THE ROOF COMES FIRST · WHITEPAPER

What if the PV panel could not burn?

Module selection and the fire safety of flat roofs with PV

CENTRAL QUESTION

How much of the fire risk of PV above a flat roof can module selection solve?

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Prepared for asset owners, risk engineers, insurers, PV designers and roofing professionals.

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Author's perspective

This series is a synthesis of published research, fire tests, standards, approvals and insurer guidance on fire safety and rooftop PV, written from an explicit roof-first perspective: I look at the complete commercial roof system and the building beneath it rather than at individual product classifications. Within that perspective I summarise what the evidence shows, add my own technical analysis and, where relevant, propose design principles. Those proposals are marked as mine and kept separate from what has been demonstrated.

My background is in architecture and building engineering. Over the past three years I have discussed this subject with engineers, risk specialists, insurers and test institutes, and I have been involved in setting up and supervising fire-test programmes for AllShield's own roof systems. That experience shapes the questions I ask; the papers test those questions against external evidence. How the sources were selected, and what remains open, is described at the end of each paper.

These papers are prepared by Olivier Langejan as lead author with support from a small team. His own professional focus is building and roof design; specialist findings are drawn from the cited evidence, with AI assistance disclosed separately in Method and sources.
I am affiliated with AllShield, which develops BarrierSheet and other roof fire-protection solutions. That commercial relationship is relevant and is therefore stated explicitly. The analysis does not assume that an AllShield product provides the effects discussed. The starting point is the physical or economic problem. Where an AllShield product is discussed, it is treated as one product-specific example and its performance should be read only within the boundaries of the cited tests, approvals and roof assemblies.

In this paper I apply that roof-first approach to one specific question: how much of a flat roof's fire risk can be addressed by selecting a less combustible PV module? This paper was written as part of my role as Chief Commercial Officer at AllShield. The subject touches directly on AllShield's commercial interests: if module selection does not resolve the complete roof-PV fire problem, measures at roof level become part of the discussion and AllShield supplies such measures. For that reason, this paper does not argue that money or structural capacity should be diverted from better modules to roof protection. It contains no product case study. The argument in Chapters 1–8 is product-neutral.

Several relationships are relevant to the evidence cited here. Grunde Jomaas, who is affiliated with FRISSBE at ZAG, co-authored the two studies on which Chapter 1 relies [1,2]. AllShield commissioned roof-PV fire testing at ZAG. AllShield BarrierSheet is FM Approved in a defined roof-PV assembly, while this paper discusses FM DS 1-15 as an institutional evidence framework [7]. The documents behind these statements are listed after the references.

None of the conclusions depends on an AllShield product being selected. A lower-combustibility module can be a legitimate and valuable part of a fire-risk strategy, and roof intervention may be unnecessary where the existing construction and evidence already provide an acceptable risk position.

Olivier Langejan
Chief Commercial Officer, AllShield

Executive summary

Selecting a lower-combustibility PV module is a legitimate way to reduce fire risk. A dual-glass module removes the polymeric backsheet as a combustible component and places glass between the internal laminate and the roof below. Module construction therefore matters.

This paper asks a different question: **how much of the fire risk of PV above a flat roof can module selection solve?**

The starting point is a hypothetical PV panel that cannot burn, melt, drip or fracture. Experimental research provides a close approximation to that thought experiment. Tests using an inert stainless-steel surface above a classified flat-roof construction showed that fire behaviour at the roof could still be altered even though the surface above contributed no fuel. Removing the combustibility of the panel therefore does not remove the roof-PV fire problem.

Real PV modules add further variables. Both glass-backsheet and dual-glass modules contain polymeric materials. Glass can reduce the exposure of those materials, but its behaviour can change during fire exposure. Material properties can also change over the service life of a module. Research on two commercial PET-based backsheet materials found that, after accelerated weathering, the flame on one of them reached a test marker 46% sooner under the laboratory conditions tested. That result cannot be generalised to all modules, but it demonstrates that fire-relevant material behaviour need not remain static over time.

Recent guidance reflects the same system perspective. CEN/TR 18326:2026 considers the roof system, PV modules and installation system together. FM explicitly recommends glass-backed PV panels in its general guidance while continuing to treat the roof beneath them as part of the fire-risk problem. For several existing-roof routes that specifically use glass-backed panels, FM combines the module choice with conditions at roof level.

This leads to a second distinction. A local PV fire can only grow while it can draw on sufficient fuel and energy. If the roof beneath the array cannot become additional fuel or support continued fire spread, one of the principal escalation paths from a local PV incident to extensive roof involvement is removed. That does not guarantee that a PV fire remains confined to one module: adjacent modules, cables, other components and sustained electrical energy can still contribute. It does mean that the roof itself no longer provides the same continuous route for escalation.

For existing flat roofs, this also creates a resource question. Budget and structural capacity are finite. The sources reviewed for this paper do not provide a general comparison of the risk reduction achieved per euro or per kilogram by module selection and by measures at roof level. The appropriate combination is therefore project-specific.

> CORE THESIS
>
> **A lower-combustibility PV module can reduce the module's contribution to a fire. Module selection alone does not establish whether the roof beneath it will become involved.**

That is why the roof remains part of the decision.

Scope

This paper addresses building-applied photovoltaic systems (BAPV) installed above flat commercial and industrial roofs. It focuses on PV-module construction, combustible content, glass and material ageing, and on what those factors can and cannot contribute to the fire performance of the roof-PV system.

Detailed questions of PV clearance and geometry, electrical ignition, fire-test classification and lifecycle economics are addressed separately within *The roof comes first* series.

Building-integrated photovoltaics (BIPV), façades and pitched residential roof systems are outside the scope of this paper.

1. What if the PV panel could not burn?

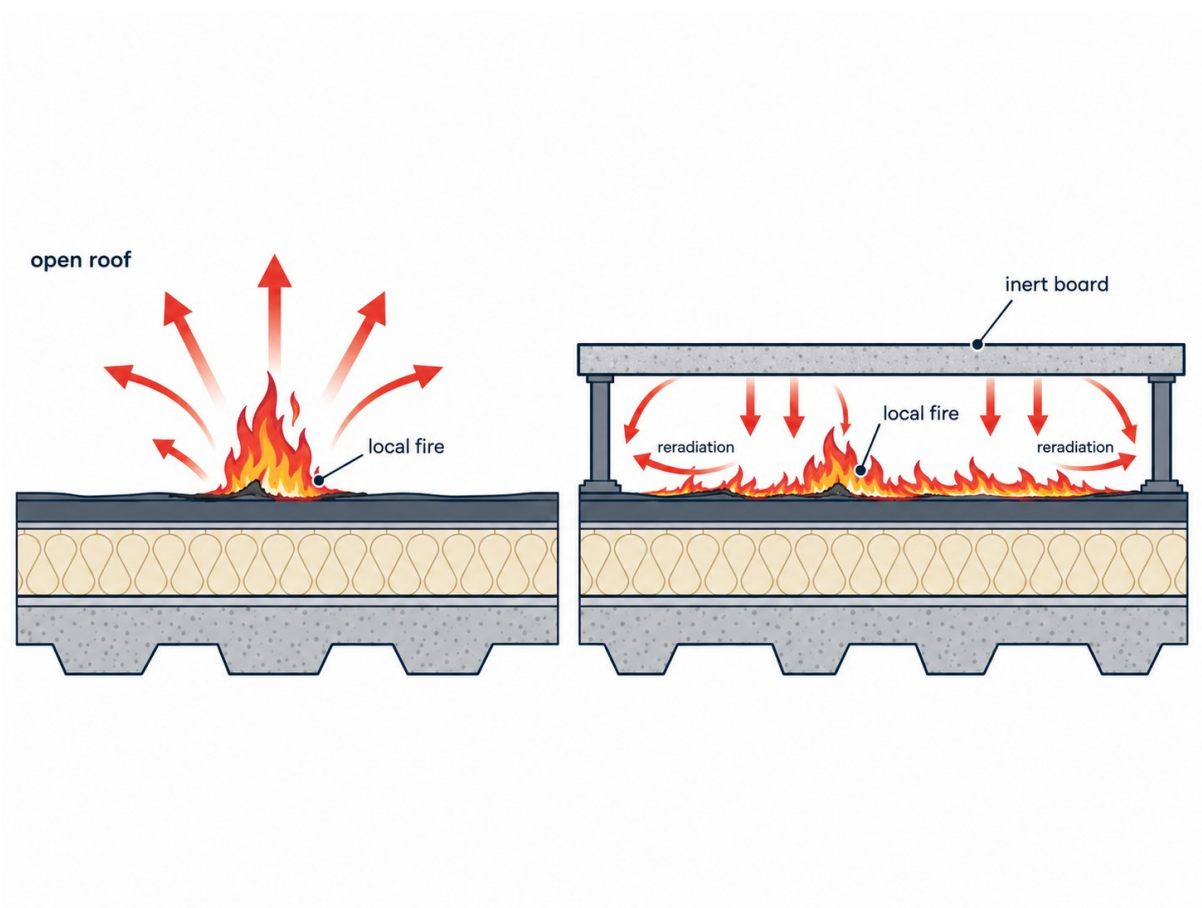
Start with a panel that does not exist. It contains no combustible material. It cannot melt, drip or fracture, and it remains intact for as long as a fire lasts. Whatever happens on the roof beneath it, this panel contributes no fuel.

Would the flat roof below it be fire-safe?

The intuitive answer may be yes: if the panel cannot burn, an important part of the fire risk introduced by PV appears to have been designed out. That answer assumes that the panel's only role in a fire is as fuel. It is not. A panel is also a physical boundary mounted above the roof covering, creating a semi-enclosed space that changes the thermal environment in which a fire on the roof develops.

This is not only a thought experiment. Kristensen, Jacobs and Jomaas [1] studied fire behaviour on a BROOF(t4)-compliant flat-roof mock-up beneath both real PV modules and a stainless-steel board. The steel board provided a non-combustible surface above the roof, allowing the influence of the overlying boundary and its geometry to be separated from the combustible contribution of a real module. Under the conditions tested, self-sustained flame spread could develop beneath the steel board when the geometry became sufficiently restrictive.

Earlier experiments by Kristensen, Merci and Jomaas [2] had already shown that a PV surface above a flat roof can increase the thermal exposure beneath it through re-radiation. The later stainless-steel experiments showed that this effect can occur without the overlying surface itself being combustible.



An inert board contributes no fuel, but changes where the heat of a local fire on the roof goes.

Two limits are important. First, these results belong to specific combinations of roof construction, ignition source and geometry. They do not define a universal clearance at which a roof becomes safe or unsafe. Second, they do not establish how one real PV module should be ranked against another.

The geometry question is examined in a separate paper in this series, *How much does PV clearance actually solve?* The remainder of this paper focuses on module material and construction.

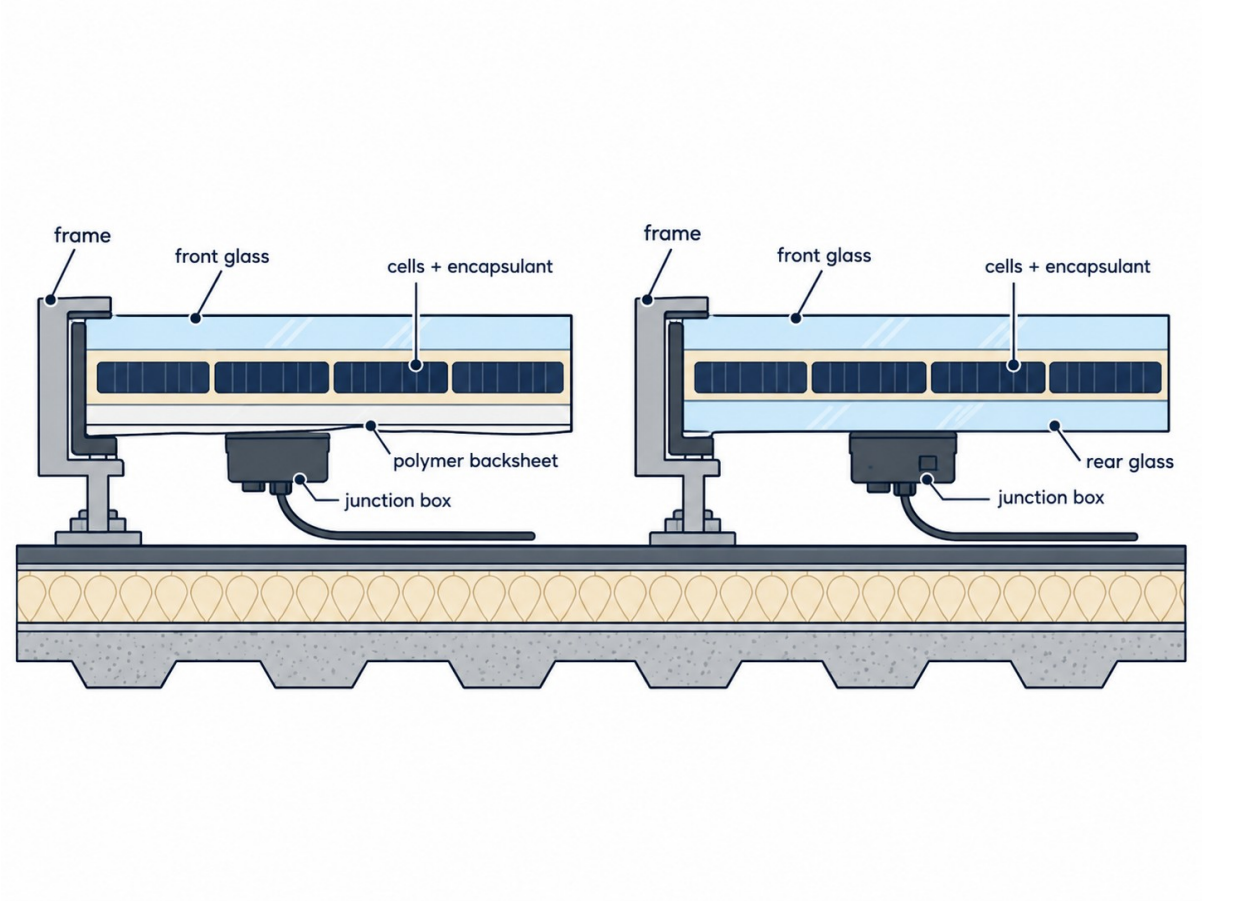
> CORE PRINCIPLE
>
> **Removing the panel as a source of fuel does not remove the panel as a boundary above the roof. Even above a roof construction that complies with an external-fire classification, an inert boundary can change the conditions under which fire spreads across the roof.**

Module combustibility is therefore one variable in the roof-PV fire problem, not the problem itself. The next question is what happens when the hypothetical inert panel is replaced by a real PV module.

2. Real PV modules are not inert

No commercially available PV module resembles the hypothetical panel of Chapter 1. A crystalline-silicon module is a laminate consisting of front glass, polymeric encapsulant around the cells, a rear layer of either polymer backsheet or glass, edge-sealing materials and electrical components such as a junction box, cables and connectors. Several of these components contain combustible polymers.

The difference between module constructions is real. In a glass-backsheet module, the rear face facing the roof is a polymeric sheet. In a dual-glass module, that sheet is replaced by glass. This removes the backsheet as a combustible component and places a non-combustible layer between the internal laminate and the space above the roof.



Glass-backsheet and dual-glass construction compared.

This is a genuine reduction in combustible content and a potentially important fire-safety advantage. Nothing in this paper argues against it.

It does not, however, make the module inert. Both glass-backsheet and dual-glass modules use polymeric encapsulants, with the chemistry depending on the module construction. EVA, one commonly used encapsulant, has a reported heat of combustion of approximately 41.6 MJ/kg [1]. Although encapsulant represents only part of the total module mass, it remains combustible material within the module. FM likewise identifies PV encapsulants as an additional source of fuel in a roof-level fire [7, §1.2.1, p. 3].

Junction boxes, cable insulation, connectors and other polymeric components can add further combustible material. Replacing a polymer backsheet with glass therefore changes the combustible content and exposure of the module. It does not remove combustible material from the PV system altogether.

The experiments described in Chapter 1 add an important qualification. In those tests, the polymer backsheets of the real modules did not sustain flame spread and the front glass remained intact in all but one experiment. The greater flame-spread length observed beneath horizontal PV modules than beneath the stainless-steel board was attributed not to burning backsheet material but primarily to the module frame, which restricted the flow of combustion products and helped retain a hot smoke layer beneath the module [1]. One of the three module types did produce burning droplets, although the authors considered their influence insignificant for the flat-roof configuration tested.

In four experiments with similar roof construction and geometry but different module types, maximum flame-spread lengths were also similar. The authors therefore suggested, cautiously and on the basis of a limited number of tests, that the geometry of the semi-enclosure may be more important than the material parameters of the module. Flame-spread rates nevertheless differed between module types and the authors explicitly stated that a much larger comparison would be needed to validate that proposition [1].

This does not diminish the value of lower-combustibility modules. It sets a boundary around that value: in these experiments, module material was not the dominant determinant of flame-spread length at the roof.

This distinction also matters when interpreting module safety qualification. IEC 61730 provides product-level safety requirements for PV modules, including construction and potential fire hazards [3]. It does not establish the fire performance of every roof, mounting system and PV-module combination in which that product may later be installed. Additional requirements can apply depending on the module's application and the national or regional rules governing its installation.

A real module therefore adds material-related variables to the effect established in Chapter 1. The next two chapters examine how glass behaviour and ageing can change those variables further.

3. What glass changes, and what it does not

Glass is not combustible and in a fire it behaves very differently from a polymer backsheet. In a dual-glass module, glass on both faces reduces the direct exposure of the encapsulant to flame and air. That is part of the advantage described in Chapter 2.

That protective function depends in part on the condition of the glass during the fire. Glass exposed to fire conditions can develop thermal stresses and fracture. A 2026 study [4] examined the influence of glass fracture on the fire behaviour of single-glazed monocrystalline silicon PV specimens under controlled radiant heat exposure in cone-calorimeter tests. Annealed glass fractured earlier than tempered glass yet ignited later, while ignition was delayed longest where the glass remained fully intact. The timing and pattern of fracture therefore affected subsequent ignition and combustion behaviour.

Two limits are important. The study concerned small single-glazed specimens in cone-calorimeter tests, not dual-glass modules mounted above a roof. The specimens also incorporated a polymeric backsheet. Its results therefore cannot be transferred directly to a particular dual-glass product, glass thickness or roof-fire scenario. What it does show is narrower: the protective role of glass cannot be treated as a fixed condition throughout a fire. Changes in the glass can change the subsequent behaviour of the laminate.

None of the experimental studies cited in this paper tested dual-glass modules above a roof. The argument about dual-glass construction therefore does not depend on evidence from a dual-glass rooftop fire test. Instead, dual-glass is given the more favourable theoretical case. If the rear glass performs perfectly and the module itself does not become involved in the fire, the module approaches the inert boundary considered in Chapter 1. Chapter 1 has already shown that such a boundary can still change the conditions under which fire spreads across the roof beneath it.

Better glass can therefore reduce what the module contributes to a fire. At best, it moves the module closer to the hypothetical non-combustible panel of Chapter 1. It does not remove the underlying roof-PV interface from the fire problem.

4. The ageing variable

A PV module is specified at the beginning of a service life that may extend over decades. The materials within that module are exposed throughout that period to ultraviolet radiation, temperature cycling, moisture and mechanical stresses. It should therefore not be assumed that every fire-relevant material property remains unchanged from installation to end of life.

A 2025 study [5] subjected two commercial PET-based backsheet materials to accelerated weathering for up to six weeks and tested the materials separately from complete PV modules using a time-to-marker flame-spread method. After six weeks, the flame on one of the two backsheet types reached the test marker 46% sooner than on the unweathered material. Both materials showed chemical and mechanical changes associated with the ageing process.

The limits of that result are important. The study concerned two specific commercial backsheet materials, tested as isolated films rather than as part of complete modules, under accelerated laboratory weathering. It does not mean that a module will burn 46% faster after a defined number of years on a roof. It does not establish the behaviour of every backsheet chemistry and it does not describe the ageing of dual-glass modules. What it does establish is that ageing can change the measured fire behaviour of some module materials.

Module selection can easily be treated as a fixed design decision: a product is specified, qualified and installed and its fire-relevant characteristics are then implicitly carried forward over its service life. The ageing study shows why that assumption deserves caution, at least for some polymeric backsheet materials.

For the comparison between glass-backsheet and dual-glass modules, this point should be read fairly. Replacing a polymeric backsheet with glass removes that particular ageing mechanism from the rear layer of the module, which is another potential advantage of dual-glass construction. It does not make every other material within the module immune to ageing.

The relevant question is therefore not only how a module behaves when it is new, but whether the material properties that matter in a fire can change during its service life. Module construction influences that answer, but it does not make it static. The same question applies to the roof beneath the array, which may already be well into its own service life when the PV system is installed. Chapter 8 returns to that point.

5. What this paper leaves to the others

Module construction is one part of the fire behaviour of a PV installation above a flat roof. Other parts are equally real, but analysing them again here would blur the narrower question of this paper: how much can be achieved through the choice and construction of the PV panel itself? They are addressed elsewhere in this series.

Geometry. Chapter 1 used the stainless-steel experiment for one purpose only: to show that a panel contributing no fuel can still influence fire behaviour at the roof. How clearance, inclination and array layout affect fire development is the subject of *How much does PV clearance actually solve?* For this paper it is enough that better module materials do not remove geometry as an independent variable.

Electrical ignition. A lower-combustibility module does not remove the electrical ignition sources of a PV installation. Their origin and thermal characteristics are examined in *DC arcs as a heat source* and the consequences of such a heat source close to the roof in *DC arcs at the roof-PV interface*. The argument of this paper does not depend on any particular ignition source. It asks what module selection can change once fire or significant heat exposure exists.

Testing and classification. What the classification of a component or roof construction proves once the installation above it changes is developed in *What does a fire test actually prove?* This paper uses that distinction only to interpret module-level qualification.

Consequence limitation within the roof. How far a rooftop PV fire can travel into the roof build-up, and what a separation layer within that build-up changes, is examined in *Beyond flame spread*. That question is deliberately left outside this paper because the subject here is module selection, not the performance of the roof assembly beneath it.

Each of these papers addresses a different intervention. Clearance changes geometry, electrical protection addresses ignition, testing describes performance under defined conditions and a separation layer addresses consequence within the roof. Module selection changes the materials placed above the roof. A lower-combustibility panel can be a meaningful part of a fire-risk strategy without being expected to do the work of the others.

Whether system-level guidance reaches the same conclusion is the subject of Chapter 6.

6. The system view

The previous chapters approached the question from the PV module itself. A lower-combustibility module can remove one combustible component, reduce the exposure of other combustible materials and avoid some degradation mechanisms associated with polymeric backsheets. None of those advantages is disputed.

Recent European and insurer guidance nevertheless treats the fire question at a wider level. CEN/TR 18326:2026 addresses building-applied PV and defines the relevant combination as the roof system, the PV modules and the installation system [6, §3.12]. The significance here is not the detail of the test methods but the recognition that module performance and roof performance form part of the same assessment problem.

FM reaches the same system principle from a property-loss perspective. Its 2026 Property Loss Prevention Data Sheet 1-15 states that “the roof-PV system acts as one during a fire event” [7, §2.0, p. 4]. FM also explicitly recommends glass-backed PV panels together with non-combustible frames and mounting systems [7, §2.1.1.4, p. 6]. Glass-backed construction is therefore clearly recognised as a desirable risk-reduction measure.

For existing roof covers that remain in place, the routes that specifically name glass-backed panels add further conditions. FM combines them with an FM Approved retrofit roof coating, with an FM Approved Class 1A re-cover assembly incorporating a non-combustible cover board directly beneath the membrane, or with specified metal-roof constructions using fibreglass or mineral-wool insulation [7, §2.1.1.2(B)–(D), pp. 4–5].

FM's supporting explanation makes the distinction particularly clear. It states that even where PV panels contain minimal or no combustible material, electrical wiring associated with the system can ignite the roof surface and that subsequent fire growth depends largely on the roof covering and insulation beneath the array [7, §3.2, pp. 15–16].

FM therefore recognises the value of reducing combustible material in the panel while continuing to treat the roof beneath it as part of the fire-risk problem. Module construction and roof construction address different parts of the same system.

7. The next euro and the next kilogram

On an existing flat roof, fire-safety decisions compete for two finite resources: budget and structural capacity. How fire risk should be weighed against lifecycle cost in the wider PV decision is examined in *The economics of the rooftop PV decision*. The question here is narrower. If module selection can reduce one part of the hazard but cannot determine the fire performance of the roof-PV system as a whole, where do the next euro and the next kilogram produce the greatest reduction in system risk?

The purpose of that question is not to trade module safety for roof protection. Lower-combustibility modules and measures at roof level address different parts of the same risk. The FM examples in Chapter 6 illustrate this directly: glass-backed panels are recommended as a risk-reduction measure while conditions at roof level remain part of several existing-roof routes. The design question is how different measures should be combined within the structural and financial limits of a particular building.

It would be easy to turn this into a simple comparison between a heavy, safer module and a light, more combustible one. As a general rule, that framing should be avoided: construction, mass, fire behaviour and price have to be established for the actual products under consideration.

FM does, however, identify a relevant trade-off in some lightweight products. Panels developed to reduce structural load and enable installation on roofs with limited dead-load capacity often incorporate additional plastic polymer components, thereby increasing fuel load [7, §3.2, p. 16]. This is not a rule for every lightweight panel, but it shows why weight and fire behaviour cannot always be treated as unrelated design variables.

The kilogram nevertheless deserves attention. On an existing flat roof, structural capacity can constrain the PV decision. FM recommends ensuring that the dead weight of a proposed PV system does not reduce the roof's resistance to snow, rain and other live loads below acceptable levels [7, §2.1.5.2, p. 13]. Module mass is one contributor to that load and measures at roof level are not necessarily weight-neutral. Every kilogram added by an intervention draws on the available structural capacity of the existing building. There is no free side to the equation.

The same applies to money. Paying more for a lower-combustibility module may be entirely rational, but it cannot be assumed that expenditure on one component produces the greatest possible reduction in risk for the complete roof-PV system. The sources reviewed for this paper do not provide a general comparison of the risk reduction achieved per euro or per kilogram by module selection and by measures at roof level. The answer is therefore project-specific: the analysis may favour a lower-combustibility module, a roof-level measure, or both.

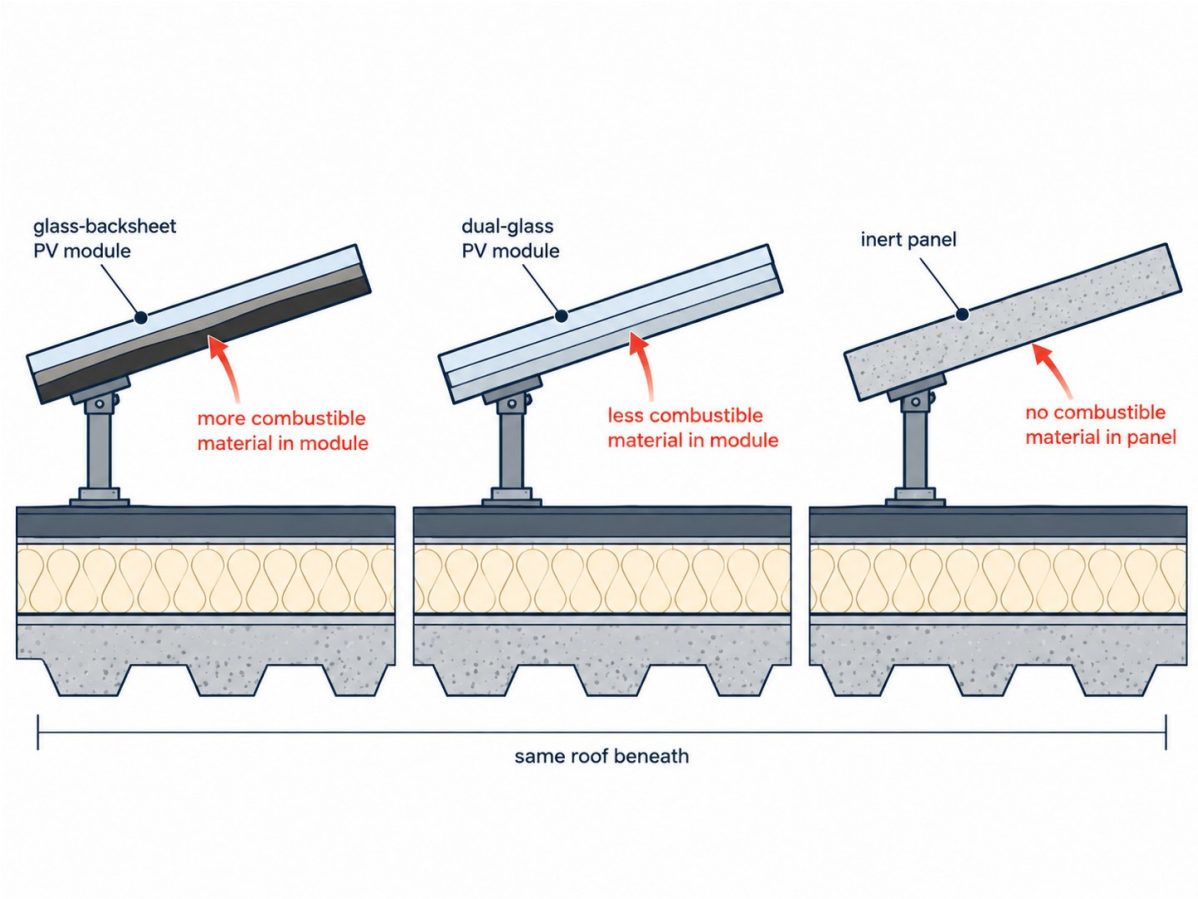
What the analysis should not do is treat the fire performance of the PV module as the complete answer. Fire-safety resources, whether measured in euros or kilograms, should be considered at the level of the roof-PV system rather than allocated on the assumption that one component can resolve the whole problem.

8. The roof comes first

The thought experiment at the beginning of this paper deliberately gave the PV panel every possible advantage. It could not burn, melt, drip or fracture. Removing the panel as a source of fuel did not remove the roof-PV fire problem, because the panel remained a boundary above the roof.

Real modules add further variables. Their construction determines how much combustible material is present and how that material is exposed. Dual-glass construction can remove the polymeric backsheet and offers genuine advantages. Glass itself can influence how internal materials are protected during a fire, and ageing can change the behaviour of some module materials over time.

None of these findings argues against choosing a lower-combustibility module. They define what that choice can achieve.



The thought experiment in one view: module construction changes the fuel above the roof, not the roof beneath it.

CEN and FM provide the same wider perspective from outside the experimental literature. The PV module is one part of a roof-PV system. FM explicitly recommends glass-backed modules and at the same time recognises that even PV panels containing minimal or no combustible material do not remove the potential for the roof beneath them to become involved [7, §3.2, pp. 15–16]. The module and the roof therefore address different parts of the same fire pathway.

Time adds another reason to begin with the roof. FM advises that an existing roof more than ten years old should be replaced or re-covered before installing PV systems that may last 25 to 30 years. It also advises against installing PV over roofs showing signs of deterioration such as leaks, cracks, delamination

or blisters [7, §2.1, p. 4]. The point is broader than fire alone: a long-lived PV investment should not be designed without first considering the condition and remaining service life of the roof that will carry it.

The wider decision sequence for existing buildings is developed in *Rooftop PV on existing commercial buildings*. This paper adds one specific conclusion to that framework: selecting a safer PV module does not remove the need to assess what lies beneath it.

This leads to a conclusion of my own, drawn from the evidence rather than demonstrated directly by it. A local PV fire can only continue to grow while it finds additional fuel or receives continued energy. FM describes how the roof assembly below the panels can become that fuel: above-deck components with a low melting temperature can melt, burn and flow, and unprotected roof expansion joints can allow an exterior roof fire into the building [7, §1.2.1, p. 3]. Where the complete roof construction, including membrane, adhesives and other components, does not provide that additional fuel or a continuous path for fire spread, a local PV incident cannot grow by recruiting the roof. It remains dependent on the finite fuel and energy within the PV system itself, although adjacent components and a sustained electrical fault can still extend it. A lower-combustibility module reduces what the PV system can contribute to a fire; a roof that does not support continued fire spread limits what that fire can recruit beneath it.

Each of these improvements is worthwhile, but none settles the question on its own.

> **A lower-combustibility PV module can reduce the module's contribution to a fire. Module selection alone does not establish whether the roof beneath it will become involved.**

For protection of the building through the roof, the decisive design objective is therefore not to make every component non-combustible. It is to prevent a local fire above the roof from finding a continuous route into extensive roof and building involvement. What a separation layer within the roof build-up can change in that escalation pathway is examined in *Beyond flame spread*.

The roof comes first.

References

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[6] CEN (2026). *CEN/TR 18326:2026 Report on installation scenarios, available test methods and national legislation to be considered for the fire performance classification of roof systems with above roof mounted PV modules*. Brussels: European Committee for Standardization.

[7] FM (2026). *Roof-Mounted Solar Photovoltaic Panels*. FM Property Loss Prevention Data Sheet 1-15, April 2026, full revision.

Documents referred to in the author's perspective

ZAG, Slovenian National Building and Civil Engineering Institute (2025). *Report 448/25-560-1-EN: About performance comparison of lightweight non-combustible sheet in rooftop PV-related fires*. Responsible investigator: Kirils Simakovs. 1 August 2025. Orderer: AllShield Holding B.V.

FM Approvals (2025). *Approval Report PR472014: AllShield BarrierSheet*. FM 4470 (April 2022) and FM 4478 (March 2025). Date of approval: 11 December 2025. RoofNav assembly 568563-0-0.

Method and sources

This is a targeted inventory and synthesis of identified knowledge, updated through the checks documented for 1 November 2026. It does not claim exhaustive coverage of the latest literature. Source findings, author analysis and practical design proposals remain distinct. The author endorses the conclusions within these evidence boundaries.

Authorship and contributions

Olivier Langejan is the lead author, supported by a small team. His professional focus is building and roof design. The papers synthesise the cited research, standards and test evidence; specialist fire-science and electrical findings are attributed to those sources rather than presented as expertise personally established across every discipline. The author endorses the synthesis and its stated limits. AI assistance is described separately below.

Scope and selection

This paper synthesises how module combustibility relates to fire involvement of the complete commercial roof. Module studies and roof-PV experiments are included to distinguish module fuel from roof fuel and thermal interaction. This is not a product ranking or a claim that changing the module alone resolves roof fire risk.

Sources and dates

The evidence base is the research, standards, approval documents, technical guidance and incident material identified in the references. This is a targeted narrative synthesis, not a systematic review. English-language sources and relevant Dutch or German material are included where cited. The original search dates and a complete search log are not available in the retained publication record, so no reconstructed search period or exhaustive publication cut-off is asserted. Sources retain their individual publication dates. The present editorial and targeted source checks were completed on 1 November 2026.

Publication range

The dated references reviewed here run from 2018 to 2026. Publication years are taken from the references, not DOI or page-range digits. This is not a claim of exhaustive coverage.

Verification

This revision checked the requested wording against the source papers and carried out targeted primary-source checks for the additions and source corrections identified in its revision history. It is not a new claim-by-claim audit of the entire paper. References identify primary documents where available; secondary accounts and access limitations are identified where material. Author interpretations and design proposals do not acquire test or approval status.

Known gaps

The reviewed evidence does not establish a universally fire-safe module/roof combination or equivalent outcomes across all roof constructions.

Reading evidence

The series distinguishes claim status (DEMONSTRATED, PHYSICALLY SUPPORTED, CONTRADICTED or UNKNOWN) from the route to the intended roof (as tested, formally covered or engineering extrapolated). A cited test demonstrates its observed outcome for the specimen and exposure. Guidance is a recommendation and a proposed framework is author analysis; neither demonstrates a product outcome. A project acceptance decision does not extend the formal scope of evidence.

AI-assisted research and writing

Artificial intelligence was used to help identify and locate technical literature, compare findings across sources, analyse evidence boundaries, organise the argument and assist with drafting and editing. AI-generated summaries were not treated as technical evidence. The selection of sources, interpretation of the evidence, conclusions and final wording remain the responsibility of the author.

Updates

New research, test results, incidents and regulation may lead to new versions. Editorial corrections and technical additions are identified separately in the revision history. Missing sources and evidence that challenges a conclusion are welcome.

REVISION HISTORY

Version	Date	Changes
1.0	21 October 2026	First published version. Rebuilt from the v0.7 review text in the series house style, with redrawn figures. Core thesis stated more precisely (module selection alone does not establish roof involvement), dual-glass advantage described as a reduction in combustible content, the roof-fuel argument applied to the complete roof construction, and Chapter 7 shortened. Revision history and the current series overview added.
1.01	1 November 2026	Editorial corrections: reframed as a roof-first knowledge synthesis; shortened the author perspective, added method and source limitations, labelled author interpretations and corrected the requested wording and transparency statements. Technical additions and source checks: No new fire-performance claims or tests.
1.02	1 November 2026	Method and sources: clarified targeted synthesis and source/analysis distinction. Existing source-specific FM recommendation retained; no new module or roof performance claim introduced.
1.03	1 November 2026	Method and sources: publication range corrected to 2018–2026 from reference publication dates. Authorship and expertise scope clarified without changing module fire-performance claims.

THE SERIES

The roof comes first is a synthesis of knowledge on fire safety and rooftop PV from a roof-first perspective, by Olivier Langejan. Each paper stands on its own; together they follow one line of thought.

At the time of this version, the series consisted of:

Paper	For	In one line
Rooftop PV on existing commercial buildings	Asset owners, developers, project teams	A decision framework for resolving roof constraints before the PV investment is committed.
Rooftop PV on new commercial buildings	Developers, architects, project teams	Designing the roof and PV as one system from the start.
The economics of the rooftop PV decision	Asset owners, CFOs, risk managers	Probability, consequence and lifecycle cost from the asset owner's perspective, including Business Interruption.
From risk models to design requirements	Risk engineers, insurers, designers	An application of five established risk frameworks to consequence-limiting design for roofs with PV.
Beyond flame spread	Risk engineers, insurers, fire engineers	How far a rooftop PV fire can travel into the roof before it becomes a building loss, and what a separation layer changes.
What does a fire test actually prove?	Insurers, risk engineers, specifiers	What a fire test result does and does not demonstrate about a real roof with PV.
DC arcs as a heat source	Insurers, risk engineers, PV designers	How DC arc faults start, persist and end in rooftop PV.
DC arcs at the roof-PV interface	Insurers, risk engineers, PV and roof designers	What determines roof exposure to a sustained DC arc and what current evidence shows about measures to limit it.
How much does PV clearance actually solve?	Insurers, risk engineers, PV designers, asset owners	What module-to-roof clearance does and does not demonstrate about the roof beneath it.
What if the PV panel could not burn? (this paper)	Asset owners, risk engineers, insurers, PV designers	What a lower-combustibility PV module does and does not change for the roof beneath it.
What does an inspection actually prove?	Insurers, risk engineers, asset owners, inspectors	What inspection can establish, what it cannot and what still protects the roof when a fault is missed.

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