Building Integrated Photovoltaic (BIPV)
Reza Shaybani – Managing Director
Scheuten Middle East
'Right from day one, I was convinced that we would grow into a global company. It is my ultimate desire to be successful in this world. For me, success means making people’s lives happy and pleasant by means of our products.'

Jacques Scheuten
Scheuten is a company run by people, for people. We connect solar and glass to innovative concepts. We give energy, sustainability, growth and life to our customers and to the world.

see it. feel it
Key Figures Scheuten Holding

• Head office & strategic activities located in Venlo The Netherlands

• Sales offices worldwide

• Company founded in 1950

• Turnover Euro 467 million (2008)

• Over 1600 employees (2008)

• 2 divisions: glass and solar with their own research departments
Scheuten Solar is a globally operating, innovative and leading solar company that develops, produces, designs and sells PV solar modules and total PV solar solutions.
Reliable Partner in Solar Solutions

- Silicon production
- Cell production
- Module production
- Module & Component Sales
- Research & Development
- Project Development
- Service & Maintenance
Wednesday, 22 April 2009
03 SCHEUTEN SOLAR OPERATIONAL ACTIVITIES
Covering the value chain

- Silicon
  - Strategic Investor
  - AE Polysilicon

- Wafers
  - OEM

- Modules
  - Scheuten Solar, made in Germany & Taiwan

- Ingots

- Cells
  - Scheuten Solar Cells
  - High Qualified Suppliers

- Installation
  - Scheuten Solar turn key systems
Scheuten Solar is a strategic investor in AE Polysilicon Corporation which holds a position in the middle of the solar value chain. It has developed a polysilicon production technology with significant process and product differentiation.
Global Presence

Sales Offices:

- Scheuten Solar Belgium
- Scheuten Solar Middle East
- Scheuten Solar France
- Scheuten Solar Germany
- Scheuten Solar Greece
- Scheuten Solar Italy
- Scheuten Solar Netherlands
- Scheuten Solar Spain
- Scheuten Solar USA
- Scheuten Solar Korea
Global Presence

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- Scheuten Solar Netherlands
- Scheuten Solar Spain
- Scheuten Solar USA
- Scheuten Solar Korea
04 SCHEUTEN SOLAR PRODUCTS
Scheuten Solar products

Our product range of high quality standard photovoltaic modules

Individually produced building integrated PV modules (BIPV)

Multisol®

Optisol®
The Multisol® modules are high performance standard solar modules that due to their low weight and sturdy design, are especially suitable for grid connected PV systems, where flexible mounting and a high energy yield are required.
The Optisol® solar elements combine solar power with an attractive appearance. The Optisol® solar elements can be tailor made in sizes up to $4 \times 2$ m and can be combined with all current glass compositions on buildings.
Optisol® unique selling points

- Custom size and shape
- Aesthetic
- High visibility → image
- Light transmission
Scheuten has over 50 employees working both directly and indirectly in the Research & Development Department – a competence centre where both knowledge and innovation are centralized.
1. From PV to BIPV
2. The BIPV product
3. Designing with BIPV / Optisol®
4. International projects
Solar Energy in buildings

- Steady
- Local
- Unlimited
- Decentralized
- Easy
- Clean
- Quiet

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Why photovoltaic in building envelopes?

- Large unused surfaces on high rise buildings
- The unlimited power of the sun
- The need for green power

Let’s use this potential!
Why integrate photovoltaic in facades and roofs?

• Reduce dependency of grid supplied power especially during peak time
• Add new feature to facade and roofing material
  ➢ **PROTECT** against climatic conditions - sun, wind, heat, rain
  ➢ and **PRODUCE** electricity

Summary

• Works as other façade materials
• Looks modern and innovative
• **AND** produces power
The difference

Standard module

- Modular structure
- Ideal for existing roof constructions
- No architectural design required
- Standard dimensions

Building Integrated Photovoltaics

- No compromise regarding to architectural design
- Added value as heat, sun and noise protection
- Innovative design components for façades and roofs
- Sustained energy production over many years
- Custom designed
### BIPV materials

<table>
<thead>
<tr>
<th>Frameless Laminates</th>
<th>Thin Film Membranes</th>
<th><strong>Optisol®</strong> glass/glass modules</th>
<th>Thin Film Modules</th>
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<tbody>
<tr>
<td>Uniform appearance</td>
<td>Uniform appearance</td>
<td><strong>Architectural</strong> appearance</td>
<td>Uniform appearance</td>
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<tr>
<td>Standard sizes &amp; shapes</td>
<td>Standard sizes &amp; shapes</td>
<td><strong>Custom</strong> sizes &amp; shapes</td>
<td>Standard sizes &amp; shapes</td>
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<td>Limited visibility</td>
<td>Limited visibility</td>
<td><strong>High visibility</strong> - &gt; Image</td>
<td>Limited visibility</td>
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<tr>
<td>Non-transparent</td>
<td>Non-transparent</td>
<td><strong>Light</strong> transmission flexible</td>
<td>Non-transparent or semi-transparent</td>
</tr>
</tbody>
</table>

*Non-transparent or semi-transparent*
What does it take to offer BIPV?

- Glass Production
- Glass Processing
- Static Engineering
- EN Standard
- Cell Production
- Module Production
- Thin Film Develop.
- IEC Certification
Optisol® - Power Producing Glass

Thousand combinations in large sizes with flexible cell layout!

OPTISOL® – basic element

- Float glass
- PV-cells
- Low iron glass

OPTISOL® basic element

OPTISOL® – insulating glass

- Float glass
- Thermo coating
- Argon gas
- Sealing
- Spacer
- Sealing

OPTISOL® basic element

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BIPV applications

1. Roof integration

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1. Roof integration

2. Facade integration
BIPV applications

1. Roof integration
2. Facade integration
3. Sun protection
BIPV applications

1. Roof integration
2. Facade integration
3. Sun protection
4. Integrated as a balustrade
BIPV as a Building Material

• Timber
• Stone
• Concrete
• Aluminum
• Glass
• BIPV

Touch the Future!

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Montage

Optisol® Module

Bypass-diodes on side of module

Optisol® Module

Optisol® Module

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When integrating photovoltaic modules into facades or roof 3 major topics must be taken into account:

- Orientation
- Shading
- Ventilation

These factors and others have impact on the efficiency of solar systems.
Orientation and inclination
Orientation and inclination

Example:
House situated South 0 degrees - 100%
Orientation and inclination

Example:
House situated SE 45 degrees - 95%

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Orientation and inclination

Example:
House situated South 75 degrees - 75%
Shading

Module power in Amp

Module voltage

With shade without bypassdiode across 18 cells

Without shade

With shade without bypassdiode

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Rear ventilation

Well ventilated

Poorly ventilated

Not ventilated

No temperature loss

Approx. 5% temperature loss

Approx. 10% temperature loss
Energy loss on system level

- Reflection losses: 4%
- Shading loss: 1-5% for standard systems
- BIPV beware – buildings, trees, structures
  Anticipate future plans
- Energy loss through heating of modules: 4-8%
- Residual loss through DC/AC conversion: 8%
06 SCHEUTEN SOLAR PROJECTS
Scheuten Solar develops and realizes large PV systems all over the world. With lots of experience in different countries, well established financial contacts and reliable investors the main focus is on solar fields and large roof systems.
Scheuten Glass Projects

Heron Tower
London
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Dongen City hall

Area: 520 m²
Rated output: 53 kWp
Number of modules: 288
Commissioning: 2002
Federal Ministry of Economy, Berlin

<table>
<thead>
<tr>
<th>Area</th>
<th>920 m²</th>
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<tr>
<td>Rated output</td>
<td>100 kWp</td>
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<td>Number of modules</td>
<td>600</td>
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<td>Commissioning</td>
<td>1999</td>
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Hotel Industrial, Paris

Area: 1010 m²
Rated output: 94 kWp
Number of modules: 330
Commissioning: 2008
Office of the Federal Chancellor, Berlin

Area: 1,270 m²
Rated output: 150 kWp
Number of modules: 756
Commissioning: 2000

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Solar-Balconies in Beukenhage, Almelo

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<td>9.6 kWp</td>
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<td>Number of modules</td>
<td>80</td>
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<td>Commissioning</td>
<td>2004</td>
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</table>
Scheuten Solar Gelsenkirchen

Area: 139 m²
Rated output: 7.77 kWp
Number of modules: 37
Commissioning: 2006

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## Sant Celoni, Barcelona

<table>
<thead>
<tr>
<th>Area</th>
<th>2,100 m²</th>
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<td>Rated output</td>
<td>approx. 160 kWp</td>
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<tr>
<td>Number of modules</td>
<td>832</td>
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<tr>
<td>Commissioning</td>
<td>2008</td>
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</table>
REWE, Gelsenkirchen

- Area: 320 m²
- Rated output: 32 kWp
- Number of modules: 160
- Commissioning: 2007
<table>
<thead>
<tr>
<th>Area</th>
<th>960 m²</th>
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<tr>
<td>Rated output</td>
<td>40 kWp</td>
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<tr>
<td>Number of modules</td>
<td>234</td>
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<tr>
<td>Commissioning</td>
<td>2008</td>
</tr>
</tbody>
</table>
British Museum, London

Architects:
Lord Norman Foster + Partner, London
Mercedes Benz, Berlin

Architects:
Lamm, Weber and Donath
Fire Department, Berlin

Architects:
Sauerbruch Hutton, New York
Apple Store Cube, New York

Architect:
Dewhurst McFarlane
Bur Juman Centre, Dubai

Architect: Kohn Pedersen Fox
BIPV sales through knowledge

BIPV Design Centre offers education & design service:

- Training courses teaching architects how to use BIPV in their building design
- A service to the architectural firms designing with BIPV
SEED
Solar Energy and Environmental Design

The course covers:
- Engineering
- Architecture
- Product
- Landscape Design
The course is designed to provide hands-on experience in sustainable design strategies and integration of solar technology of digital design and/or representation tools.
In particular the course will focus on the creative use of building integrated photovoltaic (BIPV), with emphasis in the creative process behind a successful application of solar panels in the context of contemporary design practices.
« Ombrières » photovoltaic car park

A concept designed and patented by Sunvie to bring value to your parking while offering solar and rain protection to your users.

It can be installed on new or existing parking lots.
8,000 m² of PV panels
1.15 MWp of installed power
1.4 GWh of electrical production

Saint Aunès: the largest Photovoltaic power plant in metropolitan France at time of inauguration…
Saint Aunès: the largest Photovoltaic power plant in metropolitan France at time of inauguration...
The Future of Refueling your Car!
Let’s use the potential!
Thank you for your attention!