MITREX™ | Cladify™

Building a Greener Future:
Sustainable Material Solutions Presentation

Sustainable Facades:

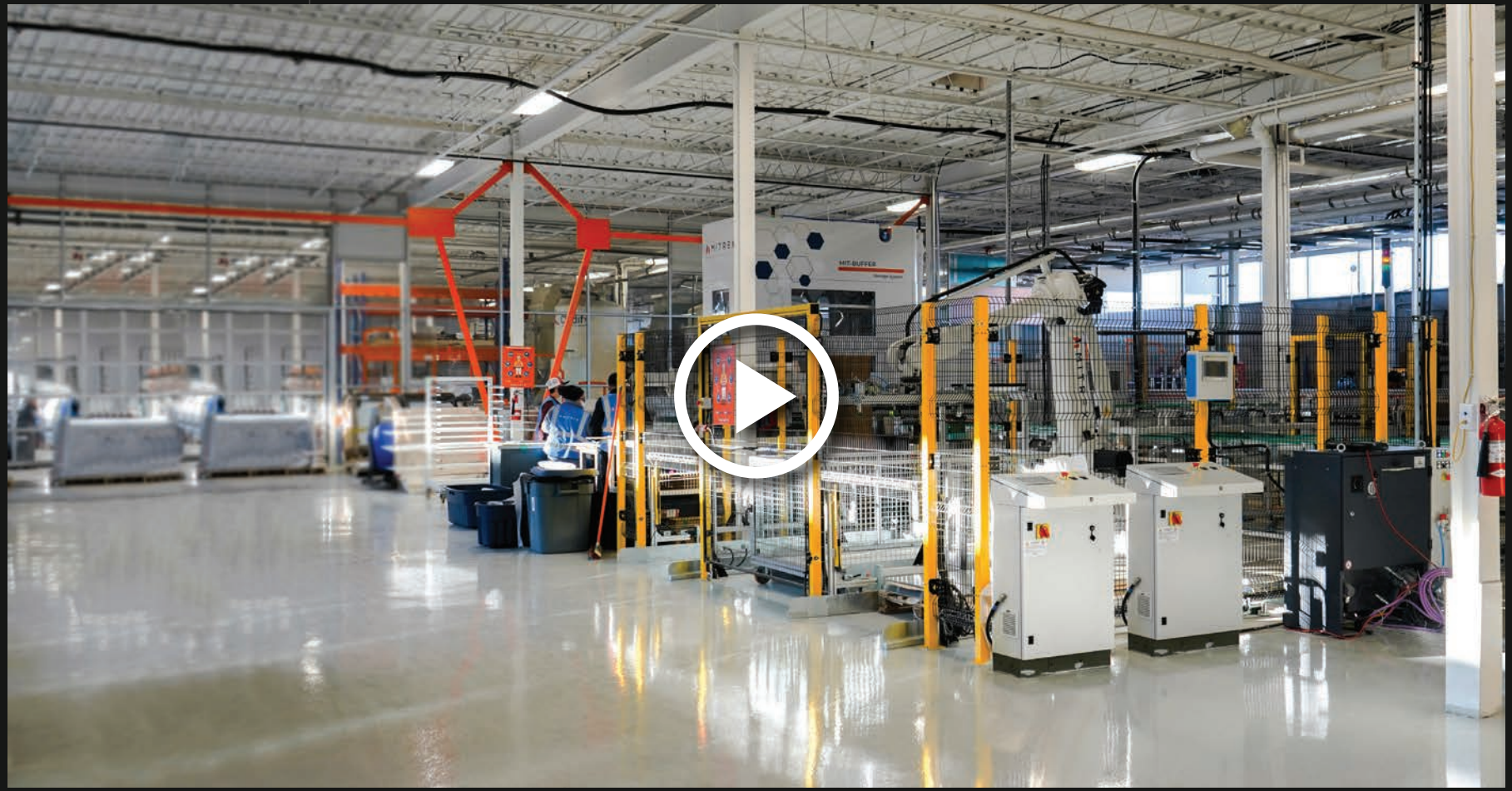
From Our Stone Roots To Solar Innovation

Stone Cladding

Lightweight Cladding

Multifacing and High-performance Cladding

Solar Facade

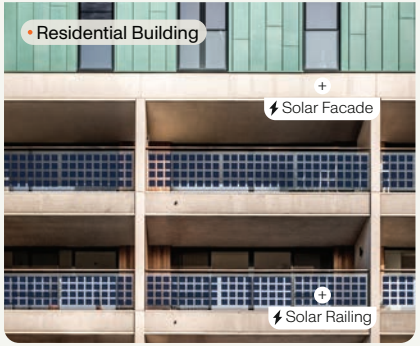


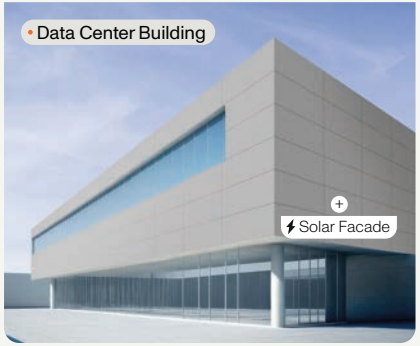
Our Mission

Our Mission is to be the catalyst that accelerates the adoption of sustainable, energy-generating,human-made structures.

Sustainable Applications

From solar glass to railing, roof and more, we aim to make any surface sustainable and energy generating.





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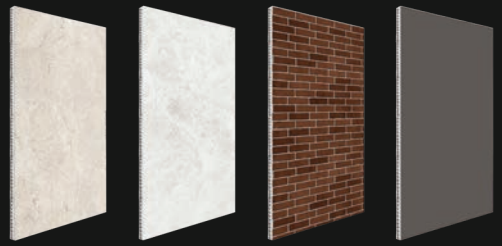
What Do We Manufacture?

Sustainable Solutions

Non Solar Facade Modules



Stone | Porcelain | Brick | Aluminum PVDF

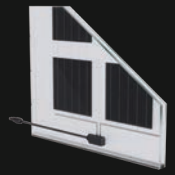
- Ultra lightweight aluminum honeycomb core technology.
- Interchangeable, multi-facing materials such as stone, porcelain, glass, brick, or coated aluminum surfaces.
- Mix and match different facings without altering the installation.

Solar Facade Modules

eFacade PRO | eFacade LITE

- Sustainable, energy generating facades at no extra cost.
- Energy-efficient solution for both existing and new facades.
- Endless surface design options.

Solar Glass



- Customizable cells layout and shapes.
- Hidden wiring and circuits.

Solar Railing

- Post and cap or base shoe railing systems.
- Customizable colours and cell layout.

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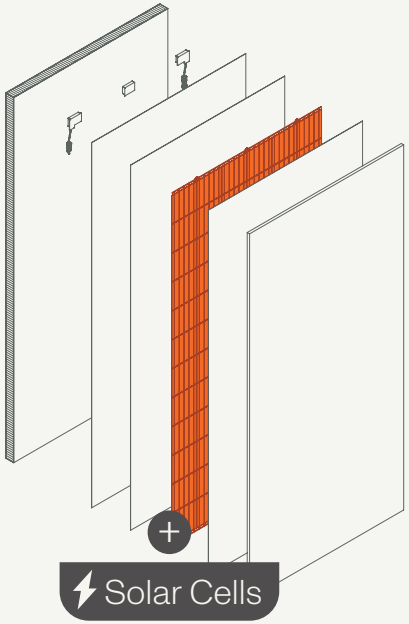
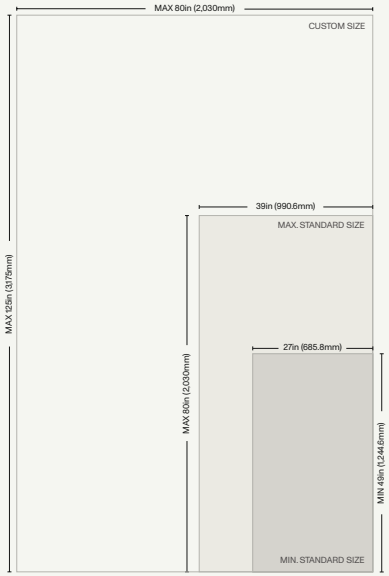
eFacade PRO

Our range of architectural solar products, including the innovative eFacade PRO, is crafted to seamlessly replace your building's facade while harnessing the power of the sun.

- Assist you with obtaining up to 41 LEED points.
- Up to R10 per inch.
- Carbon-negative product life cycle.
- World's first fire-tested BIPV.
- Size and design flexibility with the option for large format panels.



- Product Sizes



Note: These sizes are applicable for active solar modules.

eFacade LITE

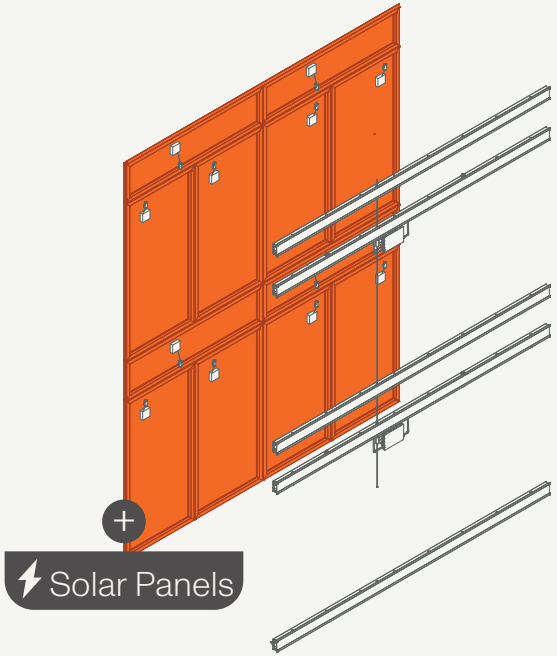
Plug & Power, Simplified Wiring
- Eliminate panel-to-panel wiring

Easy Installation
- Pre-engineered for optimal performance, ease, and aesthetic appeal

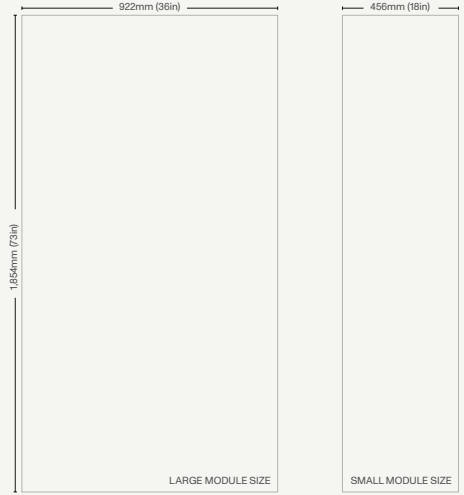
Design Versatility
- A range of architectural configurations

Sizing Options
- Modular design for customizable building solutions

Applications
- Ideal for both new constructions and retrofits



- Product Sizes



Solar Facade Facings

Mitrex

Energy Generating Building Materials

With flexibility in color and pattern choice, a new realm of possibilities opens up for architects and designers, allowing buildings to stand out or elegantly blend in, all while harnessing solar energy.

- Additionally, Mitrex offers the option to customize any colour, design or pattern to match any architectural design needs.

Your Solar Creation
Create your own design

Standard Solar Solid Colours

Icy White	Polaris	Ash Beige	Nobel Grey	Gravel Grey	Smokey Grey	Ebony Grey
5W/SQFT	9W/SQFT	11W/SQFT	10W/SQFT	11W/SQFT	10W/SQFT	13W/SQFT
Storm Grey	**Charcoal Grey**	**Navy Blue**	**Turquoise**	**Peridot**	**Dull Orange**	**Cocoa Bean**
13W/SQFT	10W/SQFT	11W/SQFT	7W/SQFT	5W/SQFT	4W/SQFT	9W/SQFT
Brown	**Red**	**Dull Yellow**	**Beige**	**Pale Rose**	**Core Black**	**Blackout**
9W/SQFT	9W/SQFT	6W/SQFT	5W/SQFT	7W/SQFT	18W/SQFT	16W/SQFT

Standard Solar Patterns

Arcturus	Astra	Moonstone	Carbo	Orbit	Rocksalt	Cassia
Limestone	Limestone	Granite	Granite	Marble	Marble	Metal
12W/SQFT	11W/SQFT	10W/SQFT	15W/SQFT	16W/SQFT	11W/SQFT	14W/SQFT

● Available colours for eFacade LITE modules

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Non Solar Facings

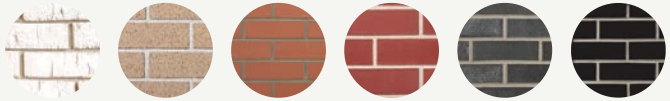
Cladify

Sustainable Building Materials

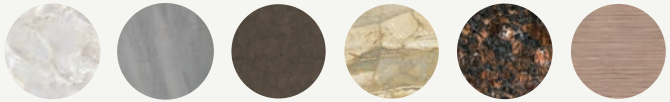
We offer comprehensive building envelope solutions, regardless of your preferred facing material.

Aluminum PVDF Facing

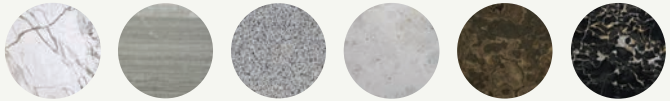
Brick Facing



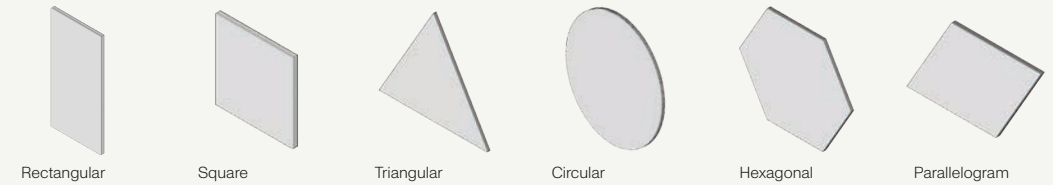
Porcelain Facing



Stone Facing



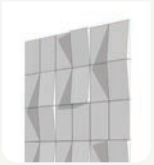
Designing With Sustainable Materials



Designing With Sustainable Materials

Assembly Shapes


Projected


Tilted


Curved


Monolithic


Fins


Doors Coatings and Ventilation

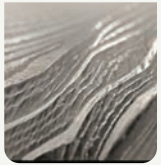
Details and Returns

Module Textures


Satin glass


Matte glass


Clear glass

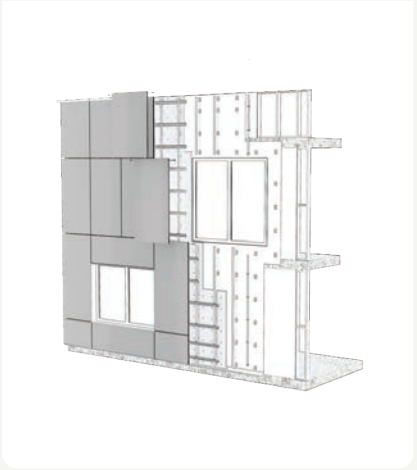

Wood glass


Fine wood glass


Stone glass

Installation Systems

We understand that your vision is unique; our solutions match it. From rainscreen to unitized wall systems, our versatile systems can accommodate any project with any facing material.



Cladishield System
Rainscreen

Claditized System
Unitized Facade

Cladifab System
Prefab Wall

Cladishield System

• Rainscreen System

An air pressure equalized cavity wall system designed to eliminate water penetration and allow ventilation. This system consists of two options: stick-build cladding where installation is panel by panel, and pre-assembled cladding where the panels are prefabricated and installed as a single unit. This results in faster installation and minimizes connection points to substrate.

- Continuous insulation and AWB.
- Achieves irregular designs.
- Precise installation.
- Stick-build requires a backup wall, whereas preassembled requires structural slabs only.
- Panels can span floor to floor and be attached to slabs only.
- Pre-Assembled has faster installation since the panels are prefabricated and installed as one unit.
- Less connection points allow for reduced thermal bridging.
- Installation of 250 SQFT/ day/ crew.

Claditized System

• Unitized Wall System

The precast system is a lightweight, versatile installation system designed to reduce costs and increase installation speed.

- Lightweight panel system and reduced structural loads.
- Improved building energy efficiency.
- Fast installation, easy transportation, reduced construction time.
- Option to install from outside by crane/ equipment or from inside with manpower.
- Reduced costs for design, transportation & installation.
- Multi-facing options such as Stone, Porcelain, Aluminum, or BIPV.
- Durable & weather resistant (UV radiation, chemicals, etc).
- Reduced maintenance.
- Installation of 500 SQFT/ day/ crew.

Cladifab System

• Pre-fab Wall System

The system is a hybrid of curtainwall and precast architectural wall panels, spanning slab to slab and transferring all the component loads to the building structure.

- Installation from inside.
- Rapid, year-round installation.
- Slab to slab panel sizes
- Reduced costs for design, transportation & installation.
- No need for structural backup of the wall.
- Lightweight panel system (no tower crane & concrete embeds needed).
- Installation of 500 SQFT/ day/ crew.

Customizable Integrations and Special Projects

Our active and non-active cladding panels can be incorporated into any pre-set custom framing system or a new system can be developed as per any requirement.

- Custom shapes are achieved through prefabricated panel assemblies.
- Compatible with manual or automated movable panel system, which can be an added benefit for active panels.
- With the combination of active, non-active panels & voids in between, the essence of a perforated facade can be captured.

Electrical Wiring Integration

MC4 Connections

Conduits Installation

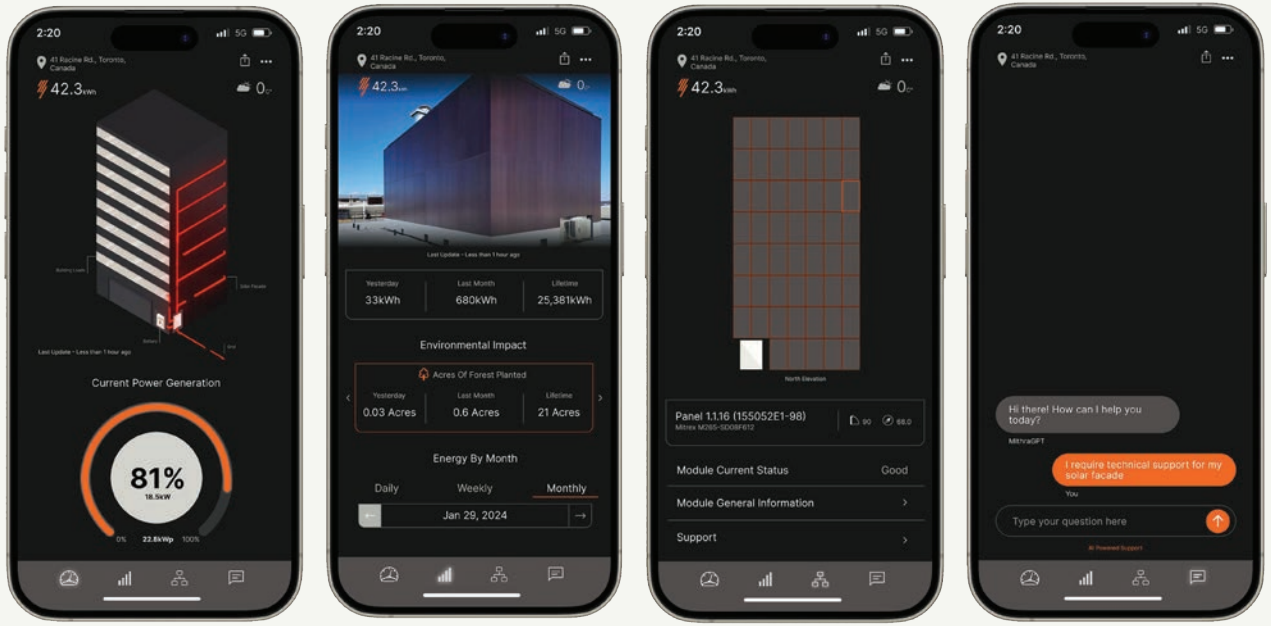
Electrical Connections -

Panel to inverter / Electrical room

Electrical Room

Monitoring System

The Mitrex Monitoring systems pairs with your energy-generating solar facade to give you real-time monitoring, and energy insights.



Our Services

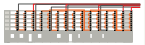
Project Initiation

Design Assist

Project Proposal & Modeling

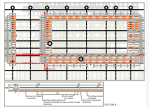
Manufacturing

Procurement & Scheduling



Project Design

Project Management



Installation Manual

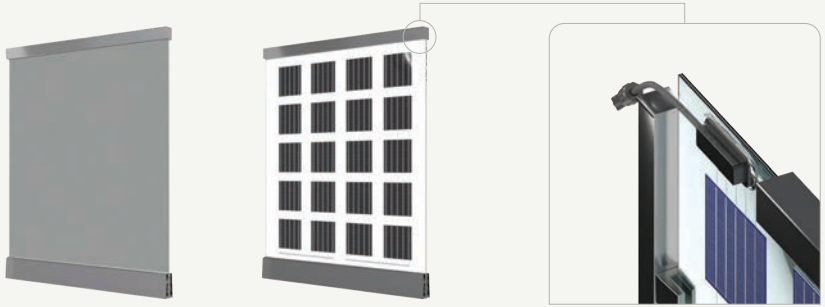
Installation

SolaRail™

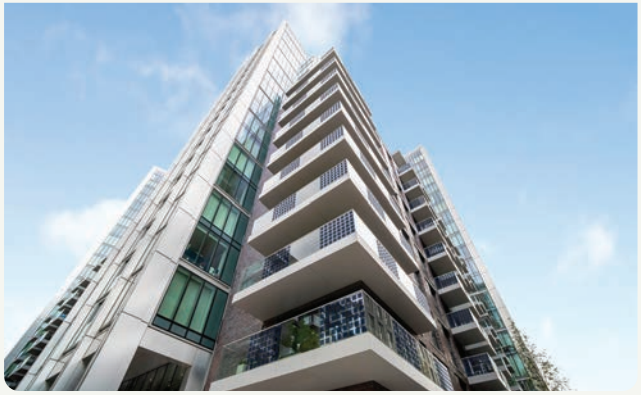
Weaving the elegance of design with the power of the sun, Mitrex Solar Railing extends energy generation to balcony railing systems with integrated solar technology.

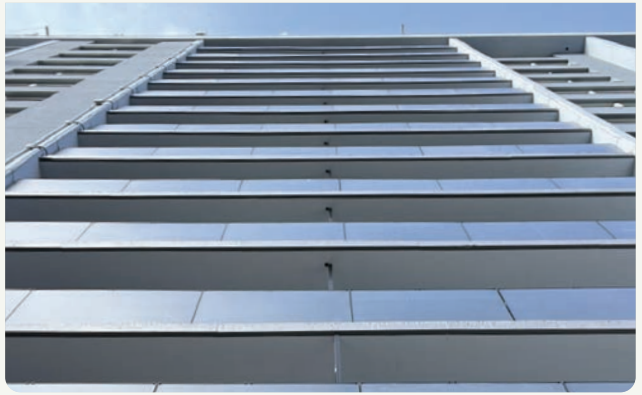
SolaRail¹
Post and cap system

SolaRail²
Base shoe system



SolaRail™ Projects



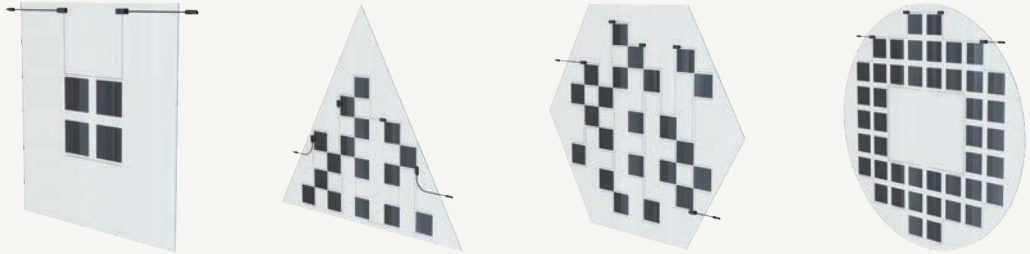


Solar Glass

Let the light in with Mitrex Solar Glass — a powerhouse in disguise, where photovoltaics meet limitless design, where color meets clarity. You're not just choosing glass; you're choosing a future where sustainability is clear as day.

Mitrex is the Solar Glass manufacturer and will only be the Solar Glass supplier, working with your preferred window manufacturer.

Solar Cells Layout Options



Solar Glass Types

Solar Glass[1]
Laminated Glass

Solar Glass[2]
IGU Double Layer Glass

Solar Glass[3]
IGU Triple Layer Glass

Solar Glass Projects

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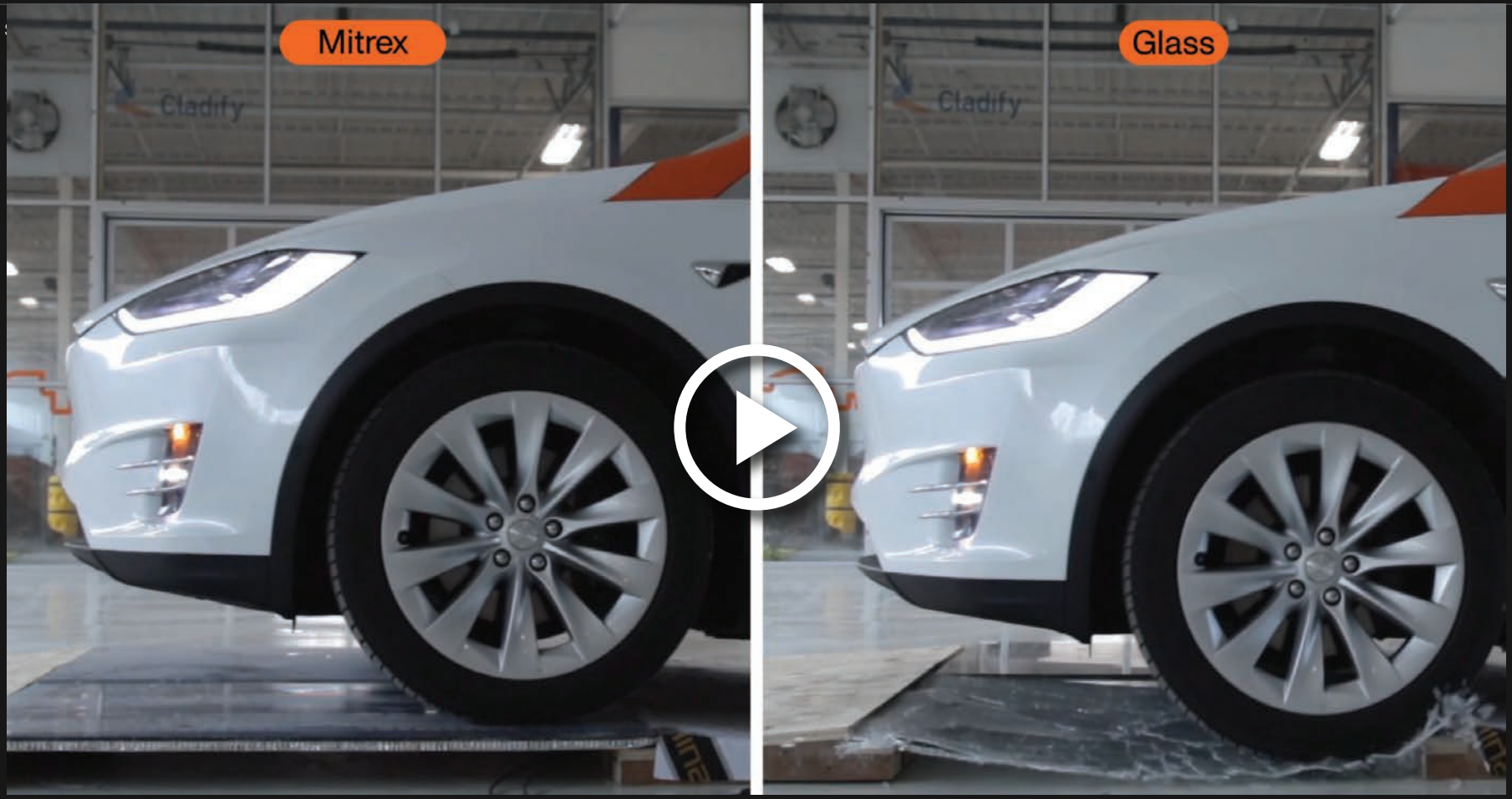
Testing and Certifications

PV Testing

- IEC 61730
- IEC 61215
- UL 61730
- UL 61215
- CSA 61730
- CSA 61215
- FSEC
- NEW YORK STATE | NY-Sun
- ETL C LISTED US

Building Material Testing

- ASTM C1048
- ASTM E2353
- ASTM E935
- ASTM E1886
- ANSI Z97.1
- NFPA 285
- EN 13501 (A2-s1,d0)
- MIAMI-DADE COUNTY
- UL S134
- UL S135
- UL S101


Mitrex
Glass
Cladify
Cladify


Floating
Airport
Military Base
Solar Farm
Shopping Center
Warehouse
Hospital
Stadium
Parking Lot
Educational Building
Greenhouse
Office Building
Data Centre
Houses
Residential Building
Bus Stop

This Is Just The Beginning

MITREX | Cladify

Why Mitrex?

Architects

- Available in thousands of colors and textures.
- Cladishield and Cladifab installation systems.
- High performing building envelope.
- Up to 40 LEED points.
- Building code compliant.
- Fire tested (ASTM E84, ASTM E136, NFPA 285, ASTM E119, S134, EN13501).
- ESG and EPD report.

General Contractors & Builders

- Lightweight panels result in faster installations.
- Traditional installation systems & electrical work (No tower crane required).
- Low scrap volume on site.
- 25 year warranty of product and performance.
- Fire tested (ASTM E84, ASTM E136, NFPA 285, ASTM E119, S134, EN13501).
- Single trade onsite / very little storage space.

Building Owners

- 25 year warranty of product and performance.
- High return on investment (ROI).
- Solar facade that increases the building value & lower the ongoing maintenance cost.
- Achieve ESG & Net Zero Commitments.
- Eligible for federal tax incentives.
- Lifetime Negative Carbon effect.

Solar Energy Generation

Environmental Impact

The Government of Canada has a goal of planting 2B Trees by 2050. We can reach this goal sooner by retrofitting buildings with BIPV.

- High-rise BIPV (100,000 SQFT) - 960,000 kWh

=

- 805 acres of U.S. forest in one year

Thank You!

Thank you for your attention.

Let's work together to shape our cities into models of sustainability and resilience. The journey towards a greener and brighter future begins with each one of us taking proactive steps to embrace innovative solutions like BIPV and drive sustainable development. Together, we can make a difference.

- **Toll Free**

+1 (855) 254 0214

- **Learn More**

mitrex.com info@mitrex.com
cladify.com info@cladify.com

- **Headquarters**

41 Racine Rd, Toronto, ON M9W2Z4, Canada
+1 (416) 497 7120

- **USA Office**

Chrysler Building, 405 Lexington Avenue Floor 26, New York
+1 (646) 583 4486

Q&A

Download this Presentation

- Pricing Comparison
- Cladishield case study
- Toronto vs. Texas financial case study
- Testing details
- Mitrex coating functionality
- BIPV energy generation
- Electricity cost over the years
- Revenue payback
- Energy payback
- Mitrex product life cycle
- Try our project simulator

- Toll Free

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- Learn More

mitrex.com info@mitrex.com
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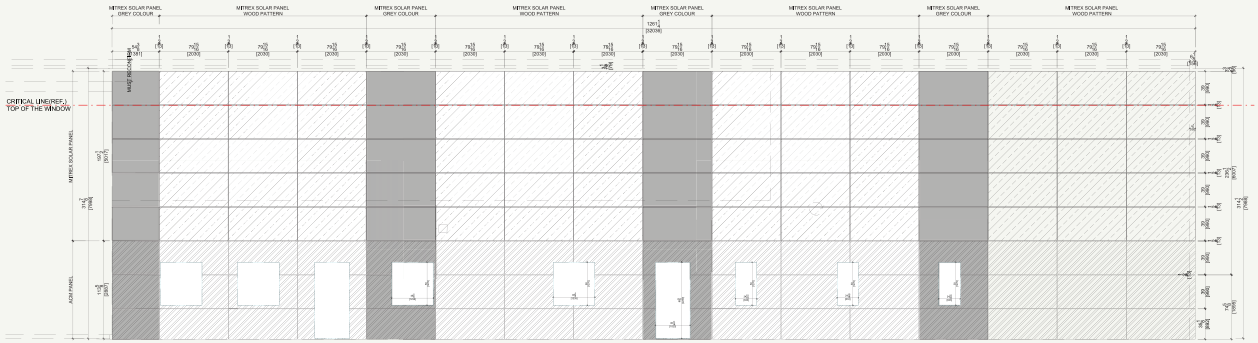
Pricing Comparison

Case Study	Aluminum Composite Panel	Precast Concrete	Mitrex
Material & Fabrication	$25	$40	$40
Labor	$35	$40	$40
Electrical	$0	$0	$15
IRA	$0	$0	30%
Net Zero 1 Year	$60	$80	$65.5
Net 30 Years	$60	$80	$20

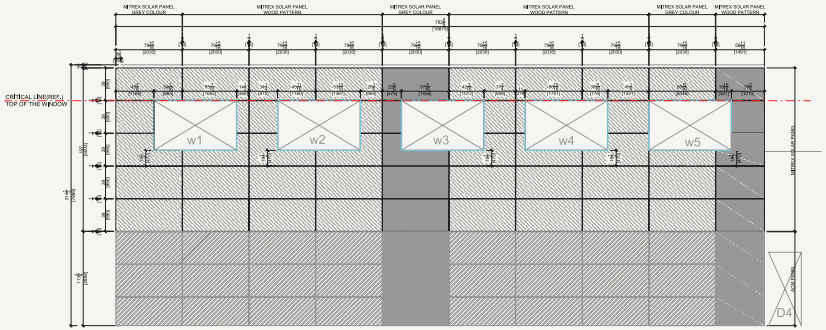
Cladishield Application Case Study

- CATEGORY:
  Government Building
- STATUS:
  Completed
- AREA:
  10,000 SQFT
- SAVING IN 30 YEARS:
  $ 624,000
- SYSTEM SIZE:
  160 kW

Architectural Drawing and Panel Layout

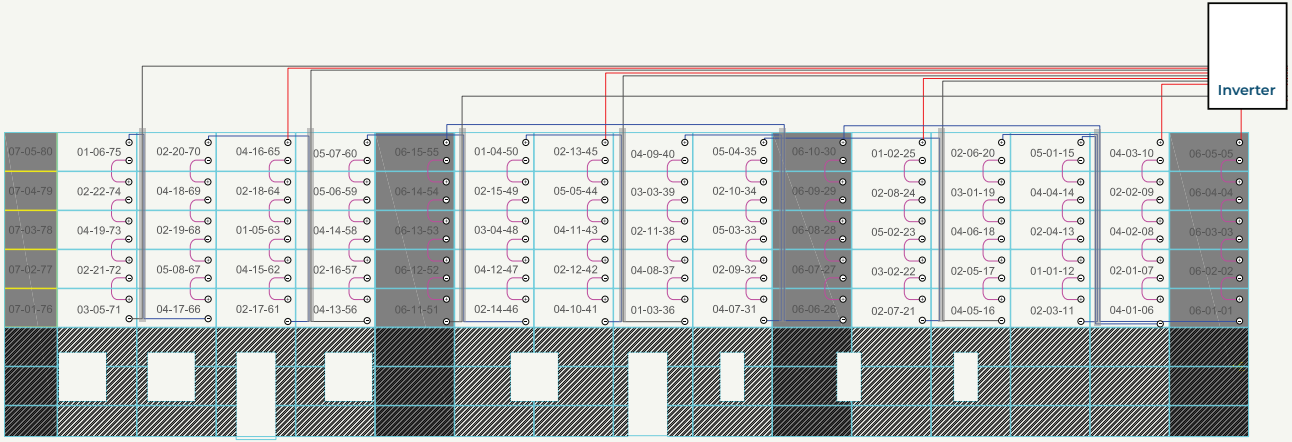


West Elevation



South Elevation

Electrical Design and Wiring Plan



West Elevation

Conduit Installation

Conduits

Wires - DC cable for panel connection.

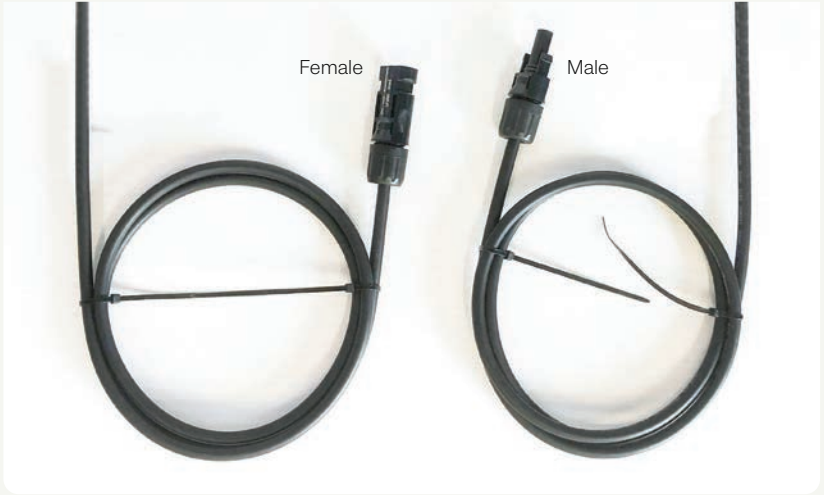
Installation of conduits - 1 1/4” PVC electrical conduit.

Electrical Connection Between Panels

Electrical Connections

Panel To Panel

MC4 solar connector.



Home Run Cable To Inverter Connection Location

Panel to panel wiring run to the roof, through the conduits.

Home Run

Electrical Connections

Panel To Inverter / Electrical Room

Electrical Room

Testing Summary

S134
National building code fire testing

S101
1 hour of fire exposure with no effect to the system and wall assembly.

61730
PV Module safety test.

61215
PV module quality test.

E1886
Cyclic Pressure (Windstorm Settings)
Passed over 3,500 pressure cycles equivalent wind load of 165 mph.

285
Standard fire test method for evaluation of fire propagation characteristics of exterior wall assemblies containing combustible components.

General Testing Summary

Test	Specification	Methodology	Result
Salt Spray Resistance	ASTM B117-16	1000 Hours of exposure.	No deleterious effects.
Density of Sandwich Core	ASTM C271/C271M-16	12" X 12" X 0.6"	327 kg/m3 (20.42 lbm/ft3)
Flatwise Tensile Bond Strength	ASTM C297/C297M-16	Load was applied to the top and bottom layers of the composite panel.	1.52 MPa (220 psi)
Edgewise Compressive Strength	ASTM C364/C364M-16	Compressive load was applied at a rate of 0.02 in/min.	Ultimate compressive strength = 37.85 MPa (5490 psi)
Flatwise Tensile Bond Strength	ASTM C365	Load was applied to the top and bottom layers of the composite panel.	1.52 MPa (220 psi)
Shear Strength by Beam Flexure	ASTM C393/C393M-16	Loaded in flexure with facing side in tension at a cross head speed of 0.025 in/min.	Maximum core shear strength = 0.94 MPa (137 psi) Facing bending stress = 8.14 MPa (1180 psi)
Flexure Creep Evaluation	ASTM C480/C480M-16	Midspan loading setup was used with facing side in tension at a cross head speed of 0.025 in/min. until achieved.	Net creep (in/day) facing - 0.029
Shear Stress and Shear Modulus	ASTM C273/C273M-18	Compressive force applied until rupture.	Ultimate core shear strength = 1.01 MPa (147 psi) Core shear modulus = 10.9 MPa (1583 psi)

Test	Specification	Methodology	Result
Laboratory Aging of Sandwich Construction	ASTM C481-99 (Reapproved 2016)	Procedure A, for six repetitions of following load cycle is applied: Immerse in water at 50 °C for 1h. Spray with steam at 95 °C for 3h. Store at -12 °C for 20h Heated at 100 °C for 3h. Spray with steam at 95 °C for 3h Heat in dry air at 100 °C for 18h.	ASTM C273; C297; C364; C393 tests were reconducted after aging: the variation was +1.36 %, -5.90%; +2.55%; -7.95%. Note: Positive variation indicates no decrease in strength after aging.
Resistance to Rapid Freezing and Thawing	ASTM C666/C666M-15	200 cycles of rapid freeze and thaw (4 °C to - 18 °C).	No visible change to facing, aluminum, or adhesive.
Flexural Strength	ASTM C880/C880M-15	Tested a composite panel with Mitrex panel.	22.83 MPa (3311.21 psi)
Tensile Properties of Adhesive Bond	ASTM C897-08 (20160	The adhesive bond never failed.	No Failure
Screw Withdrawal Test	ASTM D1761	Testing Speed: 2.5 mm/min.	2124 N
Damage Resistance Testing of Sandwich Constructions	ASTM D7766/D7766M-16	Load was applied at the specimen midpoint through a 0.5 in. diameter hemispherical steel indenter at a constant rate of 0.01 in/min until a drop-in load was observed.	No panel deformation.
Air Leakage Resistance	ASTM E283-04 (2012)	Air infiltration and exfiltration tests were performed using test pressure of 75 Pa (1.57 psf). The maximum air leakage rate was calculated and compared to the allowable air leakage.	Passed the test infiltration rate = 0.00 L/s.m2 (0 cfm/ft2) & exfiltration rate = 0.01 L/s.m2 (0.002 cfm/ft2) at 75 Pa test pressure.
Static Air Pressure	ASTM E330 / TAS 203	The test specimen was also tested to failure with both positive and negative loads. The specimen only showed a permanent deflection of 0.10 mm with a test load of + 5760 Pa (120 psf). The specimen failed at -5006 Pa, the rivets at the backside of the specimen failed.	All the panels tested met or exceeded requirements.
Uniform Static Deflection	ASTM E330-02	The test specimen was tested to ±3840 Pa (80.2 psf) to examine the deflection of 2440 mm panel, the specimen showed a maximum net deflection of 4.14 mm under positive test pressure and 4.93 mm under negative load.	No failure or permanent damage.

Testing Summary

Test	Specification	Methodology	Result
Fluorescent Ultraviolet Radiation Exposure	ASTM E1996 / TAS 201	2000 hours of UV exposure.	No visible change to glass, aluminum, or adhesive.
Large Missile Impact Test	ASTM G154 -16	Standard Specification for performance of exterior windows, curtain walls, doors, and Impact protective systems impacted by windborne debris in hurricanes.	Passed the test. A weighted 2×4 was fired at the Mitrex panel at 50 fps.
Thermal Resistance	ASTM 1363-11	Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.	0.20 m2 oC/W (1.12 hr-ft2-oF/BTU)
Linear Thermal Expansion	ISO 10545-8	Tested from room temperature to 100ºC.	11.28 × 10-6 per oC
Cyclic Pressure Loading	ASTM E1886 / TAS 203	Standard test method for performance of exterior windows, curtain walls, Doors, and impact protective systems impacted by missile(s) and exposed to cyclic pressure differentials.	Passed the test. Over 3,500 positive and negative pressure cycles were applied at ± 2880 Pa (60 psf), equivalent wind load of 165 mph.
Water Penetration Resistance	ASTM E331-00(2016)	During the 15-minute test period, using a pressure differential of 720 Pa (15.0 psf), there was no water leakage observed.	No water leakage.

Fire Safety

Test	Specification	Result
Tunnel Test	ASTM E84	Sample passed the test with Flame Spread Index = 0; smoke developed index = 0.
Non-Combustibility in Building Materials	ASTM E136	Mitrex sample passed the test requirements. There was no visible smoke or flame. The sample did not have a maximum temperature rise of more than 96.8ºC on the indicating thermocouple. The samples did not loose more than 20% of their original mass.
Multi-Story Fire Test	NFPA 285	Passed.
Fire Endurance Tests of Building Construction and Materials	ASTM E119	1 hr Fire Exposure - The Mitrex Material did not affect the fire rated wall assembly.
Standard Method Fire Test of Exterior Wall Assemblies	SI34	Passed.
Fire Classification of Construction Products and Building Elements	EN13501	Rating: A2-s1,d0

Quality Test (IEC/UL 61215)

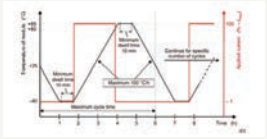
Test	Description
MQT 01 Visual Inspection	• To detect any visual defects in module: • Broken, cracked, or torn external surfaces. • Bent or misaligned external surfaces, including superstrates, substrates, frames and junction boxes to the extent that the operation of the PV module would be impaired. • Bubbles or delaminations forming a continuous path between electric circuit and the edge of the module. • If the mechanical integrity depends on lamination or other means of adhesion, the sum of the area of all bubbles shall not exceed 1% of the total module area. • Evidence of any molten or burned encapsulant, backsheet, front sheet, diode or active PV component. • Loss of mechanical integrity to the extent that the installation and operation of the moule would be impaired. • Cracked/broken cells which can remove more than 10% of the cell's photovoltaic active area from the electrical circuit of the PV module. • Voids in, or visible corrosion of any of the layers of the active (live circuitry of the module extending over more than 10% of any cell. • Broken interconnections, joints or terminals. • Any short-circuited live parts or exposed live electrical parts. • Module markings (label) are no longer attached, or the information is unreadable.
MQT 02 Maximum Power Determination	Checking the functionality of module and maximum power by checking the I-V curve.
MQT 03 Insulation Test	HiPot test with voltage of 3000V for PV modules with voltage system of 1000V for 1 min. again another HiPot test for 2 min with 1000V (system voltage).
MQT 04 Measurement of Temperature Coefficients	Determining temperature coefficients of current, voltage and peak power from module measurement.

Testing Summary

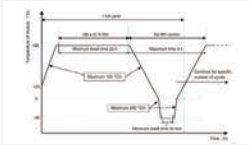
Test	Description
MQT 05 Measurement of Nominal ModuleOperating Temperature (NMOT)	Determining the solar module characteristics (Voc, Isc and Pmax) in 800 W/m², 20 degree and wind speed of 1m/s.
MQT 06 Performance at STC and NMOT	Checking the short circuit current (Isc) and open circuit voltage (Voc) and IV-curve and comparing with the rating with tolerances for both STC (1000 W/m², 25 degree and AM = 1.5) and NMOT (800 W/m², 20 degree and wind speed of 1 m/s) conditions.
MQT 07 Performance at Low Irradiance	Determining the current-voltage characteristics of module at 25 degree and low irradiance of 200 W/m² and having IV curve result.
MQT 08 Outdoor Exposure Test	Installing the module outdoor with load around its maximum power for at least 60 kWh/m². No defect should be found.

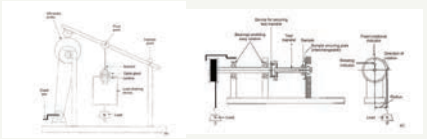
PV Quality Test (IEC/UL 61215)

Test	Description
MQT 09 Hot-Spot Endurance Test	Determining ability of module against hot-spot effects like solder melting or deterioration caused by faulty cells, mismatched cells, shadowing, or soiling. Using I-V curve tracer and IR scan to check the hot-spot by making shadow for every single cell.
MQT 10 UV Preconditioning Test	Install the module in a chamber with only UV light (between 280nm to 320 wavelength and 320 to 400nm) with maximum 250W/m² and short-circuited module (or with load in maximum power) at the 60 degree temperature. Subject the module to total UV irradiance of at least 15kWh/m² in the wavelength range between 280 to 400nm.
MQT 11 Thermal Cycling Test	Testing the module by changing the temperature repeatedly. Module to be installed in the chamber with temperature sensor attached to its middle. The temperature should change with no more than 100 degree per hour and stay at -40 and 85 for at least 10 min. during the test, module will carry the current when temperature increasing from -40 to 80 degree only. Below process will be taken 50 or 200 times.

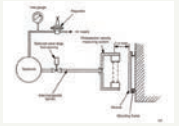
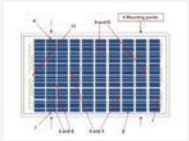


Test	Description
MQT 12 Humidity Freeze Test	Testing the module in high temperature and humidity followed by sub-zero temperature. Temperature will arise to 85 degree at maximum 100 degree per hour and keep the module for 20h in humidity of RH 85%. Then cool down to zero and then -40 degree by the speed of max 100 and 200 degree per hour. And keep for 30 min. do this process for 10 cycles.
MQT 13 Damp Heat Test	Testing the ability of module for long term humid environment. The module will be at 85-degree temperature and 85 percent relative humidity and keep it there for 1000 h (or 200 h for another test) and no defect should be found.
MQT 14 Robustness of Terminations	Checking capability of withstanding of cables and termination attachments against stresses. Force of 40N for 10s in different direction will be applied to junction box to test its retention on module surface. Cable will be pulled 50 times for 1s in the direction or the axis and then torque test will be applied for 1 min.
MQT 15 Wet Leakage Current test	Putting module in the tank of required solution to a depth sufficient to cover all surfaces (except junction box not designed for immersion). Then doing HiPot test for 2 min at system voltage (1000V).
MQT 16 Static Mechanical Load Test	Testing ability of withstanding with minimum static load. During the test electrical continuity of internal circuit should be monitored. Fixing the module on mounting base and applying 1 hour of 1.5 times of design load (per manufacturer) in front and back of the module respectively for three cycles.



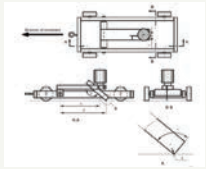


Testing Summary

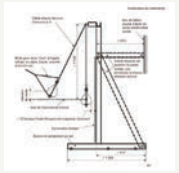
Test	Description
MQT 17 Hail Test	Testing the effect of hitting hail on the module surface (different location). Module will be installed on 90 degree tilt and room temperature. 11 hail ball at the diameter of minimum 25mm and speed of minimum 23 m/s will be fired through launcher. No major defect should be found.  
MQT 18 Bypass Diode Testing	Checking the forward voltage of diode with short circuit current in 30, 50, 70 and 90 degree Celsius, then keep the current 100% and 125% of short circuit current for one hour and check the forward voltage at 75 degree. Then checking the functionality of diode after test. It could be done by successive IV-Curve tracer at maximum power by having shaded the strings to turn the diode ON or connecting the IV-Curve tracer in reverse polarity to turn the diode ON.
MQT 19 Stabilization	Checking the power of module to make sure it is stabilizedelectrically. The power testing on three consecutive should follow below relation: (Pmax – Pmin) / Paverage < x Stabilization will be done in the beginning to check the label of each module and at the end of test to make sure degradation did not affect on the modules. IEC classified the tests in few categories just to have better view on all tests as follow: • Environmental stress tests (MST 51, MST 52, MST 53, MST 54, MST 55, MST 56) • General inspection tests (MST 01, MST 02, MST 03, MST 04, MST 05, MST 06, MST 07) • Electrical shock hazard tests (MST 11, MST 12, MST 13, MST 14, MST 16, MST 17, MST 42) • Fire hazard tests (MST 21, MST 22, MST 23, MST 24, MST 25, MST 26) • Mechanical stress tests (MST 32, MST 33, MST 34, MST 35, MST 36, MST 37, MST 42)
MST 01 Visual Inspection	Checking any visual defect or change in the module; (marking, sharp edge, bubbles, crack, delamination, bent, mechanical integrity, ...)
MST 02 Performance at STC	Checking the short circuit current (Isc) and open circuit voltage (Voc) and comparing with the rating with tolerances (same as MQT 06)
MST 03 Maximum Power Determination	Checking the functionality of module and maximum power by checking the I-V curve (same as MQT 02)
MST 04 Insulation Thickness Test	Checking the thickness of insulation thin layers (backsheet) in three points as worst cases at solder connection, edge of farmeless PV modules, laminator membrane indents. The measurement should be bigger than requirement (0.15mm+tolerance%)

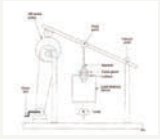
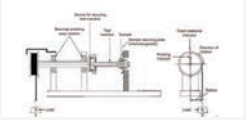
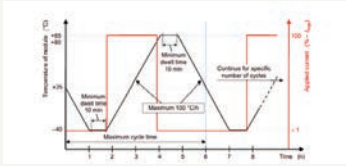
Test	Description
MST 05 Durability of Marking	Checking durability and legibility of markings on the solar panels with medium pressure 15 second by hand and cloth soaked with water and again with petroleum spirits.
MST 06 Sharp Edge Test	Accessible part of solar modules should be smooth and free from sharp edges, burrs, ...
MST 07 Bypass Diode Functionality Test	Checking the functionality of diode after test. It could be done by successive IV-Curve tracer at maximum power by having shaded the strings to turn the diode ON or connecting the IV-Curve tracer in reverse polarity to turn the diode ON. (same as MQT 18.2)

PV Safety Test (IEC/UL 61730)

Test	Description
MST 11 Accessibility Test	Checking the insulation resistance off all part of module that may be accessible to the live part by cylindrical test fixture at the pressure of 10N and at all time the resistance should be higher than 1MΩ.
MST 12 Cut susceptibility Test	Testing withstanding of polymeric material surface of module with specific fixture with force of 9N. 
MST 13 Continuity Test of Equipotential Bonding	Verifying continuous path between accessible conductive parts. Applying 2.5 times of maximum protective device current (for example 15A x 2.5) and checking the voltage for different conductive parts. Resistive should be less than 0.1 Ω.
MST 14 Impulse Voltage Test	Testing capability of insulation of PV module against overvolage (from atmosphere like impulse and switching of low-voltage equipment). Module will be covered by conductive metal foil and surge voltage will be applied to module. Dielectric should not breakdown.
MST 16 Insulation Test	HiPot test with voltage of 6000V for PV modules with voltage system of 1000V. (same as MQT 03)

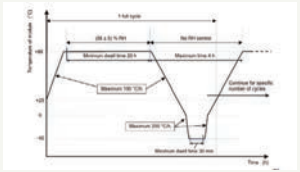
Testing Summary

Test	Description
MST 17 Wet Leakage Current Test	Putting module in the tank of required solution to a depth sufficient to cover all surfaces (except junction box not designed for immersion). Then doing HiPot test for 2 min at system voltage (1000V). (same as MQT 15).
MST 21 Temperature Test	Putting module on black painted wooden platform and checking the temperature of different location of module (normalised by changing of ambient temperature) in maximum power and no wind. Normalized temperature should not reach TI/RTE/RTL (for example 90 degree)
MST 22 Hot-Spot Endurance	Determining ability of module against hot-spot effects like solder melting or deterioration caused by faulty cells, mismatched cells, shadowing, or soiling. Using I-V curve tracer and IR scan to check the hot-spot by making shadow for every single cell. (same as MQT 09)
MST 23 Fire Test	Fundamental requirements for fire safety are not internationally harmonised. Fire resistance requirements for a PV module intended for building applications are defined in local or national building codes.
MST 24 Ignitability Test	Testing ignitability of vertical mounted PV by direct small flame under zero irradiance by external heat source. All exposed combustible material will be tested (but junction boxes, cables, and connectors). Flame will be applied at least 40mm above the bottom edge of the sample for 15s.
MST 25 Bypass Diode Thermal Test	Checking the forward voltage of diode with short circuit current in 30, 50, 70 and 90 degree Celsius, then keep the current 100% and 125% of short circuit current for one hour and check the forward voltage at 75 degree. Then following MST 07 for checking the functionality of diode. (same as MQT 18)
MST 26 Reverse Current Overload Test	Checking the risk of fire or ignition in reverse current situation. Putting module facedown to the mounting and covered by white tissue paper. Back of module should be covered by single layer of white tissue paper. With no irradiance, 1.35 times of maximum fuse size should apply to the module in reverse direction. No glass break or flaming should happen.
MST 32 Module Breakage Test	The weight of bag is around 45.5kg. Module should be mount on the frame and bag should be max 13mm far from surface and max 50mm from the centre of module. Drop height should be 300mm, and release after stabilizing. 
MST 33 Screw Connections Test	Testing screws and nuts in completely loosening and tightening (to the specified torque) for five times.

Test	Description
MST 34 Static Mechanical Load	Testing ability of withstanding with minimum static load. During the test electrical continuity of internal circuit should be monitored. Fixing the module on mounting base and applying 1 hour of 1.5 times of design load (per manufacturer) in front and back of the module respectively for three cycles. (same as MQT 16)
MST 35 Peel Test	This test is only for cemented joint. Not sure this test is applicable to our product (based on the tables 3 and 4 of IEC 61730-1). But include tensile test in some adhesion part between encapsulant and back-sheet. Module should be unframed.
MST 36 Lap Shear Strength Test	Same as MST 35 but for glass/glass module tensile test.
MST 37 Material Creep Test	Checking the adhesive between different part of module (frontsheet and backsheet, FS or BS to mounting system, JB to BS) will be done in this test. Putting the module in chamber on mounting base and increasing temperature to 105 degree for 200 hours.
MST 42 Robustness of Termination Test	Checking capability of withstanding of cables and termination attachments against stresses. Force of 40N for 10s in different direction will be applied to junction box to test its retention on module surface. Cable will be pulled 50 times for 1s in the direction or the axis and then torque test will be applied for 1 min. (same as MQT 14)  
MST 51 Thermal Cycling Test	Testing the module by changing the temperature repeatedly. Module to be installed in the chamber with temperature sensor attached to its middle. The temperature should change with no more than 100 degree per hour and stay at -40 and 85 for at least 10 min. during the test, module will carry the current when temperature increasing from -40 to 80 degree only. Below process will be taken 50 or 200 times. (same as MQT 11) 

MITREX | Cladify

Testing Summary

Test	Description
MST 52 Humidity Freeze Test	Testing the module in high temperature and humidity followed by sub-zero temperature. Temperature will arise to 85 degree at maximum 100 degree per hour and keep the module for 20h in humidity of RH 85%. Then cool down to zero and then -40 degree by the speed of max 100 and 200 degree per hour. And keep for 30 min. do this process for 10 cycles. (same as MQT 12) 
MST 53 Damp Heat Test	Testing the ability of module for long term humid environment. The module will be at 85-degree temperature and 85 percent relative humidity and keep it there for 1000 h (or 200 h for another test) and no defect should be found. (same as MQT 13)
MST 54 UV Test	Install the module in a chamber with only UV light (between 280nm to 320 wavelength and 320 to 400nm) with maximum 250W/m² and shortcircuited module (or with load in maximumpower) at the 60 degree temperature. Subject the module to total UV irradiance of at least 15kWh/m² or 60kWh/m² in the wavelength range between 280 to 400nm. (same as MQT 10 for 15kWh/m²)
MST 55 Cold Conditioning	Install the module in a chamber with temperature sensor and keep it there for 48 h with -40 degree. No defect should be found.
MST 56 Dry Heat Conditioning	Install the module in a chamber with temperature sensor. Keep the module in a chamber with 105 degree and less than 50% relative humidity for 200 h. No defect should be found.

BIPV Energy Generating Drivers

Location:

Different sides of a building receive different amounts of sunlight based on the sun's orientation.

Orientation:

- Vertical Solar Module 70% Efficiency: These modules will have minimal reduction in power due to dirt build-up. In addition, Mitrex has a patent anti-soiling coating that prevents any dirt, sand or dust settling onto the glass making the panels completely maintenance free.
- Sloped Solar Modules 100% Efficiency: In reality, panels that are sloped reduce the efficiency due to the exposure and collection of dust, sand, snow and dirt (-20% to -60%). Because of this, panels that are sloped need necessary maintenance.

Location

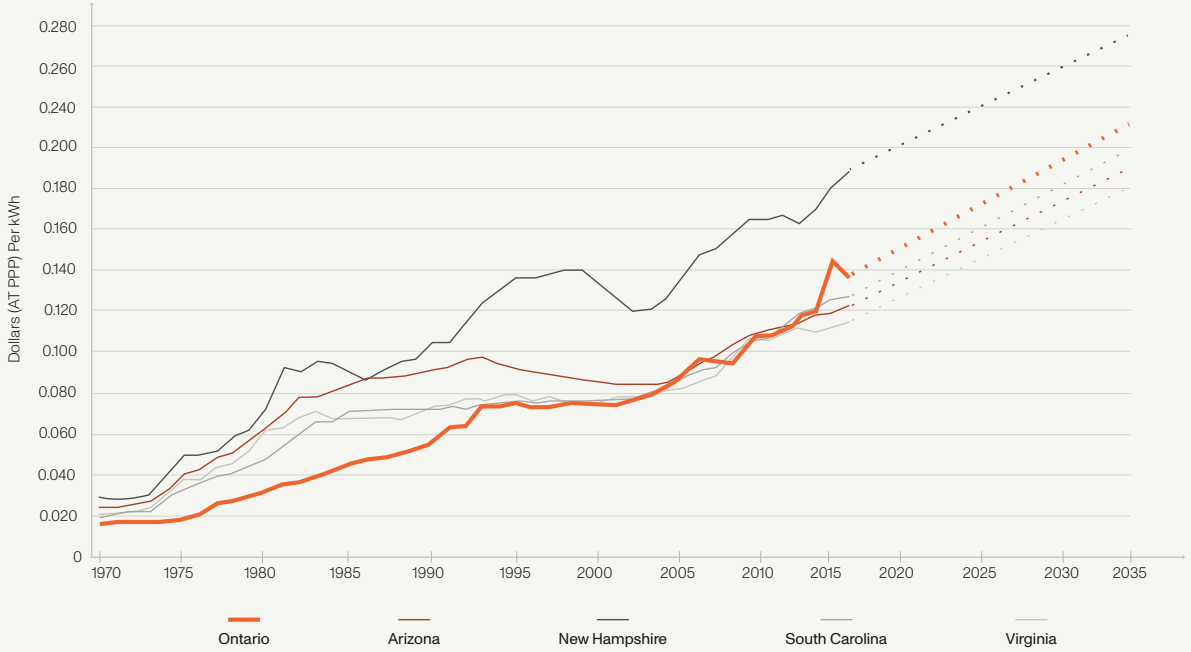
Orientation

What Do You Think The Cost Of Energy Will Be In 30 Years?

Electricity Cost Over The Years

On average electricity rates per kWh increase 1.4% - 1.7% per year in North America and almost doubles per decade.

Statistics Canada: Electric Power Statistics, Volume 2 (1970-1996); Electric Power Generation, Transmission and Distributions (1997-2004); Annual Electricity Supply and Disposition Survey (2005-2015). Energy Information Administration: State Energy Data System (SEDS).



Electric Utility Revenue per kWh for Residential Customers for Ontario and Selected States

Revenue Payback For A 2M² Panel

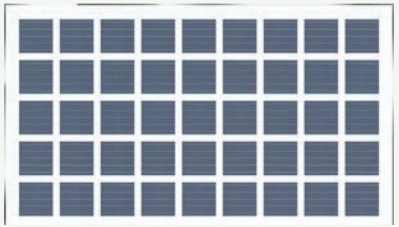
- Opaque module

In 30 years, 1 opaque 2M² panel will save you:

At 20¢ / kWh

- $2,026 in Toronto
- $2,836 in Dubai
- $3,241 in LA

- Semi-opaque module



In 30 years, 1 Semi-opaque 2M² panel will save you:

At 20¢ / kWh

- $1,807 in Toronto
- $2,529 in Dubai
- $2,891 in LA

Energy and Revenue Generation

2M² Opaque Panel

- Solar facade
- Solar camouflage
- Solar sound barrier
- Solar spandrel panel
- Solar roof
- Solar noise barrier

Toronto

Orientation	Hours of sun per day	kWh / Day	kWh / Year	At 20¢ / kWh: Est revenue per panel annually	At 20¢ / kWh: Est revenue per panel after 30 years
South	2.5	0.9	338	$68	$2,026
East / West	2.0	0.7	27	$54	$1,621
North	1.2	0.4	162	$32	$972

Dubai

Orientation	Hours of sun per day	kWh / Day	kWh / Year	At 20¢ / kWh: Est revenue per panel annually	At 20¢ / kWh: Est revenue per panel after 30 years
South	3.5	1.3	473	$95	$2,836
East / West	2.5	0.9	338	$68	$2,026
North	1.7	0.6	230	$46	$1,378

Los Angeles

Orientation	Hours of sun per day	kWh / Day	kWh / Year	At 20¢ / kWh: Est revenue per panel annually	At 20¢ / kWh: Est revenue per panel after 30 years
South	4.0	1.5	540	$108	$3,241
East / West	3.0	1.1	405	$81	$2,431
North	2.0	0.7	270	$54	$1,621

Energy and Revenue Generation

2M² Semi-opaque Panel

- Solar windows
- Solar skylight
- Solar greenhouse
- Solar railing
- Solar curtainwall
- Solar noise barrier

Toronto

Orientation	Hours of sun per day	kWh / Day	kWh / Year	At 20¢ / kWh: Est revenue per panel annually	At 20¢ / kWh: Est revenue per panel after 30 years
South	2.5	0.8	301	$60	$1,807
East / West	2.0	0.7	241	$48	$1,445
North	1.2	0.4	145	$29	$867

Dubai

Orientation	Hours of sun per day	kWh / Day	kWh / Year	At 20¢ / kWh: Est revenue per panel annually	At 20¢ / kWh: Est revenue per panel after 30 years
South	3.5	1.2	422	$84	$2,529
East / West	2.5	0.8	301	$60	$1,807
North	1.7	0.6	205	$41	$1,229

Los Angeles

Orientation	Hours of sun per day	kWh / Day	kWh / Year	At 20¢ / kWh: Est revenue per panel annually	At 20¢ / kWh: Est revenue per panel after 30 years
South	4.0	1.3	482	$96	$2,891
East / West	3.0	1.0	3611	$72	$2,168
North	2.0	0.7	241	$48	$1,445

Energy and Revenue Generation

2M² Transparent Panel

- Solar windows
- Solar skylight
- Solar greenhouse
- Solar railing
- Solar curtainwall
- Solar noise barrier

Toronto

Orientation	Hours of sun per day	kWh / Day	kWh / Year	At 20¢ / kWh: Est revenue per panel annually	At 20¢ / kWh: Est revenue per panel after 30 years
South	2.5	0.3	119	$24	$712
East / West	2.0	0.3	95	$19	$569
North	1.2	0.2	57	$11	$342

Dubai

Orientation	Hours of sun per day	kWh / Day	kWh / Year	Est revenue per panel annually	Est revenue per panel after 30 years
South	3.5	0.5	166	$33	$996
East / West	2.5	0.3	119	$24	$712
North	1.7	0.2	81	$16	$484

Los Angeles

Orientation	Hours of sun per day	kWh / Day	kWh / Year	Est revenue per panel annually	Est revenue per panel after 30 years
South	4.0	0.5	190	$38	$1,139
East / West	3.0	0.4	142	$28	$854
North	2.0	0.3	95	$19	$569

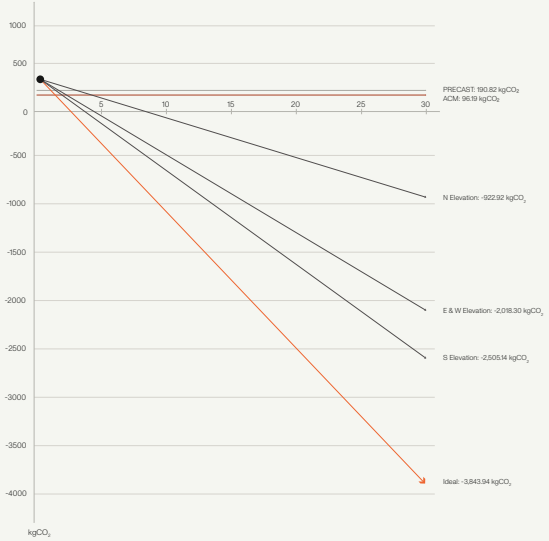
Mitrex Production Life Cycle

New York:

Mitrex Solar Cladding panels generate enough green energy to offset the carbon needed to produce them, unlike traditional materials. South facing Mitrex Solar Cladding can offset carbon in under 4 years and remove 2,505.14kgCO_2 in 30 years.

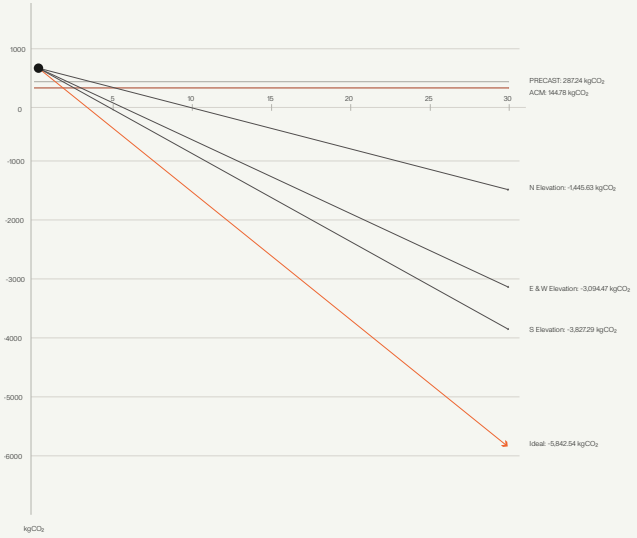
Eastern USA:

Mitrex Solar Cladding panels generate enough green energy to offset the carbon needed to produce them, unlike traditional materials. South facing Mitrex Solar Cladding can offset carbon in under 4 years and remove 3,827.29kgCO_2 in 30 years.



New York

	Hours of sun perday	kWh / Day	kWh / Year	Payback Time (years)	Carbon Saved Per Year (kgCO2)	Carbon Saved After 30 Years (kgCO2eq)
Ideal	3.25	1.27	462.64	2.49	131.85	-3,843.94
South	2.15	0.84	306.05	3.76	87.22	-2,505.14
East / West	1.75	0.68	249.11	4.62	71.00	-2,018.30
North	0.85	0.33	121.00	9.51	34.48	-922.92



Eastern USA

	Hours of sun perday	kWh / Day	kWh / Year	Payback Time (years)	Carbon Saved Per Year (kgCO2)	Carbon Saved After 30 Years (kgCO2eq)
Ideal	3.25	1.27	462.64	2.49	198.47	-5,842.54
South	2.15	0.84	306.05	3.76	131.30	-3,827.29
East / West	1.75	0.68	249.11	4.62	106.87	-3,094.47
North	0.85	0.33	121.00	9.51	51.91	-1,445.63

* Direction of panels is vertical. - * Hours of sun taken from PVsyst and rounded.

Comparing The Same Building In Toronto vs Texas Case Study

- BUILDING SIZE:
  100,000 SQFT
- MAIN CHALLENGES:
  - Long-lasting and aesthetically pleasing cladding.
  - Quick turnaround time between design approval and material availability.
  - Cost-effective option that solves above challenges at a reasonable price.

Case Study

Aluminum Panels, a common cladding material was another available option for the project.

This material is well-known in the industry. However, it also poses many concerns.

The Concerns Around Aluminum	
Thermal Performance	Aluminum panel wall systems derive their thermal performance characteristics from the amount of insulation placed in the cavity or backup wall.
Moisture Projection	The watertight performance of the panel system depends heavily on the design of the metal panel joints.
Acoustics	Aluminum panel systems do not typically offer sound insulation.
Dissimilar Metals	The concurrent use of different metals can result in stains from water runoff and galvanic corrosion, affecting the strength of the panel structure.
Pitting	As the panels are exposed to weather and pollution, their protective coating is worn down, resulting in a pitted appearance. Pitting may not be a structural concern, but it detracts from the appearance of the panel and the building.
Shadowing	Welds and stiffeners that are installed on the backsides of panels can result in shadowing. This is when the weld or stiffener is visible on the panel face, making it less aesthetically pleasing.
Maintenance	Over time, the panels will require cleaning and sealant replacement.
Oil Canning	Tension or stress that occurs over the aluminum's lifespan will distort the appearance.

Facade Cost Breakdown

	BIPV		Custom Colour Slat	
	Solar Facade (Toronto)	Solar Facade (Texas)	ACM	Porcelain
Active area (SQFT)	33,000	73,000	-	-
Non-active area (SQFT)	67,000	27,000	100,000	100,000
Active material & installation cost	$80.00	$80.00	$ -	$ -
Non-active material & installation cost	$65.00	$65.00	$62.00	$80.00
Electrical components (per/ SQFT)	$10.00	$10.00	$ -	$ -
Total per area (SQFT)	$73.25	$83.25	$62.00	$80.00
Installation total cost	$7,325,000.00	$8,325,000.00	$6,200,000.00	$8,000,000.00
System size (kW)	462	1,022	-	-
Expected annual electricity output (kWh)	271,656	704,000	0	0
Energy revenue in 30 years	$2,200,413.60	$5,702,400.00	$ -	$ -
Net cost year 1 - After ITC - IRA	$7,325,000.00	$6,354.000.00	$6,200,000.00	$8,000,000.00
Net cost year 30	$5,124,586.40	$651,600.00	$6,200,000.00	$8,000,000.00
ROI	196%	3,703%	0%	0%
Peyback period (Years)	15.34	0.81	0	0

Conclusion

Overall, Mitrex is able to offer a high-performance façade that contributes to the project's sustainability goals (minimum of 40 LEED points), and offer the client a premium aesthetic design for their new building.

Many Ev's and common elements will run using the electricity that is being generated by Mitrex Panels with a minimum investment in solar integrated solution.

- Toll Free

+1 (855) 254 0214

- Learn More

mitrex.com info@mitrex.com

cladify.com info@cladify.com

- Headquarters

41 Racine Rd, Toronto, ON M9W2Z4, Canada

+1 (416) 497 7120

- USA Office

Chrysler Building, 405 Lexington Avenue Floor 26, New York

+1 (646) 583 4486