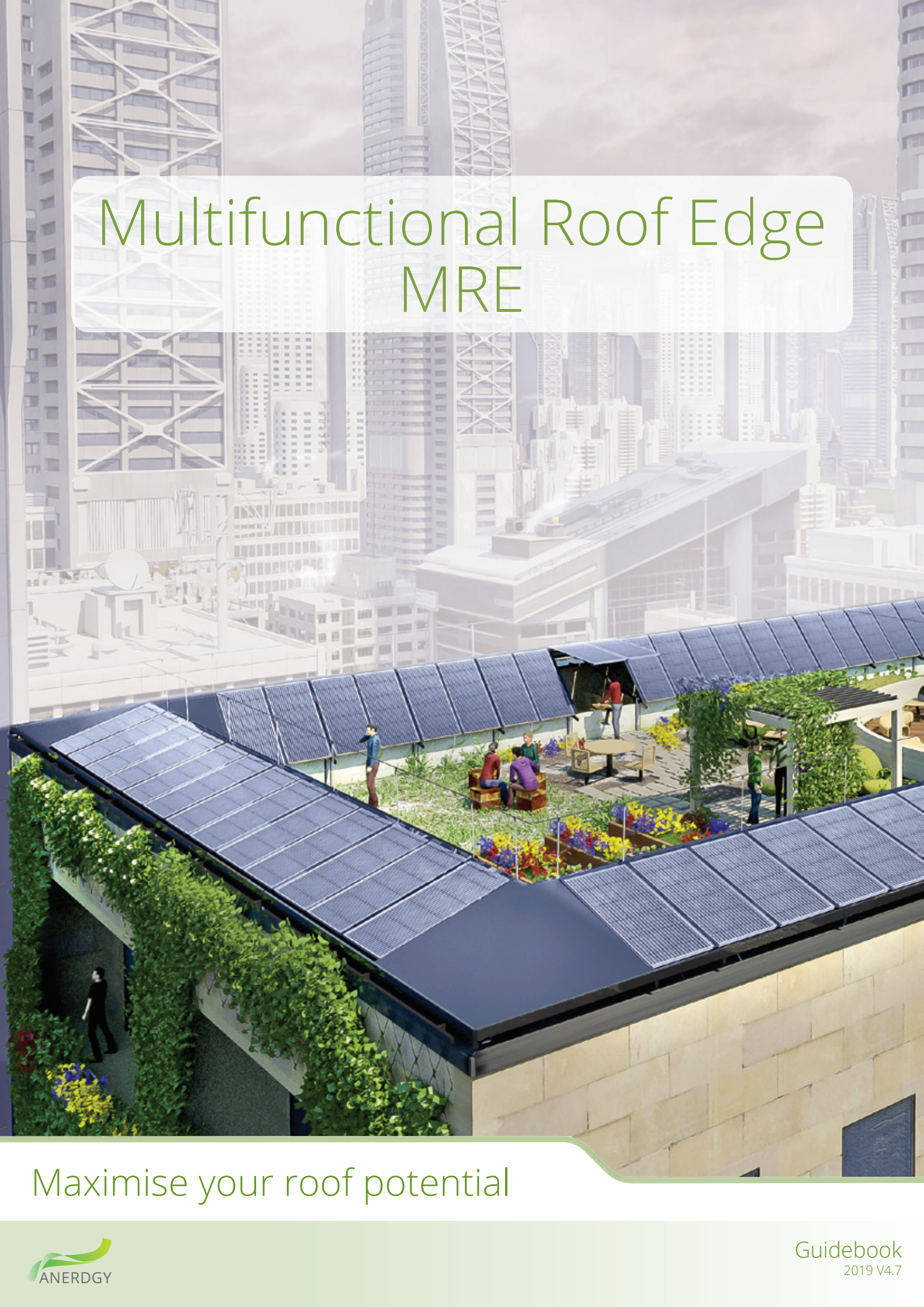


An aerial photograph of a city skyline, featuring a prominent skyscraper with a white lattice structure. In the foreground, a rooftop garden is visible, featuring rows of solar panels, greenery, and several people sitting on a bench. The garden is surrounded by a low wall and has a paved area with some furniture. The overall scene is a blend of urban architecture and sustainable design.

Multifunctional Roof Edge MRE

Maximise your roof potential

MULTIFUNCTIONAL ROOF EDGE (MRE)

FUNCTION. DESIGN. ENERGY.

WHAT IS THE MRE?

The Multifunctional Roof Edge (MRE) is a unique modular **ALL-IN-ONE Roof Edge System**.

WHAT ARE THE BENEFITS OF USING THE MRE?

- Solves space and structural challenges on flat roofs
- Combines functional elements, design options and local energy generation
- Enables easy roof terracing and greening
- Generates a high amount of local electricity & hot water

- Highly cost effective due to its multi-functionality
- Increased building value for tenants and owners



MULTIFUNCTIONAL ROOF EDGE (MRE)

FUNCTION. DESIGN. ENERGY.

INNOVATIVE ROOF DESIGN POSSIBILITIES

Many trends such as urban greening/ agriculture and local renewable energy production as well as future trends, such as the supply of drone packages, are closely linked to the building roof.

Together with the traditional functionalities of protection and hosting of building technology, roofs are becoming even more important for great building designs.



With the MRE system different roof settings are possible in an exceptionally effective and economic way.

Great roof options using the MRE. Ready and waiting for your project.

THE ART OF ROOFING

The MRE system enables different roof usages, which can be exchanged easily during the project planning and even at the construction stage. So no budgeting worries with changed circumstances – the MRE roof is the new star for successful & simple roof planning & realisation.

TECHNICAL ROOF

Safe, clean, organised & renewable

ROOF TERRACE

Community pleasure

GREEN ROOF

Superior living quality



Technical roof

The innovative MRE system brings all the required safety functions to the roof edge while generating local renewable energy. Options for easy integration of water retention, mobile phone antenna installation, ...

- Fulfill regulations easily
- Multifunction = cost saving potential
- Maximise local energy generation
- Option to upgrade to active roof usage

Roof terrace

The MRE system clears up the inner roof area by taking over many functions & by providing additional hosting space. The tenants can enjoy the roof space as a terrace for leisure activities.

- Unique combination of terrace & local energy generation
- Wind-protected terrace as an addition or alternative to balconies
- Safe & easy storage of terrace equipment

Green roof / urban farming

The MRE allows a roof to reach its full potential: Urban farming activities and maximised local energy generation. Urban farmers increase their autonomy and lower their carbon footprint in terms of food & energy.

- Most sustainable building: Combines greening with local energy generation.
- Highest reputation & certification levels achievable
- Superior living quality

MULTIFUNCTIONAL ROOF EDGE (MRE)

FUNCTION. DESIGN. ENERGY.

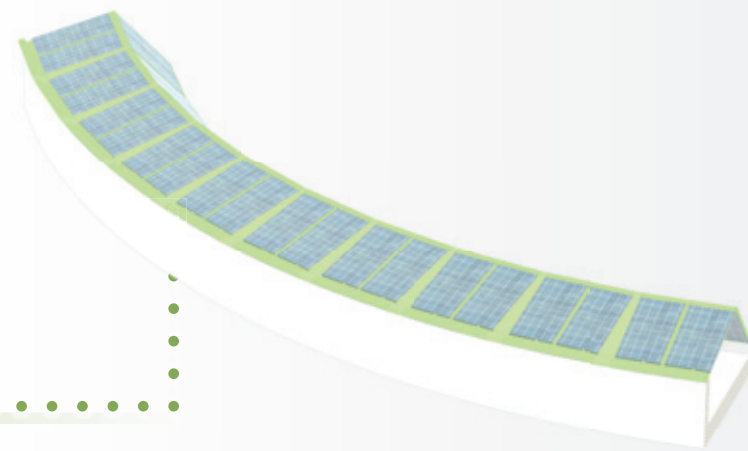
DESIGN POSSIBILITIES

DESIGN FLEXIBILITY

The MRE modules are placed along the roof edge, according to requirements and the roof layout.

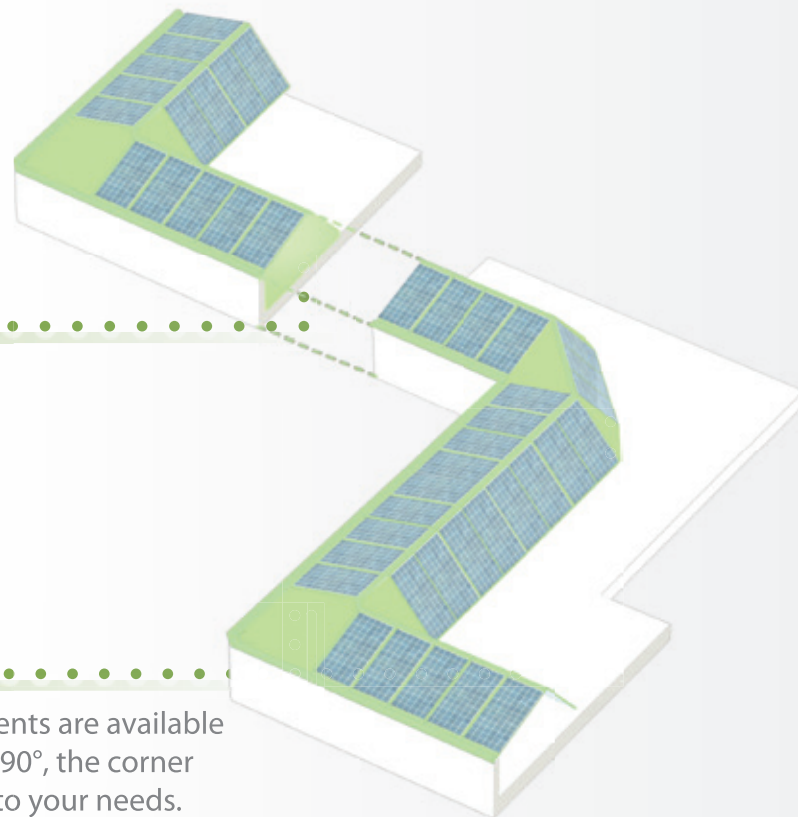
The MRE adapts to numerous rooftop geometries, by providing specific corner elements, roundings and closings. Additionally, project specific elements are available.

All the joining, closing and corner elements can be supplied in various RAL colours.



CURVED WALL ELEMENTS

Intersection elements can be defined in size and are adapted to fit the building's geometry.



CLOSING ELEMENTS

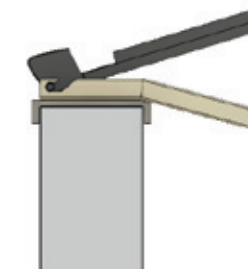
Closing elements enable the MRE modules to be capped, depending on your requirements.

CORNER ELEMENTS

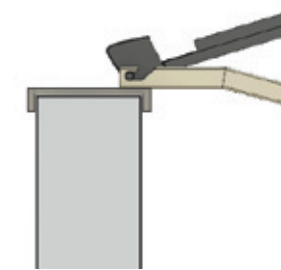
Standard inner and outer corner elements are available for right angles. For angles other than 90°, the corner elements will be produced according to your needs.

FAÇADE POSITION

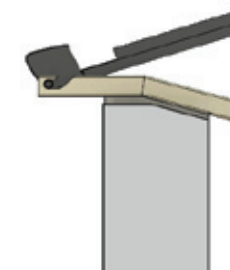
The MRE can have the following façade positions, depending on requirements : edge fit for optimal roof edge protection; interior edge for a hidden edge profile; anterior edge for a green façade connection & façade protection.



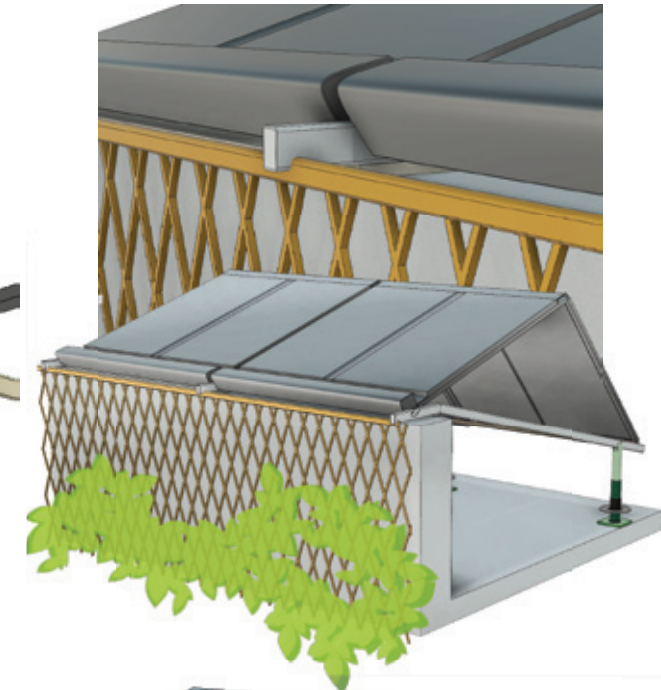
EDGE FIT



INTERIOR
EDGE

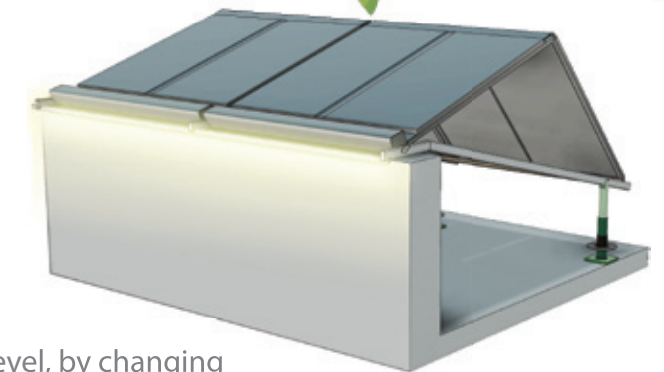


ANTERIOR
EDGE



EDGE ILLUMINATION

Emphasise the edge of the building by adding a seamless illumination onto the MRE that brings a high visual impact whilst remaining very cost competitive.



ATTICA HEIGHT

The MRE's base frame is able to adapt to any attica height level, by changing its angle position:



OTHER IDEAS?

Your design - our engineering. Just send us a sketch and we'll try our best to make it happen.

BUILDING FUNCTIONS

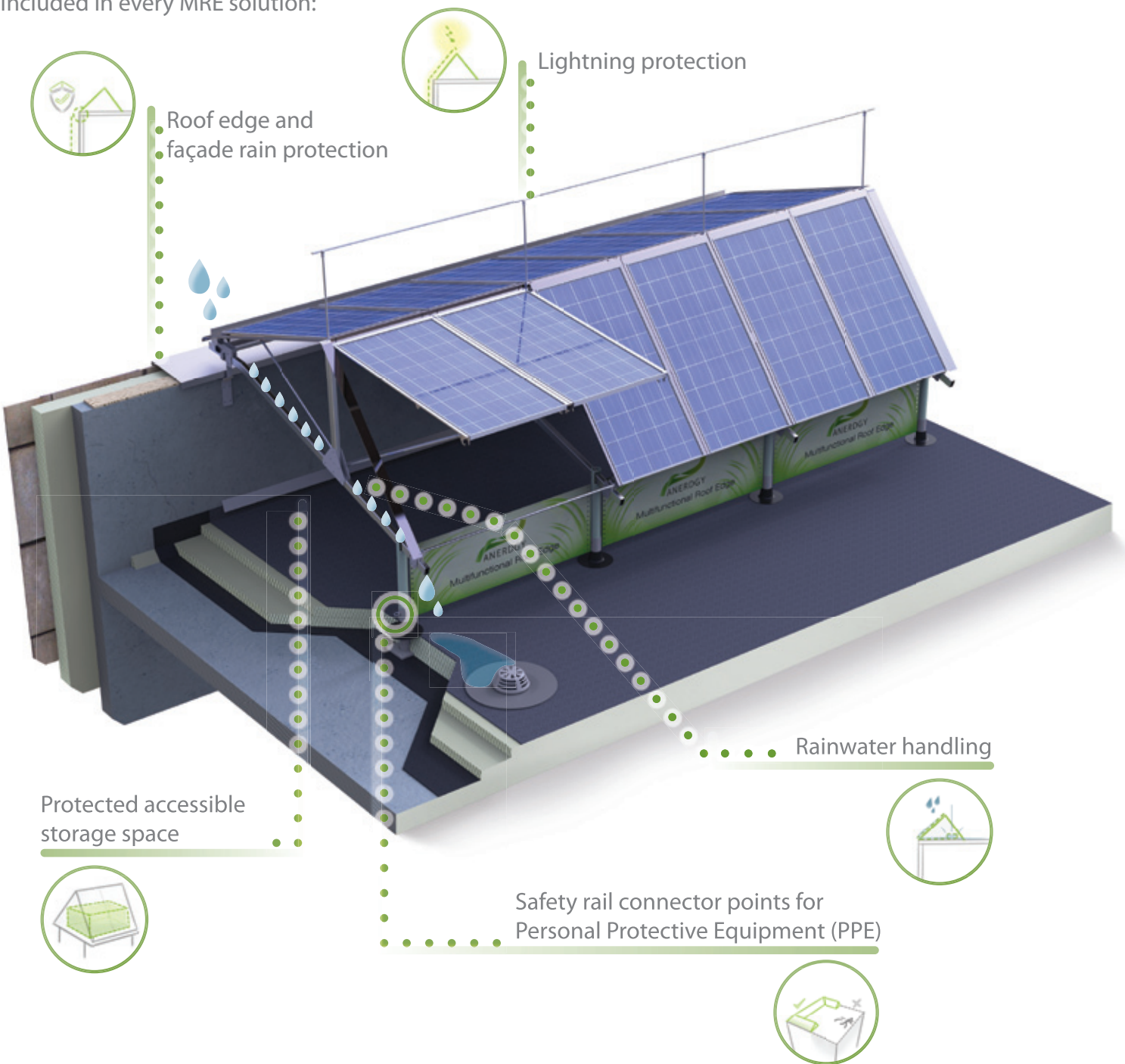
ALL-IN-ONE SOLUTION:

The integrated safety, building and lifestyle functions of the MRE provide you with a solution that reduces your project costs and planning time.

STANDARD INTEGRATED FUNCTIONS

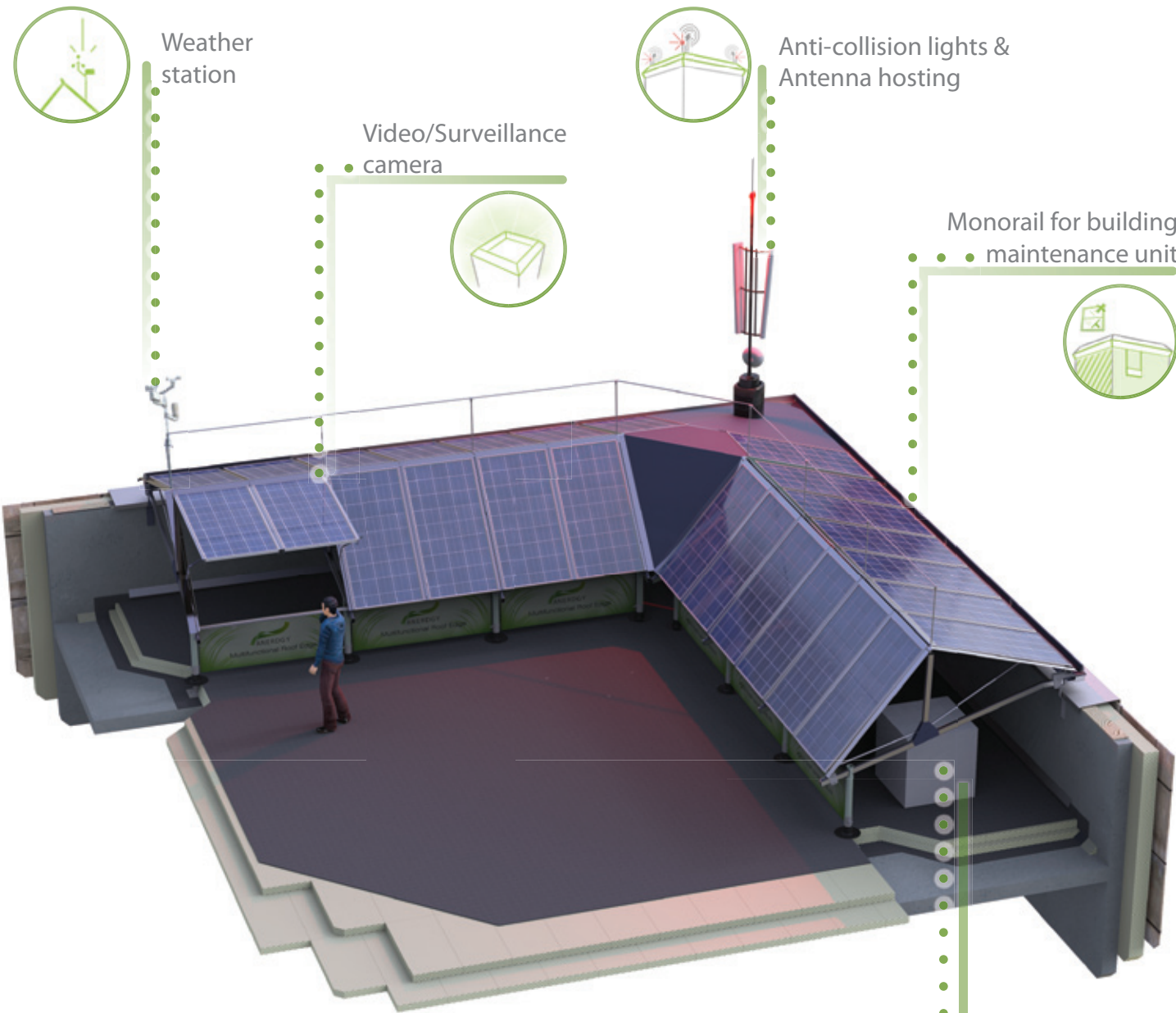
The integration of functions such as fall, rain and lightning protection into the MRE means that the building requirements and regulations can be fulfilled more easily.

Included in every MRE solution:



ADDITIONAL FUNCTIONS

The MRE is a modular system that allows other various building and lifestyle functions to be installed, provided either by Anergdy or a 3rd party.



STORAGE SPACE OPTIONS

The available protected storage space can be used in multiple ways:



MULTIFUNCTIONAL ROOF EDGE (MRE)

FUNCTION. DESIGN. ENERGY.

LOCAL RENEWABLE ENERGY

The solar radiation is used on the front and rear MRE surfaces to generate electricity as well as optional solar heat. On the rear facing surface of the MRE, there are two different technologies that can be used: photovoltaic (PV) or solarthermal panels.

PV panels

Photovoltaic technology converts sunlight directly into electricity. The solar panels allow the generation of direct current electricity.

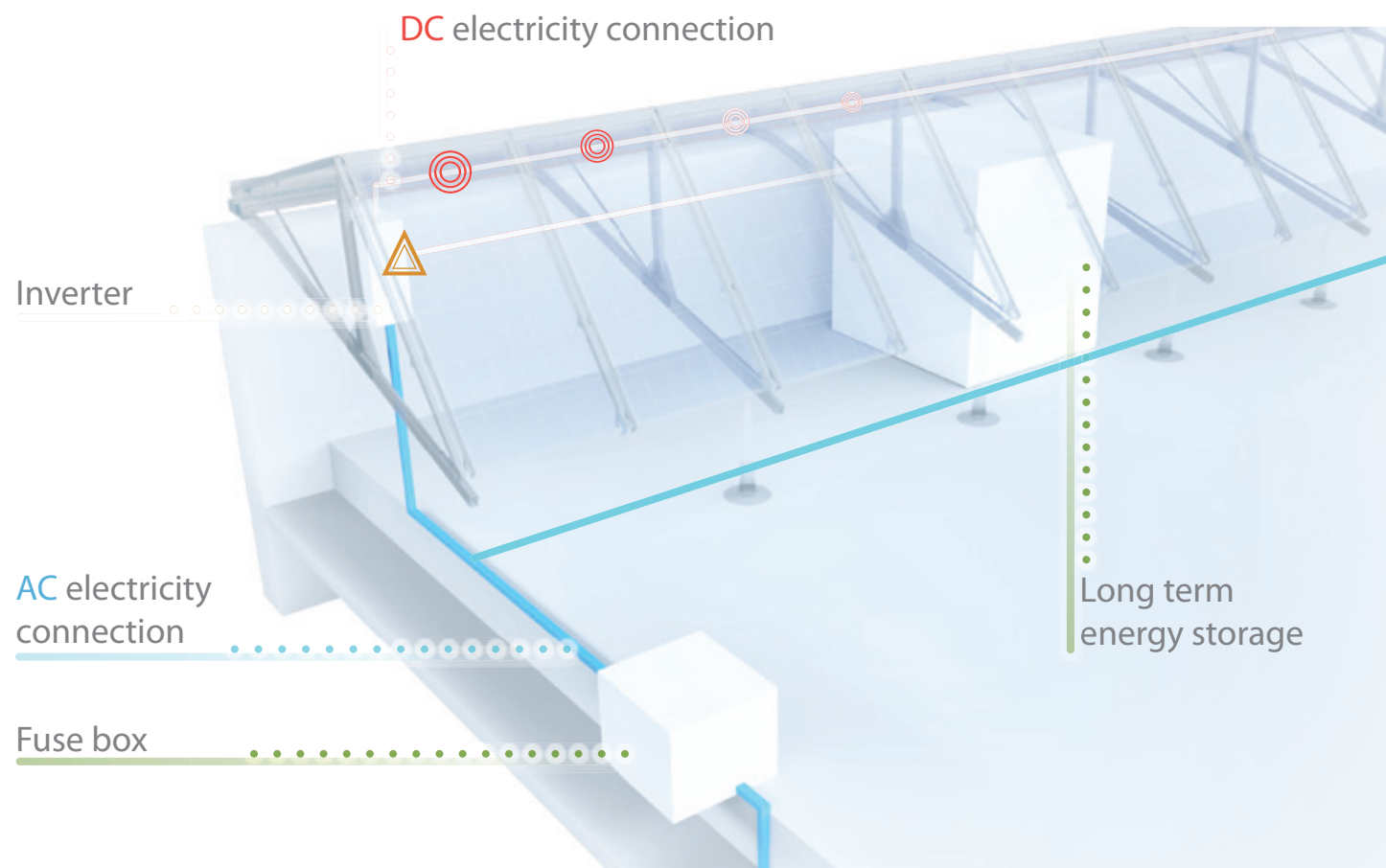


Solarthermal panels

Solarthermal technology uses sunlight to heat a fluid. The hot fluid is used in a water – air heat exchanger for building and water heating purposes.

ELECTRICITY GENERATION

Using PV technology, the solar panels allow the generation of direct current electricity (DC). A connected inverter (△) transforms the DC electricity into alternating current (AC) electricity that is used in buildings. The MRE integrates unique inverters that are installed outdoors, in order to reduce the amount of wiring.



Energy storage

Medium & long term storage
Optional feature to optimise load balancing

Inverter

Converts DC to AC electricity

Fuse box

Legal requirement to prevent fault current in case of technical issues

AC electricity

The generated electricity is handled in a standard way inside the building

House connection

The tenants receive their energy needs in the usual way - nothing changes. Depending on the chosen energy business model, the local energy generation may offer a:

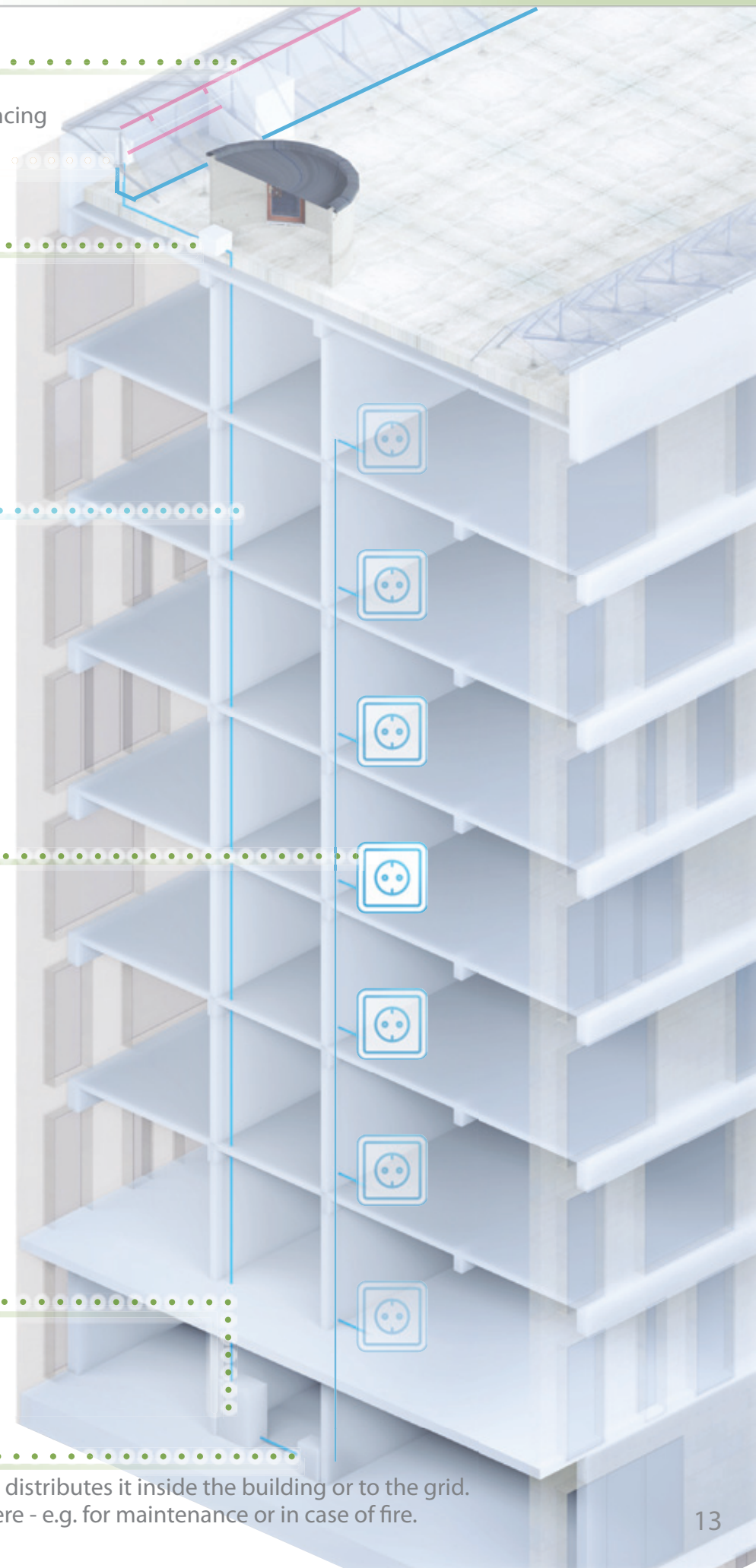
- Cost reduction of the ancillary costs
- Lower & more stable electricity price
- Energy flat rate included in the rent fee

Short term energy storage

Standard technology using Li-Ion batteries. Short term storage.

Distribution box

Measures the generated electricity and distributes it inside the building or to the grid. MRE can be optionally disconnected here - e.g. for maintenance or in case of fire.



MULTIFUNCTIONAL ROOF EDGE (MRE)

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RENEWABLE ENERGY GENERATION OPTIONS COMPARISON

Multifunctional Roof Edge - MRE

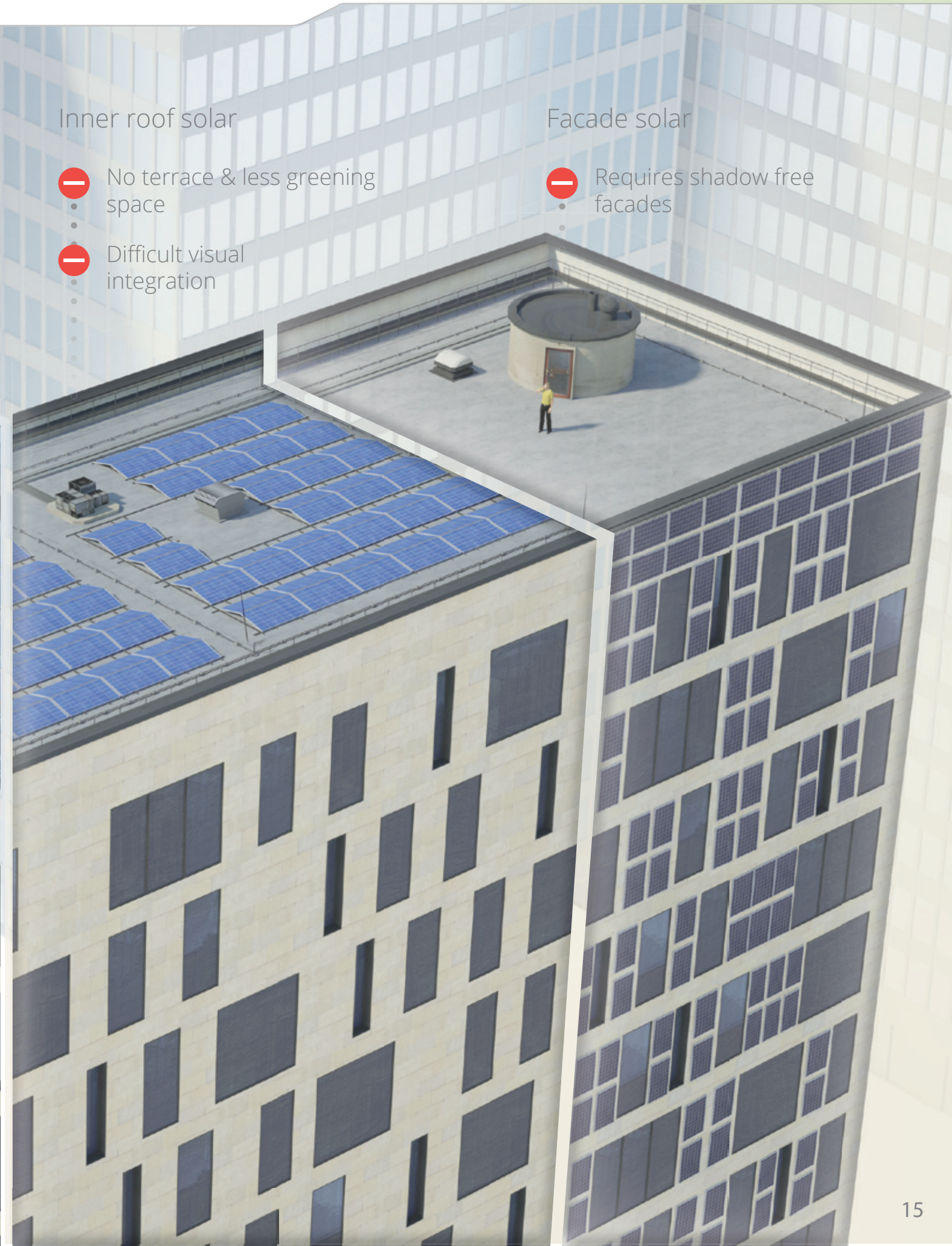
- ✓ For roof renovations and new buildings
- ✓ Superior for greening & terracing
- ✓ Various coloured or even illustrated photovoltaic
- ✓ Saving potential through multifunctionality
- ✓ Easy planning, installation & maintenance
- ✓ Supports town & government targets easily
- ✓ Low energy cost
- ✓ Highest energy generation potential
- ✓ Flexible electricity & heat production

Inner roof solar

- ✗ No terrace & less greening space
- ✗ Difficult visual integration

Facade solar

- ✗ Requires shadow free facades



MRE Variants

Anerdgy provides a unique, all-in-one modular system for flat rooftops, the MRE, which is available in two standard variants: **MRE-light** & **MRE-hybrid**. Both variants can be used together.

The MRE-light

The MRE-light offers an optimal solution for most flat roof buildings. Solar radiation is used in order to generate a high amount of local renewable energy.

It provides the basis of a multifunctional roof edge system which, if planned correctly, meets the requirements of the necessary roof regulations.

The MRE-light is a great solution for both economical and ecological aspects.



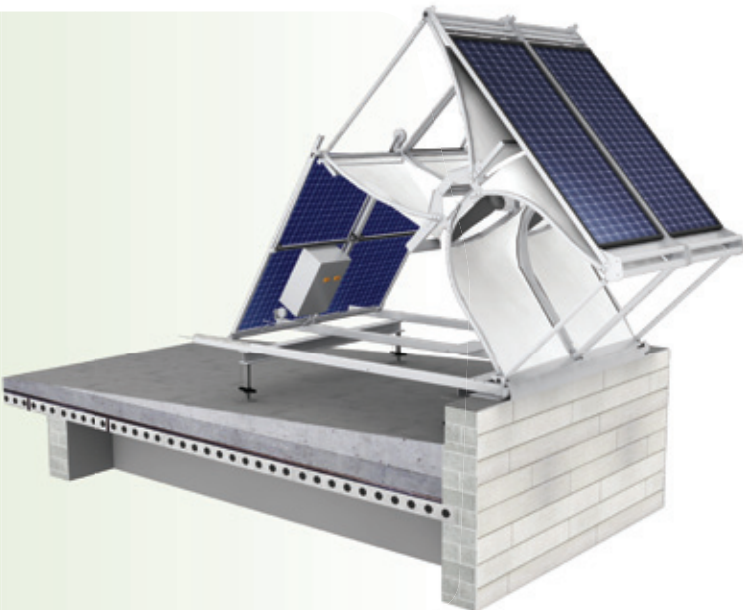
The MRE-hybrid

The MRE-hybrid offers the unique possibility to use the wind flow on flat roof edges as an additional source of energy.

Highly effective energy generation on the roof edge is achieved by combining PV with wind energy.

Beside wind electricity generation, the wind flow can also improve the efficiency of air conditioning units.

The economics of the MRE-hybrid strongly depend on the use case, the specific conditions of the location & regulatory aspects.



INNOVATIVE TECHNOLOGY

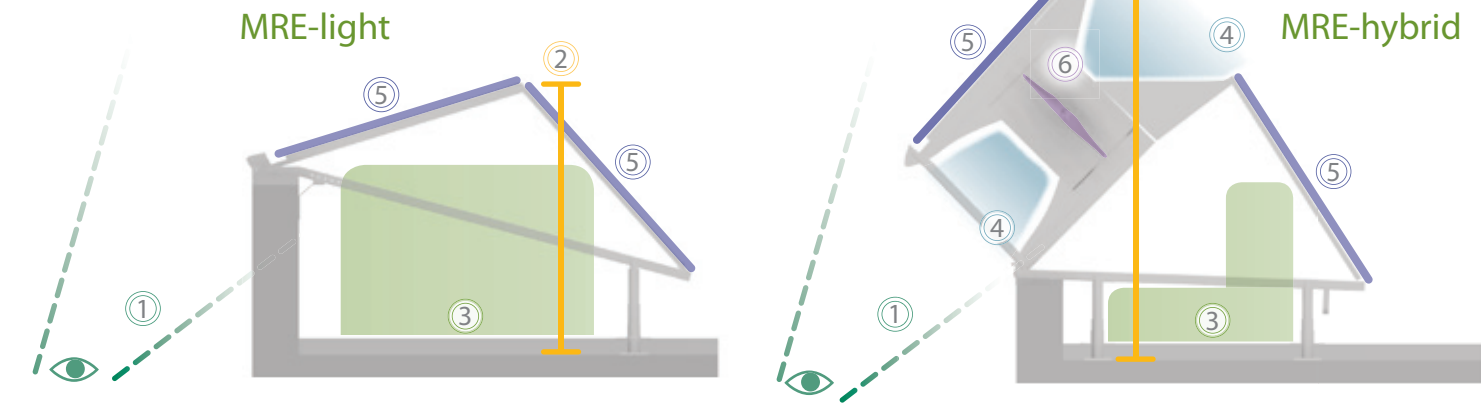
Both products are based on the same innovative technology that combines integrated building functions, countless design options & local renewable energy generation.

All the additional features presented for the MRE-light are also available for the MRE-hybrid.

BUILDING REQUIREMENTS

For best results, the attica height of the building should be taken into consideration: while the MRE-light is suitable for both low and high atticas, the MRE-hybrid performs best on low height atticas.

What are the differences between MRE-light & MRE-hybrid?



① Visibility from the street	Visible or hidden edge profile; can support a green façade structure / illumination system. Ideal for fulfilling regulations where building height is calculated including technical equipment.	Visible edge profile and customisable in terms of colour; additional elements available: closing grids, green facade connection, illumination. Ideal for a façade design topping.
② Module height	Minimised height and low angled module in order to keep visibility from the ground to a minimum. The top edge of the façade is clearly defined.	The integrated wind channel offers a visual element that connects the structure to the sky. Innovative design approach that integrates technical elements as promoters of sustainability.
③ Storage space	Maximum storage space: ~2m³/m façade length. ¹⁾ Ideal for large storage requirements with easy access. Clears the roof of technical installations.	Available storage space: ~1 m³/m façade length. Ideal for hosting smaller air conditioning units and other installations that do not require frequent access.
④ Airflow channel	Not applicable.	The wind channel creates a natural airflow, which is by far stronger than in the centre of the roof. Due to this, a significant performance improvement can be achieved for A/C units, if the heat exchanger is located inside the MRE-hybrid channel.
⑤ Solar energy generation	Solar radiation is used in order to generate solar electricity and optional solar heat. High solar energy generation with a minimum roof space occupation. Unique combination of solar electricity and solar heat.	Similar to the MRE-light, the front and rear surfaces can host photovoltaic panels to generate solar electricity. Good solar energy generation with a minimum roof space occupation.
⑥ Wind energy generation	Not applicable.	The energy of the wind is converted to electricity via the integrated wind turbines and generator. Wind electricity offers energy generation during bad weather conditions and higher local generation in windy locations.

1) Depending on attica height + PV angle

MULTIFUNCTIONAL ROOF EDGE (MRE)

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MRE-hybrid - wind electricity generation criterias

Wind speed

The natural wind speed required is a minimum of 4 m/s, for an active, average usage of wind electricity over the course of one year

Wind channel & turbine

The wind channel is specially designed to collect the natural wind flow at the façade edge. The airflow inside the channel creates a rotation of the turbine that will be converted into electricity.

Building height

The minimum building height required is ~15 meters.

Stagnation point¹⁾

Depending on the distance between the stagnation point and the edge of the façade, the angle of the wind flow on the façade edge varies. The MRE-hybrid needs to be adjusted to this angle accordingly.

Façade orientation

Wind direction and impact angle (α)

Depending on the main directions of the wind, the façade can be suitable or not for active wind electricity generation:

$\alpha < 30^\circ \rightarrow$ Façade is good for active wind usage

$\alpha > 30^\circ \rightarrow$ Façade is not good for active wind usage

1) The stagnation point is the place on a façade where the natural flow is zero. Above it, the wind will flow over the roof and below it, the wind will go downwards and sideways.

MRE-hybrid / MRE-light combined use case

By combining both variants, not only does the building benefit from all the MRE-light has to offer, but additionally benefits from any available wind.

Visual elements

The MRE-light keeps visibility to a minimum while the MRE-hybrid's wind channel becomes a visual element that connects the structure to the sky

Full roof usability

Also the combination of the MRE system variants offer a full roof usage flexibility.



MULTIFUNCTIONAL ROOF EDGE (MRE)

FUNCTION. DESIGN. ENERGY.

Building Related Aspects

STATIC LOADING

The MRE's static loading has intentionally been kept to a minimum, enabling it to also be installed on building renovations.¹⁾

Snow , wind and additional loading

The MRE is designed to support wind and snow as well as additional loadings e.g. rain water storage.

Load bearing pillars

The pillars transfer the loading to the structural roof and wall elements of the building.

Structural walls

The structural walls are the main building elements transferring the loads to the foundations of the building.

WATERPROOF CONNECTION

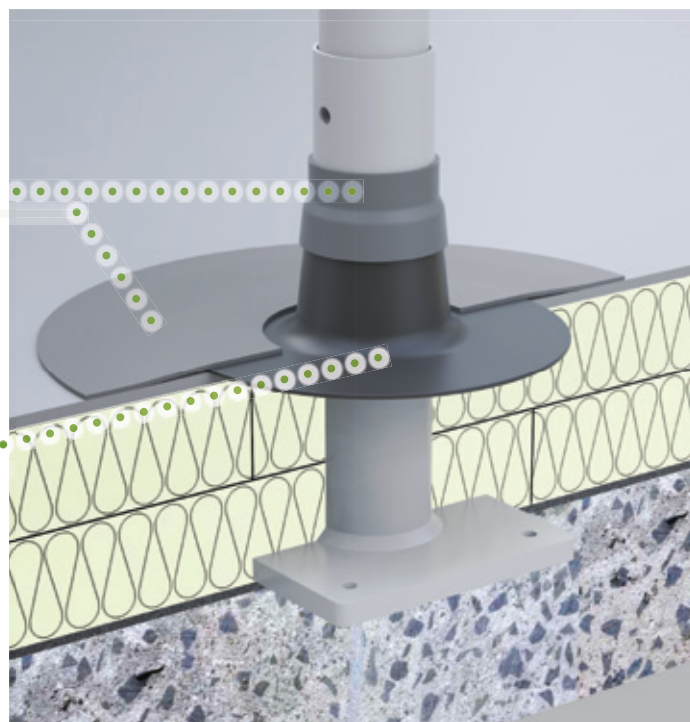
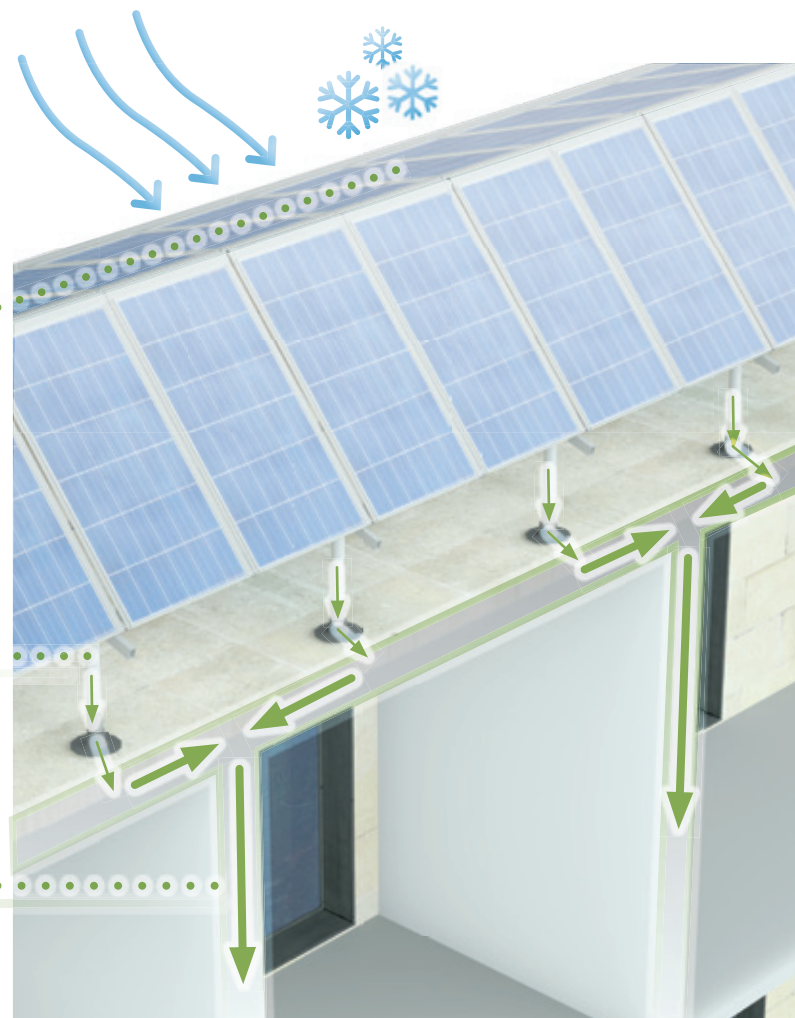
The secure waterproof connection between the load bearing pillar and the roof is achieved by:

Synthetic paint / roofing felt

An additional layer of water proofing roofing felt or synthetic paint is added on the rubber / EPDM sleeve to double protect the insulation from any water ingress.

Rubber / EPDM Sleeve

This ensures a long lasting connection between the roof water sealing layer and the load bearing pillars.



User related aspects

MRE-light

The MRE-light has a negligible visual impact from the street view and no vibration & noise effects.

MRE-hybrid

Tenants have a higher awareness of the MRE-hybrid as it is visible from the street and has a moving rotor. The unique visual effect combined with the moving rotors has been positively received by both building owners and tenants as well as increasing awareness of locally produced renewable energy.

Shadowing

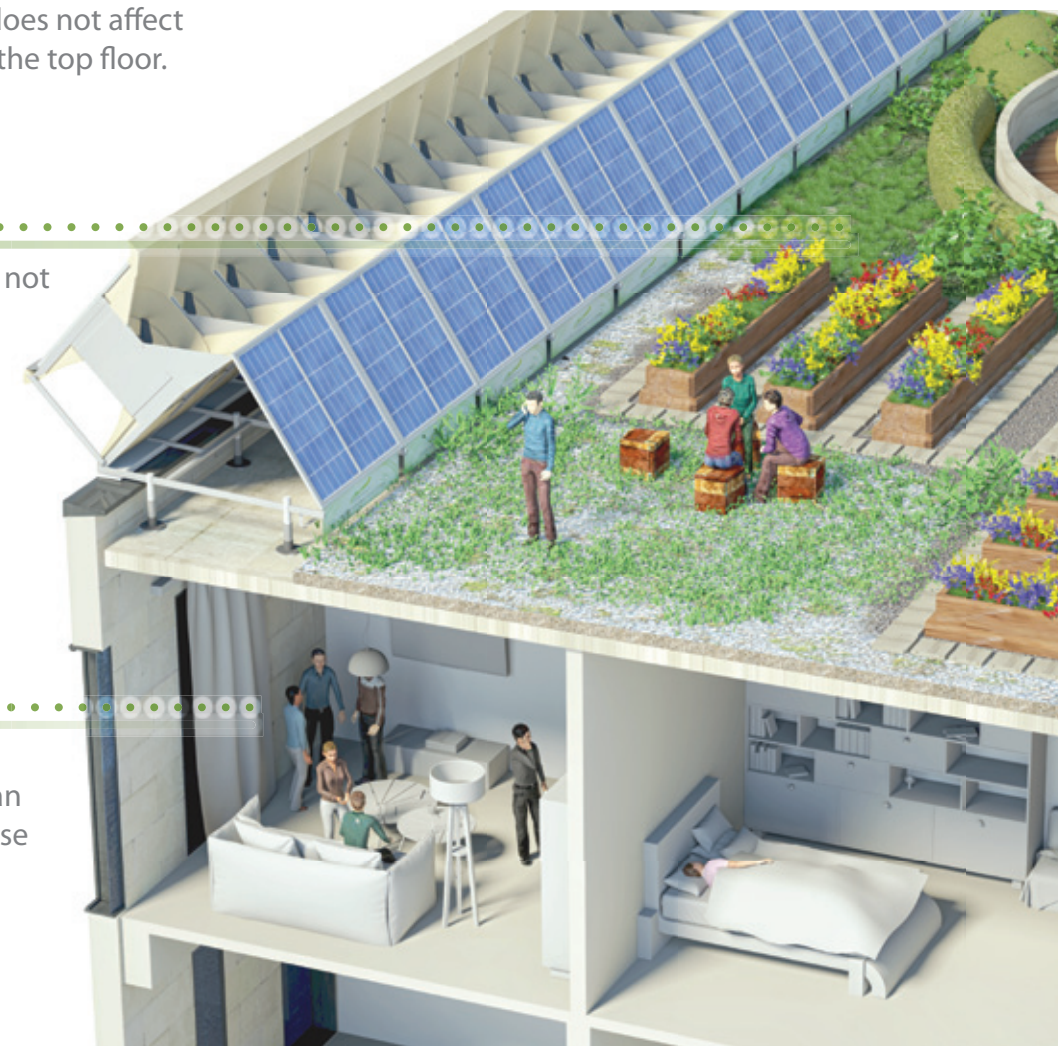
Shadowing is minimal and does not affect activities that take place on the top floor.

Rooftop usage

Activities on the rooftop are not affected by the MRE-hybrid. The roof becomes a quality living space for the tenants and can be used to its full potential.

Vibration/Noise

The MRE-hybrid has been tested and meets the German residential vibration and noise requirements.²⁾



MULTIFUNCTIONAL ROOF EDGE (MRE)

FUNCTION. DESIGN. ENERGY.

From planning to maintenance

Anerdgy provides support and tools to make the process of planning, installation and maintenance as easy as possible.

PLANNING

The MRE roof configurator is simplifying the planning process. With only 3 steps, the MRE modules are placed. Then it's time to add design options, functional aspects and energy definitions.

Placing the MRE modules:

1. Roof geometry

The first step is to define the outer rooftop geometry. The MRE can adapt to multiple roof profiles, including curved or angled geometries. This is done by using specific elements.

2. Roof edge position

The MRE's position relative to the attica helps in defining the desired visibility of the profile or the option of becoming a support for other elements, such as the green façade support or illumination.

3. Quantity & type

Both the number as well as the type of the MRE module variant are selected.

4. Options selection

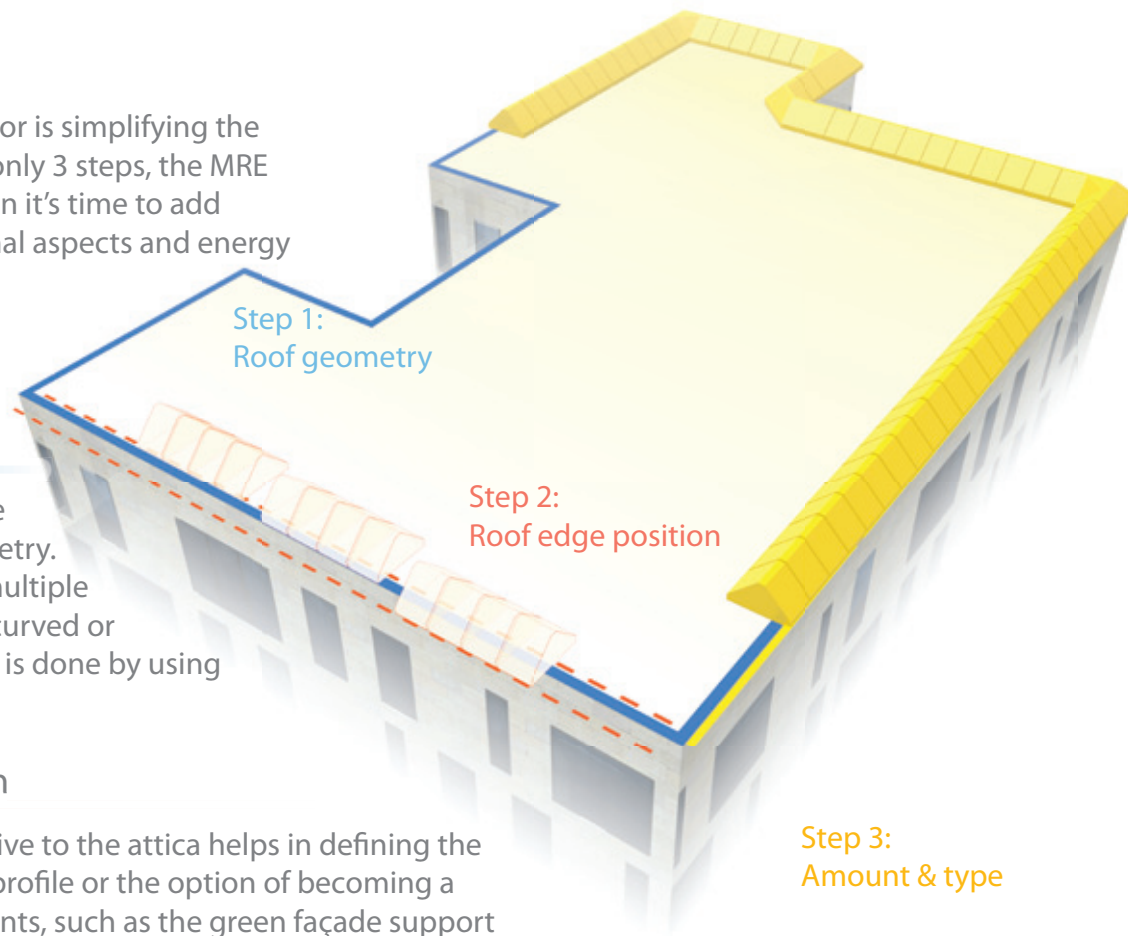
A large set of options are available to optimise both the building design and, especially, the roof usage with the MRE system.

Energy & Budget forecast

The MRE roof configurator directly projects the expected yearly energy generation as well as the investment cost. This can be used as a target review or as a design criteria.

Building permit approval

The MRE solution often simplifies the building certification approval process.



INSTALLATION

Anerdgy solutions are designed for fast and reliable installations by using trained local partners who provide high quality services from product transportation to final installation.

Quick and easy installation

The MRE modules are designed in order to be quickly installed on the rooftop. Each step of the process is planned in order to ensure a great result. The installation consists of the following steps:

1) Floor & attic roof connection - roofer's work

The load bearing pillars & elements are positioned and fixed to the roof slab and in the case of a high attica on the attica. These will be sealed during the normal roof insulation work.

2) Base frame

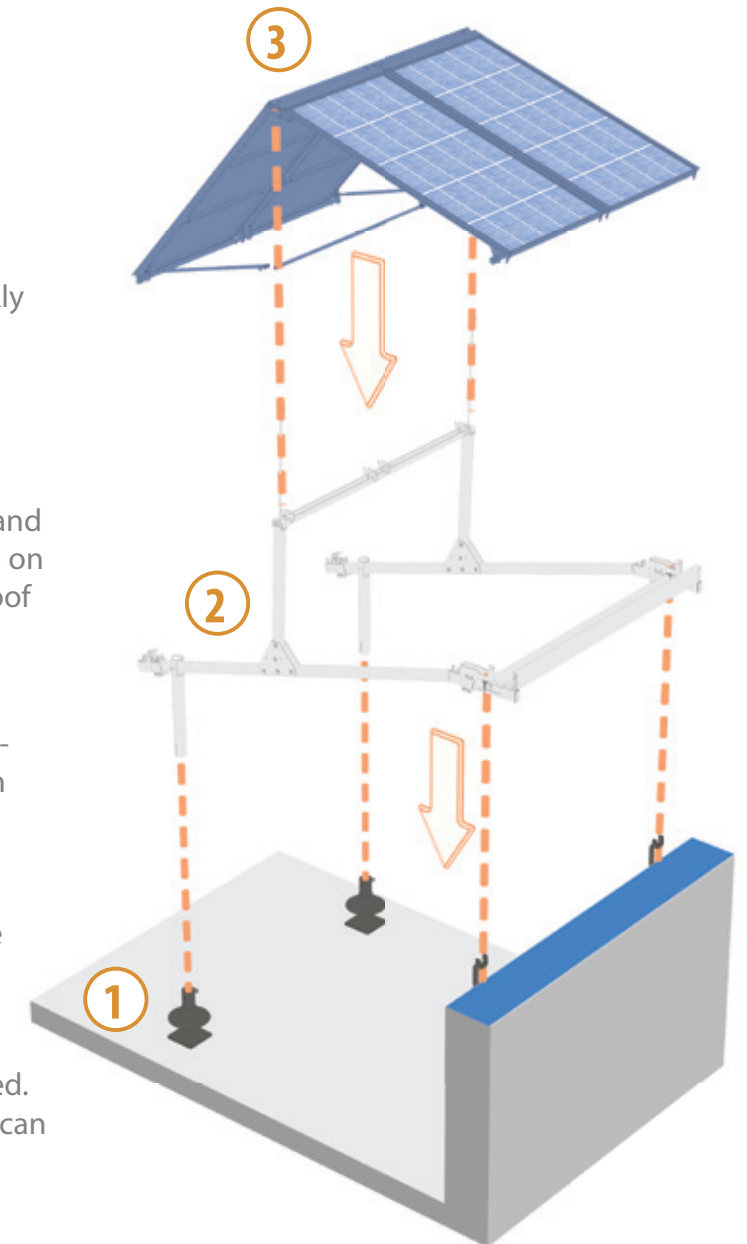
The base frame is quickly and easily fixed to the pre-installed pillars. The drainage & lightning protection elements are then placed.

3) Solar/Wind elements

After frame installation, the remaining elements are placed on top.

4) Additional options

Finally the additional options chosen will be installed. Thanks to the flexibility of the MRE, system options can also be added as an upgrade at a later date.



MAINTENANCE

Once the modules have been installed, the users can enjoy all the benefits of the renewable energy, without worrying about constant major maintenance requirements. Our products are designed to perform at a high level for at least 20 years, with minimal maintenance actions which include:

Easy cleaning

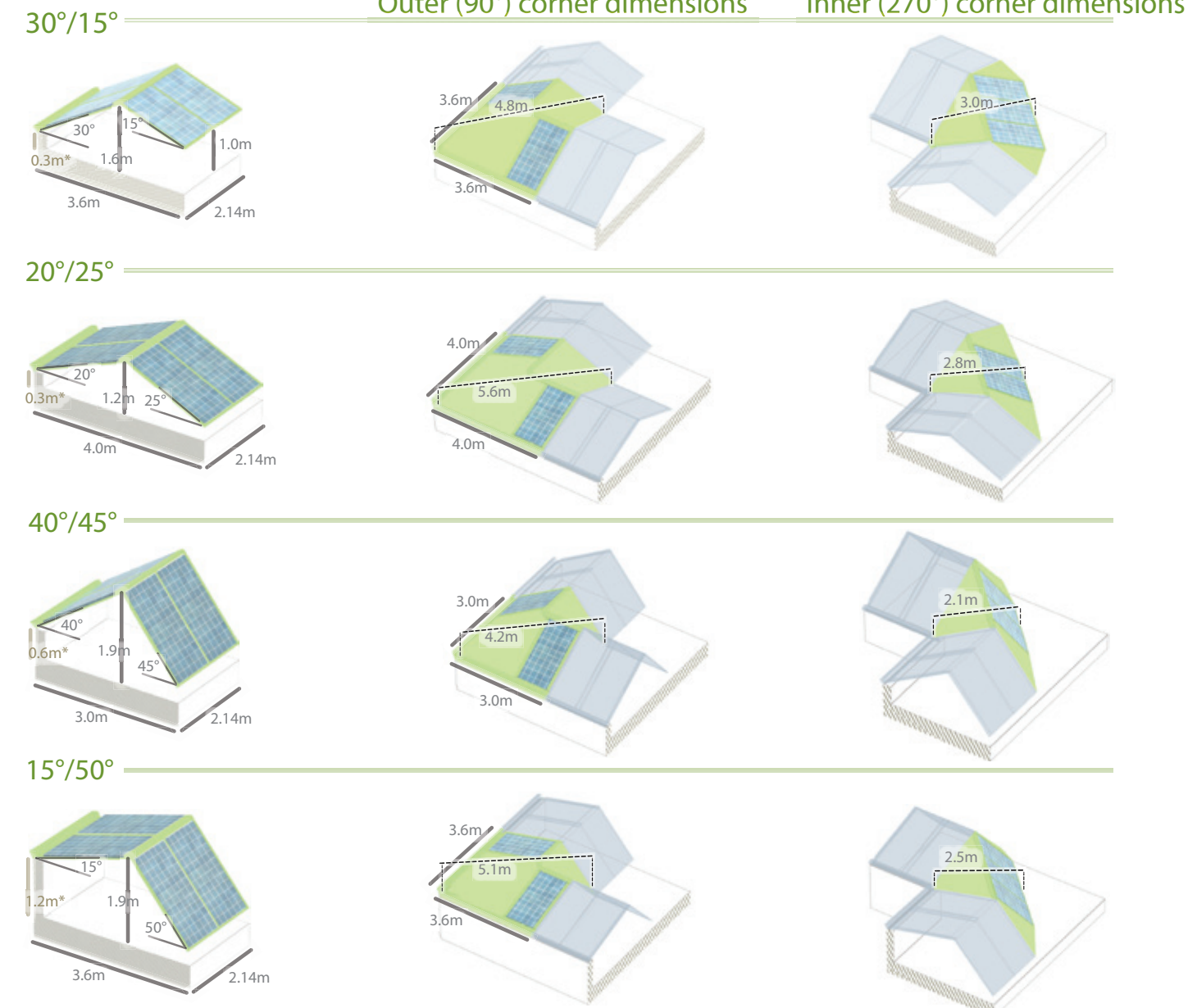
One of the minimal maintenance recommendations is cleaning, in order for MRE energy generation to perform well. The MRE design supports quick and easy cleaning of the modules.

Effortless parts replacement

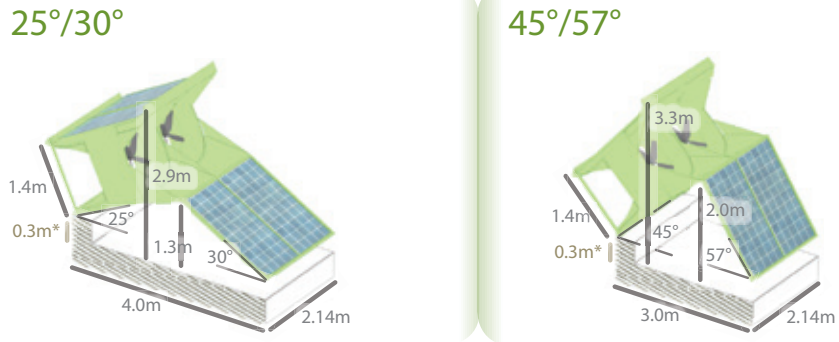
If required, parts of the MRE modules can be easily disassembled and replaced. This ensures a fast and headache-free repair.

STANDARD DIMENSIONS*

MRE-light dimensions



MRE-hybrid dimensions



*The MRE-light modules are adaptable to any attica height levels. MRE-hybrid is suitable only for flat and standard attica height levels. Full degree of freedom corner alignments are achievable, from straight rows (180°) to chamfered inner alignments (310°) and sharp outer corners (50°).

STANDARD FEATURES AND OPTIONAL EXTRAS

Standard MRE elements	Options by Anerdgy	Options via 3rd party
MRE-light straight ● PV el. 1300W¹⁾ ● PV el. 650W + ST heat 1000W¹⁾	○ Base frame: straight / tilted ○ Intersection elements	○ Rainwater storage ○ Energy Storage
MRE-light outer corner ● PV el. 650W¹⁾	○ Façade greening connector	○ Bee hive
MRE-light inner corner ● PV el. 650W¹⁾	○ Façade illumination	
MRE-hybrid ● PV el. 1300W¹⁾ ● Wind el. 1000W	○ Pneumatic rear panel lift ○ Support frame for heavy items	

FIGURES²⁾

	MRE-light Range	MRE-hybrid Range
Occupation space factor		
Direct space usage - distance from roof edge [m]	2.5 - 3.5	2.5 - 4.1
Indirect space occupation ³⁾	110%	120%
Energy generation potential per area		
Energy Yield per meter facade length [kWh/m year]	400 - 600	500 - 800
Investment		
Energy investment per meter facade length [k€/m]	1.0 - 2.0	1.5 - 2.5
Structural investment per meter facade length [k€/m]	0.3 - 0.7	0.4 - 0.8
Resulting renewable energy cost		
calculated based on 20 years lifespan [c€/kWh]	7 - 15	12 - 20
calculated based on 30 years lifespan [c€/kWh]	5 - 12	9 - 17
Return on investment (ROI)		
Energy ROI [%/year]	4 - 11	2 - 8
Flat/office/shop rent rate increase via terrace ⁴⁾ [%/year]	5 - 10	5 - 10
Roof space rent rate - urban farming, restaurant ⁴⁾ [%/year]	5 - 10	5 - 10

1) Abbreviations refer to PV - photovoltaics, generating solar electricity and ST - solarthermal, generating solar heat.
2) The given figures are only indicative, without any guarantee. Figures are based on 2019 technology status for Europe - Mainland.
3) Installation requires more space due to walkways, shadow areas, ...
4) The indicative figures are Anerdgy estimates based on cities over 100'000 population.

REFERENCES

MRE-light

Voreppe, France - In October 2018, MRE hybrid modules were installed on the roof of an apartment building.



MRE-hybrid

Berlin, Germany - At this location, MRE-hybrid modules are installed and operating on the rooftop of an apartment building since October 2016.



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