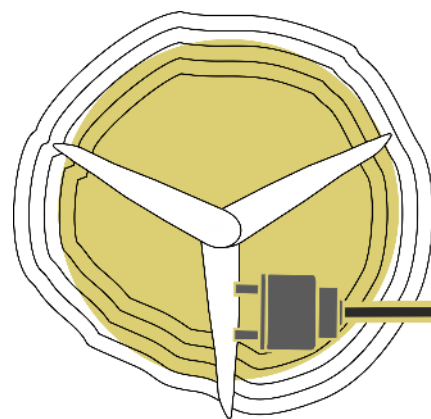




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net zero energy buildings





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Implementing Partner



SESSION MODERATOR



DEEPA PAREKH

Sr. Project Manager
Environmental Design Solutions



Rooftop PV



Building Integrated PV



Small wind turbines



13th December '19

Renewable Energy Technologies for NZEBs



Brief Introduction

- 40 GW from rooftop solar & 60GW from wind is targeted by 2022
- Renewable energy is integral to NZEBs
- Awareness of RE technologies, and applications is essential to make NZEBs the norm.





Gaurav Gupta

Director, Linear Energy



Wim Van de Wall

Owner, WallVision BV



Md. Shamir Khader

Business Developer,
WallVision BV



Arun George

Founder CEO, AvantGarde
Innovations



QnA



MAITREE



Click a pic
of an interesting
facade that has

40%-60%
window wall ratio
(WWR)

and share it on
social media
with #nzebindia
by 27th Dec



#nzebindia
photocontest
December '19



10th January '20

@ 4:00 PM

High Performance by Design | Avasara Academy

Presentation by
Samuel Barclay
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Occupant Perspectives : NZEB at CEPT University

With Rajan Rawal
Principal Director
and Dr. Yash Shukla
Technical Head
CEPT



**OVERVIEW
IGBC NET ZERO ENERGY PROGRAM**

With Dr. Shikra Dhaka
Counsellor
IGBC



**OVERVIEW
USGBC LEED ZERO PROGRAM**

With Emma Hughes
Project Manager
USGBC



**GREEN CONVERSATIONS
MINISTRY OF NEW AND RENEWABLE ENERGY HEADQUARTERS**

With the Design Team



**GREEN CONVERSATIONS
UNNATI**

With Anshul S Lal
Principal, UNNATI
&
Project Team

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NZEBs Case Studies

Case studies of energy efficient and net zero energy with a focus on India, provide important insights to the feasibility of the concept.

Considering the concept is still in its nascent stage in India, it is very useful to study how architects and building owners have gone about setting net-zero and energy efficiency goals in the selected buildings. Moreover, the selected case studies are in various stages of design and implementation, with some already in the measurement & verification stage, enabling the demonstration of different aspects of net-zero implementation. This section contains the details of operational NZEBs, and will be updated periodically as more NZEBs emerge on the horizon.

The focus of the case studies is on the energy efficiency measures that have been implemented in the projects, the range of energy performance indices (EPI) the

- NZEBs in India
- international case studies
- detailed case studies
- nalanda university [PACE-D pilot]





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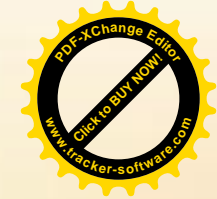
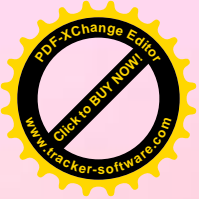


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EFFICIENCY

nzeb@edsglobal.com





LINEAR ENERGY

ROOFTOP SOLAR SYSTEMS
14 Dec, 2019.



COMPANY OVERVIEW

We provide for all your Energy Needs

Linear Energy PVT. LTD. is a Solar Photovoltaic Developer providing Tier-1 Products and Complete Energy Solutions in the fields of Solar PV, Energy Efficiency and Power Quality Management.



Leading New Business Models

We were the **first** to develop a **Private REC Solar PV Plant**, back in 2012.

Also we were the **first** to achieve **Net-Zero Bill** for a **Net-metered Customer** in India, in 2016.



Energy Solution

Whatever be your **Energy Need**, We provide a **Great and Reliable Solution** – Off-grid, On-grid, Gen-set sync, Storage.

We have delivered more than 115 solutions so far!



Registered and Certified

We have been **registered** with **MNRE, Govt. of India** since 2015. We have rating of **#3C** from SMERA accreditation agency and have delivered solar solutions to NGO's, HNI's, Zila Panchayats and PHED Contractors.



Quality meets Lowest Cost

Rest assured. We achieve **Cost Competency** by our presence in the **Value Chain** and through long-term relationship with **Tier-1 Vendors!** No wonder we have aggregated more than **10 MWp** of Solar Solutions. ◀ ▶





SERVICES - SUMMARY

DEVELOPER

Off-grid Solar
On-grid Solar
Solar Water Pumps



DISTRIBUTORSHIP

Modules: Panasonic
Inverter: SMA, Zever, Solis, Microlyte
Battery: Luminous, Eastman

EPC

Roof-top Solar
Ground-mount Solar
Floating Solar

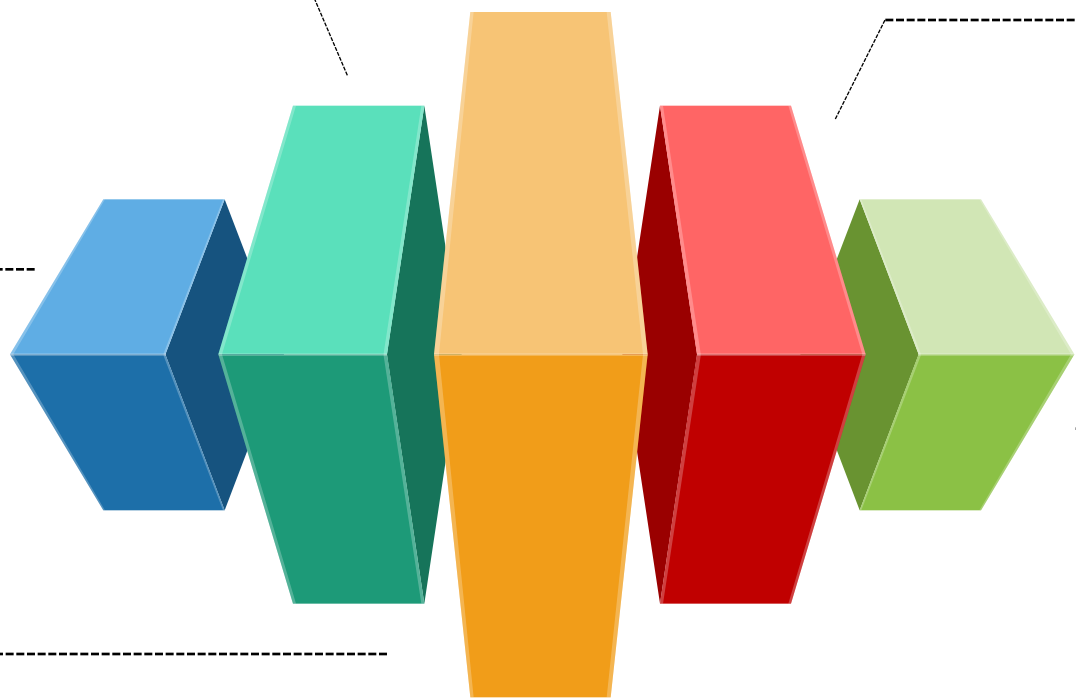


MANUFACTURING

Combiner boxes
Solar Structure

I&C

Roof-top Solar
Ground-mount Solar
Floating Solar



Quality

We use only Tier-1 equipment for our projects!

Time

We believe in on-time delivery because time is money!

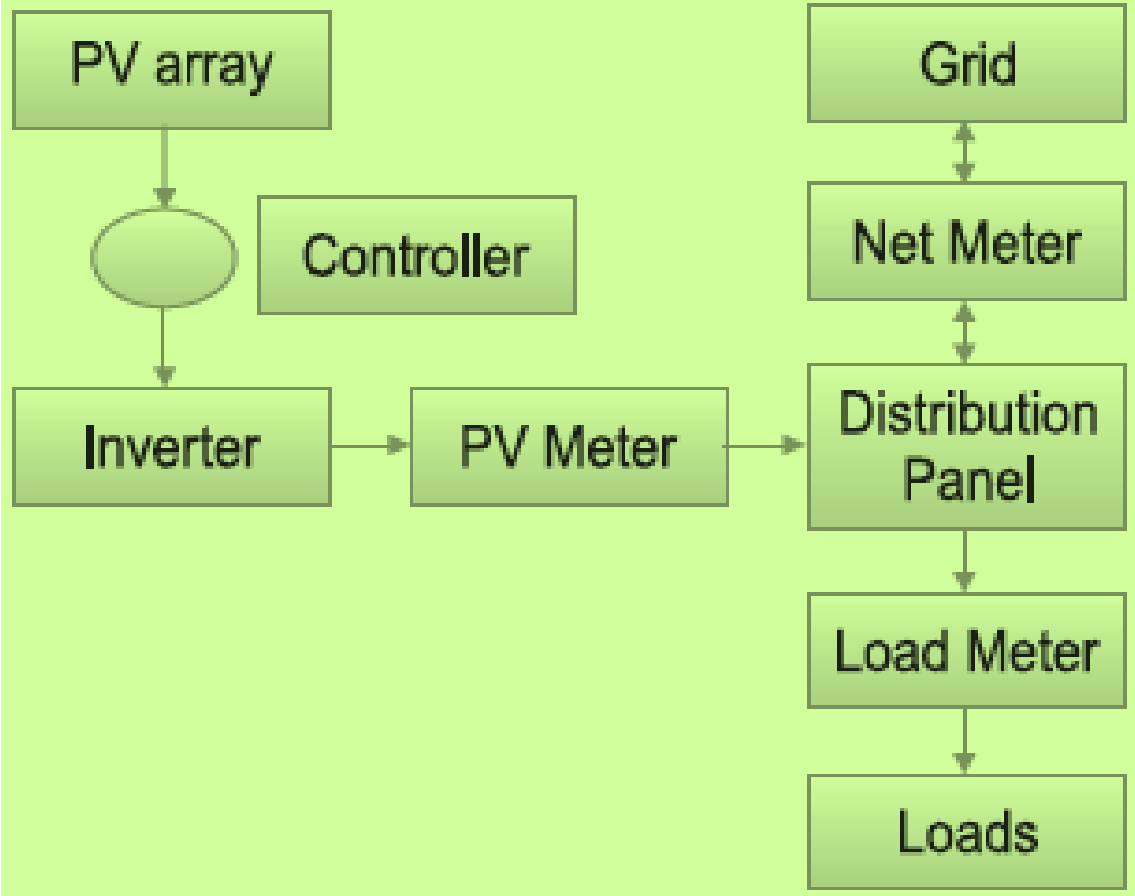
Cost

We deliver at lowest cost without compromising on quality!





Energy Flow Solar Rooftop Project



Rooftop Solar Project Process Flow





Planning, Analysis and Design

Scope	Common Errors	Latest Trends
<p>Planning:</p> <ul style="list-style-type: none">Acquisition of Data, by a trained site surveyor, for understanding of load requirement, type of load and Grid quality & availability.Study of Roof conditions, entails assessment(wrt Solar panel mounting & shading analysis), wiring routing, earthing and LA planning.	<p>Due to Communication gap between end client and planning personal or site surveyor over clients energy requirements leads to errors.</p> <p>The surveyor should also interact with client's maintenance and electrical department since their priorities have to be understood and captured in site survey form.</p>	<p>Drones are being used conduct site survey of roof conditions. Drones provide orthomosaic models with accuracy level of 1 meter or better which can be imported into other software for further detailing and study.</p>



Planning, Analysis and Design

Scope	Common Errors	Latest Trends
<p>Analysis: Software and trained manpower are used to analyze the data as per relevant IEC code/Local electrical laws.</p>	<p>Report from one software alone cannot provide accurate picture, results of two or more software should be correlated and used.</p>	<p>Helioscope /Pv syst/ Google Earth Sketchup are being used to site survey of roof conditions.</p>
<p>Design: Final Module layout, Structural Drawing, cable routing, Inverter Sizing, Shadow analysis, maintenance planning and aesthetics check.</p>	<p>All final designs should be discussed and signed by the final client. Maintenance is most important aspect of Solar power plant design.</p>	<p>As built design of solar power projects to verify the initial design proposed and also plan maintenance activity.</p>



IEC codes Relevant for Execution

Execution

- Installation of Solar MMS.
- Installation of Solar panels.
- Wiring of solar modules and safety equipment connection.
- Wiring of Inverter and safety equipment connection.
- Earthing and LA Installation.
- Connection with LT panel.

- IEC 62759-1 :Photovoltaic (PV) modules – Transportation testing, Part 1:Transportation and shipping of module pack units.
- IEC 62109-1, IEC 62109-2 :Safety of power converters for use in photovoltaic power systems - Part 1: General requirements, and Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters. Safety compliance (Protection degree IP 65 for outdoor mounting, IP 54 for indoor mounting).
- General safety requirements for connectors, switches, circuit breakers (AC/DC):
 - a) Low-voltage Switchgear and Control-gear, Part 1: General rules
 - b) Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers
 - c) Low-voltage switchgear and Control-gear, Part 3: Switches, Disconnection , switch-dissconnectors and fuse-combination units
 - d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests
- IEC 60269-6: Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection .
- IEC 61643-11:2011 / IS 15086-5 (SPD) ,Low-voltage surge protection devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods .
- IEC 60227 / IS 694, IEC 60502 / IS 1554 (Part 1 & 2) :General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for outdoor installation) .
- IEC 62561 Series (Chemical earthing) IEC 62561-1 Lightning protection system components (LPSC) - Part 1: Requirements for connection components .
- IEC 62561-2 Lightning protection system components (LPSC) - Part 2: Requirements for conductors and earth electrodes .
- IEC 62561-7 Lightning protection system components (LPSC) - Part 7: Requirements for earthing enhancing compounds .
- IEC 60529 Junction boxes and solar panel terminal boxes shall be of the thermo plastic type with IP 65 protection for outdoor use, and IP 54 protection for indoor use .
- IS 2062 / IS 4759 : Material for the structure mounting .



Technical Guidelines and Best Practices

Solar PV Roof Mounting Structure

Aluminum frames will be avoided for installations in coastal areas.

Solar Panels

Plants installed in high dust geographies like Rajasthan and Gujarat must have the solar panels tested with relevant dust standards (Applicable standard would be IEC 60068-2-68).

Fuse

The fuse shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

Cables

For the DC cabling, XLPE or, XLPO insulated and sheathed, UV-stabilized single core flexible copper cables shall be used; Multi-core cables shall not be used.

For the AC cabling, PVC or, XLPE insulated and PVC sheathed single or, multi-core flexible copper cables shall be used; Outdoor AC cables shall have a UV-stabilized outer sheath.

The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.

The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.

The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm.

Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.

All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm; the minimum DC cable size shall be 4.0 mm² copper; the minimum AC cable size shall be 4.0 mm² copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.



Operation and Maintenance.

For sustained advantage in using solar power plant, there is a imperative requirement of proper operation and maintenance plan.

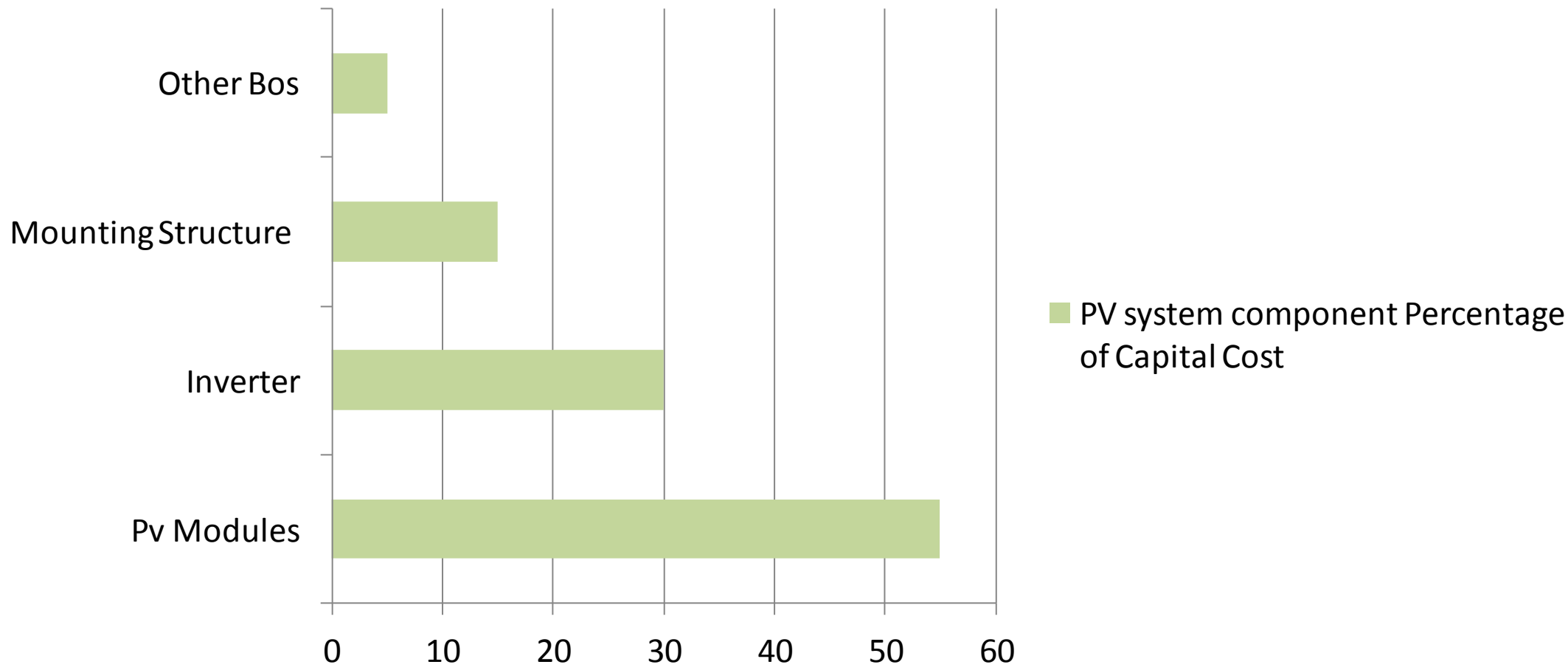
Basic tenets of maintenance plan:

1. Cleaning Cycle.
2. Quarterly/Yearly check of all major components.
3. Performance monitoring and benchmarking.

Basic tenets	Cleaning Cycle	Quarterly/Yearly check.	Performance monitoring and benchmarking.
Do's	Identification of dusting cycle as per site conditions. Regular cleaning based on dusting cycle at site especially summer season.	Check all connections, visual inspection of panels, earthing value check and LA continuity check.	Configure RMS for all errors alert.
Dont's	Don't Use of hard water. Don't Climb on panels. Don't clean the panels in the day, do it only after solar production has stopped.	If any problem is identified, don't procrastinate the change of component and the system checked again after installation of the component.	Don't give access to many people ,adds to the confusion. Don't ignore any error as it has long term consequence on components health.

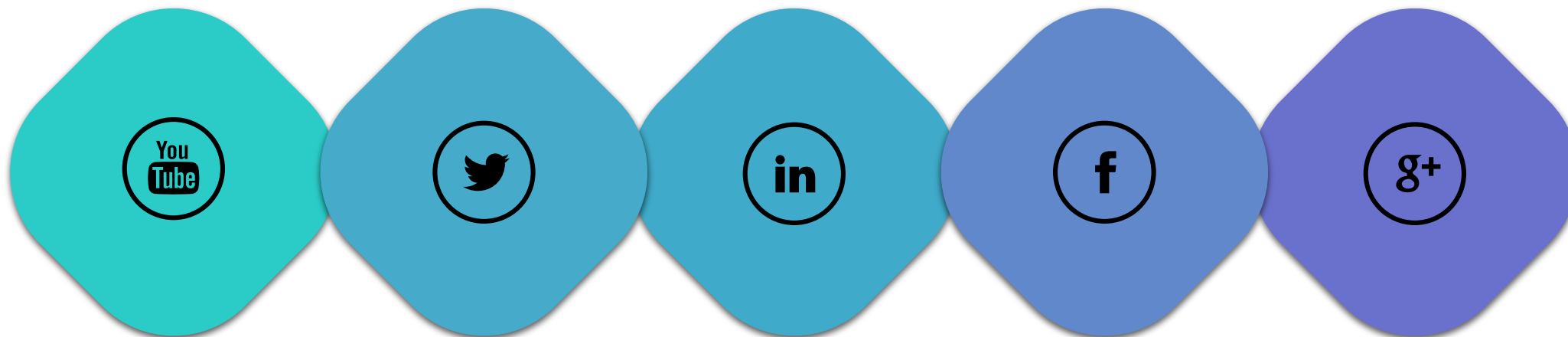


PV System Component Percentage Of Capital Cost





CONTACT US



+ 91-11-41661902/3/4



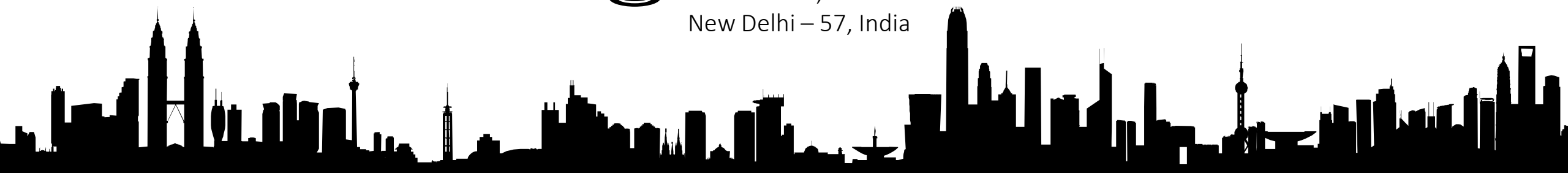
www.linearenergy.in



marketing@linearenergy.in



A 10/3, Front Ground Floor,
Vasant Vihar,
New Delhi – 57, India





WALLVISION B.V.



A SOLAR PERSPECTIVE

Presented by Mohamed Shamir Khader



AN UNDERSTANDING

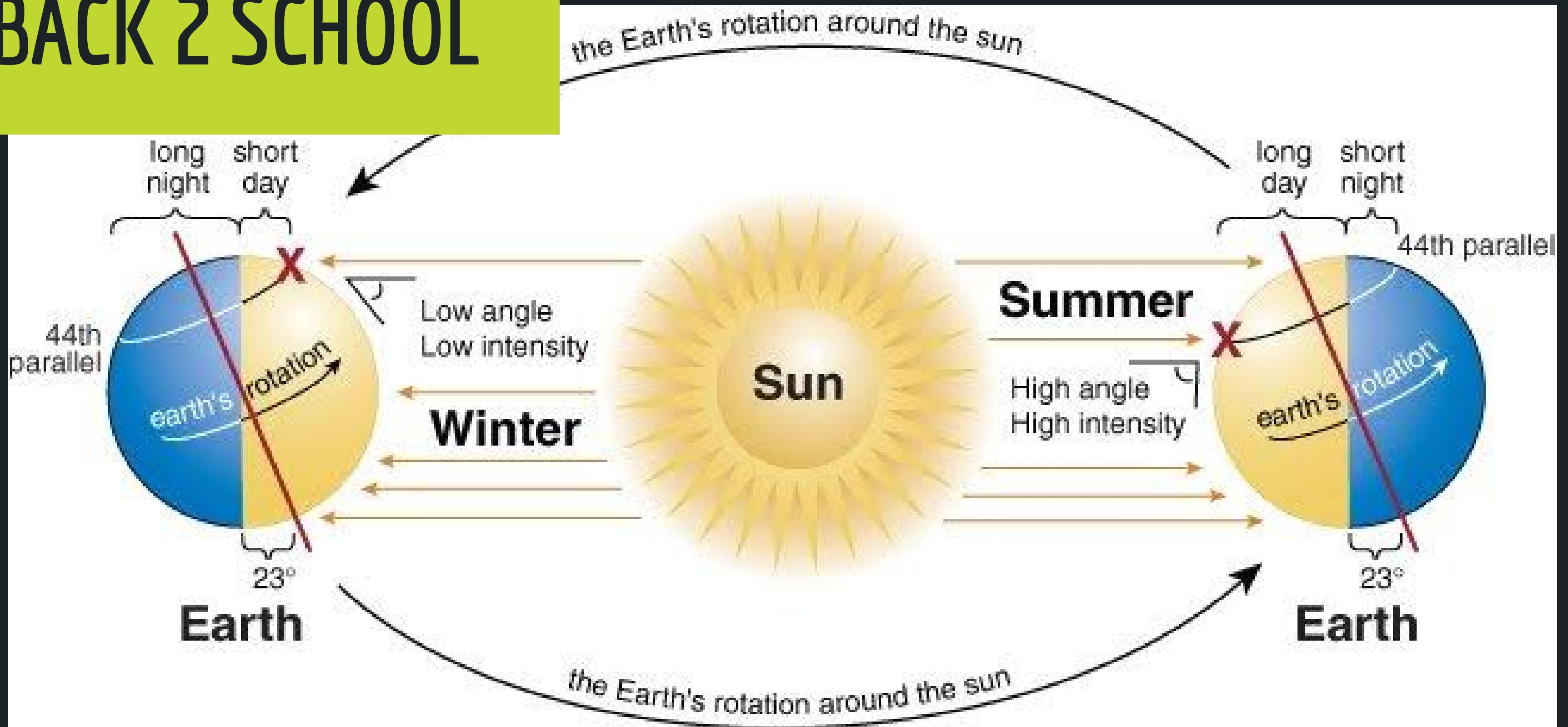
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- BIPV- Xplored
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- More than $E=MC^2$
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- ZIGZAGSOLAR®- An Insight
- ZIGZAGSOLAR®-Xplained
- Asia vs Europe- A Natural Edge
- Contact Us





BACK 2 SCHOOL





LOW RISE vs HIGH RISE

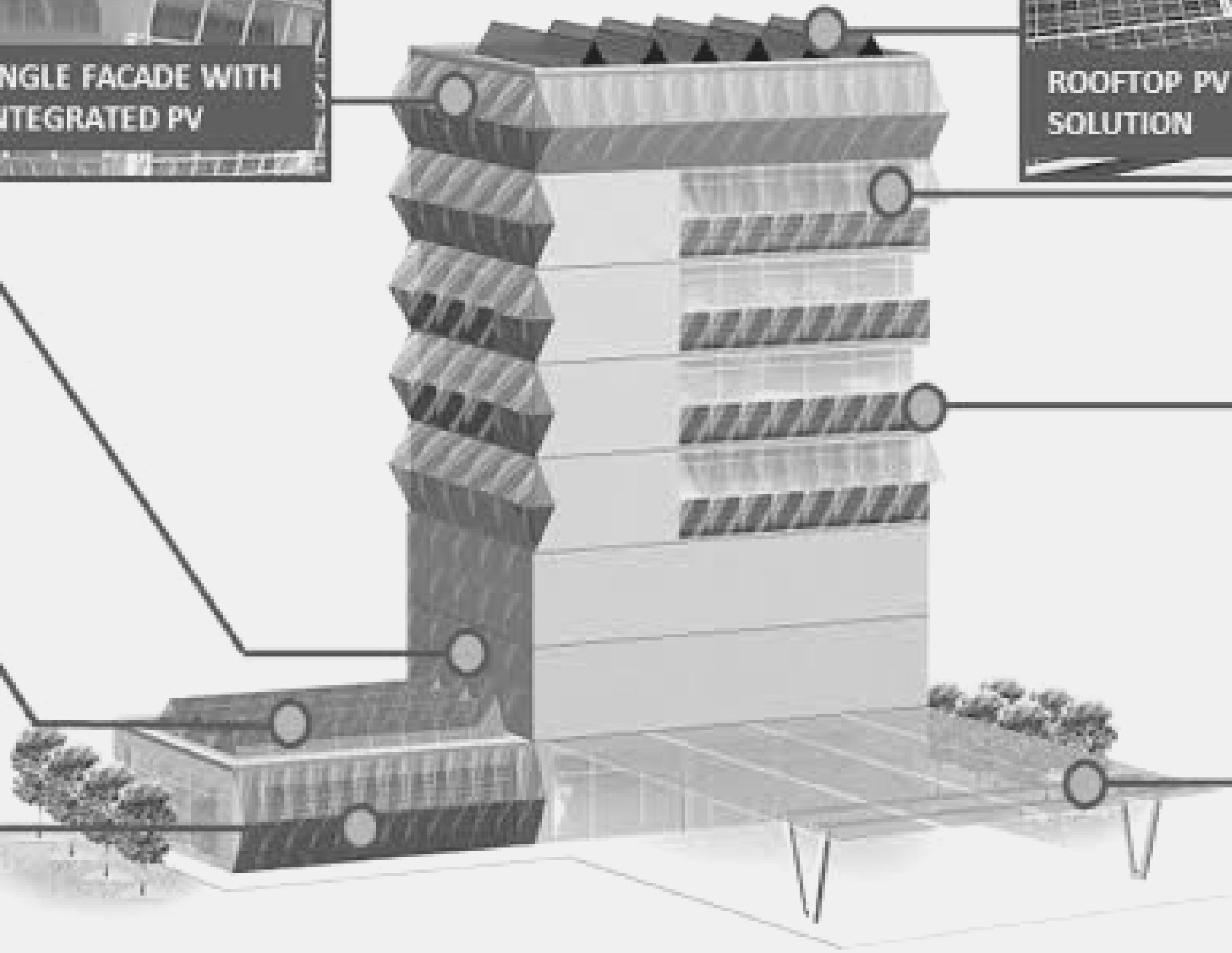
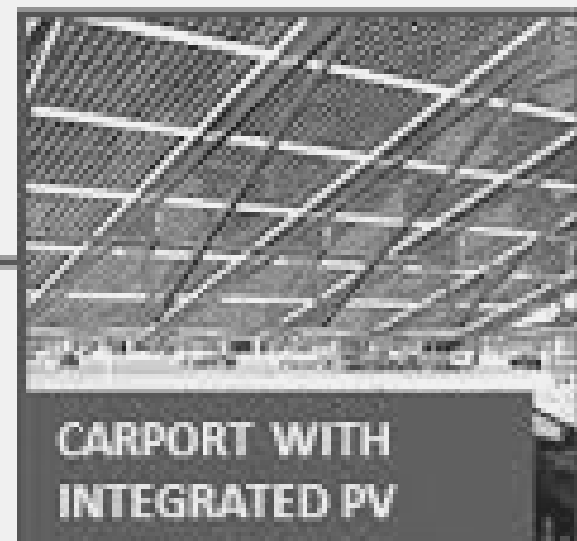
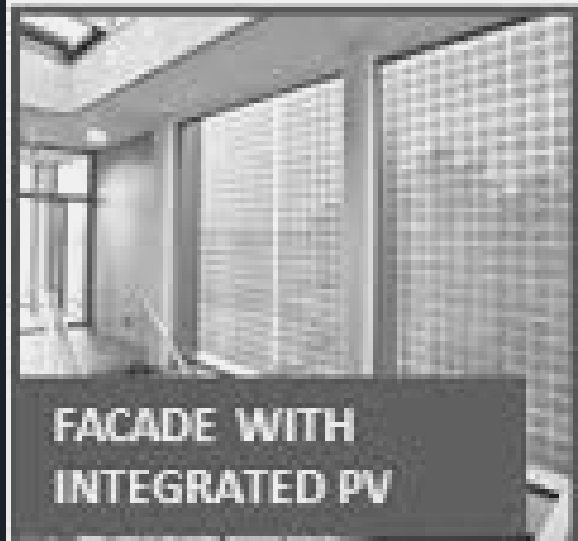
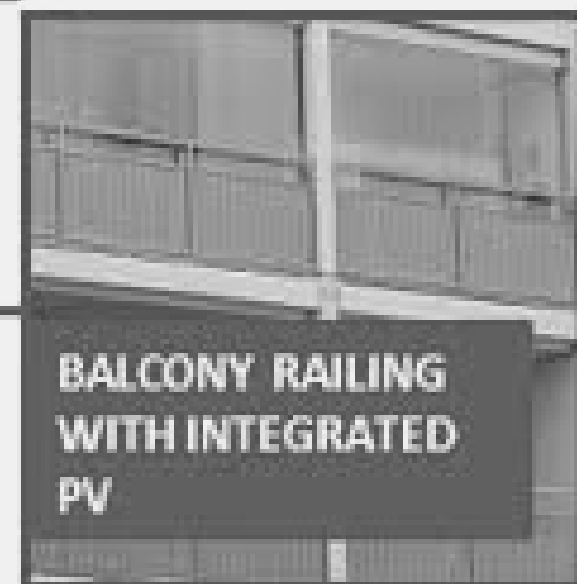
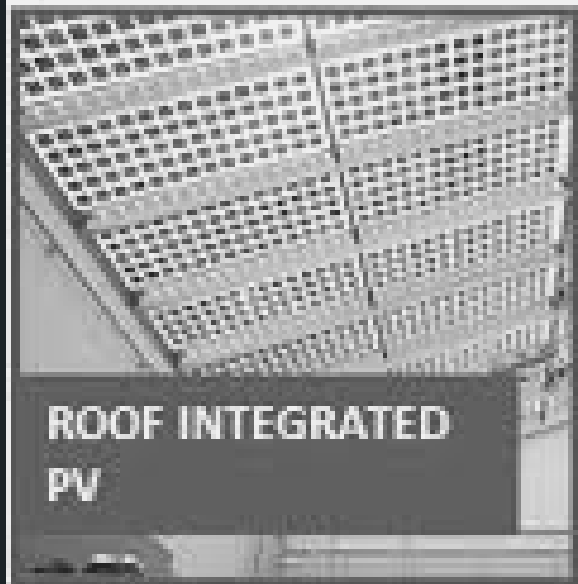
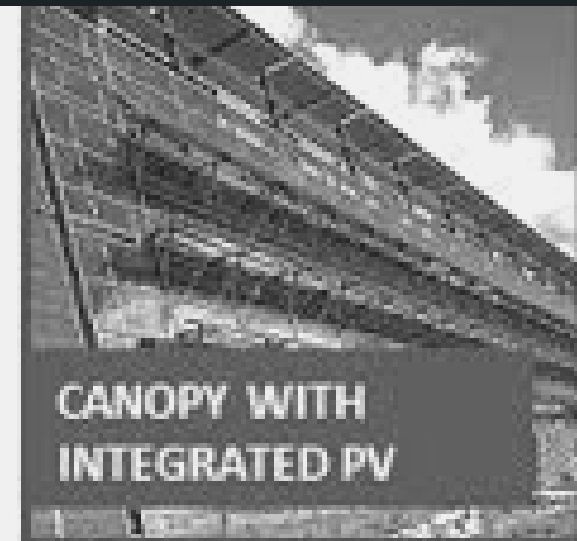
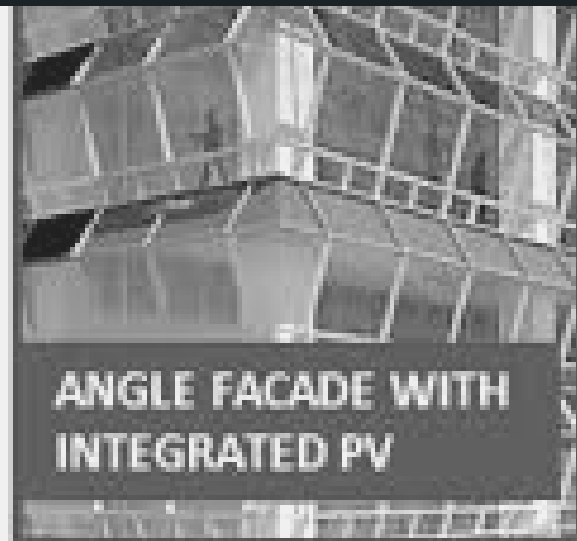


BIPV XPLORED

FUTURE MEETS THE PRESENT

A spectrum of stakeholders design, engineer and build a piece of art that will transform the building to the future by protecting the present.

Wide applicability of BIPV





BAPV

Building Applied Photovoltaics consist of solar cells or modules systems that are installed on roofs. This does serve any other purpose apart from electricity production.

BIPV

Building Integrated Photovoltaics are solar cells integrated into the building envelope elements, such as construction materials as roof tiles and ceramic or glass facades. BIPV serves dual purpose - as a protective skin and electricity generation.





MORE THAN $E=MC^2$

ARCHITECTURAL DESIGN

The ultimate challenge on integrating BIPV technology onto buildings is the architectural design.

TECHNICAL PARAMETERS

Solar, structural, electrical parameters needs to be understood as part of the design.

INSTALLATION AND MAINTENANCE

Installation and maintenance of BIPV technology in India poses a huge challenge.



TYPES OF BIPV/BAPV

AN INSIGHT

WINDOWS AND FAÇADES

- Windows
- Warm façades
- Cold façades

ROOFS AND COVERINGS

- Full roof solutions
- Tiles

ACCESSORIES

- Balconies, balustrades
- Sklights
- Solar glazings



ZIGZAGSOLAR® - AN INSIGHT





ASIA VS EUROPE
A NATURAL EDGE

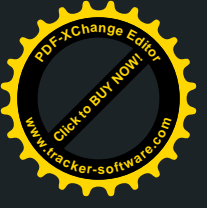


200 MWh

South facing building

6048 SQ.M

Copenhagen international school,
Nordhavnen, Denmark



675 KWp

South & West facing façade

6408 SQ.M

Police commissionerate building,
Hyderabad, Telangana



FOR MORE ON BIPV...

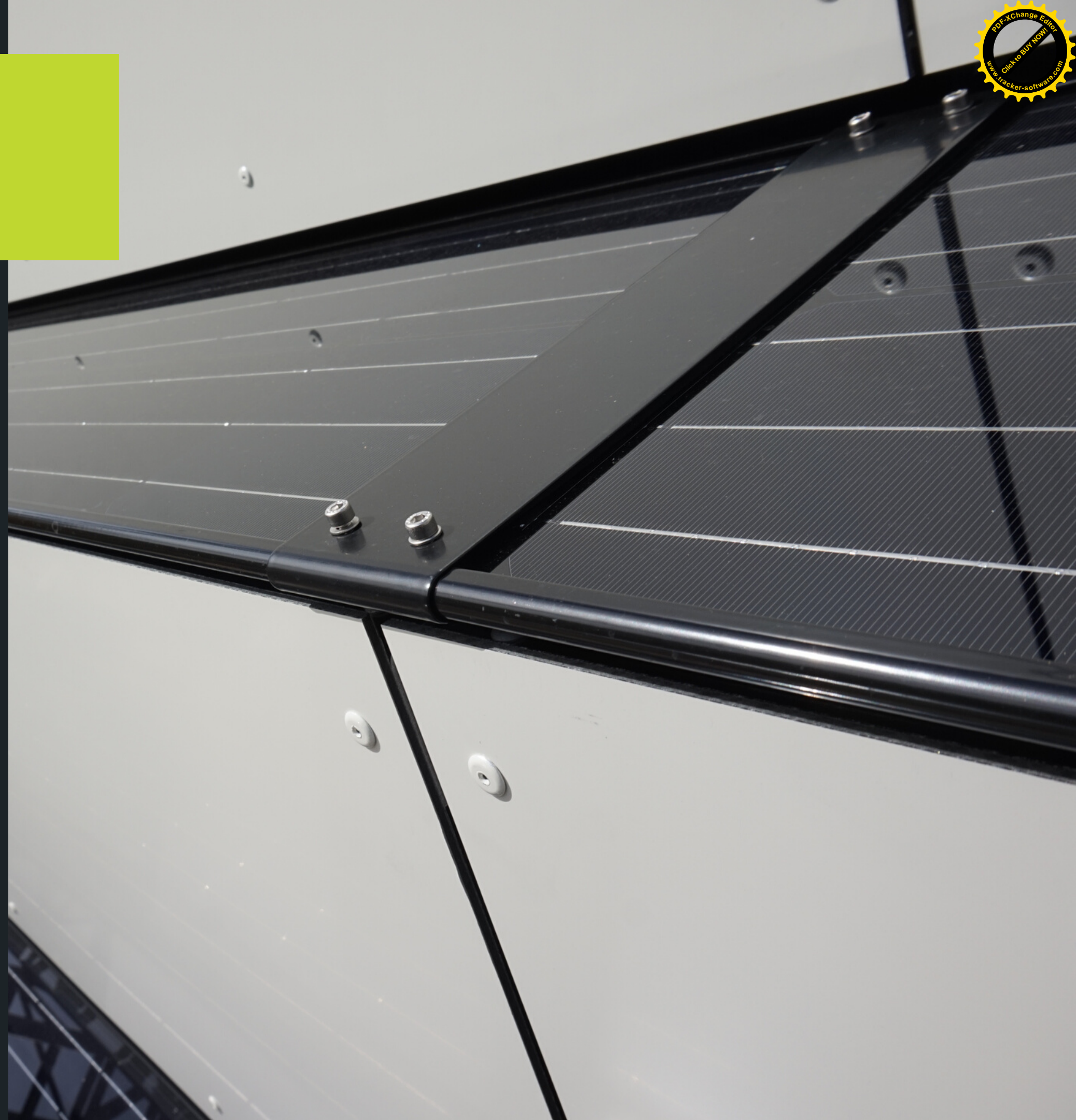
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PHONE NUMBER

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Small Wind Turbines to make Buildings Go Green





ABOUT Avant Garde Innovations

- Chosen by 'GLOBAL CLEANTECH INNOVATION PROGRAMME (GCIP) 2015' as one of top 20 Innovation in India.
- 1st & only Small Wind Turbine company officially recognized by the Govt of India under the 'Make in India' manufacturing initiative.
- 2nd time chosen by the UN again at the 1st UN Innovation Summit 2019 held in India and showcased amongst the Top 20 Innovations.



AVATAR™ - I

- Super efficient Axial Flux Turbine: Multi-Phase, Multi-Voltage and Brush-Less.
- Daily output of 5 kWh at mean wind speeds of 5.5 m/s.
- Direct Drive and Gear-less
- Starting speed of just 1.4 m/s breeze.
- Cut-in speed is 1.9m/s breeze.
- Survival speed of 60 m/s of cyclonic winds.
- Noiseless.
- Automatically faces any wind direction.
- Temperature Range is meant for harsh marine , snow, desert area.



PRACTICAL CAPACITY OF AVATAR™- I



AVATAR™- I (1kW) can run 84 LED bulbs for 1 continuous hour at minimum average wind speed of 2m/s.



84 LED lights of 10 W each



PRACTICAL CAPACITY OF AVATAR™- I AT HIGHER RATED CAPACITY



AVATAR™- I can run all the appliances for 5 continuous hour at average wind speed of 5.5m/s.



3 LED 10W each



1.5 TONN AC



150lt Refrigerator



2 FANS 75W each



LAPTOP 40W

BIRD FRIENDLY



HEIGHT : 80 m



- HEIGHT : Only 6 - 10 m
- Visibility Paint on blades



WIND OR SOLAR?

- Duration of Power Generation
- Space Utilization
- Annual Generation
- Efficiency
- Life of Battery
- Maintenance
- Effect from Air pollution





More kWh per sq meter





INTEGRATING AVATAR™ WITH BUILDINGS

- Cost of per kW of AVATAR™ Small Wind Turbine is less.
- Can be installed in urban areas as the most areas has average wind speed of 3-4m/s.
- RPM control for longer bearing life and safe rooftop installation.
- AVATAR™ contributes to LEED points.
- Tall rise building are advantageous to Small Wind Turbine.
- ECBC policy for dedicating portion of rooftop for RE
- Virtual net-metering
- Energy trading using block chain technology.



CURIOUS??

ASK!!