KNAUF INSULATION

Futureproof flat roofs

Insulation solutions built to last

Build on us.

The number of solar panel installations on roofs is increasing and, thus, so does the fire risk of these buildings. Assessing and mitigating the risk at a system level is crucial for enabling robust solutions.

Grunde Jomaas,
Head of Department for Fire-safe Sustainable Built Environments, ZAG.

IFE Fire Safety Conference, Dublin, October 2024

Today's flat roofs must deliver long-term, functional use

Roofs have always played an essential role in the energy efficiency of buildings, but now they are becoming spaces for energy generation, storage and socialising as well. A flat roof must deliver functional use for the life of the building – it must be futureproof – and that has significant implications for your specification.

The use of photovoltaic (PV) or 'solar' panels for roofs, is seeing rapid growth across the EU[1], partly driven by the European Commission's REPowerEU Plan, which aims to accelerate a transition to renewable energy generation.[2]

The Energy Performance of Buildings Directive has introduced a timeline for Member States to implement solar energy generation: [3]

From 2027	From 2028	From 2029	From 2030	From 2031
on all new public and non-residential buildings > 250m²	on all existing public buildings > 2,000m² and on existing non-residential buildings > 500m², where the building undergoes a major renovation	on all existing public buildings > 750m²	on all new residential buildings and on all new roofed car parks physically adjacent to buildings	on all existing public buildings > 250m²

As well as regulatory changes, factors like sustainability, price and accessibility are all driving the uptake of the technology, and it's expected that the use of rooftop solar panels will outpace large-scale plants by 2028.[4] So, even if your design does not currently require a functional roof, ensuring solar-readiness should be a key consideration for all buildings in design today.

With increased functionality comes increased risk. This can mean risk of liability to specifiers, contractors or building owners. It can also mean financial risk and, in the case of fire safety, even risk to life. Flat roof design needs to adapt. That means ensuring the longevity of core performance criteria, as well as considering additional factors like enhanced fire safety and increased load bearing.

Futureproof flat roofs are becoming the new standard, so consider the current and future needs of your building. Whether you're designing for energy efficiency, solar installation or regular access requirements, your insulation must support that use for the life of the building, whilst keeping occupants safe and comfortable.

[1] European Commission: Solar energy

[2] European Commission: RePower EU

[3] Directive (EU) 2024/1275 of the European Parliament and of the Council, of 24 April 2024, on the energy performance of buildings

[4] International Energy Agency, Renewables 2023 analysis and forecast to 2028

What makes a flat roof futureproof?

Every new building needs a futureproof flat roof. One that keeps occupants warm, dry and safe, that supports the increasingly functional requirements of rooftops, and that's built to last.

It reduces fire risk

Installing rooftop solar panels increases the risk of fire occurring and changes the fire dynamics of the roof. It's essential that the materials in your build-up do not contribute to the spread of a fire, should one occur.
Read more on the next page.

It's energy efficient

Energy efficiency is of increasing importance to specifiers, building owners and occupants. An energy efficient building minimises heat gains and losses, optimises heating and cooling technologies and reduces energy bills.

It makes the building comfortable

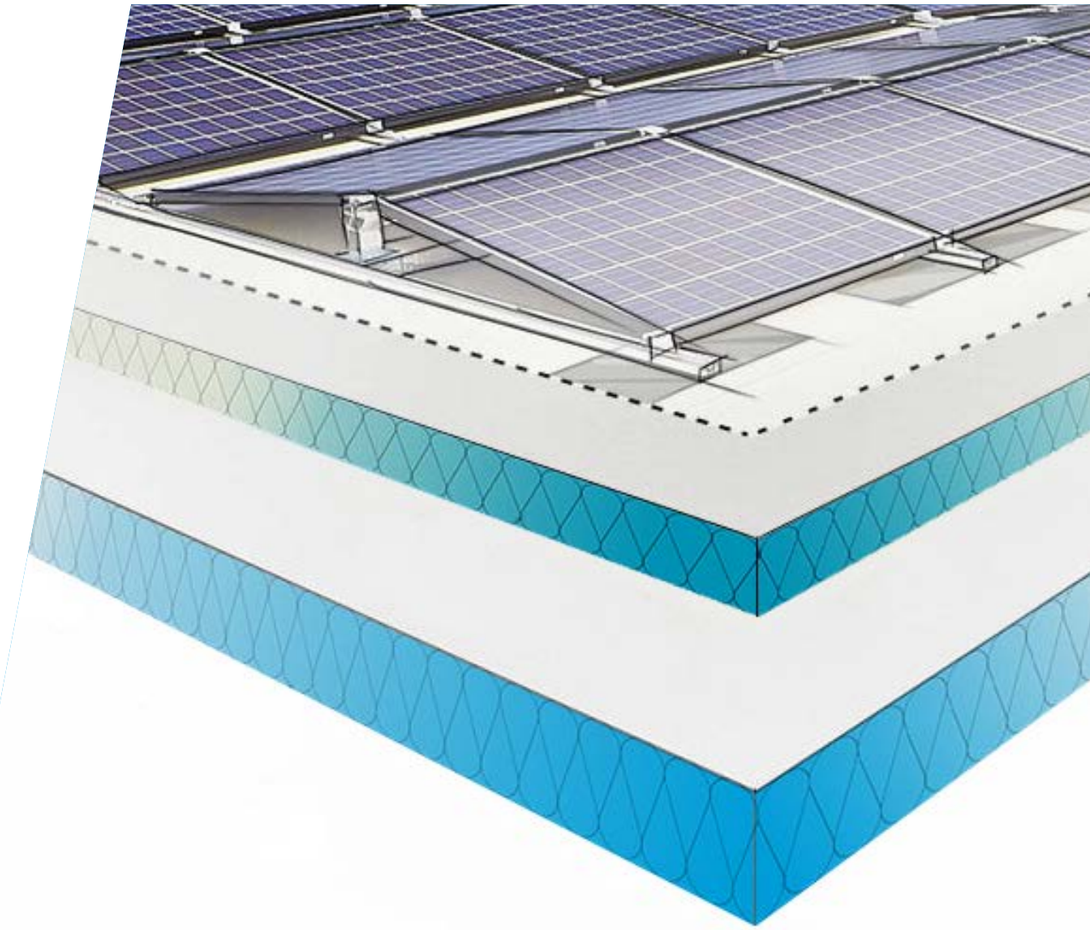
Weather conditions are becoming more extreme, so it's more important than ever to maintain a comfortable indoor temperature. Occupants should also be protected from unwanted noise – particularly in locations where the roof may experience a lot of rainfall or hail.

It can withstand increased loads

Solar panels, mounting equipment, construction, plant access and higher footfall all increase the load on a roof. It's also important to consider the impact of weather conditions like snow or rain, which can pool on flat roofs, adding weight.

It's engineered to last

Your building will be in use for years to come, so your roof must stand the test of time and be adaptable to future requirements. Specifying the right insulation, tailored to your future project needs, will ensure your build-up lasts and does not need to change if solar panel or access requirements increase.



The essential common ingredient in every futureproof flat roof is ***the right insulation.***

Rooftop solar panels and fire risk

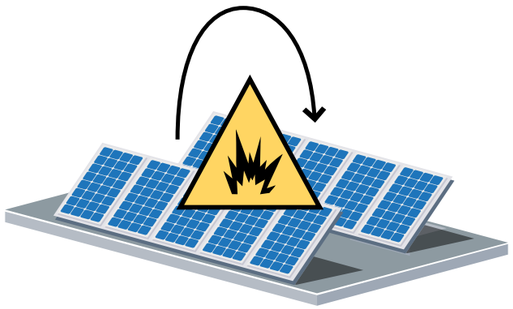
An estimated average of 29 fires per GW of PV capacity occur each year[5] and legislation is driving more installations than ever before. **Building regulations don't yet reflect the increased level of fire risk,** so it's essential to understand and address this at the design stage.

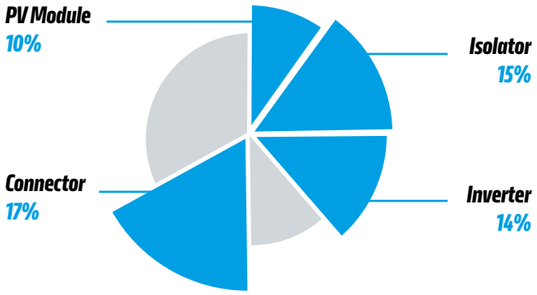
Adding solar panels to a roof increases fire risk in two ways:

Greater chance of ignition

Solar panels and their associated equipment increase the chances of a rooftop fire occurring.

Issues such as installation faults, electrical faults, low-quality products, damage to components and a lack of proper inspection and maintenance can lead to electric arcing.[5] This is when electricity 'jumps' through the air, from one conductor to another, creating intense heat that can ignite other components[5] or external materials.





Normalised contribution of PV system components towards PV-related fires.
Based on data from UK, Germany and Australia.

A fault tree analysis by The University of Edinburgh found arcing to be the main cause of ignition in PV-related fires. The study identified the PV module, isolator, inverter, and connector as the components most often linked to ignition.[6]

Because solar panels are exposed to the elements, factors like weathering, moisture ingress and interference from animals can also create faults that were not there at installation. For this reason, regular inspections are essential.

Following more than 600 safety audits of rooftop solar panel systems, the Clean Energy Associates found that 97% of systems had major safety concerns.[7]

[5] 0.0293 fires p/MW calculated as a weighted mean, based on four national data sets. Source: Fault tree analysis of fires on rooftops with photovoltaic systems, Nur Aliah Fatin Mohd Nizam Ong et al, 2021

[6] Fault tree analysis of fires on rooftops with photovoltaic systems, Nur Aliah Fatin Mohd Nizam Ong et al, 2021

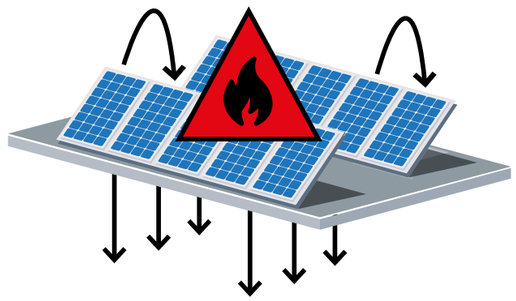
[7] Clean Energy Associates, Solar Rooftop Safety, Top 10 Safety Concerns, 2023

Accelerated spread of fire

Solar panels change the fire dynamics of a roof. Whether or not they are the source of the fire, they can have a significant impact on how it spreads.

Penetrations like cabling create a route for fire to pass between the building and the roof. So, an unrelated fire from within the building has the potential to become a rooftop fire, if it spreads via the solar panel equipment. Similarly, it is important to consider that fire may spread to the roof from a neighbouring building, especially in densely populated urban areas.

If this happens, solar panels can create a route for fire to pass more quickly across a roof, by spreading from panel to panel. This can enable the fire to bypass compartment boundaries, putting more of the building at risk. When fire becomes trapped underneath solar panels, it can also radiate heat back down towards the building, risking the integrity of the roof structure.



A study by The University of Edinburgh found that:

> *An initial fire underneath a solar installation can transform into a hazardous scenario due to the changed fire dynamics of the existing roof.[8]*

Solar fires don't typically self-extinguish and can be harder for fire fighters to access, due to building height, electrical hazards or the fire being covered by panels. For functional roofs with a regular footfall, it is also important to remember that escape routes from the roof are longer.

To help protect the building and its occupants, a solar-ready roof requires ***insulation that does not add to the increased fire risk.***

[8] The University of Edinburgh, Experimental Study of the Fire Behaviour on Flat Roof Constructions with multiple Photovoltaic (Solar) panels, 2018

What to look for in your insulation

Insulation is a vital component of any futureproof flat roof, but different products behave in different ways. It's essential to choose insulation that meets all your requirements.

Non-combustibility

The fire risk profile of a roof must always be assessed as a whole system.
The right insulation will:

- Interact safely with other system components
- Not contribute to the spread of a fire

> *The consequence of solar panel fires on roofs relates to the panel geometry and the roof combustibility, and particularly the material choice immediately below the roof membrane.*
>
> *If fire safety is a paramount concern, then using a non-combustible material is recommended.*
>
> **Grunde Jomaas**
> **Head of Department for Fire-safe Sustainable Built Environments, ZAG**
> Webinar on Fire Safety Guideline for Building Applied Photovoltaic Systems on Flat Roofs, FRISSBE and ZAG, June 2024

Knauf Insulation's unfaced Rock Mineral Wool products are non-combustible with the best possible Euroclass A1 reaction to fire classification.

Using non-combustible rock mineral wool insulation provides greater peace-of-mind because it will not contribute to the spread of a fire, should it occur.

Increased durability and longevity

The right insulation will:

- Withstand the required load from the building and any additional equipment on the roof
- Be resilient to weather conditions, whilst supporting the function of the roof
- Continue to perform for the life of the building

Rock mineral wool insulation is robust. Certain products designed for flat roof applications have high compressive strength and point load, allowing them to withstand additional loads from solar panel systems, as well as environmental factors like snow, ice, hail, and high winds.

Rock mineral wool insulation is also designed to last for the expected lifetime of an average building. Its longevity reduces the likelihood of costly remediation work later.

Thermal and acoustic comfort

The right insulation will:

- Minimise the passage of heat through the building envelope, increasing energy efficiency and occupant comfort
- Absorb sound, reducing unwanted noise and creating a more peaceful indoor environment

> *Mineral wool has superior sound insulation properties. This can be beneficial in reducing noise from rain or other external sources, creating a more comfortable indoor environment.*
>
> **Maro Puljizević, Project Manager - Acoustics, Knauf Insulation**

Rock mineral wool insulation delivers reliable thermal performance by trapping heat between its strands. Its flexible nature also means it's easier to install correctly. It adapts to minor imperfections in the substrate, maintaining close contact and minimising unwanted air gaps. This helps to ensure your thermal calculations translate into real world, as-built performance.

The random orientation of the **mineral wool fibres allows more sound waves to be absorbed,** giving it excellent acoustic properties and helping to preserve occupant wellbeing.

Rock Mineral Wool for flat roofs, by Knauf Insulation, delivers against all these essential performance criteria.

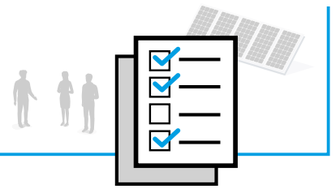
How Knauf Insulation can help

Expertly engineered for your project

Every Knauf Insulation flat roof is carefully calibrated to the specific needs of your building. We conduct extensive calculations, backed by data, and based on three important criteria:

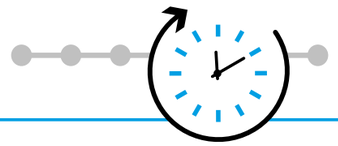
1 What's your **roof requirement?**

What functions does your roof need to fulfil, and is it likely to require solar panels now or in the future?



2 What's your **desired design life?**

How long does the roof need to last?

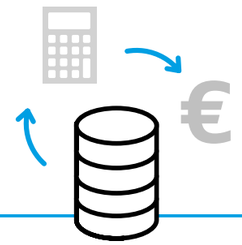


3 What's your **exposure profile?**

Where is the building, how is it oriented, and what weather will it face?

Based on your input, we will recommend the most cost-effective build-up.

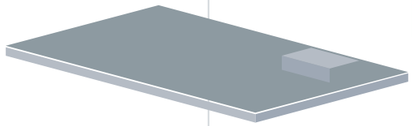
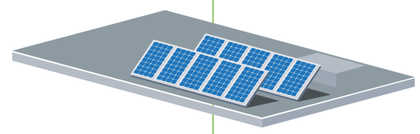
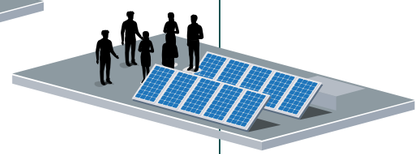
The criteria above determine the required performance of the roof insulation. We will then calculate the optimal insulation build-up to deliver that performance, using our methodology backed by the Czech Technical University in Prague. Drawing on our extensive range of products, we will find the most cost-effective solution for your build.



The performance you need. Nothing you don't.

Solutions for every roof

We provide insulation solutions for futureproof flat roofs of every function:*

STANDARD	SOLAR-READY	SOLAR-PLUS
Non-combustible insulation for reliable **thermal and acoustic performance** for the life of the building		
	+ **Enhanced mechanical strength**	+ **Maximum mechanical strength**
		
Suitable for simple flat roofs with no access requirements **See solutions on page 12**	Suitable for flat roofs with solar panels and associated maintenance requirements **See solutions on page 14**	Suitable for flat roofs with solar panels and other functional requirements **See solutions on page 16**

Need help finding your best solution?

Knauf Insulation has the industry experience, technical expertise and breadth of product range to offer flat roof solutions that provide the performance you need, without costly over-specification.
Our calculations are based on data backed by the Czech Technical University in Prague, to ensure we find the optimal solution for your project.

Tested and verified by the **Czech Technical University in Prague**

Visit your local website for more information about our insulation solutions.

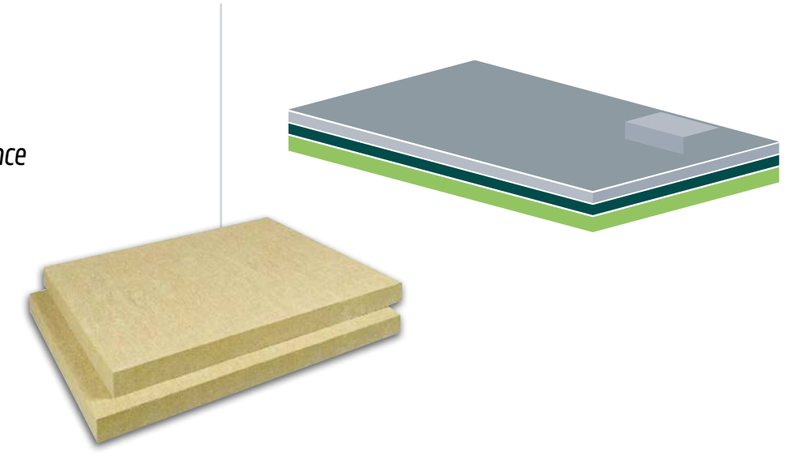
* Solar-ready and Solar-plus solutions are not available in every location. Speak to our team to learn which solutions are available in your area.

Standard: For energy efficiency

Our Rock Mineral Wool insulation is extensively tested and **proven to deliver reliable thermal, acoustic and fire safety performance.**

Two layers delivers:

- ➔ *Good mechanical properties*
- ➔ *Excellent thermal performance*



Our Rock Mineral Wool hard roof insulation boards have excellent technical properties which deliver thermal, acoustic, and fire safety performance in warm sealed flat roofs. They are not susceptible to air moisture absorption, are resistant to microorganisms, insects and the development of mould and are resistant to ageing. They also contain a large quantity of recycled material, helping to contribute to a circular economy.

The 'Standard' solution features a layer of insulation with a higher bulk density and a second layer, with a lower bulk density. Combined, the two layers deliver good mechanical properties, excellent thermal performance, and easier handling. All our unfaced Rock Mineral Wool insulation is non-combustible with the best possible Euroclass A1 reaction to fire classification.

Solution benefits:

	SOUND ABSORPTION	FIRE SAFETY	VAPOUR PERMEABILITY	RESISTANCE TO AGEING	THERMAL PERFORMANCE	MECHANICAL PERFORMANCE
STANDARD	✓	✓	✓	✓	MAXIMUM	GOOD
SOLAR-READY	✓	✓	✓	✓	ENHANCED	ENHANCED
SOLAR-PLUS	✓	✓	✓	✓	GOOD	MAXIMUM

Example build-up:

Resistance of Knauf Insulation roof insulation boards to permanent loads – R_K

PRODUCT Top layer Bottom layer	λ_D [W/m·K]	CS (10) [kPa]	PL (5mm) [N]	SURFACE LOAD [kN/m²]	LOAD on the supporting slab [kN]			LINE LOAD on the linear support [kN/m]			LOAD on the supporting slab [kN]		
				Full surface	400mm x 400mm	300mm x 300mm	200mm x 200mm	400 x 1000	200 x 1000	100 x 1000	Ø 150 mm	Ø 200 mm	Ø 300 mm
SmartRoof Top	0,038	≥70	≥650	43	3.1	1.7	0.7	8	4	2	1.5	1.9	2.6
SmartRoof Thermal	0,036	≥50	≥500										

- The calculation of the allowable load assumes the double-layer installation of insulation boards.
- The expected total thickness of the insulation boards is from 20cm to 30cm.
- The expected long-term deformation under the calculated load is defined project to project. It can be between 1mm and 5mm.
- For greater allowable deformations, the loads can be higher.
- For cases outside the assumptions in the table, a specific calculation can be made γ = 1.

Data shown are based on an imaginary roof with the following assumptions:

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- Wind loading for Wind Area Four in Czech Republic.
- Terrain category two.

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Certifications:

Get your tailored flat roof solution today.
Visit your local website for more information.

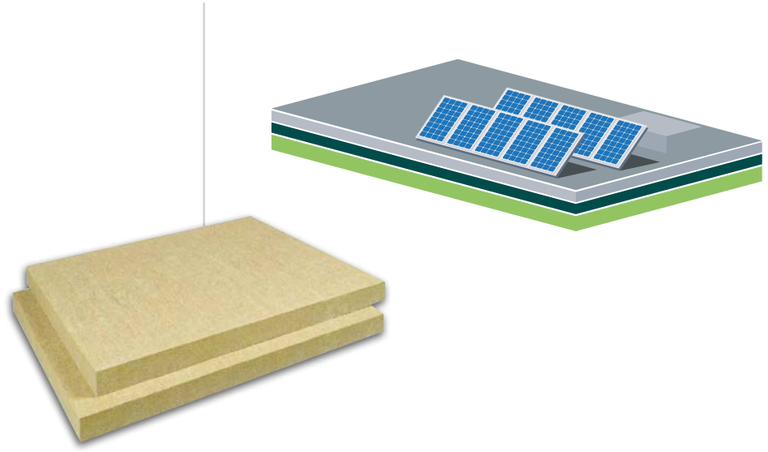
Solar-ready: For energy efficiency + solar

In addition to delivering proven thermal and acoustic performance, **our Rock Mineral Wool insulation has the fire resistance and durability required for solar-ready roofs.**

Two layers delivers:

➔ *Compressive strength*

➔ *Thermal performance*



Our Rock Mineral Wool hard roof insulation boards have excellent technical properties which deliver thermal, acoustic, and fire safety performance in warm sealed flat roofs. They are not susceptible to air moisture absorption, are resistant to microorganisms, insects and the development of mould and are resistant to ageing. They also contain a large quantity of recycled material, helping to contribute to a circular economy.

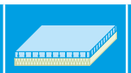
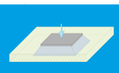
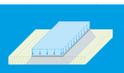
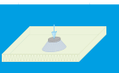
The 'Solar-ready' solution features a layer of insulation with a higher bulk density, to support the weight of a solar panel installation, and a second layer, with a lower bulk density. Combined, the two layers deliver compressive strength, thermal performance and easier handling. All our unfaced Rock Mineral Wool insulation is non-combustible with the best possible Euroclass A1 reaction to fire classification.

Solution benefits:

	SOUND ABSORPTION	FIRE SAFETY	VAPOUR PERMEABILITY	RESISTANCE TO AGEING	THERMAL PERFORMANCE	MECHANICAL PERFORMANCE
STANDARD	✓	✓	✓	✓	MAXIMUM	GOOD
SOLAR-READY	✓	✓	✓	✓	**ENHANCED**	**ENHANCED**
SOLAR-PLUS	✓	✓	✓	✓	GOOD	MAXIMUM

Example build-up:

Resistance of Knauf Insulation roof insulation boards to permanent loads – R_K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DDP-X	0,039	≥90	≥800	48	3.5	2	0.9	9	5	2.4	1.6	2	2.8
SmartRoof Thermal	0,036	≥50	≥500										

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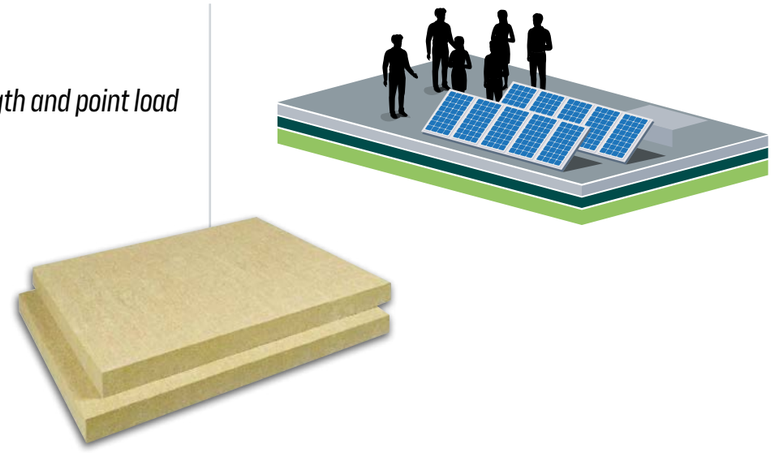
Solar-plus: For energy efficiency + solar + enhanced access

Alongside the thermal and acoustic performance you need, our Rock Mineral Wool insulation has the **fire resistance, compressive strength and durability to support roofs with additional functionality.**

Two layers delivers:

- ➔ *Very high compressive strength and point load*
- ➔ *Good thermal performance*
- ➔ *Good mechanical properties*



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The 'Solar-plus' solution features a layer of insulation that delivers very high compressive strength and point load, due to its higher bulk density and top surface. This secures the best load distribution combined with low deformation. A second layer provides good thermal performance and mechanical properties. All our unfaced Rock Mineral Wool insulation is non-combustible with the best possible Euroclass A1 reaction to fire classification.

Solution benefits:

	SOUND ABSORPTION	FIRE SAFETY	VAPOUR PERMEABILITY	RESISTANCE TO AGEING	THERMAL PERFORMANCE	MECHANICAL PERFORMANCE
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SOLAR- READY	✓	✓	✓	✓	ENHANCED	ENHANCED
SOLAR-PLUS	✓	✓	✓	✓	**GOOD**	**MAXIMUM**

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SmartRoof Extra	0,039	≥100	≥1000	62	4.5	2.5	1	10	6	3	1.8	2	3
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Many of our roof products have FM Approvals, *confirming that the complete roof assembly meets the performance requirements of FM Standard 4470.*

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Case study

Urban Ring: *Solar integration for a hotel roof*

Urban Ring is a 1,000m² hybrid hotel and workspace in Ljubljana, Slovenia. At a time of rising energy prices, the hotel decided to refurbish the roof with solar panel integration to increase its energy efficiency and reduce reliance on external electricity sources. Knauf Insulation was chosen for its reliable, multifaceted performance.

Complex requirements

Urban Ring needed insulation that would deliver thermal performance to meet demanding U-values and increase energy efficiency. Fire resistance was also a critical performance factor, as the insulation needed to withstand the high temperatures generated underneath solar panels. Additionally, the insulation had to be strong enough to support the additional weight of the solar panel system without compromising safety or performance.

Why Rock Mineral Wool?

Knauf Insulation's unfaced Rock Mineral Wool is non-combustible with a Euroclass A1 reaction to fire classification and delivers superior heat resistance – an essential requirement for the safety of hotel staff and guests. Its higher density also allows it to withstand the additional load from a solar panel system and its mechanical strength supports the long-term durability and stability of the roof.

Why Knauf Insulation?

Knauf Insulation was chosen because of its proven track record of providing high-quality, reliable insulation solutions, including for notable sites such as Ljubljana Airport.

The business' technical expertise and support also played a crucial role. From an initial assessment of the roof's load-bearing capacity to the final product recommendation, Knauf Insulation provided valuable guidance to ensure the project met all safety and performance requirements.

Working with Knauf Insulation was seamless and efficient. The insulation provided thermal performance, fire safety, strength and durability, while also being easy to install. Their technical team also supported each stage of the project, with insights into correct specifications and application methods.

Mr. Žagar, Hotel Owner

Achieving energy independence

The roof refurbishment not only improved Urban Ring's energy efficiency, it also ensured its long-term sustainability. Despite energy prices having decreased since the initial planning stages, the hotel continues to consume around 70% of the electricity it generates, demonstrating the long-term value of the solar panel integration. The hotel was also able to secure subsidies for green energy through ecological funding, which helped to offset some of the initial investment in the system.

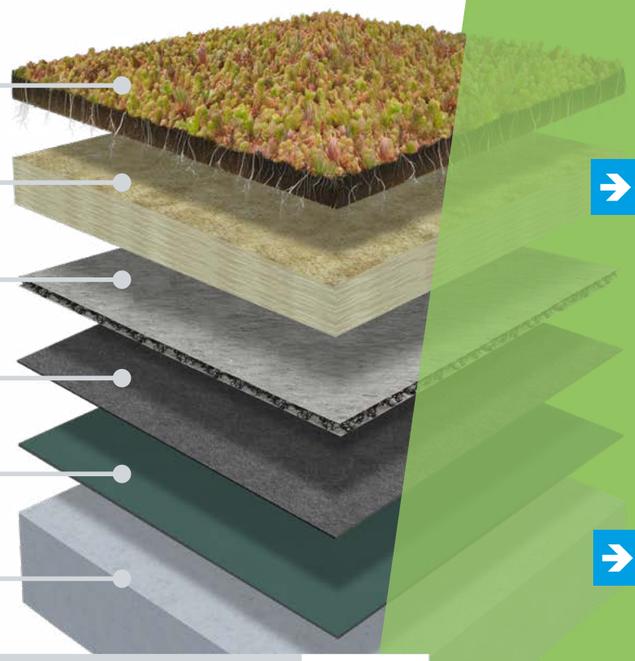
Rock mineral wool insulation is an excellent choice for anyone considering integrating solar panels. By using high quality materials and working with experienced partners like Knauf Insulation, building owners can ensure their projects meet performance standards while delivering long-term energy savings and sustainability.

Mr. Žagar, Hotel Owner

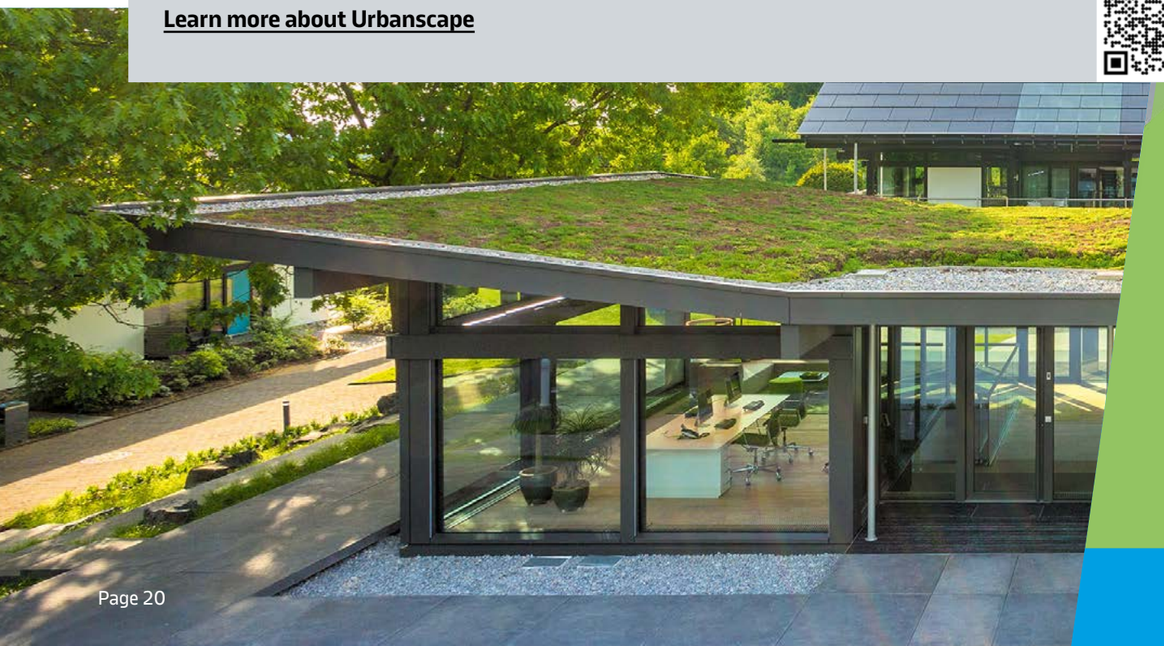
Sustainable flat roof design:
Advantages of incorporating a green roof system

As urbanisation accelerates and flat roofs become more versatile, it's important to consider the sustainability of your design. Green roofs are growing in popularity and can enhance the aesthetics of urban spaces while providing critical environmental, economic and social benefits.

The Urbanscape Green Roof System integrates a modular, pre-vegetated layer design, providing immediate green coverage and excellent environmental performance from day one.



Learn more about Urbanscape



Benefits of Urbanscape:

Lightweight construction

The system uses a lightweight growing media that is 8-10 times lighter than traditional green roof substrates and can hold up to 3-4 times more water per unit volume, compared with other systems. This makes it suitable for installation on lightweight structures that require reduced weight, without compromising performance.

Reduced irrigation

The system's innovative design minimises irrigation requirements, thanks to its integrated water distribution system. The efficient moisture management provides balanced irrigation that conserves more water, compared with conventional sprinkler systems.

More sustainable

Crafted from natural rock mineral mixtures, the system's porous structure supports extensive root development and healthy plant growth. This makes it a robust and environmentally responsible solution that is both effective and resource-efficient.

Fire safety

The Urbanscape growing media is non-combustible with a Euroclass A1 reaction to fire classification so it will not contribute to the spread of a fire, should it occur. This provides enhanced safety and minimises fire risk for both the building and its occupants.

Faster installation

Only 2-5 tonnes of substrate are required to cover 1,000m² of roof space with the Urbanscape growing media, compared with over 100 tonnes for traditional systems. This reduction in materials and labour means a faster, more cost-effective installation.

Superior thermal performance

With superior water retention and absorption capabilities, the system effectively conserves water and reduces runoff. The growing media can also be tailored to the climate zone, to optimise performance.

Water conservation

With superior water retention and absorption capabilities, the system effectively conserves water and reduces runoff. The growing media can also be tailored to the climate zone, to optimise performance.

Enhanced acoustic performance

The system provides excellent sound absorption, reducing noise pollution and improving the comfort and wellbeing of building occupants. This also contributes to a healthier urban environment, by mitigating the negative impacts of noise on public health.

For futureproof flat roofs, trust the experts

Knauf Insulation is part of the Knauf Group, a family-owned, multi-national manufacturer of building materials and construction systems.

With more than 45 years of experience, we exist to create better buildings. We do this by working in partnership with designers, contractors, merchants, policymakers and others to drive higher standards across the construction industry.

Our flat roof solutions have become a trusted and indispensable feature of modern architecture and design. We have a strong track record of delivering reliable, consistent performance across a broad range of applications, including warehouses and large-scale production facilities.

+6,000
employees worldwide

28
manufacturing sites

+15
countries

Whatever your requirements, our engineering experts will find the right solution for your project. *Speak to our team today, for a cost-effective recommendation that's built to last.*

Visit your local website for more information

View our EPDs

Use our online BIM Factory to model, test and explore your specification

Extensively tested and third-party certified:

The RAL quality mark is an indication that our products can be used and handled safely without health hazards.

Certified by EUCEB, our mineral wool fibres are bio-soluble and safe to use. Our insulation is designed with both safety and performance in mind.

Our products sold in the EEA are CE Marked, indicating that they meet high safety, health, and environmental protection requirements.

Independently verified, market leading Environmental Product Declarations provide transparency on the lifecycle and environmental impact of our products.

Many of our roof products have FM Approvals, confirming that the complete roof assembly meets the performance requirements of FM Standard 4470.

KNAUF INSULATION

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Build on us.