BERGEN

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RENEWABLE ENERGY REFRESHER

BERGEN GROUP NEWS LETTER

PV Technology and equipment supply in India

A NEW KID ON THE BLOCK

CONTENTS

BERGEN TWIN Technologies Private Ltd, an international Joint Venture (JV) company was established in 2020 by H2GEMINI, Switzerland and BERGEN, India after their two decades of successful project coordination to serve the Indian upcoming PV market.

PV technological scenario has been fast changing in last 5 years. PERC technology has completely dethroned the conventional multi-crystalline silicon solar cell technology. The future technologies knocking on the horizon are, TOPCON and HJT. To bring in these challenging technologies in Indian upcoming PV manufacturing plants, BERGEN TWIN has geared itself to provide the best equipment and processes for these technologies to its Indian customers. BERGEN TWIN aspires to lead the nation in this complex technological field by providing one point concept-to-completion solution.

They have developed key technologies for PECVD, PVD, Texturing and Matrix automation. For other equipment they are authorised to integrate equipment from Tier-1 OEM suppliers. They specialise in line engineering and integration, process technologies and quality management.

H2GEMINI, a Switzerland company, founded by famous names in the PV industry Dr. Dirk Habermann and Uwe Habermann, twin brothers, who worked in Germany in famous PV equipment and technology supplying companies for more than two decades. Dr. Dirk Habermann was the CTO of Schmid and Meyer Burger, Germany and possesses more than 40 patents in PV technology and equipment development. Mr. Uwe Habermann was Director of Integrated Fab solution at Schmid Group and Head Project Engineering at Meyer Burger Germany. They have founded H2GEMINI in Switzerland to develop and produce high efficiency process equipment and technologies for PV industries.

BERGEN SOLAR POWER AND ENERGY LTD, a well-known integrator of turn-key PV cell and module lines in India for their partners in USA, Europe and China since beginning of the PV solar cell and module manufacturing in the country. They have the honour of supplying 90% of the cell and module manufacturing capacities in India. They have built a strong team for installation and commissioning of PV equipment, maintenance of manufacturing lines, process engineering and production ramp-up in last 15 years. Bergen Group had been successfully setting up the Solar Cell and Module Lines by providing integration & automation services to Indian manufacturers since 2005. Almost everyone who is in cell and module manufacturing industry is aware of the capability of Bergen. Since 2005, cell manufacturing companies like Moserbaer, Indosolar , Jupiter , Adani , Tata Power Solar ,Websol, BHEL , were all supplied the Capital Machinery through Bergen. Now Dr.D.N Singh, Ex CTO of Indosolar is heading the BERGEN SOLAR SEGMENT. A lot of hard work has gone in last one year to finalize the equipment, partners for optimizing the Lines for the HJT as well P-Mono PERC and N-TOPCON .

A UNIQUE & WINNING GROUP : H2GEMINI & BERGEN forming BERGEN TWIN Company is ready to launch the unique combination of process equipment and technology for Cell Lines to keep their customers ahead of competition and be future ready.

Rajinder Kumar Kaura
Chairman and Managing Director
Bergen Group of Companies

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BERGENTWIN
technologies pvt.ltd.

BERGEN and the twins Dr. Dirk and Uwe Habermann have a successful PV project history in India for more than 2 decades. BERGEN will be responsible for the local installation and technical execution of the project. The international installation and customer support will be provided by the team of engineers with many years of PV project experience .

After 2 decades of successful project cooperation BERGEN and H2GEMINI established in 2020 the international JV. BERGEN TWIN is responsible for local India customer project support, project execution, local manufacturing, after sales services, customer manufacturing support, operation and maintenance support, logistics, commercial, spare parts managements, accounts, finance and administration. The BERGEN TWIN team is providing a 24/7 local technical support during warranty period.

H2GEMINI is responsible for Line Engineering, Project Execution and Quality, Manufacturing of the key technologies PECVD, PVD and the H2GEMINI own Matrix Automation in Germany, the Integration of the tier1 OEM sub supplier:

CORE TEAM


Dr. Dirk + Uwe Habermann
Founder (CTO) Founder (CEO)

Michael Neumayer
specialist electrical engineering
former Leybold Vaccum, AMAT
Head of Econ, Product Mgt. PVD

Monica Fachinetti
specialist process and project engineer
former Watkins-Johnson, MEMC,
SCHMID, Oxford Inst. Plasma Technolc
Project Director Back-End, Quality

Dr. Zineb Seghrouchni
specialist process and project engineer
former Meyer Burger, Oerlicon AG,
Tokyo Electronics
Project Director Quality
+20 years semiconductor/PV

Dr. Benjamin Strahm
Former Head of Meyer Burger Research
(20+ years HJT research)
Process Support Cell Design

Franz Schneider
former Applied Material, Laybold
Head of mech. engineering vacuum,
+40 years experiance

Rajinder Kumar: BERGEN
JV Partner

CEO

Director

Director

OUR R&D AND TECHNOLOGY PARTNERS

We at H2GEMINI are pleased to unite with our long time friends and partners the three world leading institutes for photovoltaics and especially heterojunction cell technology in our project consortium. With INES, CESM and ISE we have a successful cooperation in many projects, from development of single processes to complete overall production processes

CEA INES is the world's leading institute in the field of high-efficiency solar cells. The experienced team from Dr. Anis Jouini will lead the process ramp-up and performance optimization and the long-term process development. CEA INES and H2GEMINI manage RELAINCE with a streamlined process and technology roadmap for sustainable technology leadership.

As energy evolves to meet the ever-expanding needs of the 21st century, CSEM is at the forefront of technological and digital developments across the fields of renewable energies and energy management services. We are using advanced technologies to help our customers thrive throughout this smarter landscape, optimizing renewable energies and their integration, storage, monitoring, control, and maintenance.

Fraunhofer ISE develops materials, components, systems and processes in five business areas. In addition to its R&D, the institute offers testing and certification procedures. Furthermore, it features an excellent laboratory infrastructure and is certified according to the quality management standard, DIN EN ISO 9001:2015. Founded in 1981, Fraunhofer ISE, with a staff of over 1200, is the largest solar research institute in Europe.

In the field of plasma technology, simulations and analyses, H2GEMINI relies on the leading expertise of Qunatemol, London.

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HJT IN-LINE PHILOSOPHY

The concepts for cell production can basically be divided in two production principles: 1. The "cluster concept" here each process step is operated as a decoupled process island 2. The “in-line concept” wherein the aim is to keep the substrates in a controllable closed process system.

Both production principles have the goal of exposing the substrates to the atmosphere as little as possible. For this purpose, an "in-line" material flow is simulated in the cluster concept by an elaborate concept of nitrogen cabinets, in which the wafer-substrate carriers are temporarily stored.

In the in-line process, the wafer substrates are naturally located in a protected atmosphere. Heterojunction (HJT) cell technology combines the advantages of monocrystalline silicon (c-Si) solar cells with the good absorption and superior passivation characteristics of amorphous silicon (a-Si), which have been observed in a-Si thin film technology using readily available materials.

From this point of view the HJT cell is a "crystalline thin film" solar cell. Since the main steps in the production of the solar cell are thin-film processes, H2GEMINI has adopted its line design more in line with the typical system concepts in the thin-film and display industry. According to the motto: "Never change a running system".

Through the consistent application of the In-Line process in the a-Si (amorphous silicon layers), the advantages of the In-Line process can be used in the manufacturing process of the HJT cell and the disadvantages of the clustered production process (traditional solar cell production) can be avoided. In-Line process technology offers the following advantages:

1. cross-contamination: In a cluster plant, the production process is decoupled and after each process step the substrates are discharged from the process chamber and loaded into the following process step. This results in mechanical stress and contamination due to multiple loading and unloading in atmospheric conditions. Downtimes between the process steps lead to change processes on the substrate surface, which can change the physical and chemical properties of the surfaces. At the same time, additional particles are picked up which are fed into the next process plant. This is completely avoided in in-line plants.

2. process time : The additional transport routes and the loading and unloading of buffer storage and process equipment swallow up expensive operating time, which is lost in productivity and must be compensated by additional machine capacities.

3. space requirement: Clustered system concepts require a large amount of space and increased automation and personnel expenditure. In order to protect the cell substrates from contamination, the transport routes must be evacuated. This is done by nitrogen-flooded channels and bridges. These are costly and complex to maintain. For the transport of substrates by operators or AGVs, free paths must be created and crossings with passenger traffic must be avoided or separately secured.

These measures result in a space requirement that is higher by factor 3 than in a comparable in-line production. In the H2GEMINI In-Line process, the cell substrates remain in the vacuum during the vacuum processes and only leave the system when all layers have been completely applied. In order to avoid the introduction of impurities that are harmful to the atomic layer, H2GEMINI has built a tray-less CVD system. The “Microenvironment" design allows lower cleanroom class requirements. The highest clean room class is reduced to the interface between wafer cleaning and CVD loading. For the metallization area, a partition wall separates it from the production area.

Dr. D.N. Singh
CEO
Bergen Solar Power and Energy Ltd.

NEWS UPDATE

BERGEN

Longi claims 25.19% efficiency for p-type TOPCON Solar Cell

Chinese PV module maker Longi has achieved a power conversion efficiency rating of 25.19% for a TOPCon solar cell.

The achievement, which has been confirmed by the Institute for Solar Energy Research in Hamelin (ISFH), is purportedly a world record for a p-type TOPCon cell.

Airtel's Data Centers Go Green Sourcing Power from a 14 MW Captive Solar Project

Digital communications solutions provider Bharti Airtel announced that it will begin sourcing power from a 14 MW captive solar project to meet the energy requirements of its core and edge data centers in Uttar Pradesh.

The facility in Tilhar is the first of the two solar projects being set up by Airtel in partnership with AMP Energy. The second project at Begampur is expected to go live in the next quarter.

These projects are being set up as part of its mission to reduce its carbon footprint.

Jakson Group launches half-cut mono PERC module in India with capacities ranging 450 W to 600 W

Solar firm Jakson Group has launched the Helia Series – a range of locally developed PV modules using half-cut mono PERC solar cells. With over 21% efficiency, the series will be in both monofacial and bifacial categories, with variants ranging from 120, 132, 144, and 156 half-cut cells configuration. The Helia series will start from 450 W and go up to 600 W, making Jakson the first module manufacturer in India to offer solar modules with over 520 W capacity.

IREDA has invited EOI for Selection of Manufacturers for Setting up Manufacturing Capacities for High Efficiency Solar PV Modules under the Production Linked Incentive Scheme

IREDA has invited EOI for Selection of manufacturers for setting up Manufacturing Capacities for High Efficiency Solar PV Modules under the Production Linked Incentive Scheme.

Regarding the deadline for submission of the responses for IFA, it is hereby informed that the same has been extended till August 31, 2021.

	Milestone	Date.
1	Last date for Application Submission	31 August, 2021
2	Technical Response Opening Date	01 Sept, 2021
3	Declaration of Successful Applicants	27 Sept, 2021
4	Issue of Letter of Award (LOA)	30 Sept, 2021.

NEWS UPDATE

BERGEN

Rooftop Solar

- With its many advantages, rooftop solar systems could have been the most popular power alternative in India's homes and establishments: It is sustainable, causes minimal distribution losses, allows dedicated transmission and requires no land use. Yet, as of December 2020, it makes for only about 20% of all the solar energy capacity installed in the country--6,792 MW of the total of 34,197 MW.
- To understand the reasons, we picked Nagpur, a central Indian city with 300 sunny days a year, for a two-part investigation. The average annual solar radiation in Nagpur is about 5.09 kWh/m2/day. To put it in context, 90% of India receives 5 kWh/m2/day of solar radiation, but only in summer months.
- Despite this advantage, of the 532,000 properties with solar rooftop potential in Nagpur, only 2,528 (0.47%) have actually installed it--2,187 residential properties and 341 non-residential, commercial or mixed use. As an incentive, the city's municipal corporation offers a 5% discount on property tax for those using rooftop systems but even that has not helped much, we found.

The implications of a messy Meyer Burger-Oxford PV divorce for European perovskites

Perovskite developer Oxford PV and heterojunction (HJT) solar manufacturer Meyer Burger appear set for a difficult decoupling – at least insofar as the companies' "exclusive cooperation" on the commercialization of perovskite tandem PV technology is concerned. And with perovskite tandem devices acknowledged by many to represent the future of high efficiency PV, the development could represent a significant disruption to the commercialization of the technology in Europe.

Oxford PV announced an end to the co-operation on Friday, with Meyer Burger yesterday stating it was "exploring its legal options" in response to the development.

The winding up of the "exclusive cooperation" was not widely expected as the partnership appearing to have been on a sound footing – not least by virtue of Meyer Burger's considerable investment in Oxford PV.

Oxford PV has attributed the strategic decision behind the separation to Meyer Burger's pivot to manufacturing – which occurred after the companies had entered into the collaboration, in March 2019. The initial cooperation agreement was supposed to establish a 200 MW HJT/perovskite tandem line and involved Meyer Burger taking an 18.8% stake in Oxford PV. The deal also included an option for Meyer Burger to double that investment by the end of 2020

Europe had just 650 MW of solar cell manufacturing capacity at the end of 2020

The latest version of the Photovoltaics Report produced by German research body the Fraunhofer Institute of Solar Energy Systems (ISE) has laid bare the state of European photovoltaic manufacturing at the end of 2020.

The continent had 22.1 GWp of solar-grade polysilicon production capacity at that point, according to an executive summary of the latest update of the document, published yesterday. According to the report, Europe's polysilicon capacity was held by Norwegian-based, Chinese state-controlled manufacturer Elkem, and by German businesses Wacker and Silicon Products.

NEWS UPDATE

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Global Solar Lighting Systems Market to Reach $11.2 Billion by 2026

A research report published by Global Industry Analysts Inc., (GIA) makes the prediction that the global solar lighting market will reach $11.2 billion by 2026.

The global market for Solar Lighting Systems is estimated at US $ 5.5 Billion in the year 2020. Thus, the revised size of US$11.2 Billion by 2026 will entail growing at a CAGR of 13% over the analysis period. LED, one of the segments analyzed in the report, is projected to grow at a 15.2% CAGR to reach US$9.3 Billion by the end of the analysis period. After a thorough analysis of the business implications of the pandemic and its induced economic crisis, growth in the Other Light Sources segment is readjusted to a revised 8.4% CAGR for the next 7-year period. This segment currently accounts for a 36.6% share of the global Solar Lighting Systems market.

NTPC and SolarArise Win RUMSL's 450 MW Shajapur Solar Auction; Lowest Tariff – ₹2.33/kWh

NTPC Renewables and Talettutayi Solar Projects Nine (SolarArise) were declared winners in the Rewa Ultra Mega Solar Limited's (RUMSL) auction for 450 MW of solar projects at the Shajapur Solar Park in Madhya Pradesh. NTPC quoted the lowest tariff of ₹2.33 (~$0.0313)/kWh in the auction.

NTPC Renewables won a capacity of 105 MW quoting ₹2.35 (~$0.0316)/kWh, and also a capacity of 220 MW quoting ₹2.33 (~$0.0313)/kWh. Talettutayi Solar Projects Nine (SolarArise) won a capacity of 125 MW quoting ₹2.339 (~$0.0314)/kWh.

Rayzon Solar to add 1.2 GW of mono PERC module capacity

The Gujarat-based manufacturer is scaling its production lines up to 1.5 GW with the addition of 1.2 GW of mono PERC output capacity by the end of December. The new line will produce up to 600Wp panels with an efficiency of 21.4%.

The existing module production line of Rayzon Solar

The manufacturer will add a 1.2 GW mono PERC (passivated emitter and rear contact) line to its existing 300 MW state-of-the-art facility in Gujarat. The capacity addition will complete by December end.

Rayzon Solar's existing facility is equipped with an automated stringer and laminator having the capacity to produce 335Wp polycrystalline and up to 400Wp monocrystalline modules.

Kamlesh Gohil, international business development head at Rayzon Solar, told pv magazine the new 1.2 GW production line will be equipped to produce mono PERC solar panels with wafer sizes up to 220 mm. It will have the capacity to produce panels with up to 600Wp output and an efficiency of 21.4%.

NEWS UPDATE

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Coal India Forms Subsidiaries for Solar Manufacturing and 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 a 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 have formed a Joint Venture (JV) with NLC India for this purpose.

Indian Oil to Build a Green Hydrogen Plant in Mathura

Oil and gas corporation IndianOil is set to build the country's first green hydrogen plant at its Mathura refinery. The company will wheel wind power from its project in Rajasthan to yield green hydrogen through electrolysis at the Mathura plant. The company zeroed in on Mathura as the project site due to its proximity to the Taj Mahal to sensitize the masses about protecting the monument from pollution. The firm will likely utilize green power from the grid to power the project, thereby decarbonizing some parts of the manufacturing.

Tata Power Solar Doubles Cells, Modules Manufacturing Capacity to 1,100 MW

Tata Power Solar has announced the expansion of its manufacturing unit in Bengaluru, taking the total production capacity of cells and modules to 1,100 MW.

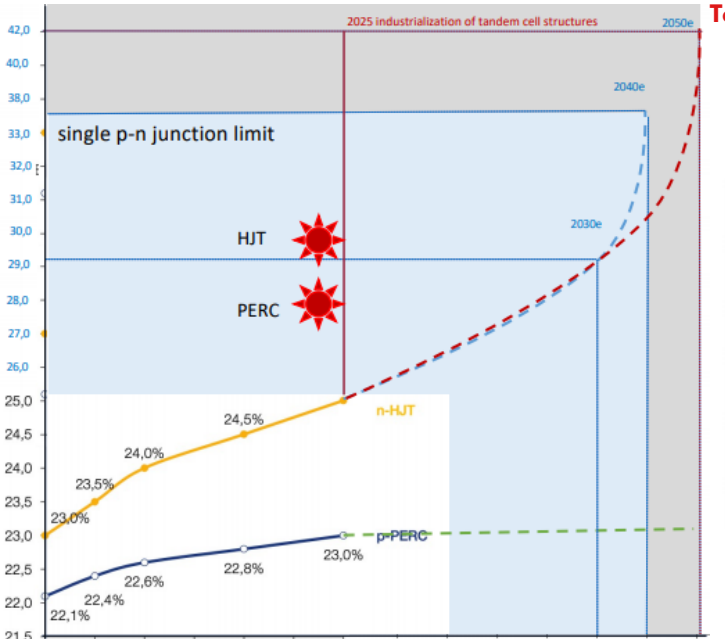
The latest expansion move has increased the Bengaluru-based plant's manufacturing capacity of cells from 300 MW to 530 MW with mono passivated emitter and rear cell (PERC) and modules from 400 MW to 580 MW with mono PERC half-cut technology.

The production lines are capable of handling 166-210 mm wafers and module wattage ranging from 440W to 530W with the option for bifacial modules.

The company said that the conducive climate created by the central government towards making India a manufacturing hub and lessen its dependency on other countries for solar cells and modules gave it the confidence to go ahead with the expansion.

The expansion was prompted by the increase in demand for solar modules and by the likely growth following the government's 'Atmanirbhar Bharat' (self-reliant India) push, the company said.

BERGEN TWIN TECHNOLOGY ROADMAP



Tandem Cells

- Theoretical maximum efficiency for the single p-n junction solar cell efficiency is 33.7%.
- Theoretical maximum efficiency of multi junction silicon solar cells is 44,0%

Improvements in:
- Advanced process technology and materials
- High performance wafer material

- **Cell Designing**
- **Realization of Multi Junction Cells**

H2GEMINI Solar-Roadmap

H2GEMINI has an integrated technology roadmap based on the optimization of the individual steps between wafer fabrication and cell production. The goal is to demonstrate a monolithic 30% HJT cell in an industrial process and standard wafer format by 2025. The first basic processes have already been successfully realized.

PRODUCT UPDATE

BERGEN

System for SDR, Texturization & Clean
GEMINI qTex powered by exateq

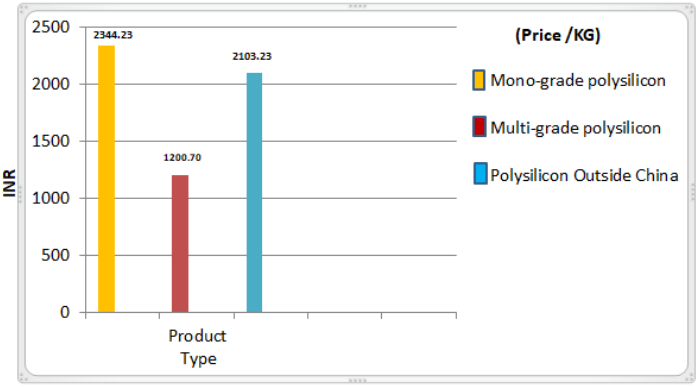
This wet-chemical system is a batch system, using wet carriers in order to transport the wafers through a bath sequence. The system consists of several baths, using wet chemistry to run an alkaline texturing recipe required for HJT cell processing for mono crystalline wafers. The system is an inline tool, where wafers are fed in and after processing directly loaded in the CVD process to prevent efficiency losses caused by wafer
contamination

The wet chemical etch process removes saw damage and textures the surface for improvement of optical properties by increasing the roughness of the wafer surface and improving the capability of photon capture. To extend the bath lifetime and to lower the consumption of chemicals and water, a Bleed & Feed system and continuous measurement of concentration is included. The process contains the H2GEMINI patented Ozone Clean for high performance semiconductors.

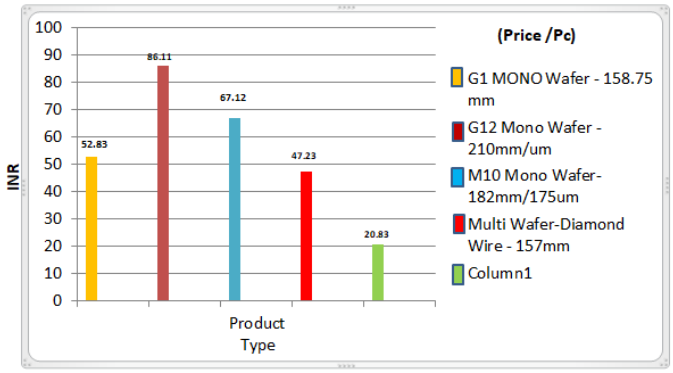
MARKET ANALYSIS

Price update

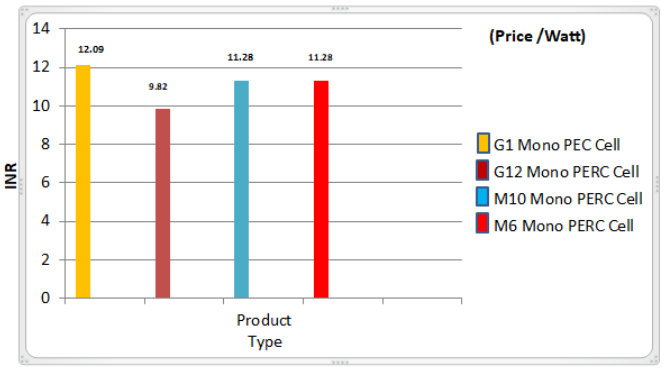
Polysilicon Spot Price Update-Virgin Poly (Spot, Contract)/Granular



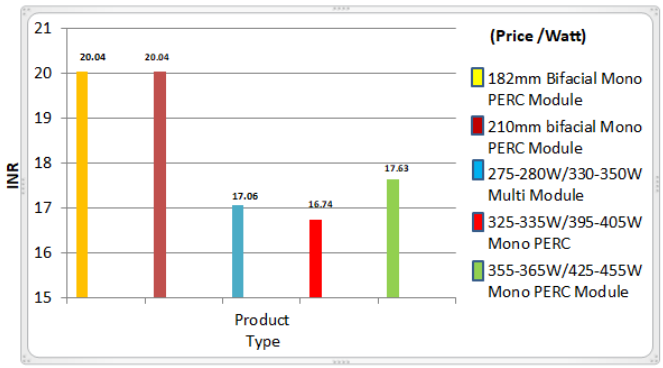
Wafer Spot Market Price Update - Multi SI/Mono G1M6



Cell Spot Market Price Update - Multi/Mono/PERC



Module Spot Price Update - Multi/Mono



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EDITORIAL TEAM

Rajinder Kumar Kaura
CMD

With nearly 43 years of contributions in conventional and non conventional power and electronics field, he is pioneer and pathfinder in developing solar & electronic industry in India. His contributions in bridging he 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 States 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, USA, 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 standards 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 38 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 Cells & Photovoltaic Modules and undertaking the turnkey installation of the solar based power projects.