Dow Performance Silcones and BIPV

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Key Facts About Dow

2016 Sales of $48.2 Billion

- 2016 sales: $48B
- 2016 Op. EBITDA\(^1\) of $9.8B
- 2016 Cash Flow from Operations of $5.5B
- ~56,000 employees
- >7,000 product families
- Sales in 175 countries

Corporate Stats

\(^1\) Operating EBITDA is defined as EBITDA excluding the impact of “Certain Items.” where “EBITDA” is defined as earnings (i.e., “Net Income”) before interest, income taxes, depreciation and amortization.
Narrower and Deeper Market Focus Enabled by Technology Platforms, Operational Excellence and Flexible Integration

ADVANTAGED BACK-INTEGRATION

- Ethylene
- Propylene
- Silicones

WORLD-CLASS SCIENCE AND ENGINEERING CAPABILITIES

- High-Throughput Research
- Catalyst Discovery & Ligand Synthesis
- Polymer Science
- Material Science
- Formulation Sciences
- Process Engineering
- High-Performance Computer Modeling
- Application Development

NARROWER, DEEPER END-MARKET PRESENCE

- Packaging
- Transportation
- Infrastructure
- Consumer
- Energy/Water
- Durables & Industrial

Consumer-Driven Demand in Core End-Markets Propels Growth, Driven By Sustainable Urbanization Trends in Emerging Geographies
Dow Corning within Dow

- Since 1 June 2016: Dow Corning fully owned by Dow Chemical
- Gradual integration
- Continued emphasis on innovation in silicones
- Includes some synergy projects that combine organic and silicone chemistries
# Rebranding: Company Name vs. Product Brand

<table>
<thead>
<tr>
<th>Company Name and Logo</th>
<th>Existing</th>
<th>Future</th>
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</thead>
<tbody>
<tr>
<td>Dow Corning Corporation</td>
<td>🟢 DOW CORNING</td>
<td>🟢 The Dow Chemical Company</td>
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<tr>
<td>or</td>
<td>🟢 DOW CORNING</td>
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<table>
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<tr>
<th>Accompanying Consumer-Facing Product Brand Logos</th>
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<tbody>
<tr>
<td>XIAMETER®, Molykote®, Multibase®, Dow Corning Toray, Silastic®</td>
<td>🟢 XIAMETER®</td>
<td>🟢 DOWSIL™</td>
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• Alternative cell encapsulants
• Electrically conductive adhesive for back-contact modules
• Conclusion
Silicone sealants used in buildings

In BIPV systems:
• Weatherproofing sealants
• Structural glazing sealants
• Adhesives for laminate bonding
Attaching laminate to support: frame sealants versus structural sealants

Frame sealant

Glass

Back-sheet

Structural Sealant

Structural Sealant

Structural Sealant

Structural Sealant
Example 1: Gaoxiong stadium (Taiwan)

- 8844 PV panels
- Provide 80% of stadium’s power consumption
- Used Dow Corning structural sealant for laminate bonding
Dow Corning SEED R&D building
Seneffe, Belgium

- Glass-glass laminates
- Bonding with Dow Corning silicone structural sealant
Silicone cell encapsulant

- Standard PV encapsulant: Ethylene Vinyl Acetate (EVA)
- Standard lifetime of EVA modules: 25 years
- Façades and roofs have longer lifetime
- Yellowing of modules is disturbing in BIPV systems
- Replacement of PV elements in integrated façade or roof is difficult

preferable to use alternative encapsulants that enable longer lifetime

- Polyolefin encapsulant
  - Sheet form → straight replacement for EVA
  - More durable than EVA

- Silicone encapsulant
  - Best durability
  - Liquid dispensing
Electrically conductive adhesive for back-contact modules

- BIPV favors modules with uniform appearance
- Back-contact cells are preferable
- Module shapes vary to fit roofs and facades
  Need for cell interconnecting technology suitable for complex geometries
- Solution: monolithic module integration of back-contact cells using patterned interconnecting foil
- Electrical joint material is critical for reliability and durability
- Silicone Electrically Conductive Adhesives particularly well suited
Conclusion

- Durability and reliability is even more important for BIPV than for conventional PV
- Silicone materials provide outstanding durability
- Dow Performance Silicones supply various important materials for BIPV:
  - Weatherproofing sealants
  - Structural glazing sealants
  - Adhesives for laminate bonding
  - Cell encapsulants
  - Electrically conductive adhesives