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Atmanirbhar (Self-reliant) Bharat

Creating a Solar Manufacturing Eco-system

Moderated by

Mr. Prashant Mathur
Chief Marketing Officer
adani Solar

Speakers

Mr. Sandip Mehta
Managing Director
GG

Mr. Harsh Vardhan Govil
Chief Operating Officer
adani Solar

Mr. Akshat Doshi
Managing Director
VISHAKHA

Mr. Manjunath N Reddy
Managing Director
DhaSh

Mr. Swapnil Walunj
Head - Marketing
BOROSIL renewables

Date: Friday, May 29th, 2020 | **Time:** 4pm onwards

adani
Solar

Speaker: Mr Sandip Mehta

Managing Director

GG Group

gg-group.com

COMPANY PRESENTATION

PV Ribbons

PV RIBBONS

GG Cables and Wires India Pvt Ltd
Bangalore

A Unit of Gebauer & Griller Group
Austria

- Headquarters
- Production Plants
- Sales, Design & Engineering Offices

Established in1940, 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

Bangalore Unit

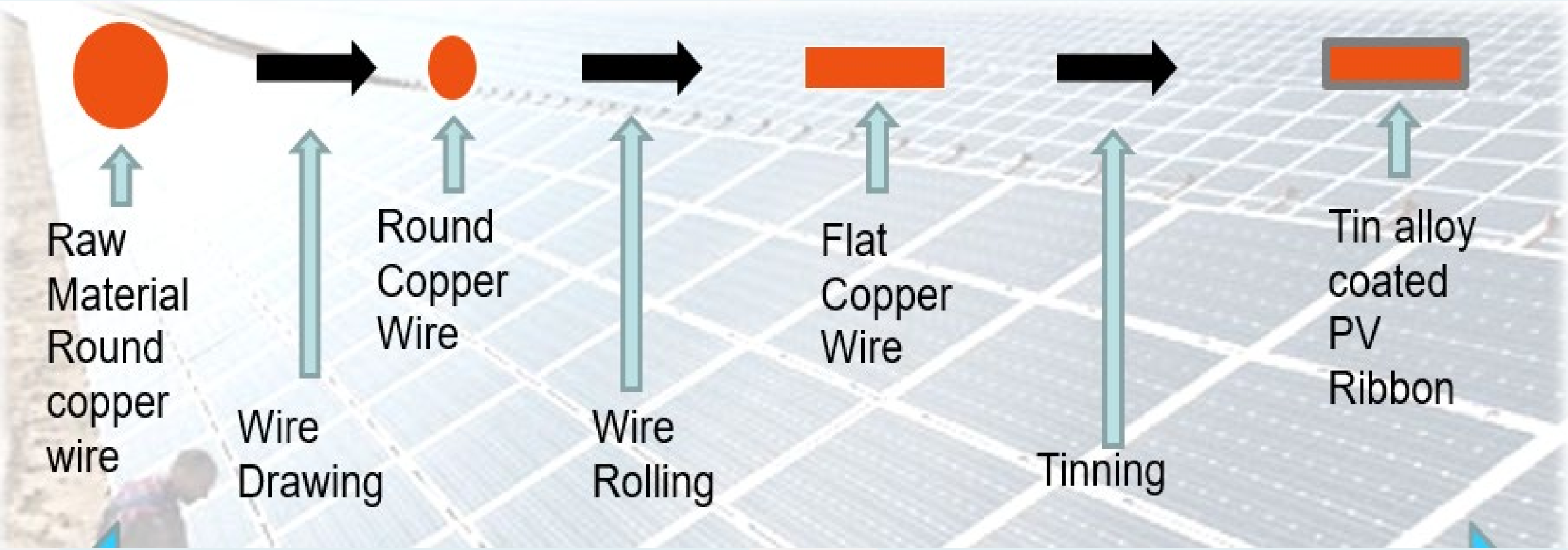
Bangalore Harness Section

Bangalore PV Section

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



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

gg-group.com

Thank you!

Gebauer & Griller Kabelwerke Gesellschaft m.b.H.
Muthgasse 36 | 1190 Wien | Austria

adani
Solar

Speaker: Mr Akshat Doshi

Managing Director

Vishakha Renewables

VISHAKHA
Group
Dedicated to innovation

Vishakha Renewables P Ltd,
Vishakha Solar Films P Ltd &
Vishakha Metals P Ltd

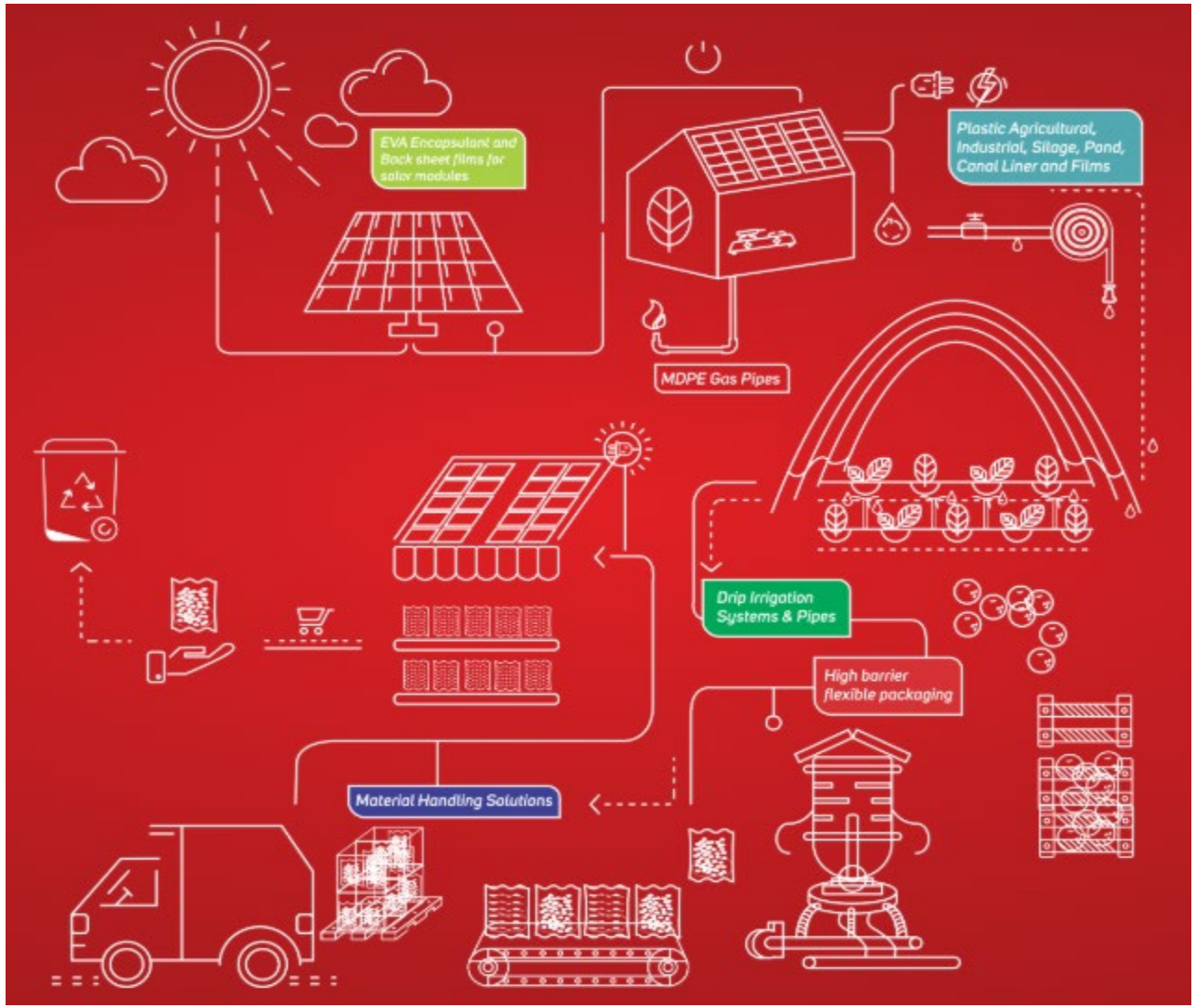
MSTPL, APSEZ, Mundra, Kutch District, Gujarat - 370435

VISHAKHA®

Vishakha Group Companies

- Vishakha Polyfab
- Vishakha Irrigation
- Vishakha Industries
- Vigi Agrifilms

- Vishakha Renewables
- Vishakha Solar Films
- Vishakha Metals



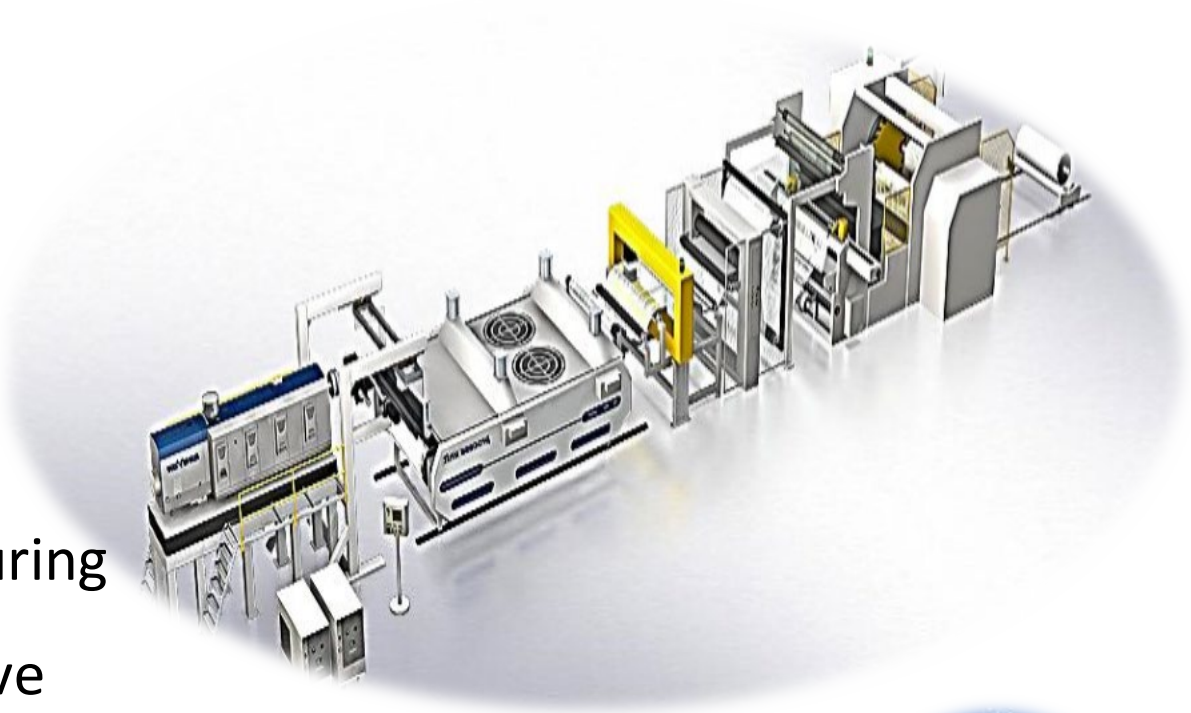
VISHAKHA®

Vishakha Group Companies

VISHAKHA®

Vishakha Renewables – EVA & POE Encapsulant

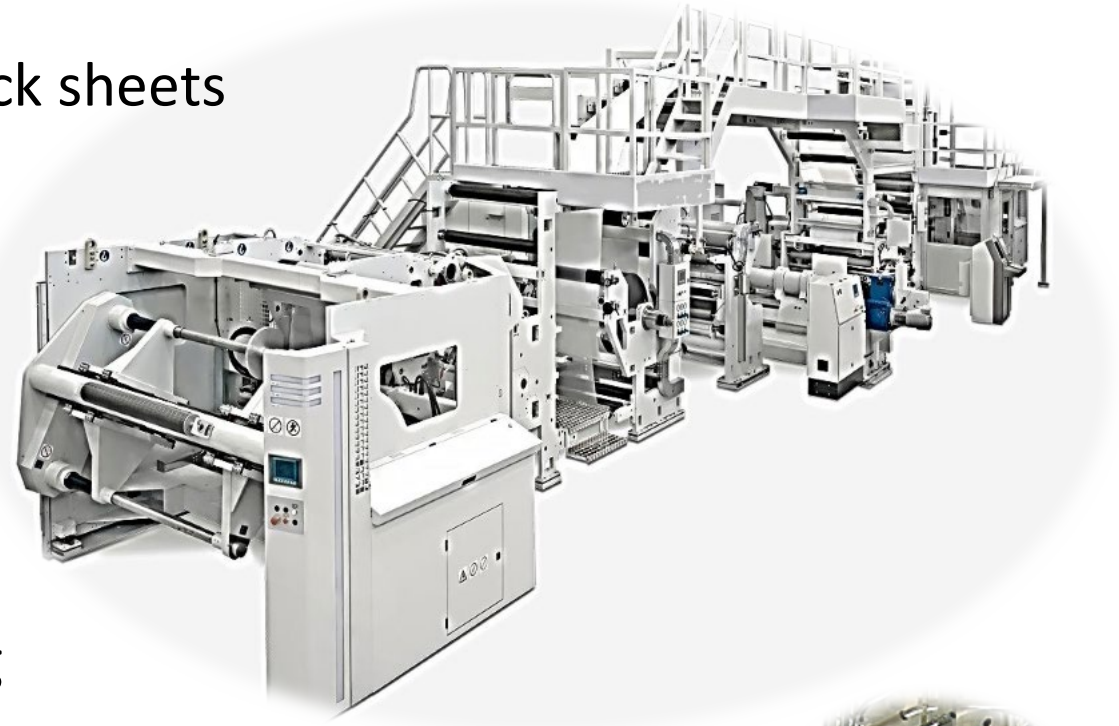
- Extrusion process
- German Technology
- Proven raw materials
- Near Zero shrinkage
- Clean room manufacturing
- Single dosing of additive
- Stringent Quality & reliability checks



VISHAKHA®

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



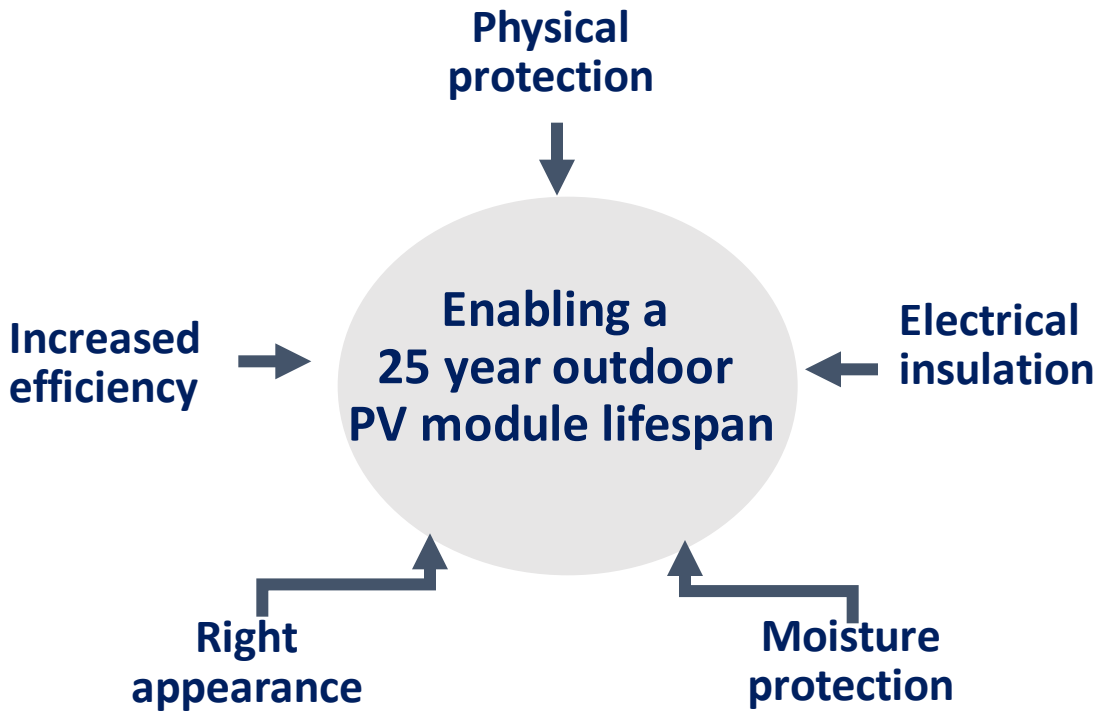
VISHAKHA®

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

VISHAKHA®

Requirements of a solar module

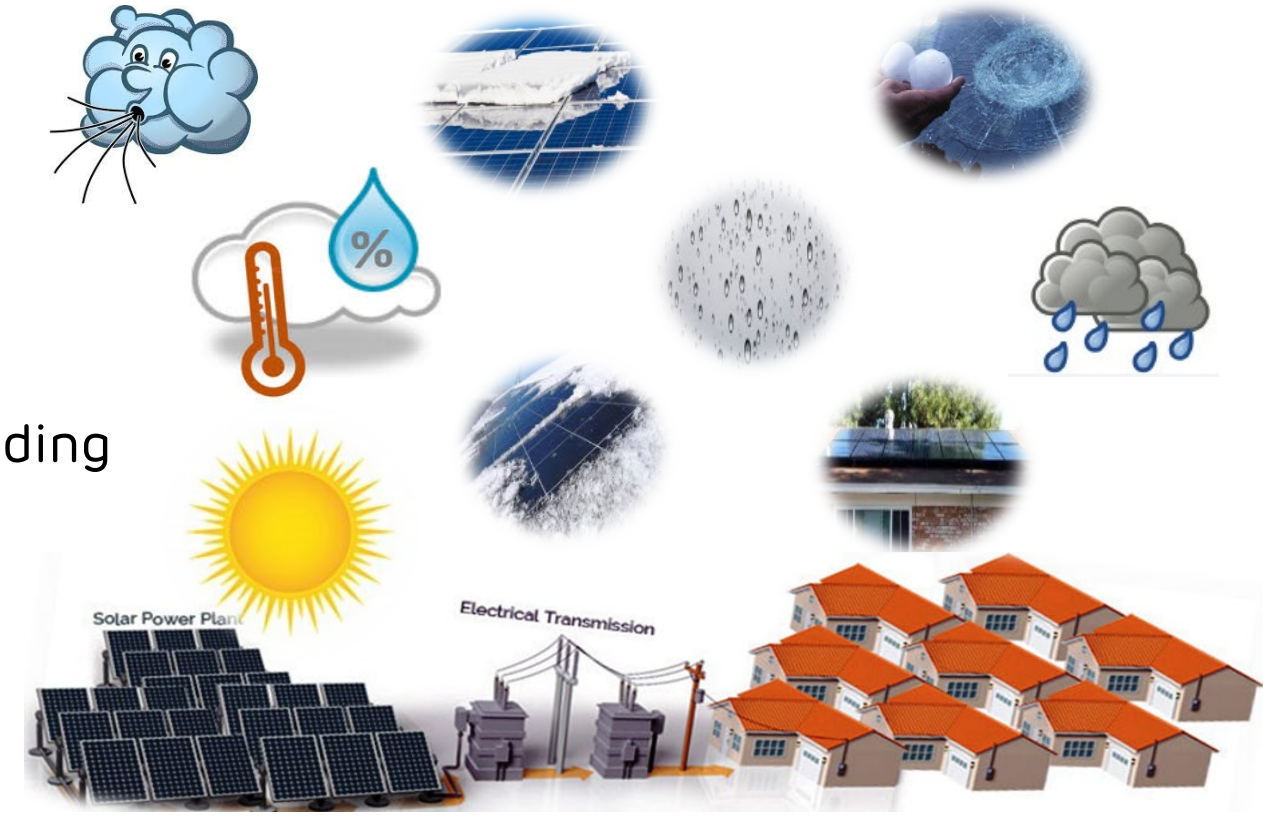


All most all the required properties of a solar modules are dependent on our products especially EVA & BS

VISHAKHA®

Factors influencing the reliability of modules

- Mechanical impact
- Humidity / Moisutre
- 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

VISHAKHA®

Proven properties of our products

EVA

- Moisture proof
- Weather resistance
- Transparency
- Adhesion with Glass
- Adhesion with BS
- PID free
- Thermal Stability
- No Discolouration

Backsheet

- Moisture proof
- Interlayer Adhesion
- Reflectance (white BS)
- Transparency (Transparent BS)
- Adhesion with EVA
- No yellowing
- No polymer degradation
- UV withstanding

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

VISHAKHA®

Top performer : DNVGL/PVEL 2018 & 2019 score card

DNV·GL

Manufacturer	Module Model
Adani (Mundra Solar)	ASP-7-xxx

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)

VISHAKHA®

UL certification & File Nos

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

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

S.N	EVA/POE Encapsulant *	BACKSHEET #
1	VISHAKHA FC I	VISHAKHA PET
2	VISHAKHA FC II	VISHAKHA PVDF
3	VISHAKHA FC II P	VISHAKHA PVF
4	VISHAKHA FC II TP	VISHAKHA PET 1500 V
5	VISHAKHA UFC II P	VISHAKHA PVDF 1500 V
6	VISHAKHA UFC II TP	
7	VISHAKHA POE	

*** White EVA for better reflectivity**

 # Available in White, Black & Transparent type

VISHAKHA®

Vishakha Renewables ISO 9001:2005 & 14001:2015

CERTIFICATE OF COMPLIANCE

ICS

INTERNATIONAL CERTIFICATION SERVICES PVT. LTD.

This is to certify that the

QUALITY MANAGEMENT SYSTEM of

VISHAKHA RENEWABLES PVT. LTD.

Plot no. IND-15, MSTPL, Sector-01, South of APL/CGPL Power Plant, Near EMC Bridge, Tunda Village, Adani Port & Special Economic Zone, Taluka - Mundra, District - Kutch 370 435, Gujarat, India

has been assessed and registered as complying with the requirements of the following International Standard:

ISO 9001:2015

The Quality Management System applicable to:

Scope : Manufacturing and Supply of EVA Encapsulants.

Registration No.	: RQ91/9939
Registered Date	: 11th May, 2018
Issue Date	: 21st May, 2018
Expiry Date	: 10th May, 2021

JAS-ANZ

IAF

Director

International Certification Services Pvt. Ltd.

Accredited by Joint Accreditation System of Australia and New Zealand

Validity of this certificate is based on periodic audits of the management system defined by the above scope and is contingent upon prompt, written notification of significant changes to the management system and/or its components thereof shall be immediately communicated to ICS.
Further clarifications regarding the scope of this certificate and the applicability of ISO 9001:2015 requirements may be obtained at www.icsasian.com

22/23, Goodwill Premises, Swastik Estate, 178 CST Road, Kalina, Santacruz (E), Mumbai – 400 098, Maharashtra, India. Tel.: 022-42200900

TNV

Certificate of Registration

Certificate No: 180630029101

This is to Certify that the Environment Management System of

VISHAKHA RENEWABLES PRIVATE LIMITED

PLOT # IND 15, MSTPL, SECTOR 1, SOUTH OF APL & CGPL, NR. EMC BRIDGE, VI. TUNDA, TA. MUNDRA, DI. KUTCH, GUJARAT, INDIA

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

ISO 14001:2015

This Certificate is valid for the following scope

"MANUFACTURING OF EVA AND POE FILMS"

(IAF Group- 14)

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 full member of International Accreditation Forum (IAF), to check validity of this certificate please visit www.isoindia.org

United Accreditation Foundation
3510,Colmar,Norfolk, VA 23509,
United States of America

Pragyesh Singh, CEO
TNV Certification Pvt Ltd
CIN: U74900UP2011PTC046719
Accredited by United Accreditation Foundation (UAF)

Registered Office: TNV House, 537-B/187-B, Amber Vihar, Lucknow-20 India, Ph: +91-522-2786527-28, Mail: info@isoindia.org

VISHAKHA®

Vishakha Solar Films ISO 9001:2005 & 14001:2015

CERTIFICATE OF COMPLIANCE

ICS

INTERNATIONAL CERTIFICATION SERVICES PVT. LTD.

This is to certify that the
QUALITY MANAGEMENT SYSTEM of

VISHAKHA SOLAR FILMS PVT. LTD.

Plot No. IND 10-11A, MSTPL, Sector-01, South Of APL/CGPL Power Plant, Near EMC Bridge, Tunda Village, Adani Port And Special Economic Zone, Taluka - Mundra, District - Kutch – 370 435, Gujarat, India.

has been assessed and registered as complying with the requirements of the following International Standard:

ISO 9001:2015

The Quality Management System applicable to:

Scope : Manufacture and Supply of Solar Back Sheet.

Registration No. : RQ91/9938
Registered Date : 11th May, 2018
Issue Date : 21st May, 2018
Expiry Date : 10th May, 2021

JAS-ANZ

IAF

Director
International Certification Services Pvt. Ltd.

Accredited by Joint Accreditation System of Australia and New Zealand

Validity of this certificate is based on periodic audits of the management system defined by the above scope and is contingent upon prompt, written notification of significant changes to the management system and/or its components thereof shall be immediately communicated to ICS.
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22/23, Goodwill Premises, Swastik Estate, 178 CST Road, Kalina, Santacruz (E), Mumbai – 400 098, Maharashtra, India. Tel.: 022-42200600

Certificate of Registration

Certificate No: 180630029102

This is to Certify that the Environment Management System of

VISHAKHA SOLAR FILMS PRIVATE LIMITED

PLOT # IND 10 & 11A, MSTPL, SECTOR 1, SOUTH OF APL & CGPL, VI. TUNDA, TA. MUNDRA, DI. KUTCH, GUJARAT, INDIA

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

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 full member of International Accreditation Forum (IAF),
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UAF

United Accreditation Foundation
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Validity of this certificate is subject to continued compliance of the management system standard and successful completion of audit as planned by TNV from time to time. Further clarification regarding the scope of this certificate and the applicability of standard may be obtained by consulting the organisation. This certificate remains property of the TNV and must be returned on request.

VISHAKHA®

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

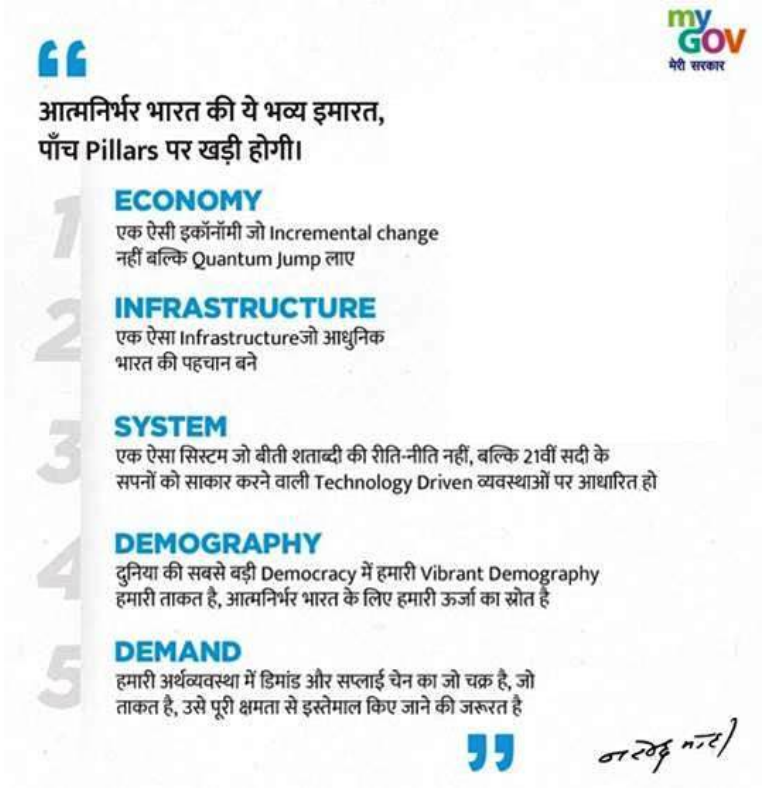
VISHAKHA®

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

Aatmanirbhar Bharat : Demand – one of the 5 pillars

- Good demand for our products will also make way for companies to invest in manufacturing of raw materials for EVA & BS in India



- Chienese & 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 manfacturing 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**

VISHAKHA®

Be “vocal” for “local” : Promoting MADE IN INDIA

- 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-suffecient and self-reliant

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

: **Honorable Prime Minister Shri. Narendra Modi**

VISHAKHA®

Few of our customers

GOLDI™

adani™

JAKSON™
EMPOWERING PEOPLE

PV POWER TECH
Energizing a sustainable future

RAYZON™
GREEN ENERGIES

OWN THE SUN

SONALI SOLAR

navitassolar

sanelite
Technologies Private Limited

Ankursolar®
SOLAR PANELS • PV SYSTEM INTEGRATOR • EPC

Lubi

SOVA SOLAR®

Himalayan Solar
Power Solution for a Shining Future

powertrac

Lets us Pladge to be

#Vocal for Local

AatmaNirbhar Bharat

Thank You

adani
Solar

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

Content

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

Uninterrupted Power – Full Stack
THERMAL | RENEWABLE | TRANSMISSION

Multi-Modal Logistics and Warehousing

Industry Quality Water

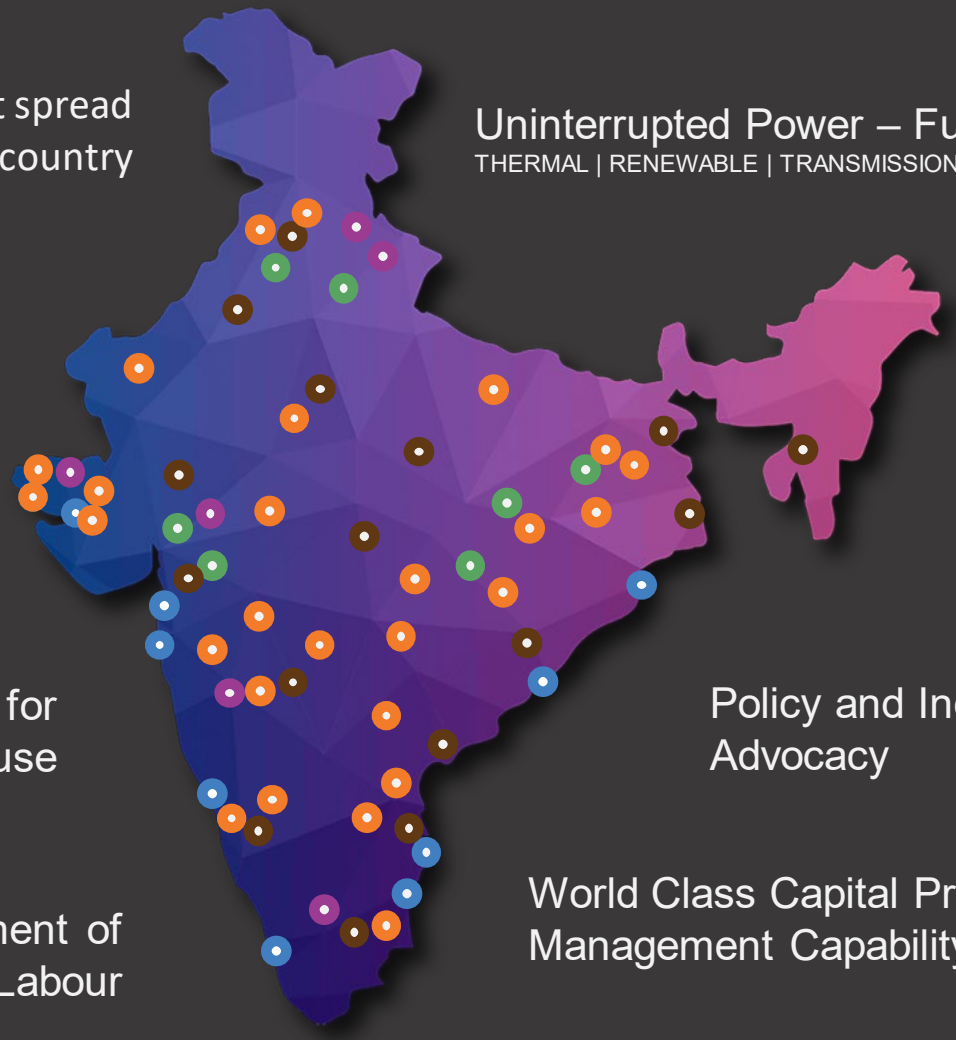
Land Acquisition

Required permitting for domestic and export use

Policy and Incentive Advocacy

World Class Capital Project Management Capability

Rapid Development of Qualified Labour



Content

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 17&54 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

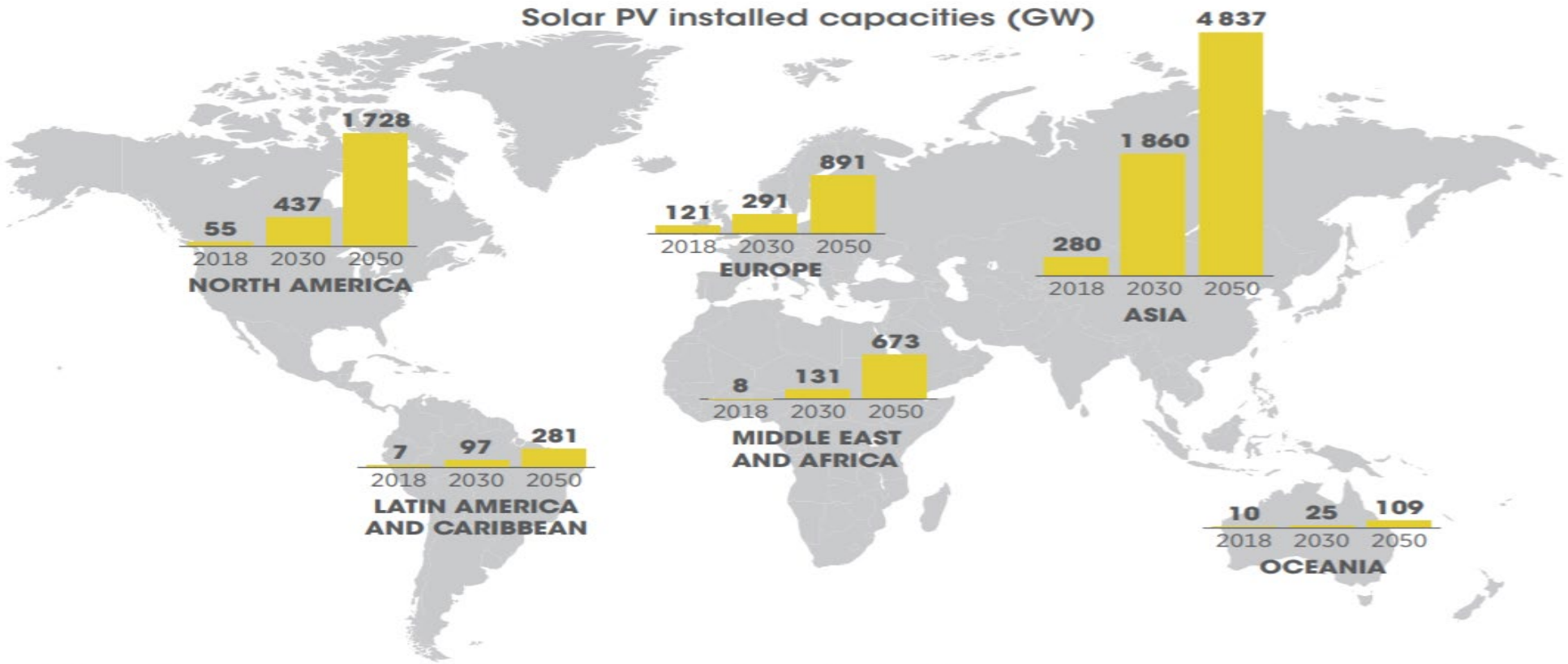
- Seamless connectivity across APSEZ zone.
- 120 Kms arterial and sub arterial roads & additional 30 Kms to be added soon.
- National Highway 8A Extension, State Highway 48 & State Highway 6 provide excellent external connectivity to APSEZ

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.

Solar PV installed capacities (GW)

Among the world's regions, Asia is poised to dominate global solar PV installations in the REmap scenario, followed by North America and Europe



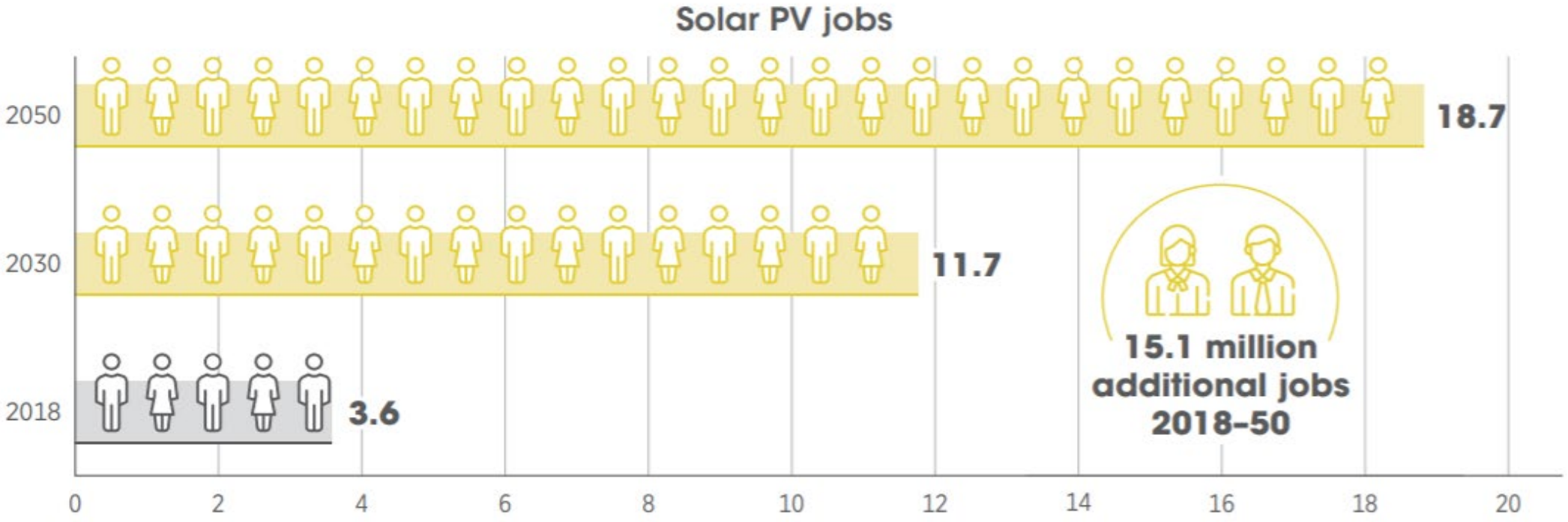
Disclaimer: *The designations employed and the presentation of material herein do not imply the expression of any opinion on the part of IRENA concerning the legal status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries*

Sources: Historical values based on IRENA's renewable energy statistics (IRENA,2019c) and future projections based on IRENA's analysis (2019a).

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

SOLAR PV SECTOR EMPLOYMENT

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

	FOR ANNUAL INSTALLED CAPACITY			FOR CUMULATIVE CAPACITY		
1		China	30,1 GW	1	China	204,7 GW
(2)		*European Union*	*16,0 GW*	(2)	*European Union*	*131,7 GW*
2		United States	13,3 GW	2	United States	75,9 GW
3		India	9,9 GW	3	Japan	63 GW
4		Japan	7,0 GW	4	Germany (EU)	49,2 GW
5		Vietnam	4,8 GW	5	India	42,8 GW
6		Spain (EU)	4,4 GW	6	Italy (EU)	20,8 GW
7		Germany (EU)	3,9 GW	7	Australia	14,6 GW
8		Australia	3,7 GW	8	UK (EU in 2019)	13,3 GW
9		Ukraine	3,5 GW	9	Korea	11,2 GW
10		Korea	3,1 GW	10	France (EU)	9,9 GW

Source: IEA PVPS

Product Offering

Poly Crystalline Module for Large scale and rooftop PV installation

Adani was the top performer for all the above test by PVEL in 2020

Test Performed	IEC Criteria	PVEL Criteria	PVEL's Test results Adani module
Thermal Cycling	200 cycles @ -40^{0}C to +85^{0}C	400 cycles @ -40^{0}C to +85^{0}C	2%
Dynamical Mechanical Load Sequence	Not part of IEC	1,000 cycles of alternating loading at 1,000 Pa + TC-50 + HF-10	2%
Potential Induced Degradation	96hrs @ 85% RH and 85°C – 1500V	2 cycles of 96hrs @ 85% RH and 85°C – 1500V	2%

Certifications:

IEC 61215 / 61730 / 61701 / 62716 / 62804; UL1703 / CEC (California)Listed

Mono PERC Mono facial or P-PERC Bifacial

Lower LCOE
Higher IRR

N- PERT Bifacial

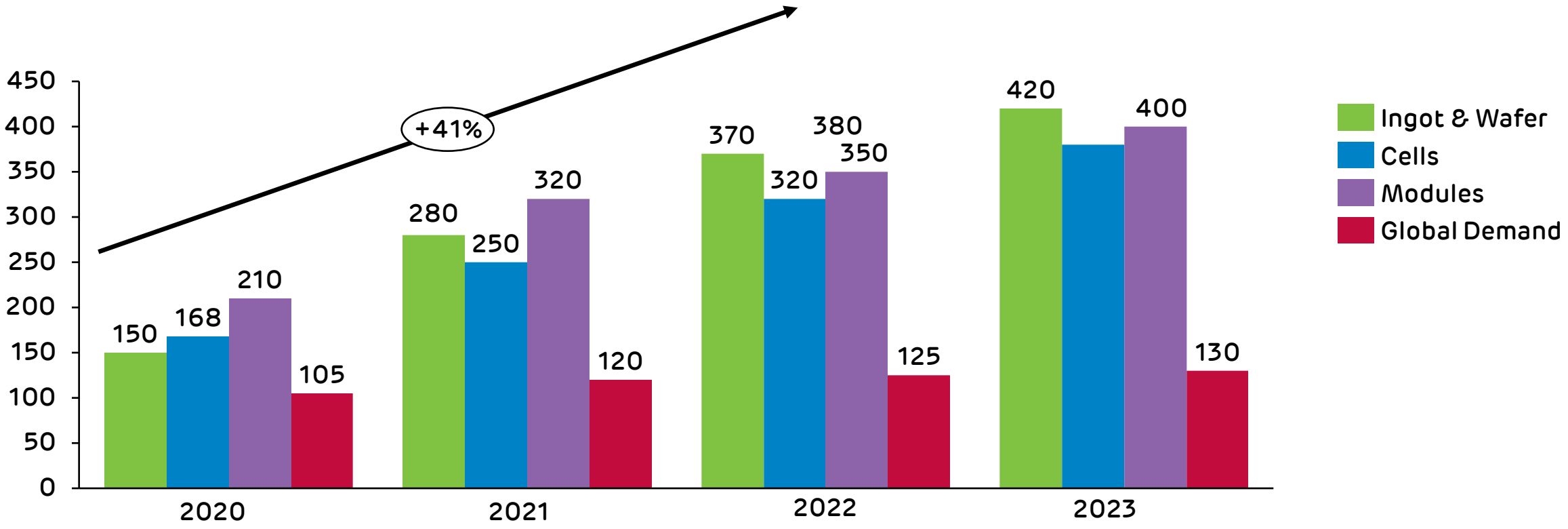
Lowest LCOE
Highest IRR

Certifications:

IEC 61215 / 61730 / 61701 / 62716 / 62804; UL1703 / CEC (California)Listed

Global Value Chain

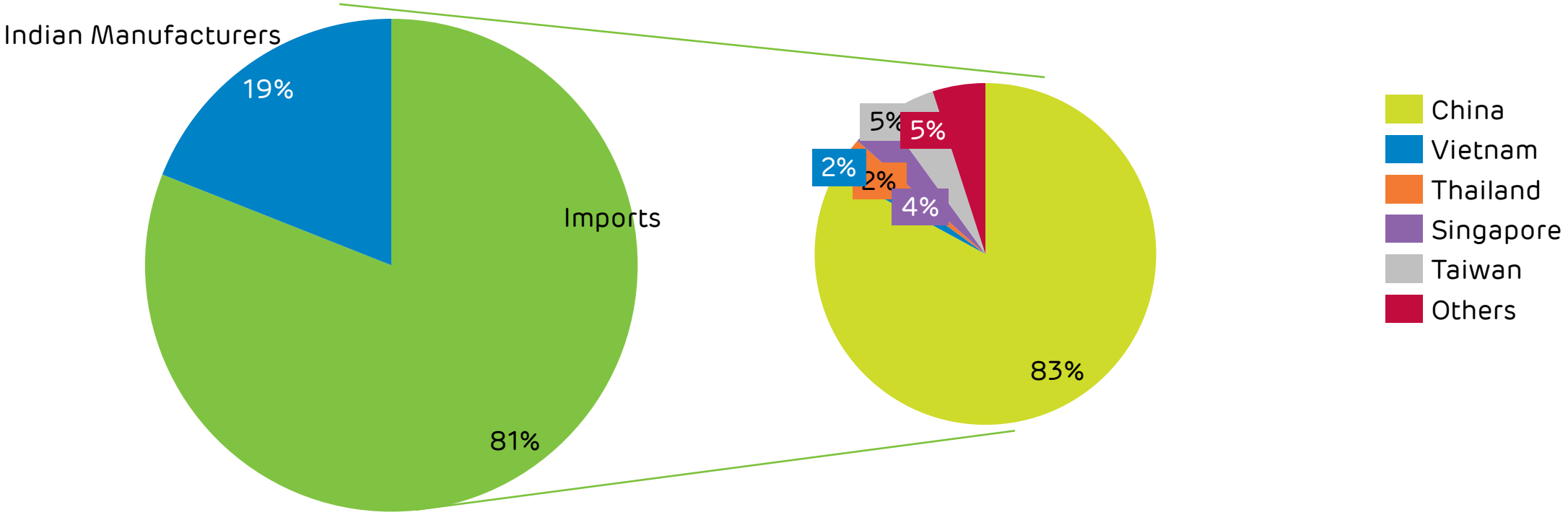
China – Wafer + Cell + Modules Capacity



Source:-BNEF

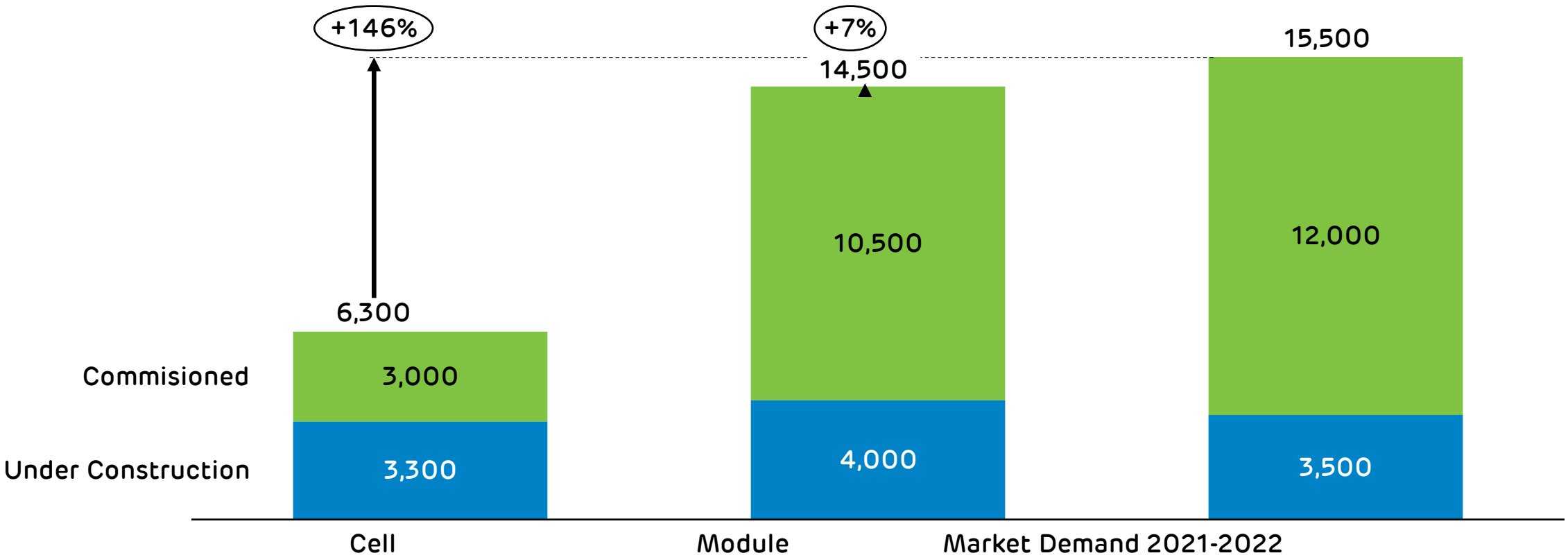
- China already is manufacturing way above the global demand.
- The global demand is increasing only by 5-8% YoY, but the Wafer-Cell-Module capacity ramp is more than 40% YoY leading to one country having a manufacturing capacity of 3 times the global demand.
- This would lead to serious dumping situation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

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.

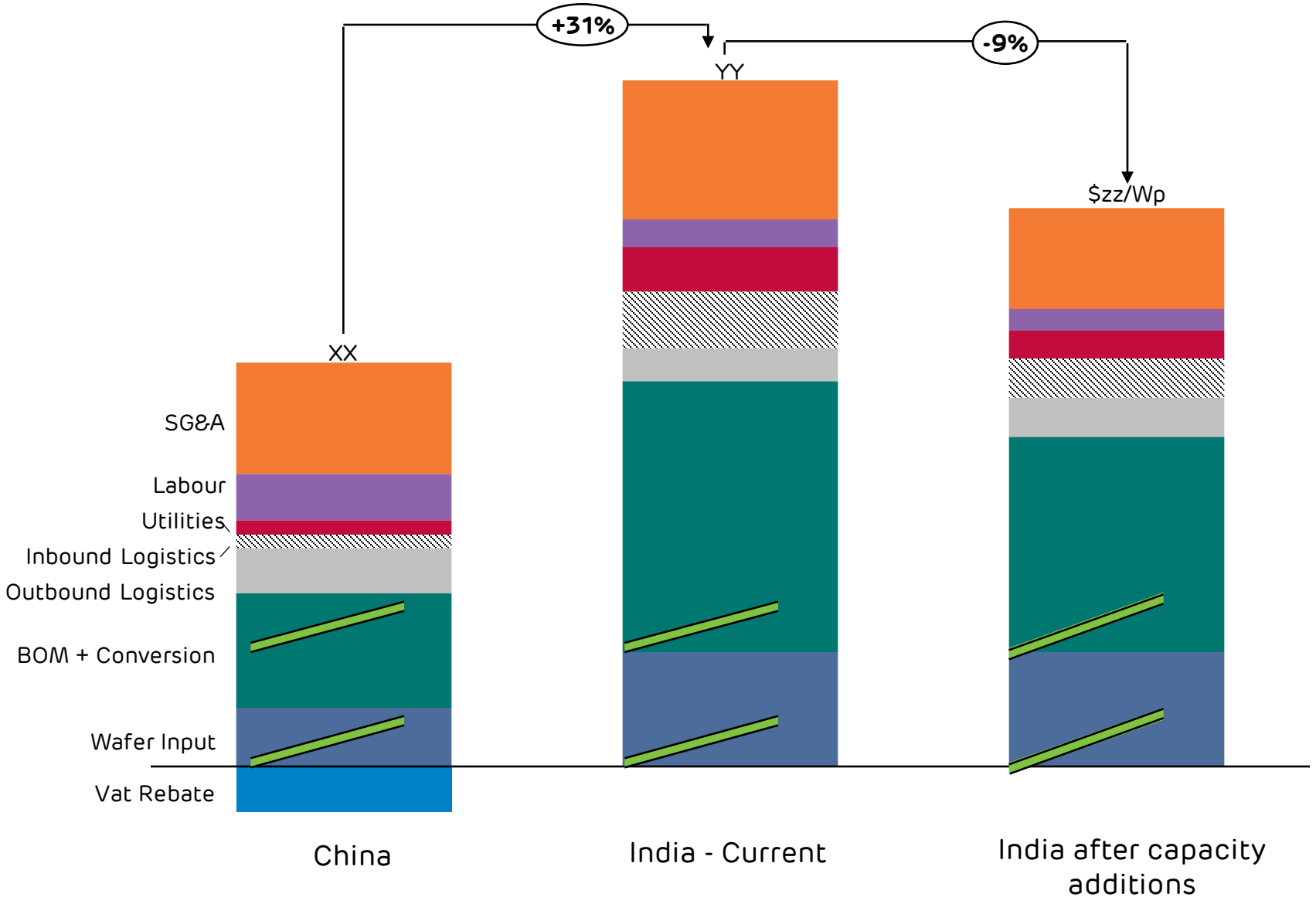
Cells & Module Manufacturing Unit – India as of Q4 2019



- India is currently having module capacity to meet only it's 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.

Source: BloombergNEF.

Comparison between India / China COP



- India has to bear a huge inbound logistics , Utility costs and higher BOM + conversion cost due to lack of local eco-system.
- 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

adani
Solar

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

5 GW

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

1000+

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

Made in India

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

आत्मनिर्भर भारत

Our Products…

24A rated JB
first time in the industry

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**

- **DS JB13-1500 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

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

Certifications

- 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

Thank You

Address: Plot No 110/D | 8th Cross | Phase 2 | Bommasandra Industrial Area Bengaluru – 560 099
Contact: +91 98805 11221 | Email: reddy.manjunath@dhashtec.com

adani
Solar

Speaker: Mr Swapnil Walunj

Head Marketing

Borosil Renewables

BOROSIL renewables

INTEGRITY CUSTOMER FOCUS RESPECT CONTINUAL IMPROVEMENT ACCOUNTABILITY SAFETY

OUR VISION IS TO BE THE MOST CUSTOMER-CENTRIC COMPANY IN INDIA

Aatmanirbhar Bharat - Creating a Solar manufacturing ecosystem

15 slides: 15 mins

Webinar on 29th May 2020

AATMANIRBHAR BHARAT

BOROSIL®

Made in India since 1962

BOROSIL renewables

Making Solar glass in India since 2010

India's 1st and only solar glass manufacturer who can supply a 100% import substitute product

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

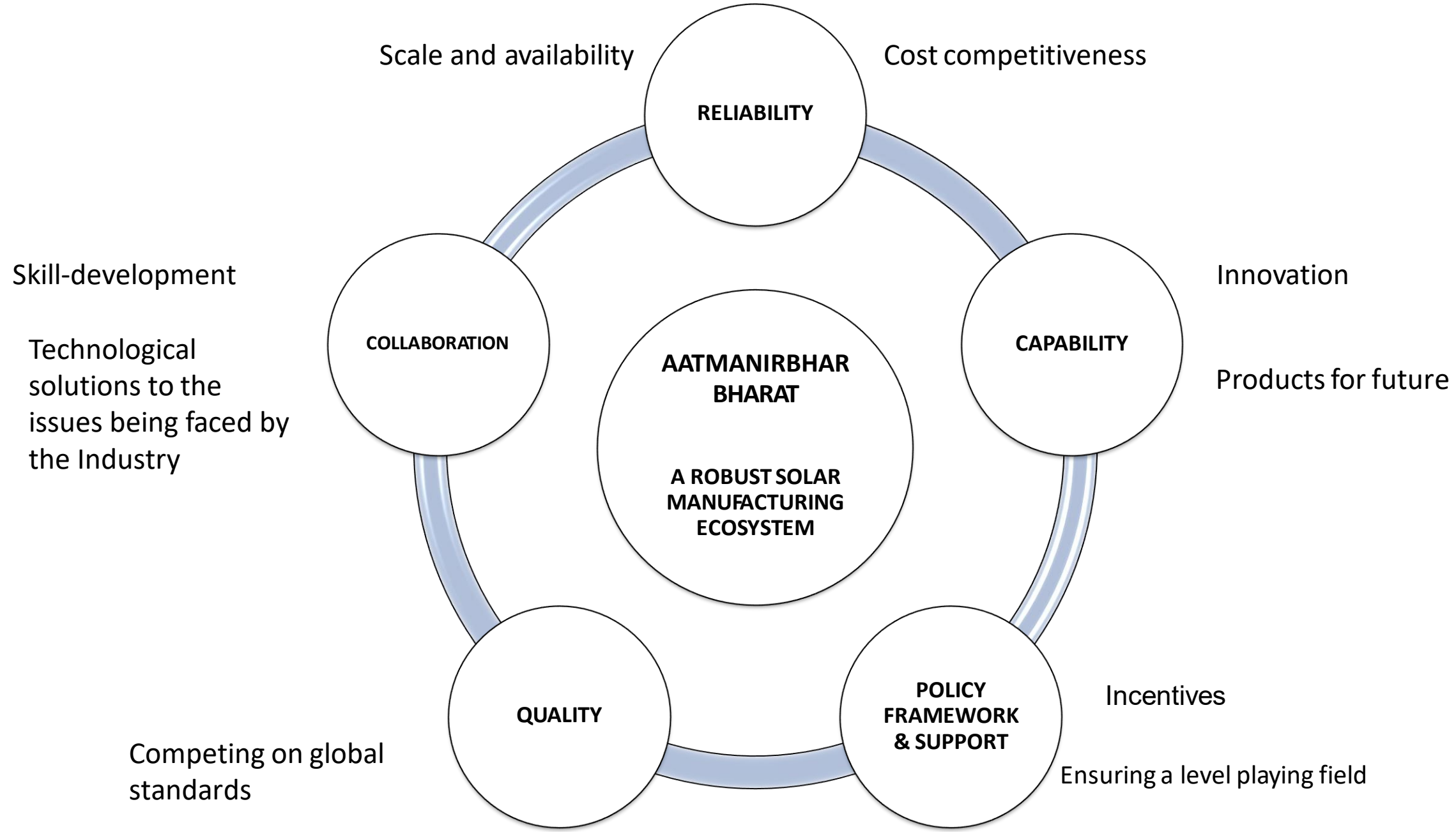
AGENDA

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

1

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



2

1. Aatmanirbhar Bharat

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

   - **Reliability**
   - Capability
   - Quality
   - Policy Framework and support
   - Collaboration

THE BOROSIL GROUP: LEADERSHIP GUIDING CONSISTENT GROWTH

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

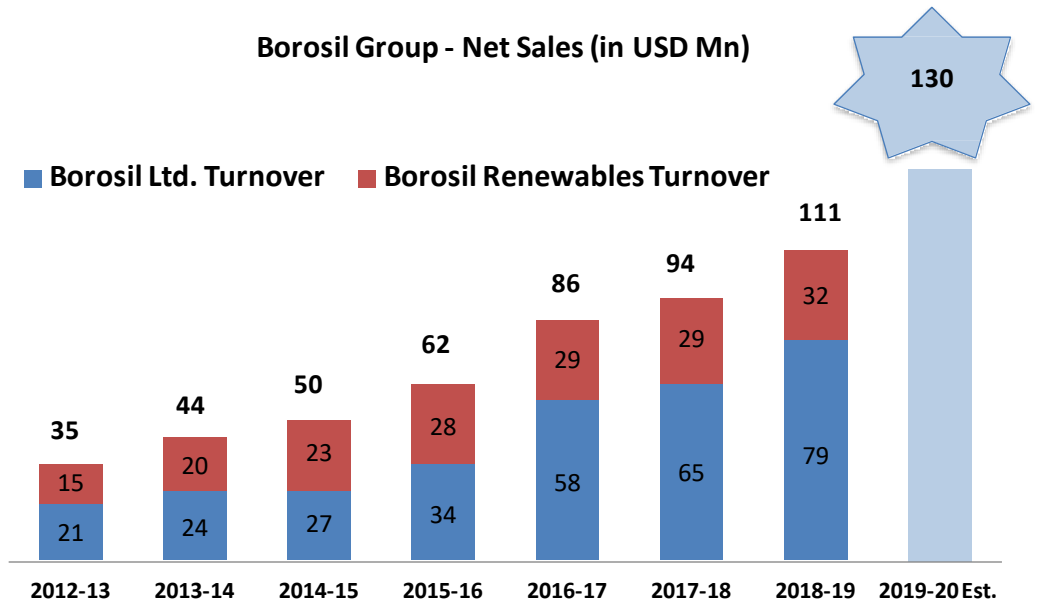
Scientific, Industrial & Laboratory Glassware

Pharmaceutical Packaging

High Performance Textured Solar Glass

Borosil Renewables Ltd.

(Formerly known as Borosil Glass Works Ltd in which Gujarat Borosil Ltd. has amalgamated)



Continuing a journey on path of high growth through innovation and customer centricity

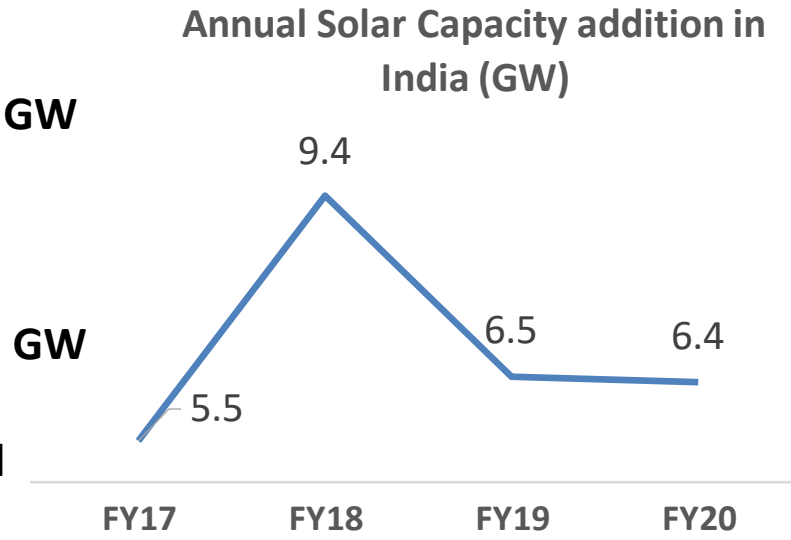
OUR STATE-OF-THE-ART MANUFACTURING FACILITY

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.

3

1. Aatmanirbhar Bharat

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

   - Reliability
   - **Capability**
   - Quality
   - Policy Framework and support
   - Collaboration

PRODUCT PORTFOLIO AND FEATURES

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

Glass Composition	**Borosil Solar Glass** / **Borosil Solar Glass without Antimony** NoSbEra				
Enhanced Features	High Efficiency Matt-Matt finish **Shakti**	Anti-glare Solar Glass ***Selene***	Anti Reflective (AR) Coating	Anti Soiling (AS) Coating	AR+AS Coating
Glass Thickness	2.0 mm	2.5 mm	2.8 mm	3.2 mm	4.0 mm
Market Segments	High Performance Solar Glass for PV	High Performance Green House	Solar Rooftop	Bifacial, Glass-glass, BIPV	Solar Thermal
Customized sizes	Glass for 96/ 72/ 60 cells module (and other sizes specified by the customer)		Glass for Small Area Modules (SAM glass)		

PIONEERING ACHIEVEMENTS

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

प्रधान मंत्री
Prime Minister

New Delhi
04 October, 2017

Shri Pradeep Kheruka,

I congratulate Gujarat Borosil Limited on having successfully completed trials of fully tempered 2mm solar glass. Your enterprise is contributing towards the twin goals of 'Make in India' and enhancement of India's solar power capacity.

Your work in boosting the renewable energy sector is appreciable. Environmentally conscious organisations can play an instrumental role in strengthening India's commitment to sustainable development.

I congratulate the management and the staff of Gujarat Borosil Limited for their good work in scaling new heights and enhancing the Indian manufacturing industry's profile globally.

I congratulate and wish the Gujarat Borosil Limited all success for the inauguration of a new facility.

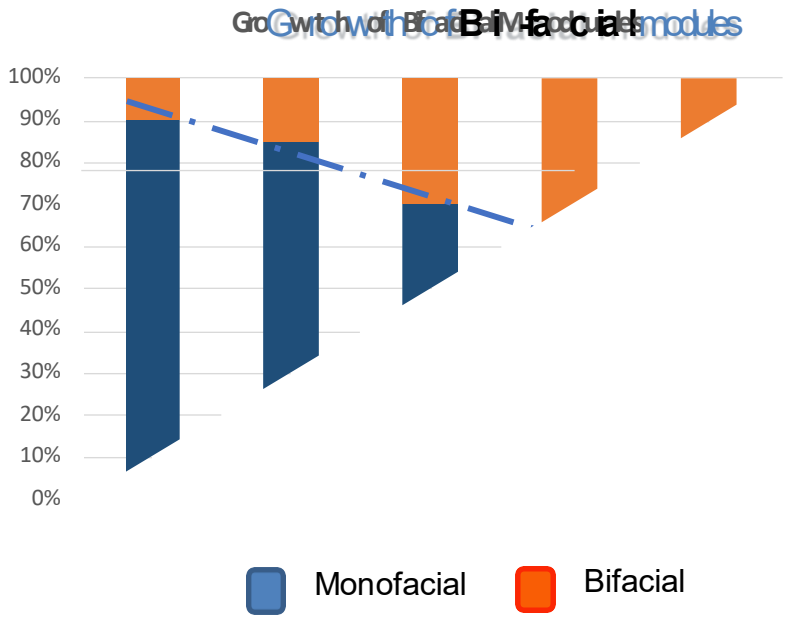
Yours sincerely,

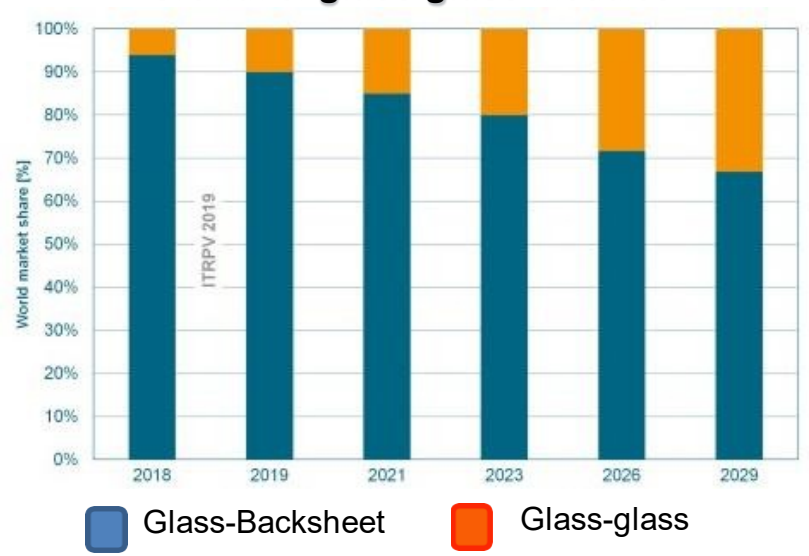
(Narendra Modi)

Shri Pradeep Kheruka

World's 1st company to produce 2 mm fully tempered solar glass

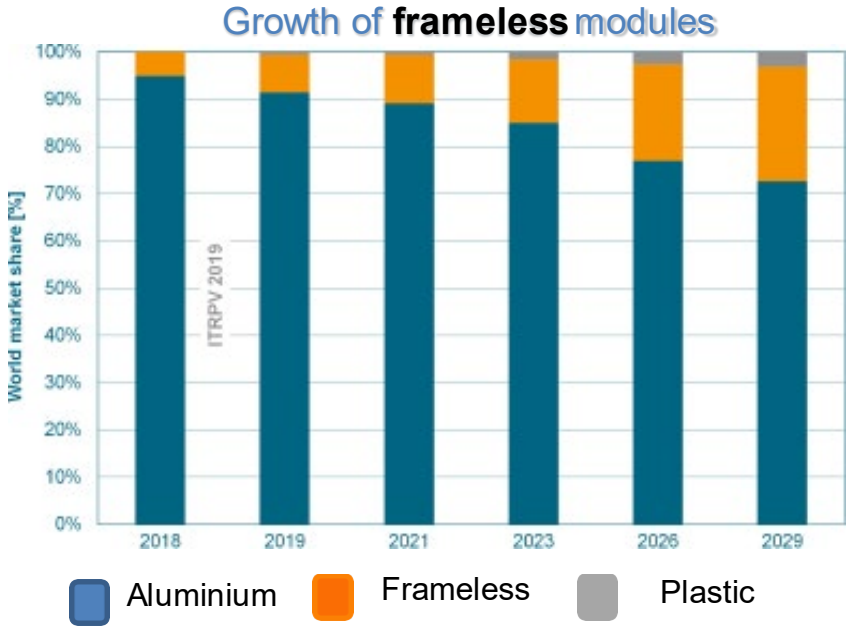
SOLAR PV MARKET IS MOVING TOWARDS THINNER GLASS

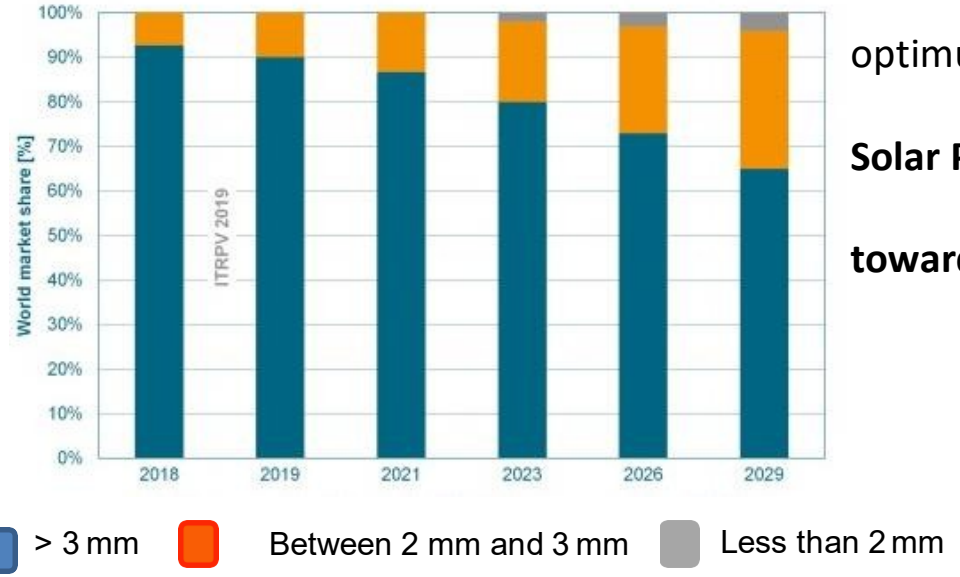




Solar PV market is moving towards

- 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**

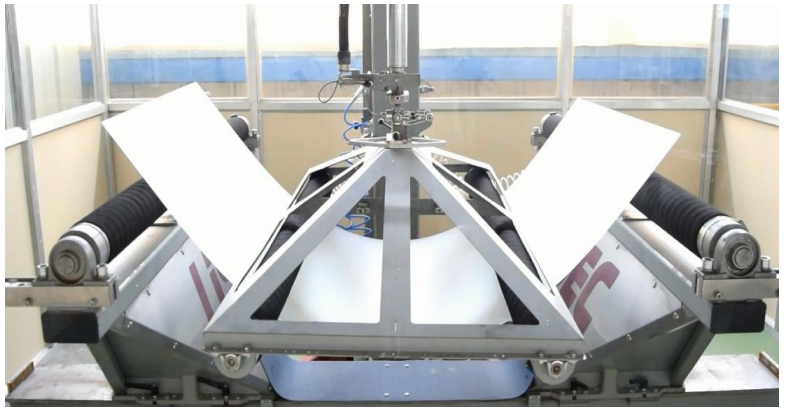
Ref: International Technology Roadmap for PV 2019

FULLY TEMPERED THINNER GLASS UP TO 2 MM

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

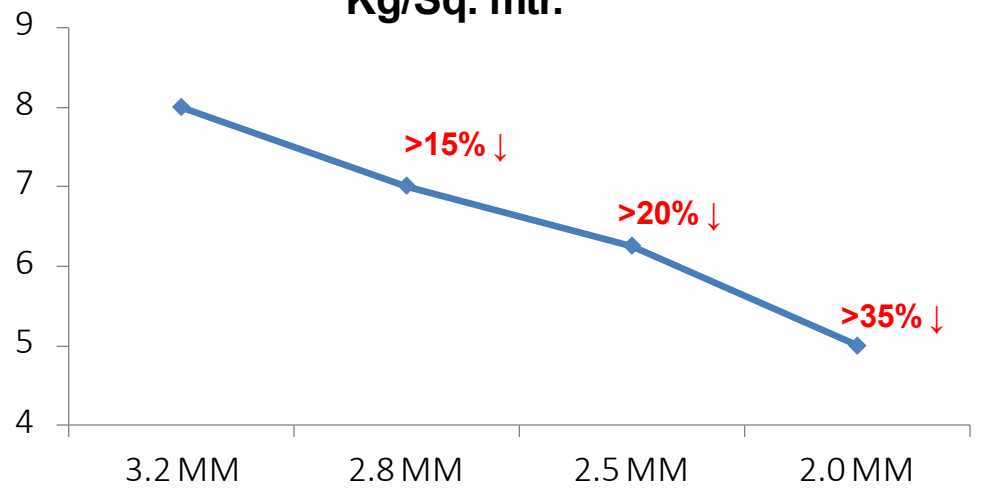
2x stronger than imported solar glass which is only heat-strengthened

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



4 POINT BENDING TEST

- 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 **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

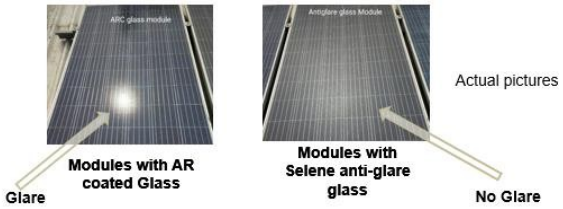
INNOVATIONS BY BOROSIL IN SOLAR GLASS

Shakti: High Efficiency Solar glass in matt-matt finish

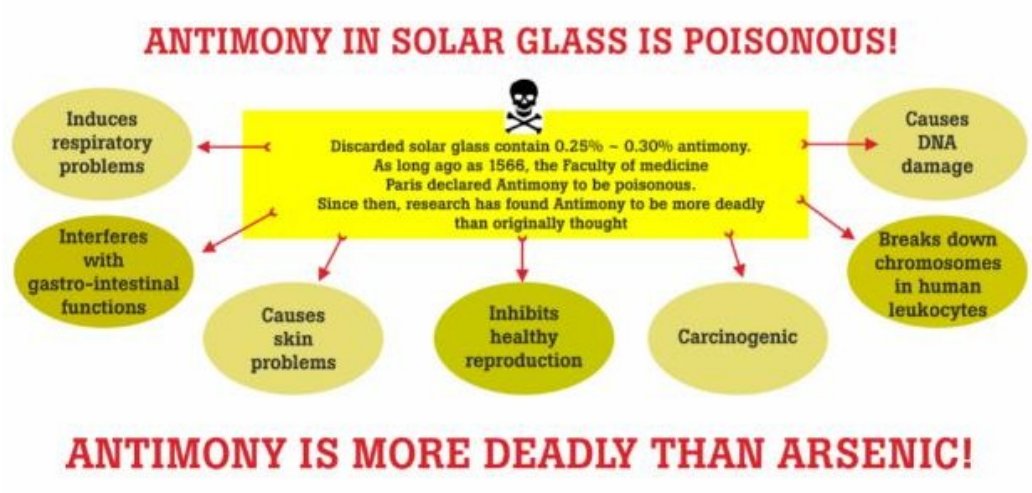
- Recently developed a solar glass with matt finish on both sides
- **Higher module output up to 0.5%**
- Higher transmission = Higher output by the modules = **Higher IRR**
- Transmission value reaching higher than 94% with use of an appropriate AR Coating
- **No changes necessary in certification of 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



NoSbEra: 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.

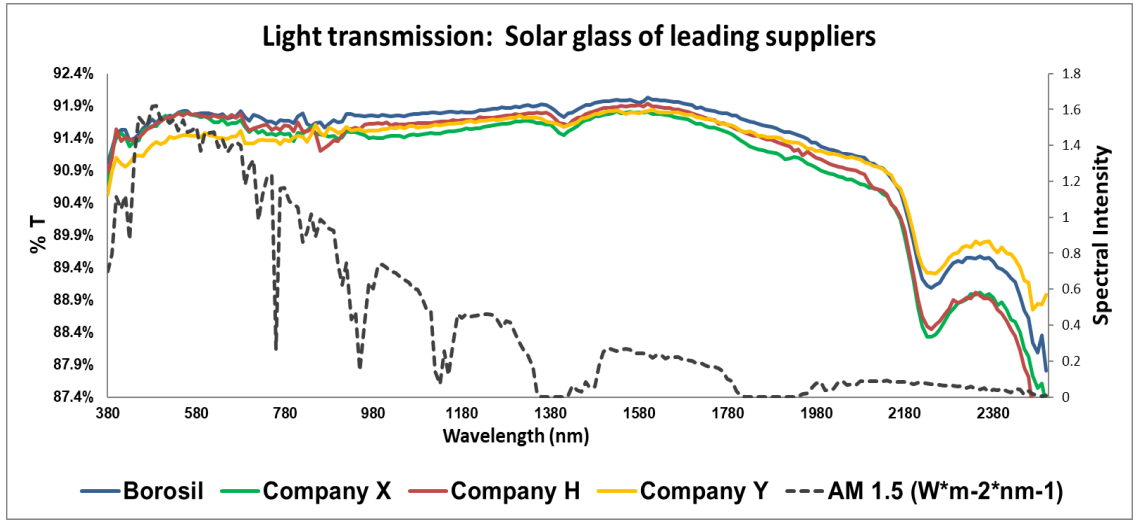
VALUE TO THE CUSTOMERS THROUGH DIFFERENTIATED PRODUCTS

ENGINEERED FOR LONG TERM DURABILITY

- Low sodium. Low PID (potential induced degradation)
- High chemical durability: superior glass performance
- Very High hydrolytic resistance

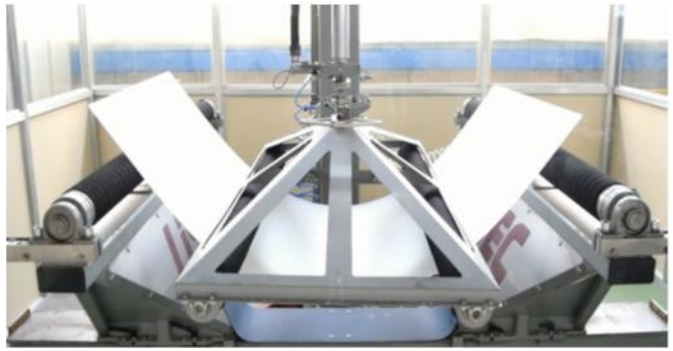
	Wavelength range (nm)		
Supplier	380 - 780	380 - 1100	380-2500
Borosil	91.76%	91.68%	91.31%
Company X	91.73%	91.51%	91.00%
Company H	91.74%	91.58%	91.08%
Company Y	91.41%	91.39%	91.18%

HIGHER TRANSMISSION



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



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

Normal heat strengthen glass

Borosil's fully tempered glass

4

1. Aatmanirbhar Bharat

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

   - Reliability
   - Capability
   - **Quality**
   - Policy Framework and support
   - 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

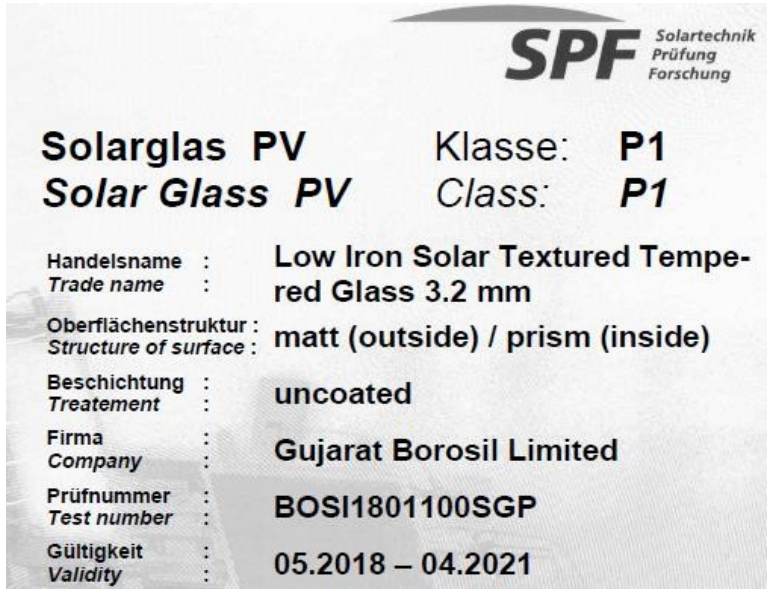
Details

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

SPF CERTIFICATIONS

3.2 mm



SPF Solartechnik Prüfung Forschung

Solarglas PV Klasse: **P1**
Solar Glass PV *Class:* ***P1***

Handelsname / *Trade name*	Low Iron Solar Textured Tempered Glass 3.2 mm
Oberflächenstruktur / *Structure of surface*	matt (outside) / prism (inside)
Beschichtung / *Treatement*	uncoated
Firma / *Company*	Gujarat Borosil Limited
Prüfnummer / *Test number*	BOSI1801100SGP
Gültigkeit / *Validity*	05.2018 – 04.2021

Test SPF Certification Solar glass (PV, Vers. 1.1)
Validity 05.2018 – 04.2021
Result Solar Glass (PV) of class P1 **Label** **SPF18•315-P1**

Transmission Factor $F_{\tau, PV}$ = 0.951

Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Transmittance Nr. BOSI1801100G
Date: 1.3.2018

IAM Weighting Factor $F_{IAM, PV}$ = 0.992

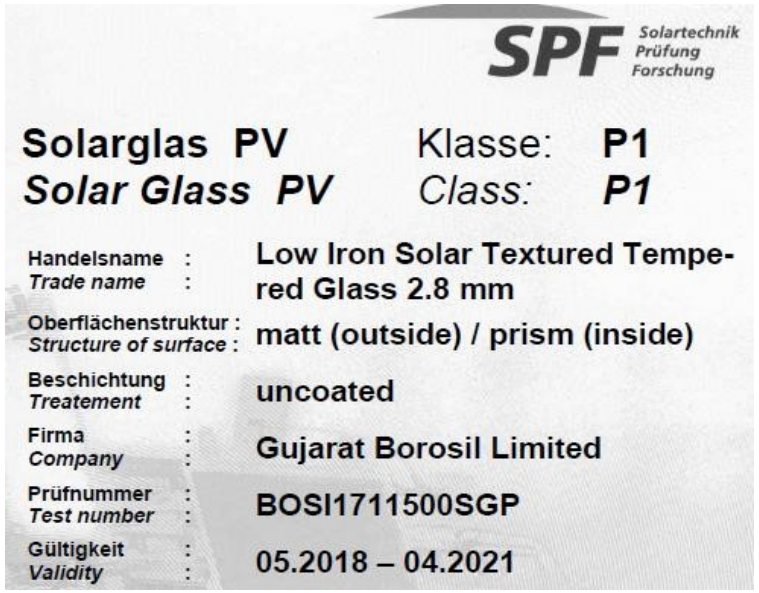
Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Incidence Angle Modifier Nr. BOSI1801100P
Date: 1.3.2018

Photodegradation Factor $F_{UV, PV}$ = 1.001

Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Transmittance Nr. BOSI1801100G & Test Report Transmittance Nr. BOSI1801101G
Date: 7.5.2018

Glass efficiency value $\eta_{GI, PV}$ = 0.944

2.8 mm



SPF Solartechnik Prüfung Forschung

Solarglas PV Klasse: **P1**
Solar Glass PV *Class:* ***P1***

Handelsname / *Trade name*	Low Iron Solar Textured Tempered Glass 2.8 mm
Oberflächenstruktur / *Structure of surface*	matt (outside) / prism (inside)
Beschichtung / *Treatement*	uncoated
Firma / *Company*	Gujarat Borosil Limited
Prüfnummer / *Test number*	BOSI1711500SGP
Gültigkeit / *Validity*	05.2018 – 04.2021

Test SPF Certification Solar glass (PV, Vers. 1.1)
Validity 05.2018 – 04.2021
Result Solar Glass (PV) of class P1 **Label** **SPF18•314-P1**

Transmission Factor $F_{\tau, PV}$ = 0.950

Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Transmittance Nr. BOSI1711500G
Date: 1.3.2018

IAM Weighting Factor $F_{IAM, PV}$ = 0.994

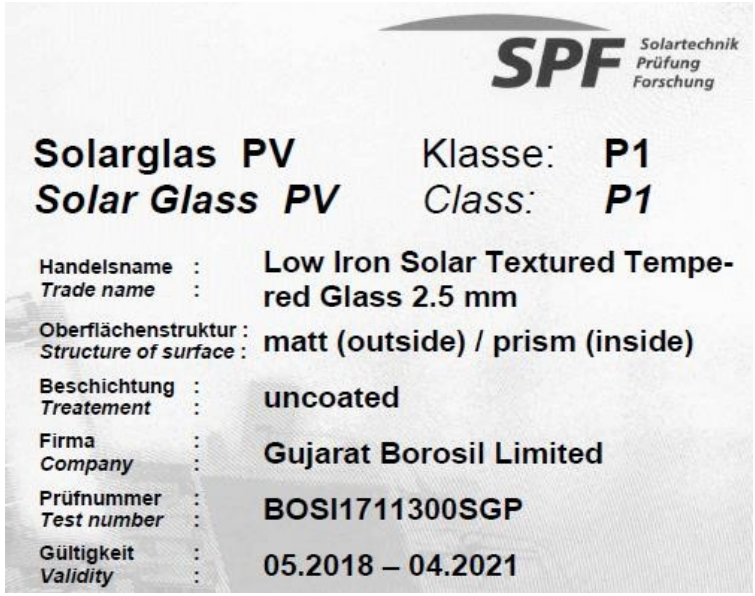
Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Incidence Angle Modifier Nr. BOSI1711500P
Date: 1.3.2018

Photodegradation Factor $F_{UV, PV}$ = 0.999

Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Transmittance Nr. BOSI1711500G & Test Report Transmittance Nr. BOSI1711501G
Date: 7.5.2018

Glass efficiency value $\eta_{GI, PV}$ = 0.943

2.5 mm



SPF Solartechnik Prüfung Forschung

Solarglas PV Klasse: **P1**
Solar Glass PV *Class:* ***P1***

Handelsname / *Trade name*	Low Iron Solar Textured Tempered Glass 2.5 mm
Oberflächenstruktur / *Structure of surface*	matt (outside) / prism (inside)
Beschichtung / *Treatement*	uncoated
Firma / *Company*	Gujarat Borosil Limited
Prüfnummer / *Test number*	BOSI1711300SGP
Gültigkeit / *Validity*	05.2018 – 04.2021

Test SPF Certification Solar glass (PV, Vers. 1.1)
Validity 05.2018 – 04.2021
Result Solar Glass (PV) of class P1 **Label** **SPF18•313-P1**

Transmission Factor $F_{\tau, PV}$ = 0.948

Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Transmittance Nr. BOSI1711300G
Date: 1.3.2018

IAM Weighting Factor $F_{IAM, PV}$ = 0.993

Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Incidence Angle Modifier Nr. BOSI1711300P
Date: 1.3.2018

Photodegradation Factor $F_{UV, PV}$ = 1.000

Source: Institution: SPF-HSR, CH-8640 Rapperswil
Report: Test Report Transmittance Nr. BOSI1711300G & Test Report Transmittance Nr. BOSI1711301G
Date: 7.5.2018

Glass efficiency value $\eta_{GI, PV}$ = 0.941

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

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1. Aatmanirbhar Bharat

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

- Reliability
- Capability
- Quality
- **Policy Framework and support**
- Collaboration

COMPETITIVE LANDSCAPE: MANUFACTURING IN CHINA

Capital Cost	Finance Cost
• 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
Operational Cost	**SGA / Marketing & Logistics costs**
• 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 Insuran**ce: 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

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

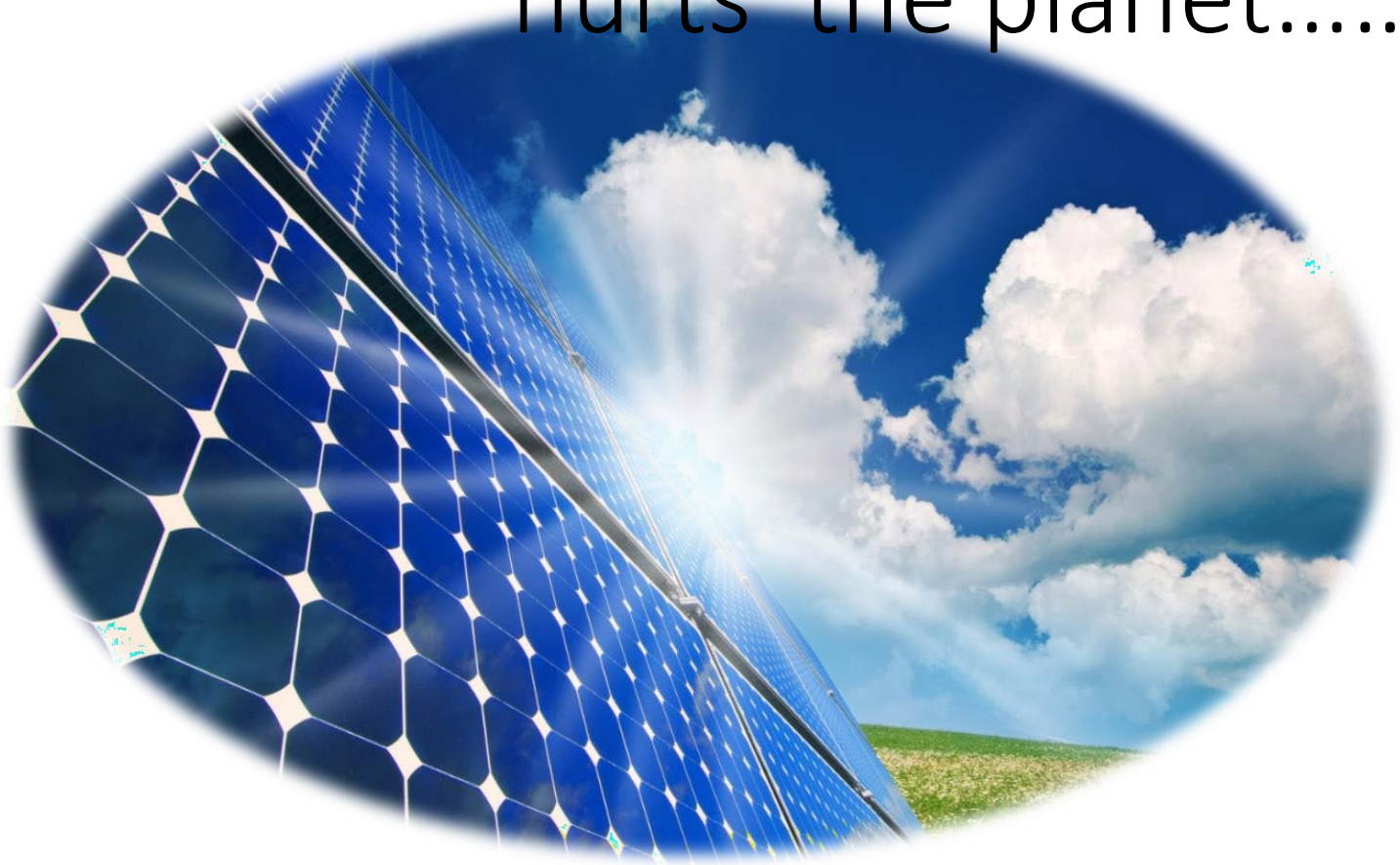
- Reliability
- Capability
- Quality
- Policy Framework and support
- **Collaboration**

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

Thank You

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