV is an important part.

The highlight of the renovated hospital will undoubtedly be the atrium. It will be the focal point of the impressive entrance hall and will have all the energy-efficient, insulating and aesthetic qualities of BiPV. A south-facing 45-degree slope uses solar energy as efficiently as possible.

The construction of the facade was preceded by an extensive study. The structure should not just have the capacity to support the photovoltaic cells; it also needs to include the required connections for the panels. Attention was also paid to ensure it is fire-resistant and maintenance-friendly. A movable cleaning installation was initially considered for the glass surface but, after consultation between Sapa Building System, the architects and the contractors, a different solution was developed and a self-cleaning facade surface with a draining system that rinses away any settled dust was installed.

The photovoltaic cells were incorporated in between two plates of safety glass. These pre-assembled modules – which are 120x240 cm in size – are connected by aluminium frame sections with built-in thermal breaks and integrated connectors to transport the generated electric energy.

Sapa also researched the support capacity of the aluminium frame and the integration of the connection points. Particularly any bending of the frame is critical. The modules with the photovoltaic cells are very heavy. Even the slightest bending of the frame can damage them or jeopardise their operation. Needless to say that keeping the construction wind and waterproof was an absolute condition in the specifications. The entire construction was developed and tested for this project especially and resulted in exterior vertical cover panels and special rubber elements. Various test set-ups were tried at the Sapa Building System testing center and the best solutions were used.

The solar energy is fed into the hospital’s electrical network, for which green power certificates are received. The annual capacity is 31,122 kWh. Every square metre produces 100 W and the total net surface area of the photovoltaic cells is 500 m².
Sapa Building System with its Variolux offer provides a complete photovoltaic package for greenhouse applications.

Renovation of ‘Palmenhouse’
Munich, Germany
For the renovation of this greenhouse, financed by the city of Munich, some glass was substituted by solar see-through panels. Because direct solar rays are harmful for some of the tropical plants in the greenhouse, modules with 35% transparency were integrated in the roof.

Project facts:
Polycrystalline panels

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
<th>Power (Wp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opaque</td>
<td>360</td>
<td>75</td>
</tr>
</tbody>
</table>

Total installed capacity 27 kWp
REC Wafer Norway AS
Porsgrunn, Norway

REC Wafer are among the world’s largest producers of PV wafers for solar applications. Their latest building in Norway has got 150 REC AE 215 std panels in front of the Sapa Facade 4150. The panels are mounted in a self-bearing console system from Sapa Solar Shading 4550.

Project facts:
REC AE 215 panels
Opaque 150 panels at 220 Wp

Total installed capacity 33 kWp
Partille Municipal Office  
Gothenburg, Sweden

When rebuilding the head entrance, Partille municipality chose Sapa Facade 4150 with Sapa Solar BIPV in order to display the use of solar energy.

The glass in the facade consists of monocrystalline cells (125 x 125 mm) in a 2-glass insulated unit with the U-value of U_g 1.1 W/m²K.

**Project facts:**

<table>
<thead>
<tr>
<th>Monocrystalline panels</th>
<th>See-through 8 panels at 250 Wp</th>
</tr>
</thead>
</table>

Total installed capacity 2 kWp
National Telecom Headquarters of Sudan
Khartoum, Sudan

In May 2007, a prestigious 2,300 m² project was started in Khartoum, the capital of Sudan. Sapa supplied aluminium systems for BIPV that were integrated in the office tower of the National Telecom Headquarters of Sudan.

**Project facts:**

<table>
<thead>
<tr>
<th>aSi standard panels</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Opaque</td>
<td>600 panels at</td>
<td>83.8 Wp</td>
</tr>
<tr>
<td>See-through</td>
<td>600 panels at</td>
<td>81.0 Wp</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>aSi corner panels</th>
<th></th>
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<tbody>
<tr>
<td>Opaque</td>
<td>100 panels at</td>
<td>30.0 Wp</td>
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<tr>
<td>See-through</td>
<td>100 panels at</td>
<td>27.9 Wp</td>
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</tbody>
</table>

Total installed capacity 104.67 kWp

Over 2,000 m² of Sapa Solar BIPV was used to create the aesthetically impressive facade.
Living Tomorrow  
Brussels, Belgium
For the exterior of the Living Tomorrow entrance, Elegance 52 GF, curtain wall was specified with PV-integrated glazing. The built-in photovoltaics in the spectacular sun roof construction contribute largely to a reduced energy consumption and an abundance of natural light to the interior of the building.

<table>
<thead>
<tr>
<th>Opaque</th>
<th>14 panels at 100Wp</th>
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</thead>
<tbody>
<tr>
<td>See-through</td>
<td>33 panels at 136Wp</td>
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</tbody>
</table>

Total installed capacity 6 kWp
# Information and support

<table>
<thead>
<tr>
<th><strong>SAPA BUILDING SYSTEM AB OFFICES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sweden Headoffice:</strong></td>
</tr>
<tr>
<td>Sapa Building System AB</td>
</tr>
<tr>
<td>574 81 Vetlanda</td>
</tr>
<tr>
<td>Phone +46 383 942 00</td>
</tr>
<tr>
<td>Fax +46 383 76 19 80</td>
</tr>
<tr>
<td>e-mail: <a href="mailto:system.se@sapagroup.com">system.se@sapagroup.com</a></td>
</tr>
<tr>
<td><a href="http://www.sapabuildingsystem.se">www.sapabuildingsystem.se</a></td>
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<thead>
<tr>
<th><strong>Denmark:</strong></th>
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<th><strong>United Kingdom:</strong></th>
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<tbody>
<tr>
<td>Sapa Building System</td>
<td>Sapa Building System</td>
<td>Scandinavian Architectural System</td>
</tr>
<tr>
<td>Langhøjvej 1 Indgang A 8381 Tilst</td>
<td>Kalvariju str. 300, LT-08318 Vilnius</td>
<td>Red Hill House, Hope Street,</td>
</tr>
<tr>
<td>Phone +45 86 16 00 19</td>
<td>Phone +370-5 273 32 92</td>
<td>Saltney, Chester CH4 8BU</td>
</tr>
<tr>
<td>Fax +45 86 16 00 79</td>
<td>Fax +370-5 275 88 12</td>
<td>Phone +44 1244 681 350</td>
</tr>
<tr>
<td>e-mail: <a href="mailto:system.dk@sapagroup.com">system.dk@sapagroup.com</a></td>
<td>e-mail: <a href="mailto:system.lt@sapagroup.com">system.lt@sapagroup.com</a></td>
<td>Fax +44 1244 681 220</td>
</tr>
<tr>
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