Nova ENERGY

HANDBOOK

NOVAGLASS
WATERPROOFING MATERIALS

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1

Introduction to Nova ENERGY Project

1.1 Nova ENERGY SOLUTIONS

Whether you wish to produce electricity from solar energy generated from your new corporate building's roof or you are thinking about such kind of installation when refurbishing the roof waterproofing or even if you are willing to give your roof on loan for such installations, well you can find a handful of tailor made solutions with **Novaglass**. It's **Nova ENERGY**, and we are ready to assist whatever your purpose will be.

Nova ENERGY is the best system to provide effective solutions to both flexible modules to obtain Building Integrated Photovoltaics (**BIPV**) and rigid modules respectively by means of Nova ENERGYFlex and Nova ENERGYPanel roofing packages.

Nova ENERGYFlex is a all-in-one option combining the waterproofing features of polymer modified bitumen membranes and the clean energy production by means of built-in photovoltaic cells on flexible sheets capable to fit nearly any kind of roofs, both existing and new.

Nova ENERGYPanel is otherwise an option to boost the performance of rigid photovoltaic panels enhancing the solar contribution thanks to **Reflecta Extra White System**, the highly reflective bright white granular finish, fire resistant, waterproofing membrane by Novaglass plus the cutting edge and safe **Nova Energy Fixing** fastening system.

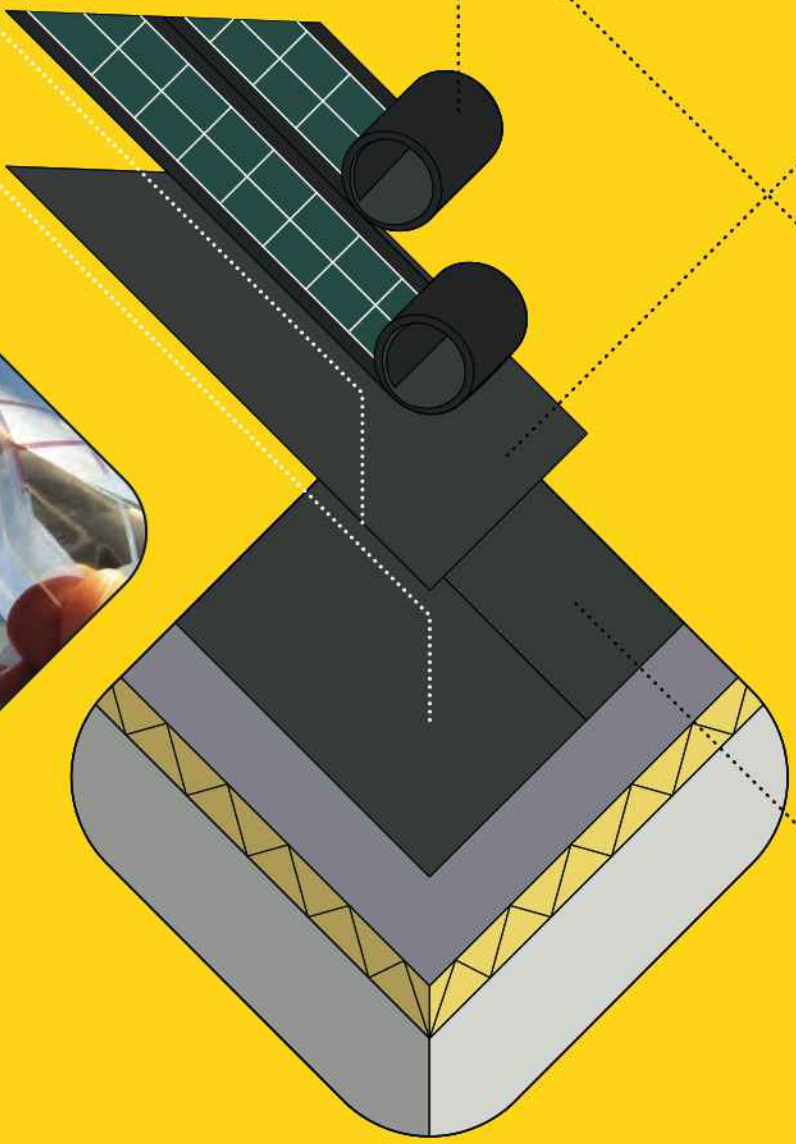
Nova ENERGY, installation instances:

Nova ENERGYFlex

1)
Flexible PV module
(Nova ENERGYFlex)
High quality fire resistant polymer bitumen waterproofing membrane
(NOVA E-30)

Nova ENERGYFlex
CIGS

Nova E - 30



Nova E-15 or
Nova E-10

Underlayer, no longer required in case of relatively young waterproofing layers, i.e. max 5 years old
(NOVA E-15 or NOVA E-10)

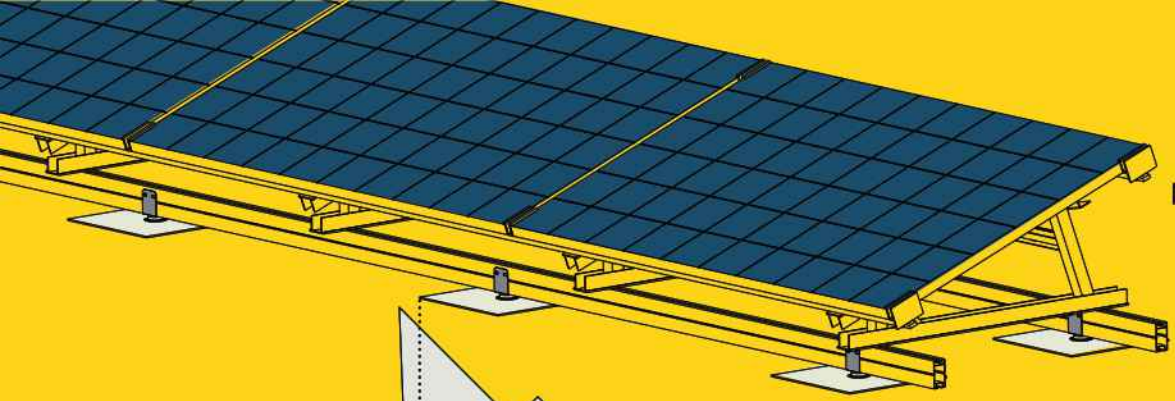
2)
Flexible PV module
(Nova ENERGYFlex)
Black polymer bitumen waterproofing membrane to connect PV modules
(NOVA E-30S)
Underlayer, no longer required in case of relatively young waterproofing layers, i.e. max 5 years old
(NOVA E-15 or NOVA E-10)

Nova ENERGYFlex

Features	Data	Surface	N. modules
Nominal Output			
275 Wp	1 KW	10 m^2	3,6 modules
300 Wp	1 KW	9 m^2	3,3 modules
Size 5745 x 495 mm			

Other amorphous silicon panels

Features	Data	Surface	N. modules
Nominal Output			
136 Wp	1 KW	15,4 m^2	7,3 modules
144 Wp	1 KW	15 m^2	7,0 modules
Size 5436 x 394 mm			



Nova ENERGYPanel

Nova ENERGY Fixing

REFLECTA
Extra White System

Nova E-15 or Nova E-10

Nova ENERGYPanel

1)
Rigid photovoltaic panel
(Nova ENERGYPanel or supplied by others)
Guaranteed fastening system suitable to the design waterproofing system
(Nova ENERGY Fixing)
Bright White fire resistant polymer modified bitumen membrane as waterproofing layer and as efficiency boosting equipment
(REFLECTA Extra White System)
Underlayer, no longer required in case of relatively young waterproofing layers, i.e. max 5 years old.
(NOVA E-15 or NOVA E-10)

2)
Rigid photovoltaic panel
(Nova ENERGYPanel or supplied by others)
High quality fire resistant polymer bitumen waterproofing membrane
(NOVA E-30)
Guaranteed fastening system suitable to the design waterproofing system
(Nova ENERGY Fixing)
Underlayer, no longer required in case of relatively young waterproofing layers, i.e. max 5 years old
(NOVA E-15 or NOVA E-10)

1.2 COLLABORATION WITH THE MOST PROMINENT PV PRODUCERS, NOVA ENERGYFLEX

Novaglass has signed collaboration agreements with the strongest and most innovative

German and North American producers of Thin Film Photovoltaic Systems for large sized and relatively light weight flat roofs to release **Nova ENERGYFlex**.

Nova ENERGYFlex is so-called **BIPV**, Building integrated Photovoltaics. Thanks to its complete architectural integration it enables access to **highest level of State Funding**.

Electricity generated by solar energy equipments is fully sustainable source of alternative energy, clean and renewable, therefore respecting the environment. Those equipments produce direct current which is transformed into alternating current connected to the grid and eventually bought by the utility.

Furthermore this system is particularly suitable for installation onto those light weight roofs (even asbestos) because the built-in solar modules together with the carrier-membrane are not bringing the system to overloads as they don't need the traditional supports and anchoring systems. Indeed no needs to drill the waterproofing or other roofing layers.

1.3 CHARACTERISTICS OF Nova ENERGY

Nova ENERGYFlex

Improvements in Photovoltaics have been quite remarkable in the last few years. They delivered a bunch of new opportunities of employment of more otherwise useless surfaces. Within this application we can bring into service Novaglass Nova ENERGY System, the effective solution developed together with German and North American PV experts.
This system features the combination of CIGS flexible modules (whose energy yield is 12% whereas any traditional amorphous silicon is 8%) together with the innovative fire resistant polymer bitumen waterproofing membrane NOVAGLASS NOVA E-30.


NOVA ENERGY

NOVA E-30
It is a plastomeric bitumen membrane. Industrially manufactured by soaking a high stability composite polyester & fibreglass mat into a waterproofing compound comprising high quality distilled bitumen modified with last generation polyolefin polymers. The waterproofing sheet is considered as self-protected type as the exposed surface is coated with fine slate flakes Black Diamond®.

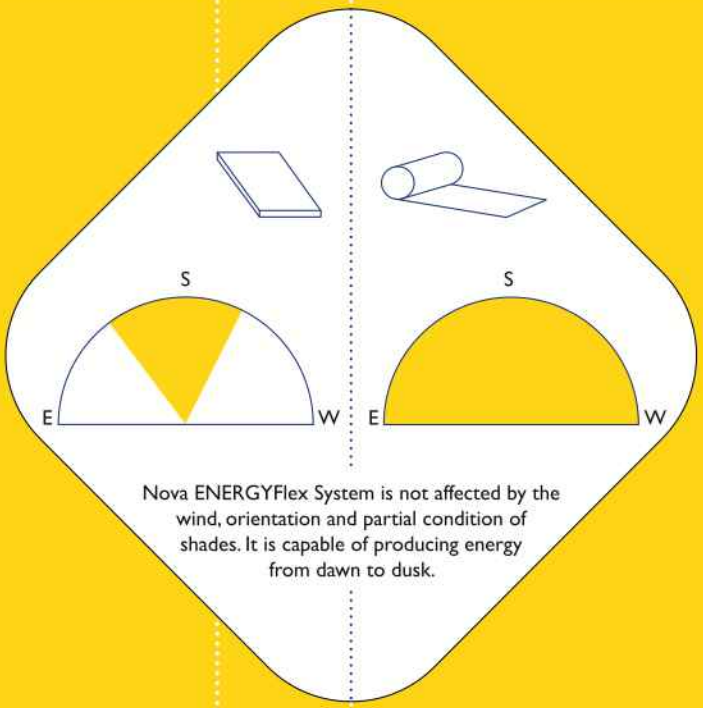
REFLECTA Extra White System
Eurostar Reflecta is a plastomeric bitumen membrane manufactured according to the afore mentioned concept, however performing an innovative coating/protection technology. The composite polyester and fibreglass mat conveys a high and durable dimensional stability as required by photovoltaic systems. It features a special high reflective, UV resistant and flexible bright white granular slate topping. An optional maintenance programme requires the application of EXTRA WHITE paint to additionally improve the durability and the reflective performance of any further installed photovoltaic panels.

NOVA E-30S
It is elastomeric bitumen membrane incorporating high stability spunbond polyester reinforcement.

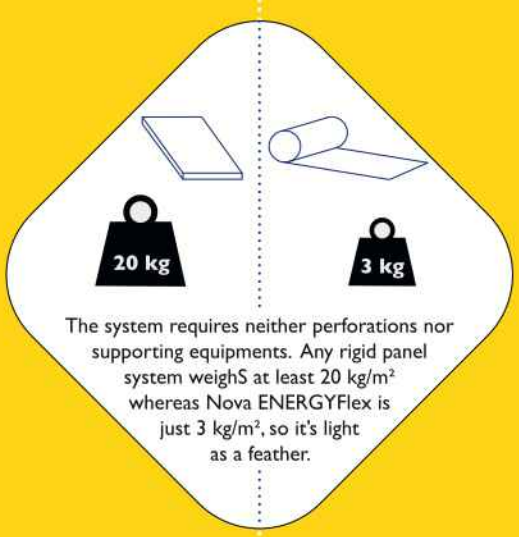
1.4 Nova ENERGYFlex ADVANTAGES

- Quick and easy assembly;
- Cost effective transportation thanks to moderate weight and reasonable overall sizes;
- Thin Film cells are by far much lighter than crystalline cells and capable to maximise feeble and dim light. For this reason they can achieve good performance in horizontal position, whatever orientation and even when partially in condition of shade;
- Optimisation of use of the available sunlight quantity and capturing it with wider angle in comparison to oriented panels;

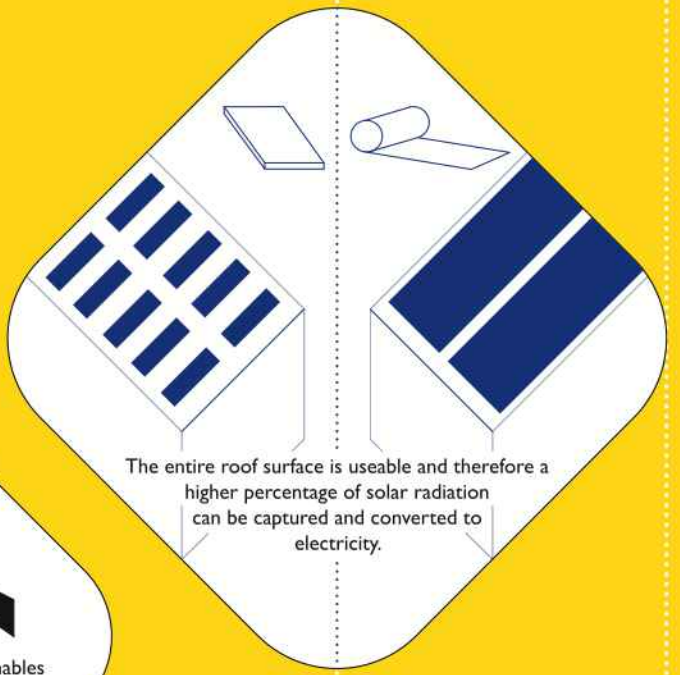
Advantages of Nova ENERGYFlex



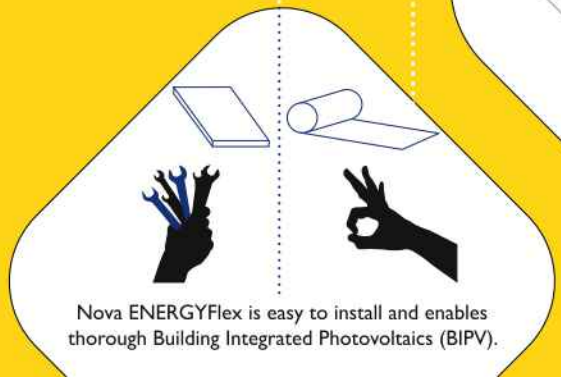
Nova ENERGYFlex System is not affected by the wind, orientation and partial condition of shades. It is capable of producing energy from dawn to dusk.



The system requires neither perforations nor supporting equipments. Any rigid panel system weighS at least 20 kg/m² whereas Nova ENERGYFlex is just 3 kg/m², so it's light as a feather.



The entire roof surface is useable and therefore a higher percentage of solar radiation can be captured and converted to electricity.



Nova ENERGYFlex is easy to install and enables thorough Building Integrated Photovoltaics (BIPV).

- They allow the full cladding of the roof available surface;
- They keep high yield even in high temperatures whereas crystalline modules decrease Energy production when overheated;
- They are the perfect solution to curved roofs (barrel vault, etc.) or to fit complex shaped roofs or when the total roof load is critical;
- They are more handling friendly as they have no glass carrier. They are self-cleaning;
- They are not causing any light reflections (therefore avoiding overheating of surrounding environment);
- They deliver full Building Integrated Photovoltaics (BIPV) allowing access to full State Funding (where applicable, check with local autority);
- All-in-one photovoltaic and waterproofing system with easy installation on most roofs needing refurbishment;
- Nova EnergyFlex System is remarkably less sensitive to wind uplift and "sail effect" in comparison with orientated rigid panels.

1.5 WARRANTIES

Nova ENERGY System can only be certified and guaranteed provided the provisions and the application guidelines of NOVAGLASS are carefully respected while installing.
In order to obtain the manufacturers guarantee it is required to use materials supplied and/or approved by Novaglass.

Product Warranty

Photovoltaic modules

- Warranty covers replacement of modules, repair of production or physical failures. It does not include any performance or energy yield guarantees onto the photovoltaic panels. Photovoltaic modules are covered with 5 years materials warranty starting from the date of purchase by the end user (Customer). It is a manufacturers guarantee onto their


GUARANTEE
SATISFACTION
SATISFACTION

photovoltaic sheets provided the installation, working and maintenance conditions comply with their recommendations.

Multiple-layer waterproofing systems

- Supplied by Novaglass are covered with a 20 years materials guarantee, provided the end user subscribes a project specific maintenance programme.

Inverters

- Are guaranteed usually 5 to 10 years, possibly with extended guarantee in case of subscription of maintenance programme.

Performance Warranty

This warranty is relevant to the electric performance of the modules, particularly their power. Producers generally grant round 80% of their panels nominal or minimal power (minimal = nominal less tolerances) after 20-25 years.
Their photovoltaic modules will perform during the first ten years after installation at least 92% minimum nominal power output; during the first twenty years after installation at least 84% and in 25 years at least 80% minimum nominal power output in Standard Test Conditions (STC).

1.6 CERTIFICATIONS

Membranes
Single products or system appraisal of Novaglass waterproofing membranes.

Photovoltaic units
For PV modules apply for producers specific certifications.

1.7 INVESTMENTS

Terms of Sale

Photovoltaic roofs require an important initial investment, though once installed they require inexpensive maintenance fees.
Terms of sale: 30% down payment at the order and 70% balance payment at the delivery.

kWh

When comparing different energy producing methods it is appropriate to sort by kW of energy yield rather than costs. Production of energy through traditional thermoelectric power plants is bearing the hidden costs of environmental damages that people pay out unconsciously.
kWh is the unit of measurement of active energy both produced and consumed. For instance to tell the quantity of such energy we may say that with 1 kWh you can prepare 40 coffee cups with a coffee machine or do the laundry at 60°C or otherwise watch TV for 12 hours. In Italy every household requires an average of 3500 kWh annually (excluding production of hot water).

Example: a solar roof capable of 3 kWp has a yearly output worth 3,500 kWh. The cost of the solar system would be round 13,000 euros. With reference to Italy, the owner of the house equipped with solar roof gets State Funding worth 1,400 euros per year (40 eurocents x 3,500 kWh) that is to say as much as 28,000 euros in 20 years. It means that the initial investment payback is 10 years. Average lifespan of a photovoltaic system exceeds 35 years and it is evidently worth the initial investment. Just to make a rough financial evaluation such a plant performs a yearly revenue worth 8%. It is as safe as Treasury Bonds issued by the Italian Central Bank (as the State is the drawer); it is much more valuable because there are no equivalent investments within the Financial Market.

1.8 PROMOTION AND ADVERTISING

Novaglass wishes to promote Nova ENERGY System in two options willing to provide sensible solutions to satisfy various requirements by prospect customers. Those options can cope with both structural and architectural situations with either flexible or rigid PV (and therefore either building integrated and not integrated). There will be useful solutions for installation of any size: big (> 200 kW), medium (100-200 kW) and small size; industrial and residential. Main target is to best fit the project effectiveness when planning and installing the different PV systems, possibly arranging partnerships with the most prominent companies within the renewable energy business in order to obtain the maximum satisfaction with the customers. To support the promotion there will be shortly available informative literature in both soft and hard copies.

2

Photovoltaics

2.1 PV TECHNOLOGY

Just a few clarifications to the various vocabularies and the different technologies.

Monocrystalline module (also single-crystal silicon, short form sc-Si)
In order to obtain monocrystalline cells semiconductors with exceedingly pure structure are used. From molten silica mass cylinder bars are grown and then sliced into thin wafers. This production method allow the product to perform high yield. They are generally seen in **black or dark blue uniform colour**.

Weight	Power	Efficiency
9-18 kg/m^2	75-140 Wp/m^2	15-18%

Multicrystalline module (also polycrystalline silicon, short form mc-Si)
Their production is less expensive than single-crystal silicon. Silica mass is forged into rods then sliced into plates. By solidification the crystalline structure obtains heterogeneous sizes and superficial imperfections. As a consequence the efficiency of such cells is lower. Polycrystalline cells are generally square or rectangular shaped. They can be recognized by a visible grain, a "**metal flake effect**".

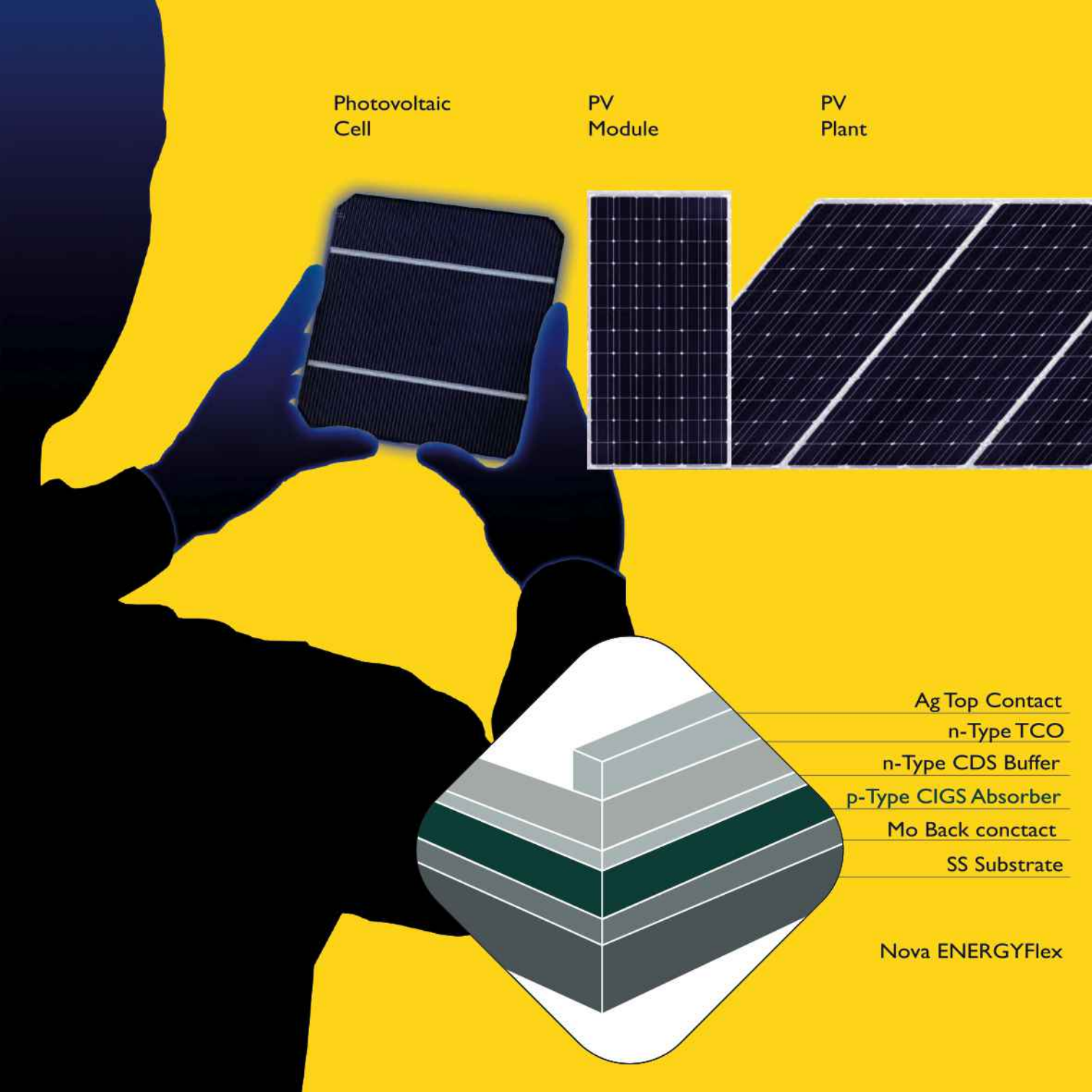
Weight	Power	Efficiency
9-18 kg/m^2	75-140 Wp/m^2	10-15%

Thin Film module (short form TF)
Thin Film cells are laid down directly onto a either glass, stainless steel or polymeric carrier. Depending on their carrier and thanks to their thinness these solar cells hence the modules are extremely flexible. Different technologies are now available, just to name a few amorphous silicon (a-Si), cadmium telluride (CdTe), copper indium selenide (CIS), etc.
Their appearance is uniform.

Photovoltaic Cell

PV Module

PV Plant

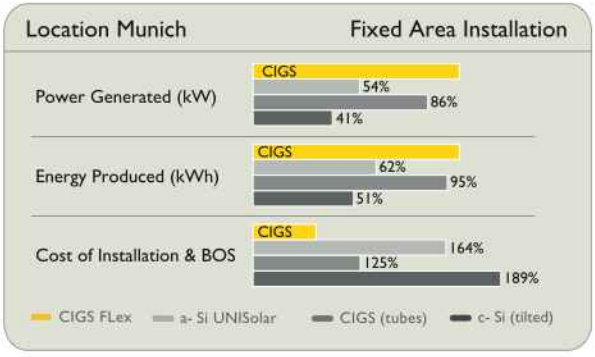


Nova ENERGYFlex

Nova ENERGYFlex, is available in two options:

A) comprising the innovative and highly efficient CIGS modules combining: copper, indium, gallium and selenium.

Weight	Power	Efficiency
7 kg/module 2,5 kg/m^2	82 Wp/m^2 Installed 275-300 Wp/module	12%

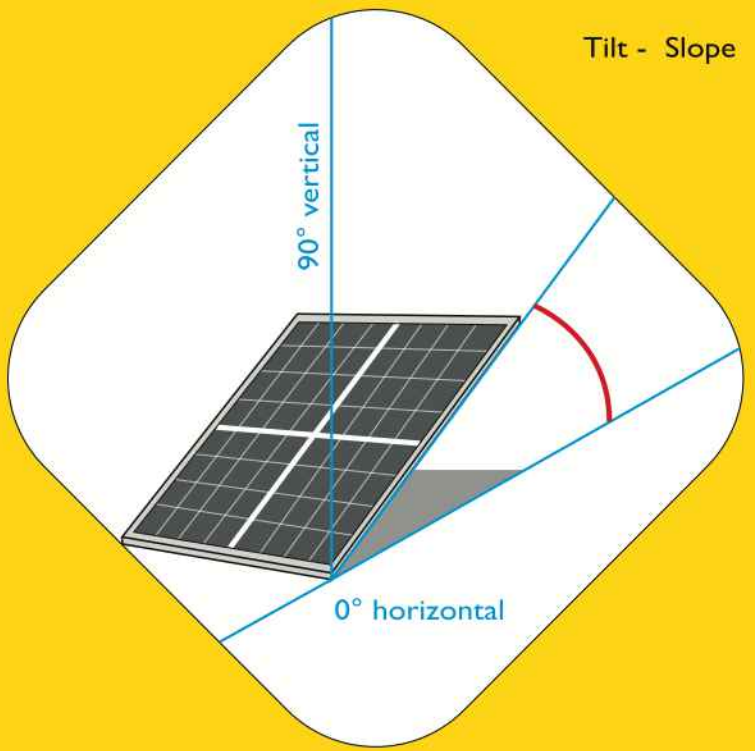


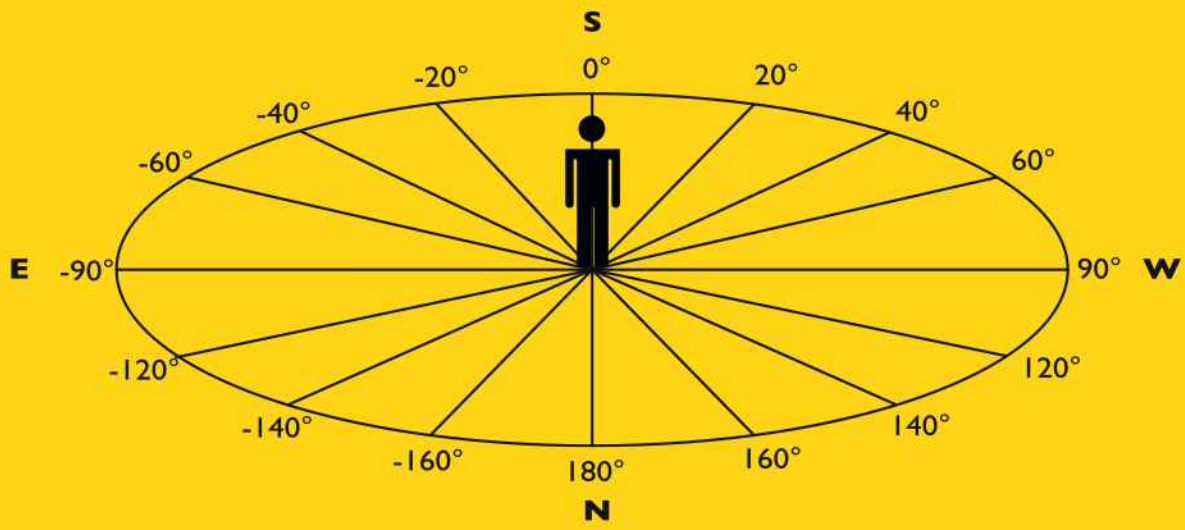
Installation costs are approximately the same as for polycrystalline silicon panels. Indeed an optimised employment of the surfaces will deliver a higher efficiency of the system. Furthermore these solar cells can perform good results even in those areas with indirect radiation (Source: Global Solar).

B) comprising laminated thin film modules based on triple joint amorphous silicon and featuring:

Weight	Power	Efficiency
7,5 kg/module 3,7 kg/m^2	50 Wp/m^2 Installed 136-144 Wp/module	6-7%

Cell structure:
3 cell layers each one featuring a different band of the sun spectrum.


Tilt - Slope
90° vertical
0° horizontal


Azimuth - Orientation
S
0°
-20°
20°
-40°
40°
-60°
60°
E
-90°
90°
W
-120°
120°
-140°
140°
-160°
160°
180°
N

2.2 MINIMUM REQUIREMENTS TO PLAN A PV SYSTEM

In order to optimise the energy generated by photovoltaic modules it is critical to follow some guidelines such as orientation, shade and ventilation.
All those details are necessary for the Novaglass Technical Department to carry out a preliminary planning of every new Nova ENERGY roof.

1. inclination of the modules
   Crystalline modules should be installed with an optimised tilt between 10° e 60° (it depends on the latitude of the place in which those panels are fitted). Nova ENERGYFlex system does not require any optimised tilt though. Their modules keep high efficiency even when modules are horizontal of in partial condition of shade.

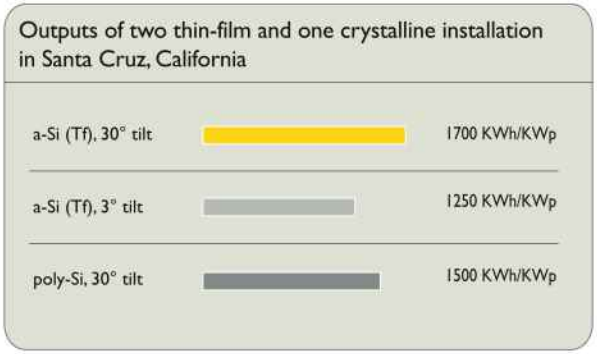
2. orientation of the modules
   Unlike the architectural principles, where North is the reference, in Photovoltaics south is the guidance and corresponds to an azimuth 0°. Orientation (azimuth) shall be as close as possible to South. If modules are set towards East, such angle will get a negative value whereas if set towards West it will get a positive one.
   For crystalline modules orientations between 60° West and 60° East can contain loss as much as 10% (depending on their inclination).

   With Nova ENERGYFlex there will be nothing lost due to either inclination or orientation. All available roof surface can be covered to produce clean energy.

   It is important to know that for all crystalline modules the following general parameters are applicable.

Referred to latitude of Venice (Italy)

1. for BIPV installed on pitched roofs orientated 1. towards South the solar energy yield is best;
2. for BIPV installed vertically on facades their solar Energy yield is about 70% when orientated to south, 50% if to either east of west;
3. for BIPV installed horizontally (flat roofs), their solar energy yield is all the way 90%;
4. at all cases orientation towards North is to be avoided.



Output data comparison. Laminated thin film can achieve nearly the same output, even when installed horizontally.

Condition of shade

Best output from solar modules is obtained when conditions of shade are avoided. Nova ENERGYFlex System can however perform best output, yet in a partial condition of shade. In the rigid crystalline systems even small shades are enough to remarkably diminish the energy output. When planning a photovoltaic system it is critical to consider the possibility that other buildings, trees or else may cause a condition of shade on the PV surface. There are distant shades, far enough to project a full shade on the entire system suddenly at once (horizontal effect). Otherwise near shades project partial shades onto the system. Partial shades shall be avoided because they cause to system (or to a string of modules) huge power breakdown. When a system is equipped with string inverters, it is important to connect them parallel to the most remarkable expected shade. Eg.: If a tree projects its shade to the PV facade, the strings shall be connected vertically.


sunlight is everywhere

Ventilation

When temperature rises with rigid crystalline module cells there will be a decrease in the strain and the power output.
Thanks to their particular and innovative technology this phenomenon will not occur with Nova ENERGYFlex modules.
For those single or polycrystalline modules, temperature will affect the power output according to the following coefficient: from circa -0.4%/°C up to -0.5%/°C. It is important therefore to provide sufficient passive ventilation behind the modules allowing adequate cooling.

Quick overview of the data requirements to plan a Nova ENERGY power plant:

- Plan view and cross sections with north-south orientation in AutoCAD format (.dwg extesions) with indication of the main switchboards, electricity meter and supply box in their *status quo*. If digital versions are not available, printouts or blueprints will be accepted provided there will be metric scale (the project preparation may require longer time to arrange new digital shop drawings).

- In case of refurbishments it is critical to consider the type of substrates (wood, concrete, metal sheet, steel deck, etc.) and their stratigraphy, thickness and all relevant information.

- Statement of the substrates steepness (percentage of slope or gradient) and indication of the water drainage (e.g.: with Nova ENERGYFlex min. 3%).

- Statement of the required system output based on own consumption or the maximum service power; statement how is the local service electricity company (power grid).

- Adequate photographic reportage of the roof and of the building. Statement of the height of the perimeter walls as well as any present installations that may cause conditions of shade.

If the roof is already fitted with waterproofing layers, it is critical to find out:

- Type, composition and age of the waterproofing system along with adequate pictures.

3

Glossary

3.1 UNIT OF MEASUREMENT

One typical characteristic of photovoltaic elements is their power. This value is given in W (watt) and refers to the quantity of energy in J (Joule) that is consumed (or produced) every second. In terms of electricity 1 Watt is the power generated by 1 Ampere of electricity that flows due to the impulse of 1 V.

1 W = 1 J/s = 1 A x 1 V

The power of the photovoltaic modules measured in standard conditions (incidental radiation 1000 W/m^2, module's temperature 25°C) is given in Wp (Watt-peak). Typically, crystalline or amorphous modules has a power higher than 100 Wp/m^2. The quantity of electric Energy supplied (or bought) by the System Operator is given in KWh (kilowatt hour). This energy E=Pxt is the result of power P (in kilowatt) and time t (in hours), during which the energy is supplied (produced).

1 kWh = 1 kW x 1 h = 1000 W x 1 h = 1000 J/s x 3600 s = 3.6 MJ

kWh is used to measure the active energy both consumed and produced. Just to give an idea of the amount of energy, we can suggest that with 1 kWh 40 cups of coffee can be prepared with an automated coffee machine; or do the laundry at 60 °C with a washing machine or otherwise watch the TV for 12 hours. Every household in Italy requires an average of 3500 kWh per year (excluding energy to produce hot water).

3.2 A-Z

Alternating Current (AC): it's the type of current whose electrons' flow change direction at regular frequencies.

environmental sustainability and money saving

Amorphous Silicon (a-Si): not crystalline form of silicon. Conversion yield of an amorphous cell ranges between 8 and 10 %.

Azimuth: on horizontal elevation, the angle between whatever directions and south, measured clockwise starting from south.

BIPV (Building Integrated Photovoltaics): it is referred to those photovoltaic elements being integral part of a building or offering a dual functionality, energy generation plus architectural element.

CIGS: high efficiency thin film module comprising Copper, Indium, Gallium and Selenium.

Degree day (DD): it is the totalised figure, comprising all days in the conventional year count, summarising positive and negative daily differences between the conventional temperature (fixed at 20 °C) and the average external temperature. The higher the figure of DD is, the lower is the average measured temperature and its climate cold in the measurement period (e.g. Treviso 2378 DD, Palermo 751 DD).

Direct Current (DC): electrons flows moves always in the same direction within the conductor. Unit of measurement is Ampere (A) which is equal to the flow of 1 Coulomb (= 6.2 x 1018 electrons) per second.

Energy meter: mechanical or electronic device to count the amount of consumed / produced energy.

Funding / Subsidy: financial services to support and promote PV by means of purchase of the Energy produced at a higher rate than the market price providing aid to compensate the installation expenses or otherwise fiscal benefit.

Grid connected plant: the grid connected plant is generally not fitted with accumulating devices. The energy produced during the insolation hours is directly supplied to the grid; vice versa when insolation is poor or null the load is provided by the grid. Such kind of systems are quite reliable when it come to the continuity of the service. It is more reliable than a stand alone plant, that in case of failure cannot be fed by any alternative source.

Inverter: equipment to convert direct current produced by PV panels into alternating current. This device is necessary when connecting the PV system to the grid.

Nova ENERGYFlex

Monocrystalline Silicon or single-crystal Silicon (mono-Si or sc-Si): crystalline silicon comprising a single crystal of silicon. Conversion yield of mono-Si cell ranges between 15 and 22%.

Photovoltaic Generator: it comprises the photovoltaic modules system properly wired in series and parallel circuits. Particularly the basic element is the photovoltaic module. Modules and panels connected in series circuits to obtain generation nominal voltage form a **string**. Electric connection in parallel circuits of strings form a **field**. As an example it may be considered that at the latitude of North Italy 2 m^2 of photovoltaic modules can perform an average of: 0.48 KWh/day during winter season and 1.16 KWh/day during summer season.

Polycrystalline Silicon or multi-crystal Silicon (poly-Si or mc-Si): it is a form of crystalline silicon comprising a number of crystals of silicon. Conversion yield of poly-Si cell ranges between 10 and 15%.

Power [W]: quantity of work (or energy) produced/consumed by a per unit of time. Measured in Watt [W] it is equal to 1 Joule per second.

Power peak or nominal [Wp]: nominal power of a photovoltaic system in standard test conditions, STC (radiation 1000 W/m^2 and temperature 25 °C). Power peak or nominal is generally measured in "Watt-peak" [Wp].

PV system: equipment comprising photovoltaic modules, wires, inverters, electricity meters used to obtain electric energy.

Stand alone plant: self working plant, with no connection to the power grid and usually fitted with system battery. Battery is necessary because the photovoltaic system can only produce energy during the daily hours, while the energy is generally consumed in the post meridian and night hours. During the insolation phase it is necessary to store all the energy that is not immediately required to later feed the load when actually available energy is poor or null. High reliability systems can be obtained by the integration of stand alone systems with traditional source systems, e.g. diesel powered generator (hybrid diesel-electric system).

Batteries for photovoltaic systems may have the following characteristics:

- Low self-discharge value
- Long life expectancy

Nova ENERGYPanel

- Negligible maintenance
- Elevated number of charge and discharge cycles.

Tilt: inclination of photovoltaic modules, expressed in degrees.

Thin Film Cell: second or third generation cell using the lamination of thing layer of semiconductor materials. Production costs of those cells are generally lower. Various semiconductor materials can be used with this technology: amorphous and micromorphous silicon, CdTe (Cadmium Telluride), CIS (Copper Indium Selenide), etc.

Three-Phase Alternating Current: means of transportation and/or distribution of electricity based on three alternating current of same frequency but reaching their instantaneous peak at different times. The resulting advantage is that the loss of energy during transportation is very low.

Triple Joint (thin film): thin Film Amorphous Silicon is the technology of the future, considering its versatility and the fields of application and its performance. In this technology as used by Parabel Solar the blue, green or red components of the solar spectrum are absorbing in different frames and the different layers.

Watt hour [Wh] (kilo-, Mega-, Giga-): quantity of energy equal to 1 W in one hour, or otherwise 3600 Joule. One kilowatt hour (kWh) is equal to 1000 Wh, 1 Megawatt hour (MWh) is equal to 1,000,000 Wh and one Gigawatt hour (GWh) is 1'000'000'000 Wh.

3.3 FAQ

What are the advantages of the photovoltaic technology?

Main advantages can be summarised here below:

- 100% environmental friendliness as there are no polluting emissions;
- saving of fossil (non-renewable) fuels;
- high reliability of the systems as there are no moving parts (provided there are no sun

Nova ENERGY reduces the need to buy electricity from the Service Provider…

tracker systems);
- extremely low maintenance and operation costs;
- system modularity (to improve the system output it is sufficient to increase the number of modules).

Indeed, it should not be underestimated that any photovoltaic plant has a high initial cost (due to the high price of the modules) and may perform an intermittent output due to the variability of the energy source (the Sun).

What does "nominal output" of a photovoltaic plant mean?

The nominal output (or even maximum, peak, plate output) of a photovoltaic plant is the electric power of the plant comprising the nominal output of every single module of the plant and measured in standard conditions (air temperature 25 °C and radiation worth 1000 W/m²).

Where can a photovoltaic plant be installed?

PV modules can be fitted onto most of the building surfaces (i.e. roof, facade, terrace, etc.) or on the ground.

To better define which is the most appropriate system, it shall be considered the presence of the followings:
- availability of an adequate area to install the modules.
- appropriate exposure and inclination of the surface of the modules.

Best conditions in Italy for instance are as follows:
- orientation toward SOUTH (also SOUTH-EAST or SOUTH-WEST with just minimal output drop);
- tilt of the modules between 25° (Southern Italy) and 35° (Northern Italy);
- no buildings or trees to create conditions of shade.

How much energy can a photovoltaic plant produce?

The yearly energy output of a photovoltaic plant depend on many factors:
- incident solar radiation on the installation site;

... saving money
and investing into
the future!

- orientation and tilt of the module's surface;
- conditions of shade;
- performances of the technical equipments connected to the plant (modules, inverters and other devices).

Given a solar plant with 1 KW of nominal power, with favourable orientation and tilt, with no conditions of shade, with no sun tracker system installed in Italy, it is possible to calculate and estimated maximum yearly output:

- northern regions 1,000 - 1,100 KWh/year
- central regions 1,200 - 1,300 KWh/year
- southern regions 1,400 - 1,500 KWh/year

It is useful to underline that the estimated average Italian household yearly consumption is worth 3,500 kWh.

How is the photovoltaic plant connected to the grid?

The connection scheme of the plant is defined by the service provider which the plant has to be connected to. Connection may be in low voltage (LV) single-phase, LV three-phase or in medium voltage (MV). Further information is available from service provider in compliance with local technical standards and rules.

Any further information is available at:

www.novaglass.com

tax incentives and rebates currently available help homeowners save even more money, making it easier than ever to go solar

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NOVAGLASS S.p.A.
Via Gattolè, 1 - 31040 Salgareda - Treviso - Italy
Tel. +39.0422.8084 - Fax +39.0422.807655
e-mail: info@novaglass.com

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