



# Future of Solar and Patterned[Textured] Glass Industry

An Indian Perspective

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# GOPAL GLASS AT A GLANCE



- Gopal Glass group is a 40 year old company and the largest Patterned (Figured) and Wired glass manufacturer in India with 450 tons/day production capacity, most efficient plant & is having 60 % national market share.
- Products:
- Patterned Glass
  - Patterned (Figured) glass is a kind of decorative translucent flat glass with embossed patterns on one or both surfaces. With the special property of decoration, figured glass can fully allow the light to pass through and on the other hand, can limit or prevent clear view effectively. It is used in partitions, windows, decorative glazing, furniture, bathrooms, etc.
- Wired Glass
  - The wire mesh is passed through the molten glass coming out from the throat of furnace while other processes are same that of manufacturing Figured glass. It is used in industrial, institutional and residential buildings for safety purpose.
- Gopal Glass is pioneer in manufacturing 2 mm Anti Glair Rolled Glass which is widely used in photo framing.
- The group is role model for technology benchmark in domestic Patterned glass industry with highest patent designs (registered glass designs) and is consuming more than 50 % electricity from renewables (both solar and wind).
- It's a zero debt company and had acquired a sick unit and made it profitable within 2 years. It started the solar glass with 150 tpd capacity under the name of Gobind Glass in Feb 2023.



# History of Glass in India

- It is said that glass was discovered by the Syrians 5000-7000 years ago, reaching Egypt and then to Rome, from where it spread across the world.
- Historically, Firozabad is popularly known as the “Glass City of India”, where it started back by 17<sup>th</sup> century and remained cottage industry till the 20<sup>th</sup> century.
- The first glass plant was set up in august 1908 by Lokmanya Balgangadhar Tilak at Talegaon, Maharashtra.



# Glass Industry outlook

- Per capita float glass consumption in India is less than 2 kg whereas in the developed world it ranges between 6 to 10 kg
- Per capita container glass consumption in India is 2.5 kg whereas in developed world it is 25 kg
- The Indian solar glass industry is growing by 3 times in coming year
- India is a hub for the glass vial industry



# Textured[Patterned] Glass



It is one of the earliest flat glass manufacturing activity in India dating back more than 100 years.

Now with the advent of float glass it has limited use but has exclusive and niche segment.

The industry is growing slowly and steadily with the new applications and processing capabilities.



# SOLAR GLASS





1<sup>st</sup> prize





## Solar Glass

In a realm where the sun's golden light resides,  
Where nature and progress in harmony collides,  
There blooms a marvel, a radiant symphony,  
Green energy whispers through solar glass, you see.

Oh, behold the magic in each fragile pane,  
Translucent skin, a celestial refrain,  
Capturing photons in a dance of delight,  
Transforming brilliance into boundless might.

Gentle sunbeams, like dancers on the stage,  
Caress the glass with passion, unbridled rage,  
Within its depths, secrets of power unfurled,  
A hymn of hope, a symphony for the world.

No longer shackled to the chains of the past,  
The Earth breathes deep, a sigh of solace at last,  
For in this radiant tapestry we've woven,  
The greener future, a paradise unbroken.

Let solar glass illuminate the path we tread,  
A gentle guardian, shielding us overhead,  
With every glimmer, a promise to inspire,  
A legacy of light, ignited by desire.

So raise your eyes to the heavens above,  
Feel the warmth, the embrace of the sun's love,  
And in that tender touch, let hope take flight,  
Green energy, our beacon of eternal light.

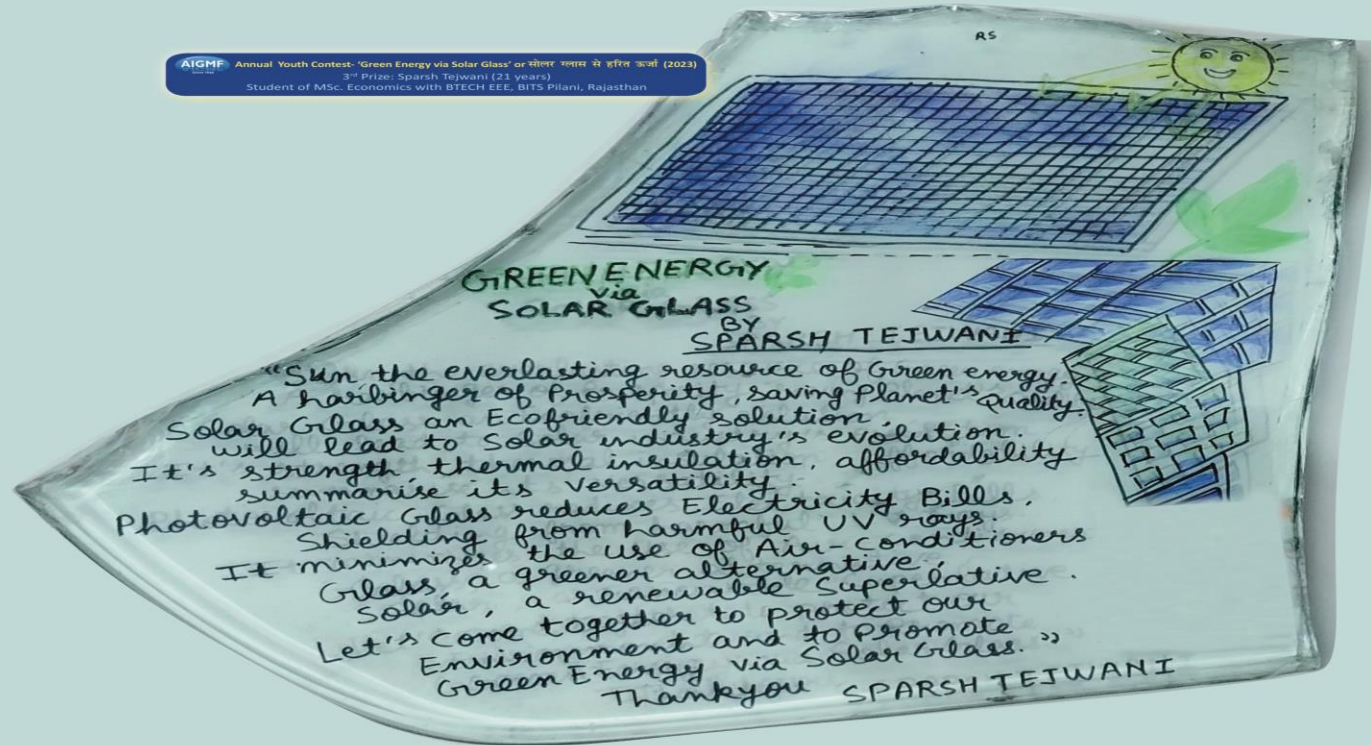
In the embrace of solar glass, we find,  
A symphony of nature and progress entwined,  
For in each beam that dances through the air,  
Lies the power to heal, the power to repair.

AIGMF Annual Youth Contest - 'Green Energy via Solar Glass' or 'सौर ऊर्जा से हरित ऊर्जा' (2023)  
2<sup>nd</sup> Prize: Sarthak Kumar (15 years)  
10<sup>th</sup> class student of Sant Nandlal Smriti Vidya Mandir, Ghatshila, Jharkhand

2nd  
prize



AIGMF Annual Youth Contest- 'Green Energy via Solar Glass' or 'सौर शश से हरित ऊर्जा' (2023)  
3<sup>rd</sup> Prize: Sparsh Tejwani (21 years)  
Student of MSc. Economics with BTech CIL, BITS Pilani, Rajasthan

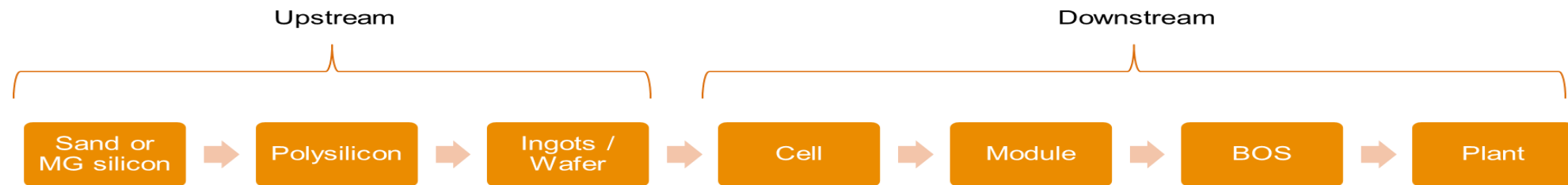


3<sup>rd</sup> prize



# Solar PV Value Chain Analysis

The global shift toward renewable energy sources has sparked a revolution in the energy landscape, with solar photovoltaic (PV) technology emerging as a pivotal player in the transition to a more sustainable future. Solar PV systems harness sunlight and convert it into electricity, offering clean, renewable power generation solutions. At the heart of this transformative technology lies the solar PV value chain, a complex network of interconnected components and processes that collectively bring solar power to life.





## Key Ancillaries in Solar PV Modules

Within the solar PV module assembly process, several key ancillaries play pivotal roles in enhancing the functionality, efficiency, and durability of solar panels.

The top (five) ancillaries basis the component-wise cost of solar modules are discussed below:

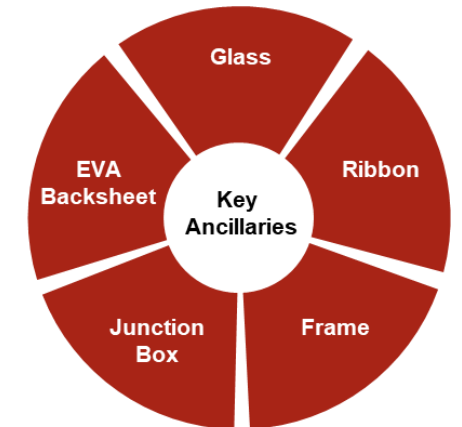
**Glass:** The front surface of a solar module is covered by tempered glass. This glass serves as a protective barrier, allowing sunlight to pass through while shielding the sensitive cells from environmental factors.

•**Ribbon and Interconnection:** Ribbons made of conductive materials like copper or aluminium connect individual solar cells within a module. They ensure the efficient flow of electricity from cell to cell.

•**Junction Box:** The junction box is a vital component responsible for electrical connections within a solar panel. It also facilitates the safe connection of multiple panels in an array and contains diodes to prevent reverse current flow.

•**EVA and Back Sheet:** Ethylene-vinyl acetate (EVA) is used to encapsulate solar cells and protect them from moisture, dust, and physical damage. EVA also helps maintain proper cell alignment and facilitates heat dissipation. Sometimes polyolefin elastomers (POE) are also used to encapsulate the cells.

•**Frame:** The frame provides structural support and rigidity to the solar module, safeguarding it against mechanical stress and environmental factors. It also aids in the secure mounting of modules on various surfaces.





## ➤ Solar PV Modules

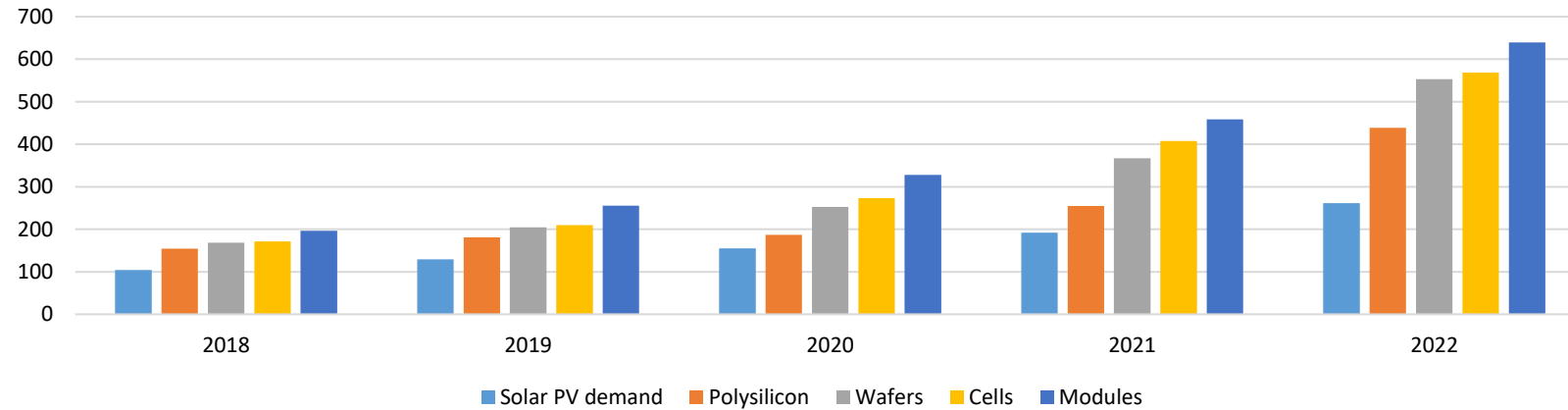
- **Existing Products:** Solar PV modules primarily consist of silicon solar cells encapsulated in protective layers. Traditional crystalline silicon modules dominate the market, with variations like monocrystalline and polycrystalline modules.
- **Evolution:** Future advancements in solar PV modules will likely focus on increasing efficiency and reducing costs. Innovations such as **bifacial modules**, which can capture sunlight from both sides, and tandem solar cells that combine different materials for higher efficiency, are expected to gain prominence. Additionally, efforts to integrate solar modules into building materials (building-integrated photovoltaics or **BIPV**) will likely grow.

## ➤ Solar Glass

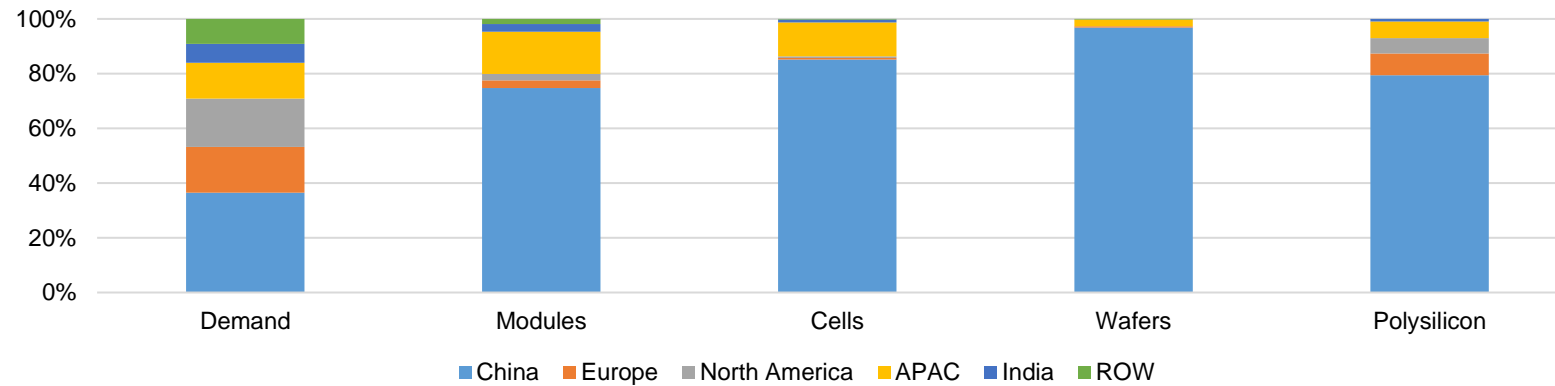
- **Existing Products:** Tempered glass with anti-reflective coatings is commonly used in solar modules to protect cells and improve light transmission.
- **Evolution:** In the near future, solar glass is expected to become even more transparent and durable. Innovations in thin-film coatings and materials will enhance light-capturing capabilities. Furthermore, efforts to incorporate smart functionalities, like self-cleaning and energy generation, may revolutionize solar glass applications.



Global Solar PV manufacturing capacity (GW)



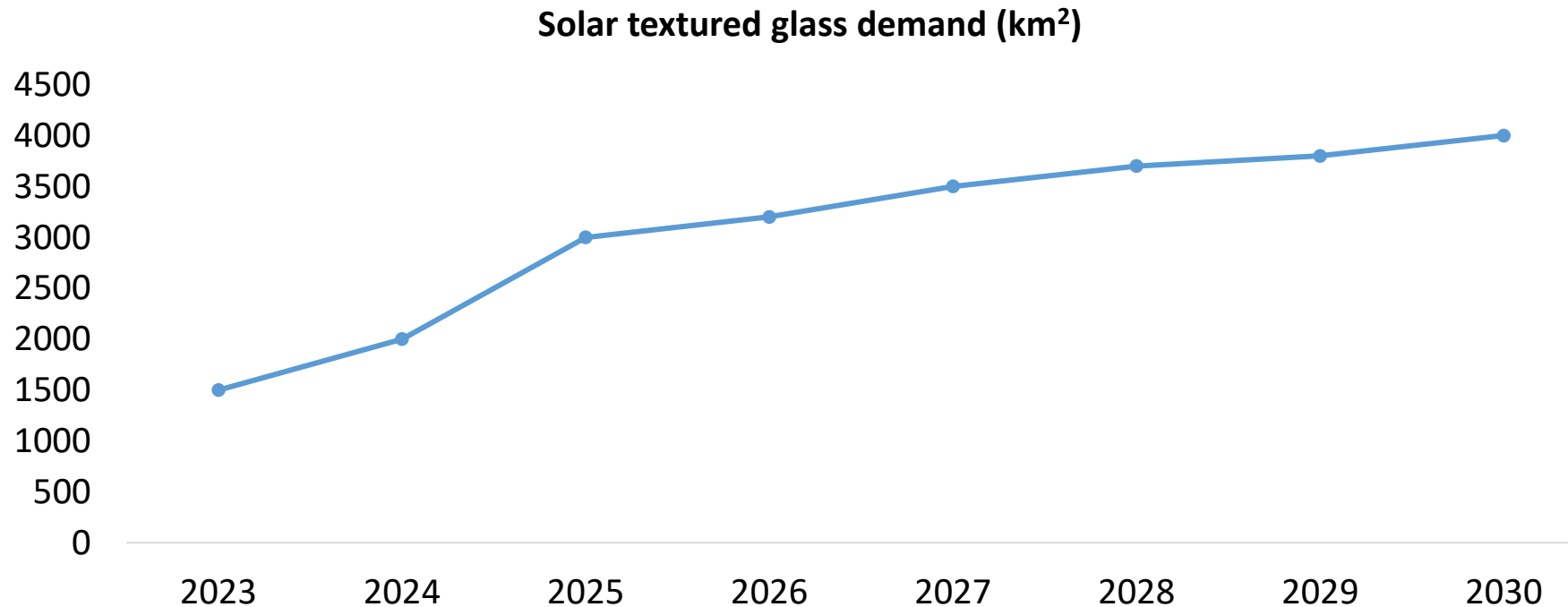
Country wise solar PV manufacturing capacity (% share)







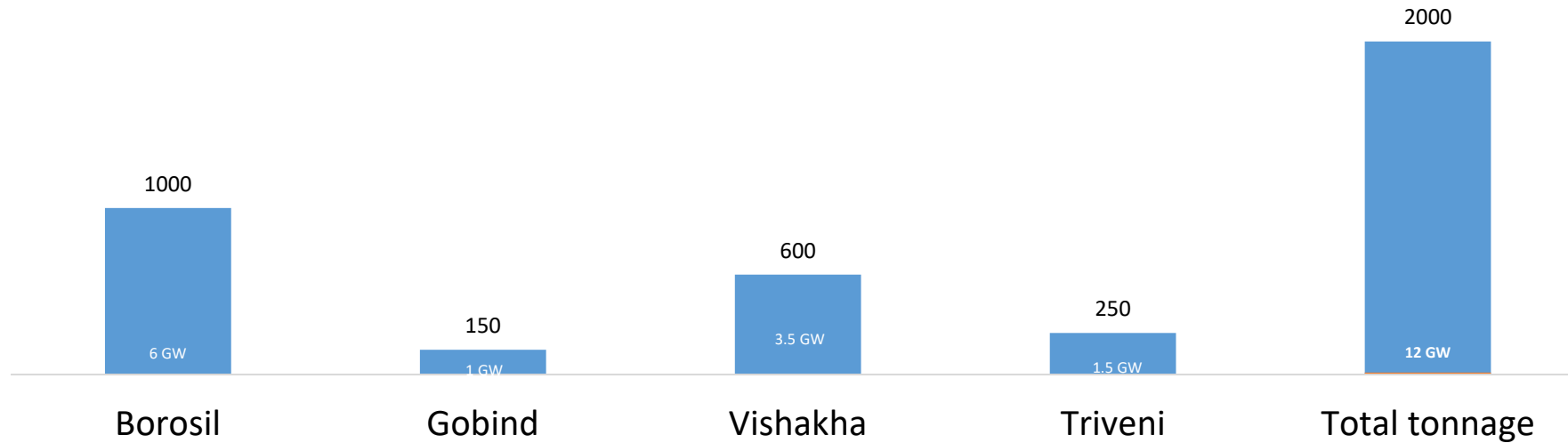
## Global demand for Solar glass Forecast



*By 2030, the **demand for solar glass** corresponds to **387 GW**, assuming that an average solar PV panel produces 8 to 10 watt per square foot of solar panel area*



### Solar Glass Manufacturing Capacity in India (TPD and eq. GW)





## Factors impacting the demand, +1 strategy, etc

- **Government Policies and Incentives:** Government support in the form of subsidies, tax credits, feed-in tariffs, and renewable energy targets significantly impacts the demand for solar PV modules. Favorable policies encourage investment in solar installations.
  - Strong policy support for solar PV is driving the acceleration in capacity growth as it remains a principal driver of solar PV deployment across the globe
- **Rapid Expansion Plans:** Solar PV module manufacturing capacity is expected to experience significant growth to meet rising demand. This growth will be driven by both established manufacturers and new entrants entering the market (expected to invest heavily in solar infrastructure).
  - Companies entering into corporate PPAs signing direct contracts with solar PV operators for the purchase of generated electricity Solar PV plants
- **Environmental Concerns:** Growing awareness of climate change and environmental sustainability drives individuals, businesses, and governments to adopt clean energy sources like solar power, boosting demand.
  - Net Zero targets: Many corporations have set their sights on becoming net zero companies, which calls for radical, quick change and extensive technology adoption across industries.
- **Falling Costs:** The declining cost of solar PV technology makes it increasingly economically viable. As solar module prices drop, more consumers and businesses find it attractive to invest in solar installations.
- **Energy Security and Technological Advancements:** Solar PV offers energy security by providing a decentralized source of electricity. This aspect becomes crucial in regions prone to power disruptions or those aiming to reduce reliance on fossil fuels. Moreover, advances in solar cell and module technology, such as higher efficiency and durability, improve the overall performance of solar PV systems, further driving demand.
- **Grid Integration:** Improved grid integration and energy storage solutions allow for a more stable and reliable power supply, making solar PV more appealing to both residential and industrial consumers.
  - Companies investing in solar PV systems on their own properties accounted for 30% of the total installed PV capacity (2021), making solar PV the most popular renewable technology in the private sector.



## Plus One Strategy

- **Geographical Diversification:** Solar manufacturers are looking to establish production facilities in countries other than China. Southeast Asian nations, such as Vietnam, Malaysia, and Thailand, have become popular destinations for solar production due to their skilled labor forces and favorable business environments.
- **Supply Chain Resilience:** The strategy aims to reduce the vulnerability of the solar supply chain to disruptions, such as trade tensions, policy changes, or geopolitical events, by having production facilities in multiple locations.
- **Market Access:** Setting up production facilities outside China allows companies to access local and regional markets more effectively, catering to specific demands and regulations and potentially reducing trade barriers or tariffs.
- **Cost Optimization:** While diversifying the supply chain may initially involve additional costs, it can enhance long-term cost optimization by reducing risks associated with relying solely on one manufacturing location (Over time, labor and production costs in China have increased, making it less attractive for some industries to continue manufacturing solely in China).

With the use of this strategy, solar module producers were able to respond to changing market dynamics and regional demand, boosting investor and customer trust. As a result, the "China +1" approach has been crucial in maintaining and boosting the worldwide demand for solar PV modules and supporting the expansion of the solar energy sector globally.

***Opportunity for India*** - India has the opportunity to cash in on the China plus one strategy as more firms seek to diversify their supply chains.

*Many global companies have recently announced investments in India adding to the idea as India offers cost competitive manufacturing, large and growing consumer market, incentives etc.*



# Key take away

- Invest In India
- Great opportunity for complete glass industry eco system for the express growth

Thank you....