Get SUNplugged
Atmanirbhar (Self-reliant) Bharat
Creating a Solar Manufacturing Eco-system

Speakers

Moderated by

Mr. Prashant Mathur
Chief Marketing Officer
adani Solar

Mr. Sandip Mehta
Managing Director
adani Solar

Mr. Harshvardhan Govil
Chief Operating Officer

Mr. Akshat Doshi
Managing Director

Mr. Marjunath N Reddy
Managing Director

Mr. Swapnil Wadunj
Head - Marketing

VISHAKHA
OHMIC
BOROSIL

Date: Friday, May 29th, 2020 | Time: 4pm onwards
Speaker: Mr Sandip Mehta
Managing Director
GG Group
GG Cables and Wires India Pvt Ltd
Bangalore

A Unit of Gebauer & Griller Group
Austria
Established in 1940, Pioneers in manufacturing of copper winding wires, nickel alloy wires, PV ribbons and Cable Harness and Assembly for automotive and elevator industry
Bangalore Unit History

- Started in June -2010

- Launched PV Ribbon Manufacturing facility in Jan -2012, on market demand from customers (supply from Linz Plant)

- Bangalore unit is an ISO 9001:2015 certified organization

- Total employees: 200 plus
Strengths – Brand, Quality, Knowhow, Market Access

- GGI was the first high quality PV-ribbon maker in India (since 2011)
- Best & consistent quality in the domestic market
- Reputation allows export business too (profound market knowledge)
- Brand and Quality very well known in the Indian market as well as overseas
- L-shaped as well as I-shaped bus bar part of the production range
- Knowhow to run the lines at high speed and productivity levels and at low scrap rates
PV Ribbon Manufacturing Process

1. Raw Material Round copper wire
2. Wire Drawing
3. Round Copper Wire
4. Wire Rolling
5. Flat Copper Wire
6. Tinning
7. Tin alloy coated PV Ribbon
Quality of Raw Material

- The bare copper wires are rolled to the required dimensions on a state of the art rolling mill ensuring accurate dimensions and burr-free edges.

- Specific process and controls are applied from very first stage of production to maintain the properties of final product.

- Tin alloy is checked at incoming and ensuring the alloying elements are within the specified tolerances on a state of the art X-Ray machine.
Infrastructure & Machinery

State of the art PV Ribbon manufacturing machines and testing facility at Bangalore
Tin alloy Coating

- The tinning process is in-line with a **special heat treatment process** which guarantees...
  
  - Uniform annealing of copper which ensures controlled and consistent mechanical properties as per customer’s specifications
  
  - Continuous tin alloy coating thickness exactly according to the customer specifications.
On line Monitoring

- During the process the ribbon is monitored
- Special cameras to check the continuous coating on both sides of ribbon surface
- On line coating thickness by special Laser gauge.
Testing of PV Ribbons

- Following tests are carried out on state of the art testing machines
- Coating thickness (both sides)
- Alloy Composition
- Yield Strength
- Elongation
- Ultimate tensile strength
- Camber
Packing

➢ To make sure that the fragile material reaches customer’s site in good condition special care has been taken for packing

➢ Spools are vacuum packed to avoid dust and humidity and can be stored for longer period Specially designed wooden crates are used to avoid transit damages to spools
Speaker: Mr Akshat Doshi
Managing Director
Vishakha Renewables
Vishakha Renewables P Ltd, Vishakha Solar Films P Ltd & Vishakha Metals P Ltd

MSTPL, APSEZ, Mundra, Kutch District, Gujarat - 370435
Vishakha Group Companies

- Vishakha Polyfab
- Vishakha Irrigation
- Vishakha Industries
- Vigi Agrifilms
- Vishakha Renewables
- Vishakha Solar Films
- Vishakha Metals
Vishakha Group Companies

- **MATERIAL HANDLING SOLUTIONS**
- **HIGH BARRIER FLEXIBLE PACKAGING**
- **EVA ENCAPSULANT & BACK SHEET FILMS FOR SOLAR MODULES**
- **DRIP IRRIGATION SYSTEMS, PIPES & MDPE GAS PIPES**
- **PLASTIC AGRICULTURAL, INDUSTRIAL, SILAGE, POND, CANAL LINER AND FILMS**
Vishakha Renewables – EVA & POE Encapsulant

- Extrusion process
- German Technology
- Proven raw materials
- Near Zero shrinkage
- Clean room manufacturing
- Single dosing of additive
- Stringent Quality & reliability checks
Vishakha Solar Films – Solar Backsheets

- PVDF, PET & PVF based back sheets
- Lamination process
- Italian Technology
- Proven raw materials
- Proprietary Primer layer
- Clean room manufacturing
- Customized product – White, Black & Transparent type
- Stringent Quality & reliability checks
Vishakha Metals – Aluminium Frame

- Casting & Extrusion
- Aluminium alloy as per ASTM B221
- Uniform & precise anodizing
- Largest state of art Anodizing Plant of India
- Precise fabrication
- Stringent raw material QC
- Dimensional tolerance as per DIN EN 12020-2
Requirements of a solar module

- Physical protection
- Electrical insulation
- Increased efficiency
- Right appearance
- Moisture protection

Enabling a 25 year outdoor PV module lifespan

All most all the required properties of a solar modules are dependent on our products especially EVA & BS
Factors influencing the reliability of modules

- Mechanical impact
- Humidity / Moisture
- Heat, cold, partial shading
- Solar irradiation / UV
- Electrical load

Vishakha EVA & BS were tested upto 3X IEC standard, internally & also the modules manufactured with Vishakha EVA & BS has been awarded the TOP PERFORMER by DNVGL
## Proven properties of our products

<table>
<thead>
<tr>
<th>EVA</th>
<th>Backsheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Moisture proof</td>
<td>• Moisture proof</td>
</tr>
<tr>
<td>• Weather resistance</td>
<td>• Interlayer Adhesion</td>
</tr>
<tr>
<td>• Transparency</td>
<td>• Reflectance (white BS)</td>
</tr>
<tr>
<td>• Adhesion with Glass</td>
<td>• Transparency (Transparent BS)</td>
</tr>
<tr>
<td>• Adhesion with BS</td>
<td>• Adhesion with EVA</td>
</tr>
<tr>
<td>• PID free</td>
<td>• No yellowing</td>
</tr>
<tr>
<td>• Thermal Stability</td>
<td>• No polymer degradation</td>
</tr>
<tr>
<td>• No Discolouration</td>
<td>• UV withstanding</td>
</tr>
</tbody>
</table>

Each property listed above are the properties of each additive/raw material
We use proven & premium raw materials to ensure the best quality and reliability
Top performer: DNVGL/PVEL 2018 & 2019 score card

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Module Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adani (Mundra Solar)</td>
<td>ASP-7-xxx</td>
</tr>
</tbody>
</table>

3.3 Encapsulants

The list of PQP-Tested front encapsulants is the following:

1. Vishaka FC-II TP (thickness N/A)

The list of PQP-Tested rear encapsulants is the following:

1. Vishaka FC-II (thickness N/A)

3.5 Backsheets

The list of PQP-Tested backsheets is the following:

1. Vishaka PET (0.32mm)
### UL certification & File Nos

Vishakha Renewables P Ltd., File No : QIHE2 - E485922  
Vishakha Solar Films P Ltd., File No : QIHE2 - E487880

<table>
<thead>
<tr>
<th>S.N</th>
<th>EVA/POE Encapsulant *</th>
<th>BACKSHEET #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VISHAKHA FC I</td>
<td>VISHAKHA PET</td>
</tr>
<tr>
<td>2</td>
<td>VISHAKHA FC II</td>
<td>VISHAKHA PVDF</td>
</tr>
<tr>
<td>3</td>
<td>VISHAKHA FC II P</td>
<td>VISHAKHA PVF</td>
</tr>
<tr>
<td>4</td>
<td>VISHAKHA FC II TP</td>
<td>VISHAKHA PET 1500 V</td>
</tr>
<tr>
<td>5</td>
<td>VISHAKHA UFC II P</td>
<td>VISHAKHA PVDF 1500 V</td>
</tr>
<tr>
<td>6</td>
<td>VISHAKHA UFC II TP</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>VISHAKHA POE</td>
<td></td>
</tr>
</tbody>
</table>

* White EVA for better reflectivity  
# Available in White, Black & Transparent type

Certificate of Registration
Certificate No: 180630029102

This is to certify that the Environment Management System of

VISHAKHA SOLAR FILMS PRIVATE LIMITED

Plot 1 & 2, A-16, Sector 1, South of APL & CGPL, VI Tunda,
TA, MUNDRA, KUTCH, GUJARAT, INDIA

has been assessed and found to be in accordance with the requirements of

ISO 14001:2015

This Certificate is valid for the following scope

MANUFACTURING OF SOLAR BACK SHEET

(IAF Group- 19)

Initial Registration Date: 30th June 2018
Issue Date: 30th June 2018
1st Surveillance on or before 30th May 2019
Valid Until: 29th June 2019
2nd Surveillance on or before 30th May 2020
Revision: 00

UAF is a full member of International Accreditation Forum (IAF),
so check validity of this certificate please visit www.iasqindia.org
Why choose Vishakha?

• Make in India initiative – contributing to the Nation
• Vishakha Group: Decades of expertise in polymer processing
• Well equipped Quality and Research & Development lab
• Stringent Quality checks on EVA & Backsheet
• Proven & reliability tested, most reliable for module’s life
• Team of experts for after sales service
• Customised products – based on feedback
• Variety of optional products
• UL certified & TUV tested
Benefits of Indian supplier

- Made in India
- Less inventory
- Less inventory, hence less planning & better cash flow
- No LC opening cost
- Fast sales & service, available in next day or in 2 days
- No forex fluctuation issues
- No customs hassles & transhipment issues
- We employ currently 100+ employees, soon it will be around 300+
- We are also expanding, for every 1 GW of expansion, we will be employing 100 more employees from all over India,
  thus providing livelihood and also contributing to Indian economy
• Good demand for our products will also make way for companies to invest in manufacturing of raw materials for EVA & BS in India

• Chineese & Koreans are dominating the raw materials for EVA & BS

• Currently most of the raw materials of EVA and BS are being imported

• Good demand in EVA & BS will be make many companies to invest in raw material manufacturing in India itself

• If raw materials manufactured in India, ultimately price will be reduced

“the cycle of demand and supply chain in the country economy, is the strength which needs to be harnessed to its full potential“  : Honorable Prime Minister Shri. Narendra Modi
General appeal to promote India products, so that we can have good demand which will help us expand, also increase buying and selling power thus decreasing the cost of the products.

In these tough times Indian Industries need to stand together and promote Indian products and build infrastructure where we are self-sufficient and self-reliant.

“local is not just the need, it is our responsibility also “

: Honorable Prime Minister Shri. Narendra Modi
Few of our customers
Let's us Pladge to be
#Vocal for Local
AatmaNirbhar Bharat

Thank You
Speaker: Mr Harsh Vardhan Govil
Chief Operating Officer
Adani Solar
Creating a Solar Manufacturing eco-system
Mundra Solar PV Limited

Lets us Pledge to be #Vocal for Local
AatmaNirbhar Bharat

29th May 2020
Adani Group – Introduction

Mundra Electronic Manufacturing Cluster – Facilities & Connectivity

Fiscal Incentives
Dreaming big and aligning vision to needs of India

Our Vision

To be the globally admired leader in integrated infrastructure businesses with a deep commitment to nation building.

We shall be known for the scale of our ambition, speed of execution and quality of operation

Revenue of $15 Billion in FY 2019
Total assets of $30 Billion
17,000+ people
At more than 70 locations
Leadership positions in India across several sectors

**Largest Private Port Company**
- 17% Indian Cargo through our ports

**Largest Transmission Company**
- 11,000 Ckm

**Largest Solar Developer**
- 2.5 GW Solar Plants
- 150 MW Wind

**Largest Private Power Company**
- 12,438 MW

**Largest Solar PV manufacturer**
- 1200 MW

**Leading private player in Airports**
- 6 Airports*

*Successful bidder
Forming an unprecedented platform for industrialization in India

- LOGISTICS
- ENERGY
- AGRI
- REAL ESTATE
- RESOURCES

A footprint spread across the country

Multi-Modal Logistics and Warehousing

Land Acquisition

Required permitting for domestic and export use

Rapid Development of Qualified Labour

Uninterrupted Power – Full Stack
THermal | RENEWABLE | TRANSMISSION

Industry Quality Water

Policy and Incentive Advocacy

World Class Capital Project Management Capability
Content

Adani Group – Introduction

Mundra Electronic Manufacturing Cluster – Facilities & Connectivity

Fiscal Incentives
Electronic Manufacturing Cluster (EMC) at Mundra well developed to cater to the need of Potential Investors

- 650 Acres land exclusively ear-marked for IT/Electronic Investment
- Basket of Fiscal & Non-fiscal incentives are available to electronic manufactures interested to invest in this cluster
- The cluster is well supported by infrastructure and logistics facilities
- Adani is already operating state-of the art 1200 MW Solar PV manufacturing facility in this cluster
  - The facility is operated by >3500 Skilled workers
Infrastructure – Land, Power, Water & ETP

40000 Acres of Land

4500 MW Power Capacity

47 MLD Desal & 200 MLD Planned

2.5 MLD CETP & Clearance for 17854 MLD
Social Infrastructure

- 255 Ha Gated Residential Township with 6400 Apartments
- 100 bed Multi-speciality hospital
- Sports Facility- Gym, Indoor Game like Badminton, Table Tennis, Snooker etc.
- Multiple Education Institutes in the vicinity
- Convenience Stores, Open Air Theatres, Jogging and Cycling paths make for an excellent living
Connected to the World through multiple modes of Connectivity:

**Airport**
- Mundra Airstrip is a Licensed airport
- 1000 Ha earmarked for developing Logistic Hub, MRO and Terminal Buildings

**Railway**
- Existing Rail Network of 210 kms (including Mundra – Adipur line)
- Time and cost saving by virtue of distance advantage for Northern hinterland
- 7 Locomotives owned by APSEZL

**Road**
- Seamless connectivity across APSEZ zone.
- 120 Kms arterial and sub arterial roads & additional 30 Kms to be added soon.
- National Highway 8A Extension, State Highway 48 & State Highway 6 provide excellent external connectivity to APSEZ

**Port**
- 12 Multi Purpose Berths
- 9 Container Berths
- Mundra is connected to all global major consumption and industrial centres through shipping lines such as Mearsk, MSC, CMA CGA etc.
The global solar market in 2018 was dominated by Asia, accounting for over half of the world's addition of solar capacity. The region's installed solar capacity reached 280 GW by the end of 2018, dominated by China with 175 GW. Under the REmap scenario Asia would continue to lead global solar PV installations, with 65% of the total capacity installed by 2030.
The solar PV industry employed 3.6 million people worldwide in 2018 and this number is expected to rise further to 18.7 million people by 2050 in the REmap case.

Sources: IRENA (2019a, 2019j).
Top 10 countries for installations and total installed capacity in 2019

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Annual Installed Capacity</th>
<th>Cumulative Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>30.1 GW</td>
<td>204.7 GW</td>
</tr>
<tr>
<td>2</td>
<td>European Union</td>
<td>16.0 GW</td>
<td>131.7 GW</td>
</tr>
<tr>
<td>2</td>
<td>European Union</td>
<td>16.0 GW</td>
<td>131.7 GW</td>
</tr>
<tr>
<td>3</td>
<td>United States</td>
<td>13.3 GW</td>
<td>75.9 GW</td>
</tr>
<tr>
<td>3</td>
<td>Japan</td>
<td>9.9 GW</td>
<td>63 GW</td>
</tr>
<tr>
<td>4</td>
<td>Japan</td>
<td>7.0 GW</td>
<td>49.2 GW</td>
</tr>
<tr>
<td>5</td>
<td>Germany (EU)</td>
<td>4.8 GW</td>
<td>42.8 GW</td>
</tr>
<tr>
<td>6</td>
<td>Spain (EU)</td>
<td>4.4 GW</td>
<td>20.8 GW</td>
</tr>
<tr>
<td>7</td>
<td>Germany (EU)</td>
<td>3.9 GW</td>
<td>14.6 GW</td>
</tr>
<tr>
<td>8</td>
<td>Australia</td>
<td>3.7 GW</td>
<td>13.3 GW</td>
</tr>
<tr>
<td>9</td>
<td>Ukraine</td>
<td>3.5 GW</td>
<td>11.2 GW</td>
</tr>
<tr>
<td>10</td>
<td>Korea</td>
<td>3.1 GW</td>
<td>9.9 GW</td>
</tr>
</tbody>
</table>

Source: IEA PVPS
Product Offering
Adani was the top performer for all the above test by PVEL in 2020

<table>
<thead>
<tr>
<th>Test Performed</th>
<th>IEC Criteria</th>
<th>PVEL Criteria</th>
<th>PVEL's Test results Adani module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Cycling</td>
<td>200 cycles @ -40°C to +85°C</td>
<td>400 cycles @ -40°C to +85°C</td>
<td>2%</td>
</tr>
<tr>
<td>Dynamical Mechanical Load Sequence</td>
<td>Not part of IEC</td>
<td>1,000 cycles of alternating loading at 1,000 Pa + TC-50 + HF-10</td>
<td>2%</td>
</tr>
<tr>
<td>Potential Induced Degradation</td>
<td>96hrs @ 85% RH and 85°C – 1500V</td>
<td>2 cycles of 96hrs @ 85% RH and 85°C – 1500V</td>
<td>2%</td>
</tr>
</tbody>
</table>
Mono PERC Mono facial or P-PERC Bifacial

N- PERT Bifacial
Global Value Chain
China – Wafer + Cell + Modules Capacity

- China already is manufacturing way above the global demand.
- The global demand is increasing only by 5-8% YoY, but the Wafer-Cell-Module capacity ramp is more than 40% YoY leading to one country having a manufacturing capacity of 3 times the global demand.
- This would lead to serious dumping situation and tariffs are mandatory to sustain the Indian manufacturing sector.

Source: BNEF
**Contribution of Imports Vs Domestic Consumption - Indian Projects**

- Indian manufacturer’s contribution only 20% of the overall market requirement.
- Indian manufacturers had additional 80% manufacturing capacities unutilized.
- Indian manufacturers were not price competitive and unable to adhere to demand at appropriate times.
- Aggressive government policies eased pressure to encourage domestic off-take.
India is currently having module capacity to meet only its domestic demand. The module capacity can ramp up to higher capacities to meet export demand from EU, US, S.A, Africa and S.E Asia.

High deficit seen in Indian cell supply for even the local demand including DCR demand.

Demand Vs Supply deficit of nearly 200% to be bridged for India to be self sufficient.

Strong local Market Demands supported by various policies will drive the domestic Cell & Module manufacturing backed by ancillary units.
India has to bear a huge inbound logistics, Utility costs and higher BOM + conversion cost due to lack of local ecosystem.

China has VAT rebate and export subsidy that helps them reduce their ASP's.

The overall Chinese COP is 31% lesser than Indian COP which will have to be compensated through Tariffs.

India can reduce the COP by further expansion and economy of scale with better supply chain by another 9%.

The duty structure need to be varied between 30%-25%-20% YoY.
Policy Support

Finance, Lending and Taxation
- Solar Manufacturing Industry to be classified as part of Electronics sector instead of Power sector considered by Banks & Solar plant manufacturing to be considered as priority sector lending.
- Removing cross subsidy adjustment in Power tariff for solar manufacturing Industries.
- Interest on loan taken for Installing roof top solar plant to be treated as deductible from taxable income.
- Solar product to be listed in Interest subvention scheme issued by RBI

Government Incentives and subsidies
- Extending MSIPS Policy with higher rate of incentives including manufacturing units being set up under manufacturing linked development rights.
- Subsidised power [@ ~Rs.2 per unit] to be given to the industry to make it competitive with the other international players.
- Export incentive should be commensurate to the duty applicable in the destination country and the additional incentive should be provided to the entity as exemption of GST.

R&D
- Subsidy for development of New Technology. It can be in the form of grants for tie-ups with MNRE or research institutions in India.
- Assistance should be provided for new Solar Test Labs @ 50% of the project cost subject to max 2 Cr.
THANK YOU
Speaker: Mr Manjunath Reddy
Managing Director
DhaSh PV Technologies Pvt. Ltd.
DhaSh PV Technologies Pvt. Ltd.
Bangalore, INDIA

Aatmanirbhar (Self Reliant) Bharat
Creating a Solar Manufacturing Eco-System

Manjunath N Reddy
Managing Director
DhaSh PV Technologies Pvt. Ltd
29-05-2020
Why Self-Reliant?

- Promote indigenous supplies
- Minimize dependency on import
- Uptrend to economic growth
- More employment
- Accountability on quality of supplies
- Potential growth in overseas market
- Vocal for Local (Create a global brand)

- Anti-dumping duty on import parts
- Subsidiary support for product certification for MSME i.e IEC, UL, BIS, CE and International standards
- Subsidiary support on capital investment
- Include components in DCR projects
- Implementation of BIS standard for components
About us...

DhaSh PV Technologies Pvt Ltd. is the manufacturer of high quality & high-performance PV Junction Boxes, Cables & Connectors with the State of Art Manufacturing facility of 2GW at Bangalore, India.

Robust in-house processes & systems, high grade testing equipment and stringent quality checks have catered enormous confidence among our clients throughout India.

With our manufacturing excellence and the Pan-India supply chain, sales & distribution, we are the preferred choice in Indigenous Products & Solutions.
Self Reliant >> Self Target

• Moving towards 5GW of installed fully automated manufacturing capacity by Oct 2020. Ready to support India’s installed capacity to the maximum.

  › Creating 1000+ employments opportunity in India with increased manufacturing capacity.

  › Localization and Backward integration of Import components, thereby reducing dependency on import.

आत्मनिर्भर भारत

5 GW

1000+

Made in India
Our Products...

Product Name: **Non-Potted Junction Box**
- DSJB07y-1500 VDC/15A, 20A, 24A/Clamping type
- DSJB08y-1500 VDC/15A, 20A, 24A/Soldering type

- High grade engineering plastics with superior RTI compared to industry average products.
- Usage of special dual chip SMT type diodes for less voltage drop, better heat dissipation and high mechanical strength.
- Rated Current of up-to 24A, suitable for Series-Parallel (SP) connection of SPV Modules used in 12V system
- Ideal for roof-top & stand-alone systems.

Product Name: **Fully-Potted Junction Box**
- DSJB13-1500 VDC/20A/Solder type

- Superior heat dissipation ability of module (inside JB) compared to diode (T0)
- Temperature rise ability of module is better than that of axial (R6)
- Engineered with excellent switching ability of module compared to axial (R6).
- Ideal for large scale ground mounted utility projects.
Our Products...

Product Name: **Spilt Junction Box**
- DS JB12-1500 VDC/15A/Soldering type

- High grade engineering plastics with superior RTI compared to industry average products.
- Usage of special dual chip SMT type diodes for less voltage drop, better heat dissipation and high mechanical strength.
- Ideal for Glass to Glass and Half cut cells Twin panels.

**PV Connector 1.5 KV DC, 35A**

- Usage of High-Grade Engineering Plastics with superior RTI value, giving a robust design
- Compatible with MC4 Connectors.
- Current carrying capacity of 35A.
- Can be used with both 4sq.mm & 6sq.mm cables.
- Complete in-house manufacturing
### Comparison: Our Product Vs Competitors

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Conditions</th>
<th>Units</th>
<th>Dhash Product</th>
<th>Other Competitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability</td>
<td>UL94/746C</td>
<td>V-0</td>
<td>Black</td>
<td>0.75mm V-0, 2.5MM 5VA</td>
<td>1 mm V-0, 2.5MM 5VA</td>
</tr>
<tr>
<td>CTI</td>
<td>IEC60112</td>
<td>Volts (max)</td>
<td>600V</td>
<td></td>
<td>225V</td>
</tr>
<tr>
<td>CTI</td>
<td>IEC60112</td>
<td>PLC Rank</td>
<td>0</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>RTI</td>
<td>UL 746B</td>
<td>Elec/Inp/Str (1.5mm)</td>
<td>°C</td>
<td>110</td>
<td>105</td>
</tr>
<tr>
<td>BPT</td>
<td>UL 746A</td>
<td>3.0 mmt</td>
<td>°C</td>
<td>125</td>
<td>120</td>
</tr>
<tr>
<td>BPT</td>
<td>IEC 60695</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GWIT</td>
<td>IEC 60695</td>
<td>0.8mmt</td>
<td>°C</td>
<td>850</td>
<td>825</td>
</tr>
<tr>
<td>Outdoor Suitability</td>
<td>UL 746C</td>
<td></td>
<td></td>
<td>F1</td>
<td>F1</td>
</tr>
</tbody>
</table>

- Higher quality insulation materials
- Higher water resistance and better insulation resistance
- Higher mechanical stability
- Worldwide delivery at favourable terms
- High quality and long life time
- High flexibility and bending capability of the cables

### Certifications

- TÜV Rheinland CERTIFIED
- UL®
Thank You
**Speaker:** Mr Swapnil Walunj  
Head Marketing  
Borosil Renewables
Aatmanirbhar Bharat - Creating a Solar manufacturing ecosystem
In the midst of every crisis, lies great Opportunity

- Albert Einstein

Join us in the journey towards

Be Vocal about Local

Economy  Infrastructure  System  Vibrant Demography  Demand

Let’s make in India with Pride, Passion and Precision

BOROSIL renewables

Made in India since 1962

India’s 1st and only solar glass manufacturer who can supply a 100% import substitute product
1. Aatmanirbhar Bharat

2. How to create a robust domestic solar manufacturing ecosystem
   - Reliability
   - Capability
   - Quality
   - Policy Framework and support
   - Collaboration
1. Aatmanirbhar Bharat

2. How to create a robust domestic solar manufacturing ecosystem
   • Reliability
   • Capability
   • Quality
   • Policy Framework and support
   • Collaboration
CREATING A SOLAR MANUFACTURING ECOSYSTEM

AATMANIRBHAR BHARAT
A ROBUST SOLAR MANUFACTURING ECOSYSTEM

- RELIABILITY
  - Scale and availability
  - Cost competitiveness

- CAPABILITY
  - Innovation
  - Products for future

- POLICY FRAMEWORK & SUPPORT
  - Incentives
  - Ensuring a level playing field

- QUALITY
  - Competing on global standards

- COLLABORATION
  - Skill-development
  - Technological solutions to the issues being faced by the Industry
1. Aatmanirbhar Bharat

2. Aatmanirbhar Bharat: From the perspective of manufacturing Solar glass domestically
   - Reliability
   - Capability
   - Quality
   - Policy Framework and support
   - Collaboration
Three Generations of BOROSIL Group:
Mr. B.L Kheruka
Mr. Pradeep Kheruka
Mr. Shreevar Kheruka

The Borosil group: From Consumer products to Solar glass

Consumer Products
Scientific, Industrial & Laboratory Glassware
Pharmaceutical Packaging

Borosil Group - Net Sales (in USD Mn)

Borosil Ltd. Turnover
Borosil Renewables Turnover

Continuing a journey on path of high growth through innovation and customer centricity
OUR STATE-OF-THE-ART MANUFACTURING FACILITY

Our State-of-the-art manufacturing facility spread over around **100 acres** at Bharuch, Gujarat with Solar glass production and processing capacity of **2.5 GW per annum** with accreditations for ISO 9001:2015, ISO 14001:2015 and ISO 45001: 2018 from TUV Rheinland
BOROSIL’s BHARUCH FACTORY
DEMAND SUPPLY SCENARIO OF SOLAR GLASS IN INDIA

- The average annual installed capacity in India during recent years has been around 7-8 GW.
- The annual solar capacity addition as per Government’s plan is 20 GW.
- As per our estimates, the installed module manufacturing capacity in India is around 12 GW.
- There exists a substantial opportunity to develop the ecosystem to cater to this demand which will percolate down to create demand for other components of solar modules.

- The demand for solar glass for domestic manufacturing of modules in the recent years has been about 5.0 GW.
- The demand in 2020 is expected to come down to 3.5 GW considering the impact of COVID-19.
EXPANSION PLANS

• As India’s only Solar glass manufacturer, Borosil Renewables have recent expanded
  ➢ by commissioning a new furnace with a capacity of 230 TPD in August’19
  ➢ and rebuilt first furnace to a higher capacity of 210 TPD in Dec’19.

• Presently, Borosil has an installed capacity of **440 TPD or 2.5 GW per year**

• Plans for further expansion are being considered as following resources are available adequately:
  ➢ Land
  ➢ Associated infrastructure like Power, Gas, Water etc.
  ➢ Finances

• All the necessary raw material to manufacture solar glass is available in India. Hence, from the perspective of strategic sourcing, it is important that the solar glass is manufactured in India ensuring timely delivery and competitive cost.
1. Aatmanirbhar Bharat

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**PRODUCT PORTFOLIO AND FEATURES**

A journey of **innovation and continuous improvement** to offer **value added products**

<table>
<thead>
<tr>
<th>Glass Composition</th>
<th>Borosil Solar Glass</th>
<th>/</th>
<th>Borosil Solar Glass without Antimony</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Shakti</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Selene</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glass Thickness</td>
<td>2.0 mm</td>
<td>2.5 mm</td>
<td>2.8 mm</td>
</tr>
<tr>
<td>Customized sizes</td>
<td>Glass for 96/72/60 cells module (and other sizes specified by the customer)</td>
<td>Glass for Small Area Modules (SAMglass)</td>
<td></td>
</tr>
</tbody>
</table>
Honourable Prime Minister of India
Mr. Narendra Modi

Message from Hon. Prime Minister on the occasion of inauguration of 2 MM Fully Tempered solar glass facility

World’s 1st company to produce 2 mm fully tempered solar glass
SOLAR PV MARKET IS MOVING TOWARDS THINNER GLASS

- Bifacial modules
- Glass to glass modules
- Frameless modules

In order to achieve the optimum module weight, the Solar PV market is moving towards use of thinner glass.
FULLY TEMPERED THINNER GLASS UP TO 2 MM

- Unique features:
  - **Higher transmission**
  - **Enhanced mechanical strength**
  - **Long term durability with least degradation**

- Most suitable for the following applications:
  - Bifacial / Glass-to-glass frameless modules
  - Floating solar applications
  - Building Integrated PV (BIPV)

- Benefits of 2.8 mm and 2.5 mm solar glass
  - **Lighter modules** will reduce the requirement of mounting structures leading to **project cost optimization**
  - Very good mechanical strength, > 175 Mpa **(Standard 90 Mpa as per EN 12150-1)**

Some of our customers have **already obtained certification** for 2.8 and 2.5 mm glass

Withstood > **180 Mpa**
(Standard **90 Mpa** as per EN 12150-1)

**4 POINT BENDING TEST**

Kg/Sq. mtr.

- >15% ↓
- >20% ↓
- >35% ↓

---

<table>
<thead>
<tr>
<th>Thickness (mm)</th>
<th>3.2</th>
<th>2.8</th>
<th>2.5</th>
<th>2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg/Sq. mtr.</td>
<td>&gt;4</td>
<td>&gt;5</td>
<td>&gt;6</td>
<td>&gt;7</td>
</tr>
</tbody>
</table>
## INNOVATIONS BY BOROSIL IN SOLAR GLASS

### Shakti: High Efficiency Solar glass in matt-matt finish
- Recently developed a solar glass with matt finish on both sides
- **Higher module output up to 0.5%**
- Higher transmission = Higher output by the modules = **Higher IRR**
- Transmission value reaching higher than 94% with use of an appropriate AR Coating
- **No changes necessary in certification of BoM** (bill of material) due to usage of matt-matt glass in place of prismatic-matt glass

### “Selene” Anti-glare Solar glass for PV projects near airports
- Reflection/glare from the PV modules installed near Airports may interfere pilot or airport staff’s visibility.
- Glare can cause a brief loss of vision/Flash blindness for a period of 4–12 s. Glare is a safety concern!
- In Dec’19 Borosil launched **Selene** SPF’s test results indicate that Borosil’s antiglare glass is suitable for airport installations

### NoSb Era: Antimony-free solar glass by Borosil
- No other forms of flat glass today contains Antimony. Only solar glass does.
- It leaches out of glass like sugar from a candy stick
- Borosil is the only solar glass manufacturer in the world who has been able to successfully remove the Antimony from Solar glass
- Based on these field trials and the certification from SPF, it is absolutely clear that modules with **Antimony free glass give a superior performance** as compared to modules made using glass with Antimony.

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**ANTIMONY IN SOLAR GLASS IS POISONOUS!**

Induces respiratory problems  
Interferes with gastrointestinal functions  
Causes skin problems  
Causes DNA damage  
Breaks down chromosomes in human leukocytes  
Causes reproductive  
Cardiogenic

**ANTIMONY IS MORE DEADLY THAN ARSENIC!**
### VALUE TO THE CUSTOMERS THROUGH DIFFERENTIATED PRODUCTS

#### ENGINEERED FOR LONG TERM DURABILITY
- Low sodium. Low PID (potential induced degradation)
- High chemical durability: superior glass performance
- Very High hydrolytic resistance

<table>
<thead>
<tr>
<th>Wavelength range (nm)</th>
<th>Supplier</th>
<th>380 - 780</th>
<th>380 - 1100</th>
<th>380 - 2500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Borosil</td>
<td>91.76%</td>
<td>91.68%</td>
<td>91.31%</td>
</tr>
<tr>
<td></td>
<td>Company X</td>
<td>91.73%</td>
<td>91.51%</td>
<td>91.00%</td>
</tr>
<tr>
<td></td>
<td>Company H</td>
<td>91.74%</td>
<td>91.58%</td>
<td>91.08%</td>
</tr>
<tr>
<td></td>
<td>Company Y</td>
<td>91.41%</td>
<td>91.39%</td>
<td>91.18%</td>
</tr>
</tbody>
</table>

#### ENHANCED MECHANICAL STRENGTH
- Withstood > **180 Mpa**, *(Standard 90 Mpa as per EN 12150-1)*
- 2 x more strength than heat-strengthened glass
- 4 x more strength than annealed glass

#### HIGHER TRANSMISSION

- **BOROSIL’S FULLY TEMPERED GLASS IS SAFER AND STRONGER**
  - Tempered glass has a breakage of small particles
  - Much safer than the large & sharp pieces resulting from broken heat strengthen glass

![Graph showing light transmission](image)

Normal heat strengthen glass  
Borosil’s fully tempered glass
1. Aatmanirbhar Bharat

2. Aatmanirbhar Bharat: From the perspective of manufacturing Solar glass domestically

- Reliability
- Capability
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- Collaboration
BEST-IN-CLASS MANUFACTURING EQUIPMENT

ANNEALING LEHR – CNUD, BELGIUM

PRECISION CUTTING LINE – GRENZEBACH, GERMANY

HIGH QUALITY GLASS WASHING

AR COATING PROCESS IN A CLEAN ROOM

GLASS TRANSMITTANCE CHECK BY PERKIN ELMER, USA

AUTOMATIC GLASS LOADING, GERMANY
NEW GENERATION TEMPERING LINE

Trend setting technology that fully tempers glass which floats on an air cushion
ENVIRONMENT FRIENDLY PRODUCTS AND OPERATIONS

• **Low carbon footprint:**
  - We are able to save 22% energy in comparison with the default score for glass manufacturing in Life Cycle Assessment. This value is the **best value so far for glass manufacturing** as per M/s. Solstyce, a French institute.
  - Use of electricity from Wind farms (1.5 MW) and 1 MW Roof-top and 3.5 MW ground mounted solar plants in development stage.

• **Low fuel consumption:**
  - With advance technology able to deliver better yield of the product with low energy consumption with a specific energy of 1200 SFC.
  - Energy efficient fore-hearth supplied by ZED-Tec, UK.

• **Pollution control measures taken:**
  - Bag filters – For fine dust control.
  - Close loop water circuit system- For water treatment and reuse of water.
  - Installed sewage treatment plant.
CERTIFICATIONS

➢ Product Certification
  • EN 410
  • SPF P1 CLASS
  • CE MARKING
  • EN 12150-1
  • EN 12600
  • EN 572-9
  • IEC 61215
  • SPF Certification for Anti-glare glass

➢ System Certifications
  • ISO 9001 :2015
  • ISO 14001 :2015
  • ISO 45001: 2018

➢ Other Certifications
  • Export House Certificate (1 star)
  • Export certificate of recognition by Govt. of India
  • AEO certificate by Govt. of India (Tier 1 category)
CUSTOMER SATISFACTION

PAN-India Presence with a significant global footprint

Most of the Indian module manufacturers have approved our Solar glass and obtained BIS certification with Borosil solar glass

We have maintained a high customer satisfaction consistently
1. Aatmanirbhar Bharat

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## COMPETITIVE LANDSCAPE: MANUFACTURING IN CHINA

<table>
<thead>
<tr>
<th>Capital Cost</th>
<th>Finance Cost</th>
</tr>
</thead>
</table>
| • Local govt. provides  
  - land & ready-to-occupy buildings on lease basis or at subsidized rates  
  - Power and other utilities at plant boundary  
  • Project Finance at 0-5% per annum interest loans with long tenures by government along with grants.  
  • Plant and machinery designed and fabricated locally  
  • Huge advantage of scale for project savings  
  • Hence, the total project cost in East-Asian countries is lower by around 15-25% than other East-Asian countries. | • Lower interest rates of 2-4%; with easier terms  
• Local governments extend tax rebates & tax holidays for 7-10 years which is huge benefit |

<table>
<thead>
<tr>
<th>Operational Cost</th>
<th>SGA / Marketing &amp; Logistics costs</th>
</tr>
</thead>
</table>
| • Low Operational cost due to  
  - Majority raw material sourced locally (benefit of huge scale)  
  - Low inventory cost (Just-in-time); many a times suppliers are across the fence, integrated manufacturing complexes (SEZs)  
  - Subsidies cost of utilities like Power, Gas and water | • Product performance Insurance: Available from local / global insurance companies at low cost  
• Low Logistics cost: Well established and low transportation costs; available at short distances  
• Exim Benefits: Available with buyer’s credit finance mechanism |

The manufacturers of tempered solar glass in China get direct subsidy benefits up to 18% for the exports
AATMANIRBHAR BHARAT: TO ENSURE LEVEL PLAYING FIELD

Policy support to ensure the level playing field

• Availability of land and other infrastructure and speedier issuance of necessary permissions

• Reduction of cost of utilities
  – To cover Natural Gas used in Industries as fuel in **GST regime** (presently there is a 6% VAT which is not eligible for credit)
  – Permission to install Solar/Wind power plants to the extent of **100% of the contract demand** (presently it is restricted to 50% contract demand)
  – **Direct subsidy to retail and agricultural customers**, and linking tariff of bulk consumers to actual “cost to serve” reducing the burden of cross subsidy on them

• Domestic Content Requirement today covers only domestically manufactured modules and Cells, this needs to be extended to other components of solar PV value chain. Making truly “Made in India” solar PV modules.

• To bring uniformity in duty structure applicable for SEZ and DTA so that the SEZs buy from local manufacturers

• Additional incentives for exports

• Anti-dumping duty to counter the market-distorting subsidies by certain countries
2. Aatmanirbhar Bharat: From the perspective of manufacturing Solar glass domestically

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COLLABORATION

• Increased collaboration between academia and industry

• Collaboration between the companies to provide the technological solutions to the key issues being faced by the industry like
  
  ➢ Impact of soiling
  
  ➢ Performance degradation of solar modules
  
  ➢ Use of technology and data for quality improvement during manufacturing and better O&M

• Creation of mechanism/program by the government (like Front Runner Program in China or development HJT/IBC in Europe) to accelerate the development of new products with higher efficiency. This will help meet the ultimate objective of making renewable power available at the lowest possible cost.

• Skill-development with support from Governments
An investment isn’t an investment if it hurts the planet……

For further enquiries, please contact:

swapnil.walunj@borosil.com, sales.lig@borosil.com
Thank You