

RENEWABLE ENERGY REFRESHER

BERGEN GROUP NEWSLETTER



PLI Scheme enhances the importance of HJT and TOPCON high efficiency cell Technologies.

Recently announced Production Linked Incentive (PLI) scheme by Ministry of New and Renewable Energy(MNRE), Government of India on 28th April 2021 has clearly favoured the high efficiency cell technologies and rightly so. As per this scheme the following performance matrix will determine the incentive for different categories module efficiencies:

PERFORMANCE MATRIX TABLE						
	Module Efficiency (%) →	During five Year period after commissioning				
		Base PLI Rate (₹/Wp)**				
		Less than 19.5%	19.50% and above but less than 20%	20% and above up to 21.5%	Above 21.5% & up to 23%	Above 23%
Module's Temperature Coefficient of Pmax* (in % per degree Celsius) ↓	Position		W	X	Y	Z
Worse than -0.40		0.00	0.00	0.00	0.00	0.00
-0.40 to -0.30	A	0.00	0.00	2.50	3.00	3.50
Better than -0.30	B	0.00	2.25	2.75	3.25	3.75

* Pmax = Maximum Power at Standard Test Conditions (STC), i.e., Irradiance 1000 W/m², cell temperature 25°C, air mass (AM)= 1.5; Module's temperature coefficient refers to percentage change in Pmax per degree Celsius rise in temperature.

** Increase in the Base PLI Rate (₹/Wp) of ₹0.25/Wp for different module efficiency has been kept to motivate and incentivize manufacturers for producing higher efficiency module which requires higher investment for R&D.

Coefficient of Pmax (Tc) will be better than -0.3%. Efficiency of thin film modules, however, will be in the range only 19.5-20% (max as of now) so it will qualify at the best for only Rs 3.25/Wp whereas for HJT technology module efficiencies will be in the range of 21.5-23% thus qualifying these modules for Rs 2.25/Wp incentives. Efficiency of HJT modules can easily go beyond 23% in coming few years and will qualify such production for the highest incentive of Rs.3.75/Wp.

The Tc of PERC and TOPCON cells will be in the range of -0.4 to -0.34%. So, PERC cells will qualify only for the Rs.2.5-3.0/Wp as PERC module efficiencies will be in the range of 20-23%. TOPCON module efficiencies could go above 23% but it still qualifies for the Rs 3.5/Wp.

One can see, therefore, that HJT manufacturing lines only can take the manufacturers to the highest slab of the PLI scheme. It is also clear that investors putting up PERC cell and module manufacturing lines should make provision for upgrading their lines to TOPCON technologies.

Module Technologies

In module manufacturing P- Mono-PERC cell technology will be the mainstream technology for coming few years. Bifacial PERC cells will, however, will be taking slowly the substantial share in the market.

Wattage per module today highest achieved is about 600 Watt, however, 500watt modules based on large wafer formats will become more popular.

Regarding bus bars 9-10 bus bars will be in vogue for coming few years slowly giving way to 11-12 bus bars and multi buss bars technologies.

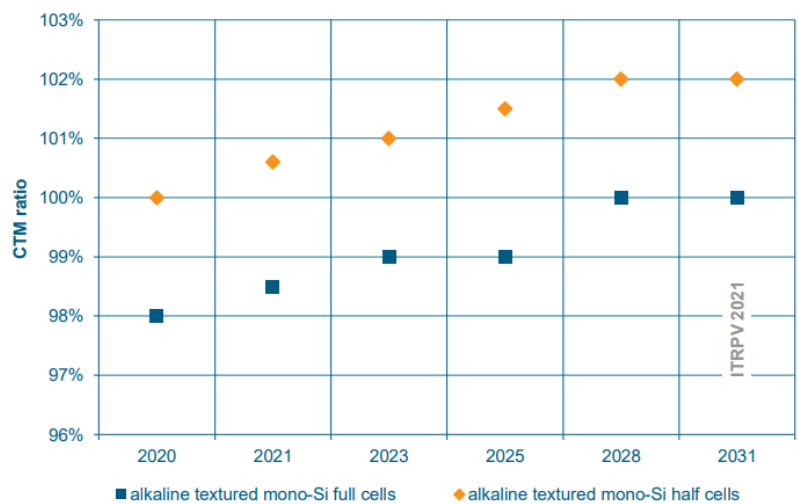
Back side material will be slowly moving towards less than 2mm glass and in some cases transparent back sheet will also be used.

Half-cut and 1/3rd cut, cell technologies will dominate the scene for coming few years, however, shingled, back contacted cell and HJT module technologies will also have some market share.

EVA will remain the dominant encapsulant, however, polyolefin may find place slowly specifically in double glass bifacial technology.

It is crucial to get as much power as possible from the assembled cells in the module. Cell-to-Module (CTM) power ratio is a good parameter to describe this behaviour. It is defined as $\text{module power} / (\text{cell power} \times \text{number of cells in the module})$. P-Mono PERC full cell modules

Trend of Cell-to-Module (CTM) power ratio



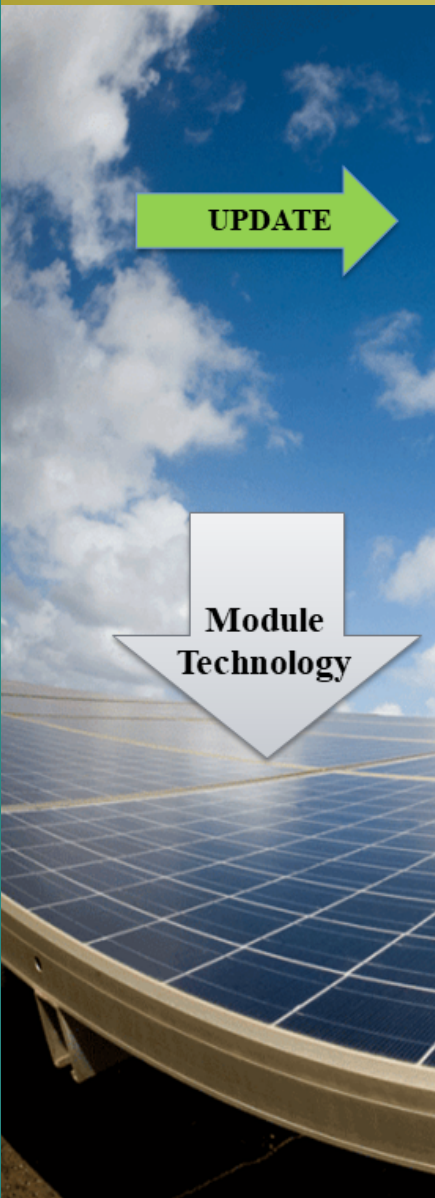
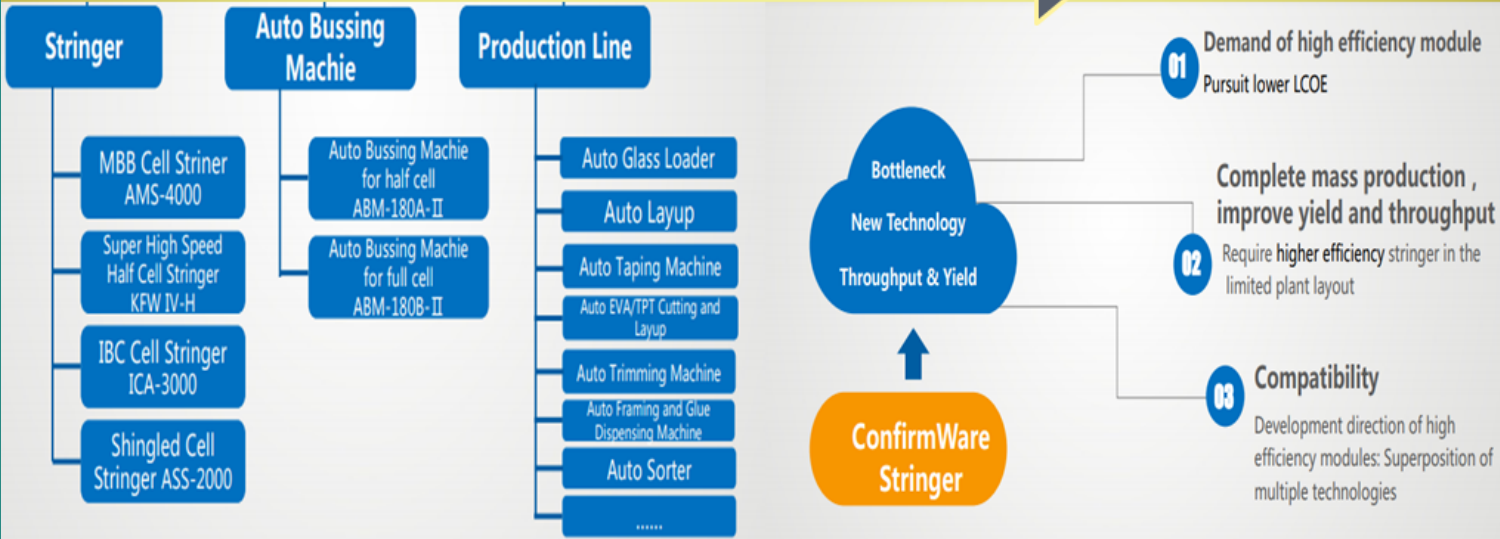
generally have this ratio less than one, but half-cut PERC modules can give CTM more than one by smart interconnection techniques and improvement in light management by redirecting the light on cell from the inactive module areas.

Dr. D.N. Singh

CEO

Bergen Solar Power & Energy Ltd.

Module Line Technology Update



Auto Bussing Machine

Contact: 0124-4986400-416
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Full compatibility with regular version
Light customization for irregular version
High customization for special version
Model : ABM-180-II



- Compatible with 156-210mm cell, 5BB-12BB full size cell/half size cell, Double glass module
- Full cell** : 6strings*10cells, 6strings*12cells
- Half cell** : 12strings*10cells, 12strings*12cells,
- Cycle : Full cell ≤ 28S Half cell ≤ 22S
- Soldering method : Hot air soldering

High yield

Cold soldering : ≤ 2% Breakage ≤ 0.03%



- Smart temperature control**
- Special technical design**
- Align system**
- Soldering**

Double guarantee of temperature-control which is Mitsubishi + self-developed temperature-control module, also equipped with real-time temperature-control monitoring system ensure the soldering temperature uniformity and stability, then keep the products be quality.

Hot air outlet: Optimized design which make the air output and air area range be accurate and ensure the soldering temperature, avoid blowing tin at the same time to make the soldering appearance cleaner.

The align mechanism combined with visual system, elevates the cell string to the specified position and completes the secondary alignment to ensure the consistency of the string spacing after soldering.

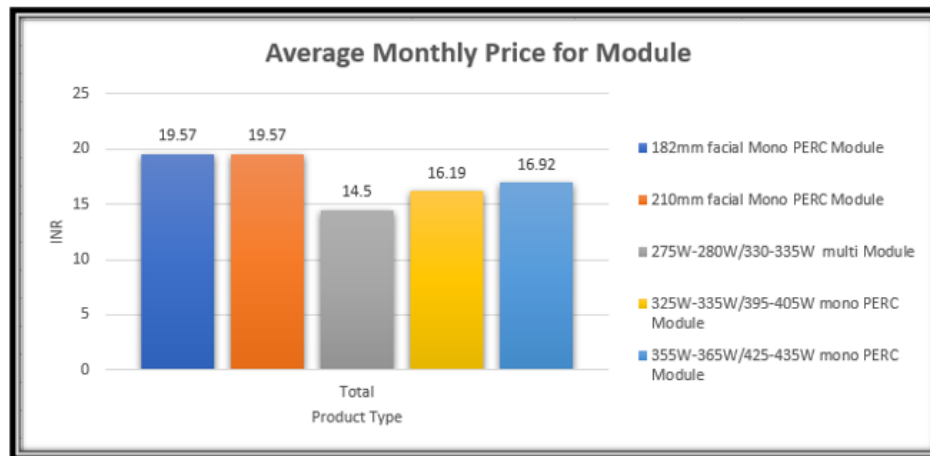
High temperature coating is applied in the soldering position to improve the soldering yield and ensure the uniformity of soldering parts.

Note: BERGEN SOLAR POWER & ENERGY LIMITED IS THE SOLE REPRESENTER OF CONFIRMWARE FOR INDIA.

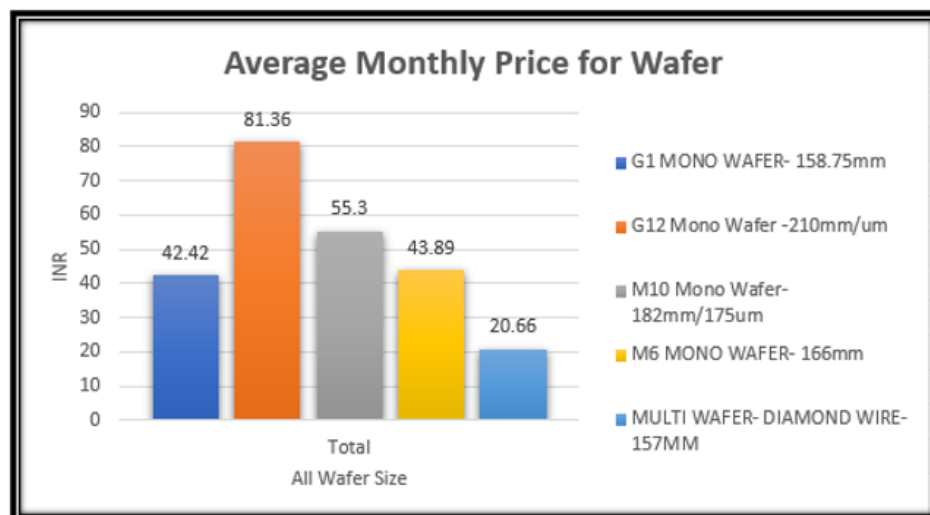
MARKET ANALYSIS

PRICE UPDATE

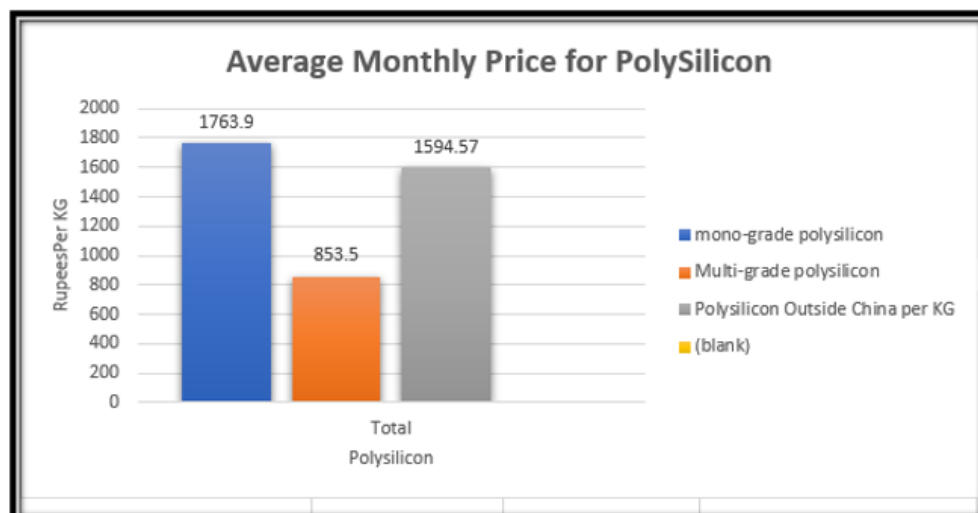
- Module Spot Price Update- Multi/Mono



- Wafer Spot Market Price Update- Multi SI/MonoG1M6



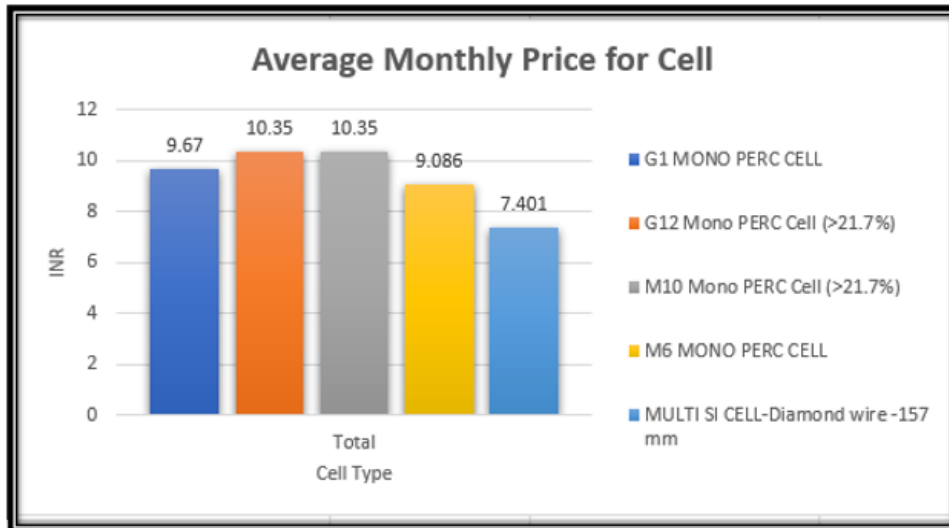
- Polysilicon Spot Price Update-Virgin poly (spot, contract)/Granular



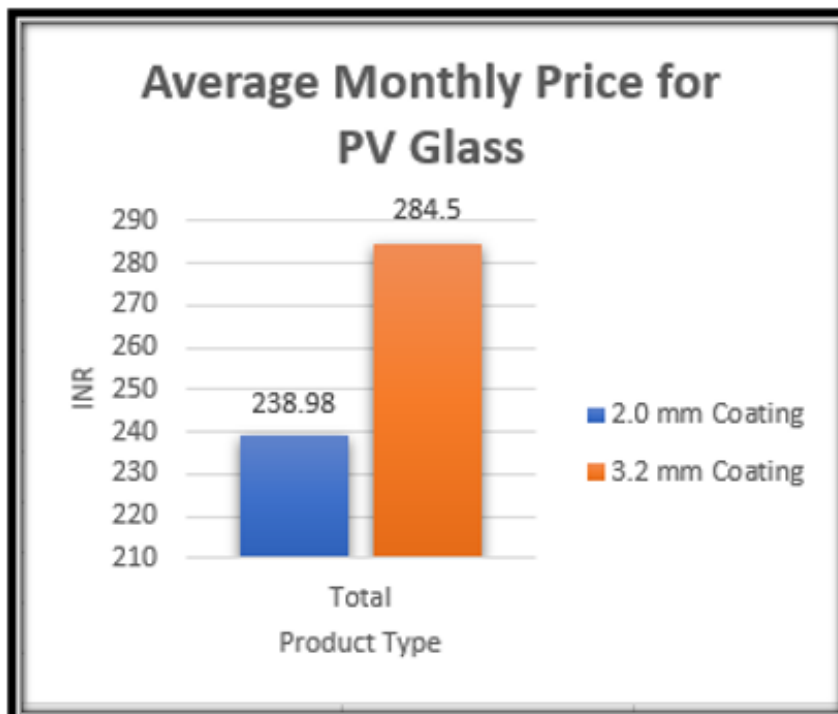
MARKET ANALYSIS

PRICE UPDATE

- Average Monthly price for CELL



- Average Monthly price for PV Glass



NEWS UPDATE

Solar Module Prices to Remain High Until Second Half of 2021: Chinese Manufacturers

Two leading Chinese manufacturers have said that the spiraling prices of raw materials like glass, polysilicon, and silver since the second half of 2020 have led to a sharp increase in the prices of solar modules.

Supply constraints could continue until the second half of this year, and the current prices of modules were the best that can be projected for the next six months, or even longer, the two companies said in separate statements.

Overall solar module cost has gone up 35% since the second half of 2020 due to spiraling raw material prices.

Silver Demand by the Global Solar PV Market Surges to 3,142 Tons

As the solar photovoltaic (PV) market continues to expand, with 18 countries achieving 1 GW installation capacity in 2020, silver's offtake by the PV industry reached 101 million ounces (Moz) or 3,142 tons in 2020. According to the 'World Silver Survey 2021,' by the Silver Institute, the demand for the precious metal surged despite an 80% drop in the average silver loading per cell over the last decade. The drop in silver loading was caused by the metalization process, which shrunk the average width of the electrode, busbar, and finger (both are electrical conductors to collect the direct current on the PV panel) from 100µm (micron) to 30µm.

Coal India Forms Subsidiaries for Solar Manufacturing and Renewable Energy Projects

The subsidiaries will manufacture wafers, cells, and ingots and take up renewable energy projects

Coal India Limited (CIL) has recently announced forming two wholly-owned subsidiaries for undertaking solar photovoltaic manufacturing and renewable energy projects. While CIL Solar PV Limited has been incorporated for manufacturing in the solar value chain (ingot-wafer-cell-module), CIL Navikarniya Urja Limited has been formed for renewable energy projects, CIL said in a BSE filing. In green push, the state-owned company had earlier announced that it would invest ₹56.50 billion (\$763 million) by March 2024 to develop 14 solar projects to help power its mining operations. CIL had also announced it would fund nearly two-thirds of the total capacity of 3 GW of rooftop and ground-mounted solar projects. The company had decided to enter into a joint venture with NLC India and fund the rest of its solar expansion plans.

NEWS UPDATE

Over 260 GW of Renewables Added Globally in 2020, Beating the Previous Record by 50%

According to data released by the International Renewable Energy Agency (IRENA), the world added more than 260 GW of renewable energy capacity in 2020.

Global renewable energy capacity additions in 2020 beat earlier estimates and all records despite the economic slowdown that resulted from the Covid-19 pandemic. The capacity addition was almost 50% more than in 2019.

IRENA's annual Renewable Capacity Statistics 2021 shows that more than 80% of all new electricity capacity added last year was renewable, with solar and wind accounting for 91% of new renewables.

India's solar imports dipped 75% in ten months

Covid-19 disruption has been cited as the chief culprit as imports from China, Thailand and Vietnam slumped from April to January, but safeguarding duty also appears to have had an impact, with unaffected imports from nations such as Myanmar, Chad and Russia on the rise and Malaysian trade keeping steady.

- Solar panel manufacturer Trina Solar has launched TrinaTracker and its 670 W+ ultrahigh power vertex module in India. The 670 W vertex module uses larger size solar cells that are 210 mm in diameter.

- Indian Army inaugurates first solar energy harnessing plant of 56 KVA in North Sikkim

- India to become No 1 EV maker in world: Nitin Gadkari

"India is moving ahead towards making electric vehicles. In due course of time we will be the number one electric vehicle(EV) maker in the world. All reputed brands are present in India," the Road Transport and Highways minister said.

NEWS UPDATE

National Average Power Purchase Cost of ₹3.85/kWh Set for Open Access Solar Projects

The Central Electricity Regulatory Commission (CERC) has set the national Average Power Purchase Cost (APPC) for open access at ₹3.85 (~\$0.052)/kWh.

The APPC would be applicable during the financial year (FY) 2021-22 or until further orders for deviation settlement regarding open access and captive wind and solar generators fulfilling regional entities' requirements.

No Net Metering Facility for Open Access Solar Consumers in Haryana

Open access solar consumers will not have the net metering facility in Haryana, according to the regulations for net and gross metering in the state proposed by the Haryana Electricity Regulatory Commission (HERC). The draft 'Rooftop Solar Grid-Connected Systems Based on Net Metering and Gross Metering Regulations 2021' says, "The facility of net metering shall not be available to Open Access consumers." The absence of provisions relating to gross metering in the existing regulations necessitated the revision according to HERC.

- Solar Tariffs May Settle Around ₹2.50/kWh After Factoring BCD in Future Auctions
- After successfully installing 2.3 Lakh smart meters on RF technology, Tata Power Delhi Distribution (Tata Power-DDL) has launched a unique 'Narrow Band-Internet of Things (NB-IoT)' technology in Smart Meters. This is the first installation of its kind in the country where smart meters have been installed on NB-IoT. The technology integration has been done involving meter manufacturers and the NB-IoT service of Reliance-Jio Network.

EDITORIAL TEAM



Rajinder Kumar Kaura
CMD

With nearly 43 years of contributions in conventional and non conventional power & electronics field, he is pioneer and pathfinder in developing solar & electronic industry in India. His contributions in bridging the gap in standards of living between rural and urban population through generation of solar power and skill development has earned him tremendous respect and recognition by countries like Norway, Japan, Germany, etc besides State and Central organizations.



Dr. D.N. Singh
CEO

Dr. D.N. Singh is a one of the most prominent leaders in solar PV and Semiconductor technology and widely known professional in India and abroad. He has a total of 46 years of experience in Industries, research and academia. He has published over 40 research papers in international and national journals. He has been invited speaker at PV Cell Tech and PV Module tech international conferences. Dr. Singh is Vice-President of Microelectronic Society of India, member IEEE and member of National Nano-Technology working group.



Dronveer Kaura
Director

After completion of academics from The OHIO State University, US, he returned to India to share the knowledge gained in his academic and serve the nation. He founded and engaged himself and his team in Industrial Automation Projects to follow industry 4.0 standard and keep India intact and way forward in the state of art technology of Automation. Under his guidance and knowledge sharing, we could develop a efficient solution for Robot Automation in the field of automobile to boost per day production. He is currently pursuing Phd in Hydrogen Fuels & Technology.



S.K. Kaul
Vice President

Having more than 20 years of experience in the field of Manufacturing, Operation, Material Management & Factory Administration. and looking after complete solutions & supply of Capital Equipment, Technology for the manufacturing of Printed Circuit Boards, Electronic assemblies, Photovoltaic Cell & Photovoltaic Modules and undertaking the turnkey installation of the solar based power projects.