

PRETIUM SYNERGY · DECISION GUIDE

Adding Solar PV and Battery Storage to Your Facility

A risk-based decision guide for commercial building owners and operators

Pretium Synergy Ltd

1. Why this guide exists

Commercial solar and battery proposals often begin with equipment:

- Available roof area
- Number of panels
- Generation forecast
- Battery capacity
- Installation price
- Expected payback

These are important, but they do not provide a complete basis for an investment decision.

Adding solar PV or battery storage changes the facility itself. It introduces new electrical sources, equipment, cable routes, control systems and long-term operating responsibilities.

This guide helps decision-makers consider three connected questions:

1. **Does the investment have a sound commercial case?**
2. **Can it be safely integrated into this particular facility?**
3. **Can the organisation operate and maintain it throughout its life?**

The purpose is not to discourage investment. It is to help organisations make a decision that remains commercially and operationally sound after installation.

Who should use it?

- Building owners
- Facilities and estates directors
- Operations leaders
- Finance directors
- Sustainability and energy managers
- Health-and-safety professionals
- Landlords and managing agents
- Procurement and project teams

2. The whole-system view

A commercial energy system should be assessed as part of one connected operational environment.

System element	Questions to consider
Business operation	What depends on this facility remaining available?
Building	Is the roof and building fabric suitable?
Electrical infrastructure	Can the existing system accommodate generation and storage?
Fire strategy	Does the proposal change ignition, spread or emergency-response risks?
Solar PV	How will generation, DC cabling and shutdown be managed?
Battery storage	Where will stored energy be located and how will an incident be controlled?
Facilities management	Who will monitor, inspect and maintain the system?
Business continuity	What happens if the equipment or facility becomes unavailable?

The whole-system decision

1. Start from the **required business outcome**.
2. **Understand the existing facility** — building and roof; electrical infrastructure; fire and life safety; operations and continuity.
3. Produce an **integrated system design**.
4. Ask: is the **residual risk acceptable**?
 - If no → redesign, reduce or defer.
 - If yes → approve and implement.

The whole-system decision: Equipment selection comes after the building, electrical infrastructure, fire strategy and operating requirements have been understood.

The central principle

Solar PV and battery storage should not be treated as equipment attached to a building. They should be treated as modifications to the facility's operational system.

3. Establish the existing risk baseline

Before assessing what solar or storage adds, understand the building as it currently operates.

Building and roof

- What is the roof construction?

- Does it contain combustible insulation?
- What is its remaining service life?
- Are there existing leaks, drainage problems or defects?
- Has its structural capacity been confirmed?
- Where are rooflights, smoke vents and plant located?
- Where are the fire-compartment boundaries?
- Does the roof have a warranty?
- Is refurbishment already planned?

Electrical infrastructure

- Is there a current electrical-condition report?
- Are there unresolved electrical defects?
- Is the main switchboard suitable?
- Are existing drawings accurate?
- Is there adequate import and export capacity?
- Are generators, UPS systems or other energy sources present?
- Are protection and earthing arrangements understood?

Fire and operations

- Is the fire-risk assessment current?
- What fire detection and suppression systems are installed?
- What materials or stock are present?
- Is the site occupied continuously?
- How quickly would a fire be detected outside operating hours?
- How dependent is the organisation on this particular facility?

Decision point

If the existing condition of the building or electrical infrastructure is unknown, the project is not ready for equipment selection.

4. What solar PV adds

Solar PV introduces:

- Modules and rooftop mounting systems
- DC connectors and cabling
- DC isolators
- Inverters

- AC connections and switchgear
- Cable penetrations
- Monitoring and communication systems
- New maintenance and emergency procedures

Principal added risks

Added risk	Possible consequence
Poor or deteriorating connector	Resistance heating, arcing or ignition
Damaged DC cable	Exposed conductor, earth fault or arc
Failed isolator	Overheating, arcing or loss of safe isolation
Inverter or AC termination fault	Local equipment fire or switchgear damage
Module hot spot or junction-box failure	Localised overheating or module damage
Poor roof penetration	Water ingress or impaired fire stopping
Inadequate array layout	Restricted access, drainage or firefighting
Weak monitoring response	Early warning is missed and a defect escalates
Ageing and maintenance damage	A previously safe installation develops faults

Important characteristic

PV modules continue producing electricity when exposed to sufficient light.

Turning off the building's incoming electricity supply does not necessarily remove voltage from conventional PV modules and DC string cables.

This does not make solar inherently unsafe. It means that design, isolation, maintenance and emergency arrangements must reflect how PV behaves in both normal and abnormal conditions.

5. Understand risk multiplication

Solar may affect an incident even when it did not cause it.

Illustrative scenario: when solar did not cause the fire

This is an illustrative scenario, not a claim about a named site. It is not a substitute for a site-specific fire-risk assessment or specialist design advice.

Consider a distribution warehouse with rooftop solar PV.

During normal operations, a fault develops in the building's original electrical wiring. The fault starts a small fire inside the warehouse. The solar installation is operating correctly and has played no part in causing it.

If the fire is detected and contained within its original area, the presence of solar may have little effect on the outcome.

But suppose the fire is not contained.

It spreads into the roof space and reaches the solar DC cables. Heat damages the cable insulation while the rooftop modules continue generating electricity in daylight.

The incident has now changed.

The fire service can isolate the building's mains electricity, which should stop the grid-connected inverter supplying AC power. But that action may not remove the voltage being generated by the modules or present within conventional DC string cables.

The damaged solar cables could introduce:

- Exposed live DC conductors
- Sustained or intermittent DC arcing
- A secondary point of ignition
- Additional risk to emergency responders
- Uncertainty about which circuits remain energised
- Delayed firefighting and investigation
- Longer business interruption

Solar did not increase the likelihood of the original wiring fault. It changed the range and severity of consequences once the fire reached it.

That is **risk multiplication**.

How risk multiplication develops

1. Existing building fault → fire starts.
2. Contained early? → localised incident.
3. Not contained → fire reaches PV infrastructure → heat damages live DC cables → arcing, shock risk or secondary ignition → harder intervention and longer recovery.

Risk multiplication: Solar does not need to cause the original fire to change its consequences. If containment fails and fire reaches PV infrastructure, the incident can acquire additional electrical, operational and emergency-response dimensions.

How design can change the outcome

If the DC cable route is kept largely outside occupied areas, the opportunity for an internal fire to involve it may be reduced.

If the system includes effective rapid shutdown, the amount of energised DC cabling may be reduced. If cable routes and isolation points are clearly documented, emergency responders can make faster, better-informed decisions.

Similarly, an array designed around firefighter access and roof-compartment boundaries may support intervention more effectively than one designed solely to maximise the number of panels.

The same solar equipment can therefore produce a different risk outcome depending on how it is integrated into the building.

6. The building often supplies the multiplier

A small electrical fault does not automatically become a major building fire. The eventual scale of an incident depends on what surrounds it.

A connector fault above a fire-resilient roof, identified promptly and safely shut down, may remain a localised equipment failure.

The same fault above a combustible roof construction, concealed beneath a continuous array and discovered late, may have very different consequences.

Similarly, a cable fault routed externally may remain isolated from occupied areas. A poorly planned route through multiple compartments can create a more complex problem, particularly where penetrations have not been properly fire-stopped.

The most serious outcomes often emerge from an interaction:

PV defect + vulnerable roof + delayed detection or intervention = potentially major loss.

Existing weakness and possible interaction

Existing condition	Possible interaction after adding PV
Combustible roof construction	A small PV fault can ignite a much larger available fuel load
Weak compartmentation	PV cable routes or penetrations can contribute to fire and smoke spread
Poor fire detection	A roof-level or under-panel incident can develop before intervention
Restricted roof access	Panels can delay observation, ventilation and suppression
Ageing electrical infrastructure	A non-PV fault may spread into energised PV circuits
Weak maintenance arrangements	Alerts, defects or physical damage can remain unresolved
Single-site business dependency	A limited incident can create disproportionate business interruption

7. What battery storage adds

Battery storage should be assessed separately from solar PV.

A battery contains stored chemical energy that remains present:

- During daylight
- At night

- During a grid failure
- After external electrical isolation

Principal considerations

- Battery chemistry
- Total stored energy
- Indoor or outdoor location
- Separation from the building
- Proximity to escape routes, windows and air intakes
- Detection of heat, smoke and off-gases
- Ventilation
- Thermal-runaway propagation
- Flammable or toxic gas accumulation
- Fire-service access
- Cooling-water requirements
- Reignition
- Damaged-battery removal and disposal

Key distinction

Solar PV mainly presents an ongoing electrical source while illuminated. Battery storage introduces stored energy that can remain hazardous independently of the grid or solar array.

The battery location should therefore be selected through a risk assessment, not primarily through installation convenience.

Where practicable, an appropriately designed external location may reduce interaction with occupied areas, escape routes and critical building infrastructure. The appropriate solution will depend on the facility and system.

8. Define the required outcome

Before asking for a system quotation, define what the system is expected to achieve.

Objective	Possible implication
Reduce imported electricity	Solar should be aligned with daytime consumption
Increase solar self-consumption	Storage may be useful
Reduce peak demand	Battery power and control strategy become critical
Address grid constraints	Generation, storage and load management should be modelled together
Support EV charging	Charging profile and electrical capacity must be included
Provide backup	Dedicated backup architecture and selected circuits are required
Operate during grid failure	Earthing, protection and island operation require specific design
Provide grid services	Additional cycling, control and commercial obligations may apply

A common misunderstanding

A battery does not automatically provide backup during a power cut.

Backup operation must be specifically designed, including:

- Which loads are supported
- How long they need to operate
- How the building separates from the grid
- How earthing and protection operate in backup mode
- How the system returns to normal operation

The right solution begins with the required operational outcome, not a preferred product.

9. Test the proposed design

Before approval, the customer should be able to answer the following questions.

Roof and building

- Is the roof suitable for the full system life?
- Has the complete roof assembly been considered?
- Will the array respect fire-compartment boundaries?
- Are access and maintenance routes preserved?
- Are smoke vents, rooflights and drainage unobstructed?
- Who protects the roof warranty?
- Will planned roof works require early removal and reinstatement of the system?

Electrical integration

- Where will the DC cables run?
- Can cabling be kept outside occupied areas where practicable?
- How will penetrations be fire-stopped and recorded?
- Where will inverters and isolators be located?
- Are equipment locations adequately ventilated and separated from combustible material?
- What remains live after normal shutdown?
- What happens after fire-alarm activation?
- How will the system interact with generators and UPS equipment?
- How will protection operate in every intended mode?

Battery storage

- Why was the proposed location chosen?
- Could an external location reduce risk?
- How is a failing cell detected?
- How is gas accumulation managed?
- How is propagation limited?
- What emergency access and water supply are available?
- How will a damaged system be monitored and removed?

Installation quality

- Who owns the complete system design?
- Are connector types and cable combinations compatible?
- How will termination and crimping quality be verified?
- How will hidden work be inspected and recorded?
- What testing and commissioning evidence will be provided?
- Is independent verification proportionate to the project's risk and value?

10. Establish the operating model

Technology does not manage itself.

Event	Required operational response
Arc-fault alert	Investigate; do not repeatedly reset without diagnosis
Connector-temperature alert	Isolate affected equipment and arrange inspection
Insulation fault	Keep the system off until the cause is identified
Loss of monitoring	Restore communications or introduce temporary checks
Fire-alarm activation	Move systems to the agreed safe state
Roof maintenance	Apply controlled PV isolation and access procedure
Storm or impact damage	Restrict access and inspect before restart
Battery alarm	Follow the defined escalation and emergency procedure
Repeated inverter trip	Investigate the underlying cause before continued operation

Named ownership is essential

The organisation should identify:

- Who receives alerts
- Who monitors performance
- Who can authorise shutdown
- Who attends outside normal hours
- Who coordinates roof and electrical maintenance
- Who maintains emergency information
- Who decides when the system is safe to restart

An alarm without an owner is not an effective control.

Information that should remain with the facility

- As-built drawings
- Electrical single-line diagram
- Array and equipment layout
- DC and AC cable routes
- Fire-compartment and penetration records
- Structural assessment
- Commissioning and test results
- Protection settings
- Shutdown and isolation instructions
- Fire-alarm interface description

- Emergency-response information
- Monitoring access and escalation routes
- Maintenance schedule
- Warranties and support contacts

These records should remain accessible to the building owner and facilities team, not exist only within an installer's portal.

11. Engage stakeholders before the design is fixed

Relevant stakeholders may include:

- Building owner and occupier
- Facilities and health-and-safety teams
- Structural engineer
- Roofing-system specialist or manufacturer
- Fire-risk professional
- Electrical designer
- Fire-alarm and suppression specialists
- Insurer and insurance broker
- Distribution network operator
- Operations and business-continuity owners

Insurer and roof-warranty requirements should be established before contracts are signed. A technically compliant installation can still conflict with insurer conditions, roof warranties or the organisation's own risk appetite.

Clarify responsibility

Responsibility	Named party required
Building and roof information	Building owner or customer
Structural suitability	Structural engineer
Roof fire and warranty assessment	Roofing and fire specialists
PV or battery system design	Competent system designer
Electrical integration	Electrical designer
Fire-strategy integration	Competent fire professional
Installation quality	Principal installer or EPC
Independent verification	Customer's technical representative
Monitoring alerts	Named operational owner
Planned maintenance	Appointed O&M provider
Emergency procedures	Facilities and fire-safety management
Documentation control	Customer or facilities team

Without this clarity, responsibility can disappear between the solar installer, electrician, roofer, fire consultant, landlord and facilities manager.

12. Make a risk-adjusted commercial decision

The financial assessment should include more than equipment and installation price.

Potential whole-life costs include:

- Roof repair or early replacement
- Structural reinforcement
- Switchboard modifications
- Network reinforcement
- Fire-safety measures
- Monitoring subscriptions
- Planned inspection and testing
- Inverter or battery replacement
- Temporary removal for roof works
- Insurance implications
- Emergency call-out arrangements
- Decommissioning and disposal
- Loss of generation during outages
- Potential business-interruption exposure

A cheaper installation can create a more expensive 25-year asset.

An illustrative design decision

A warehouse proposal initially seeks to maximise panel capacity across almost all available roof area.

A whole-system review identifies rooflights, smoke vents, compartment boundaries, restricted plant access and a roof life shorter than the expected PV life.

The revised solution may:

- Complete roof work before PV installation
- Exclude selected roof areas
- Preserve access and separation routes
- Relocate inverters
- Shorten or externalise DC cable routes
- Add defined shutdown and monitoring arrangements
- Include lifecycle inspection and maintenance

The revised system may be slightly smaller or more expensive than the first quotation. It can nevertheless offer the stronger commercial outcome because foreseeable building, operational and interruption risks have been addressed before installation.

The objective is not maximum theoretical capacity. It is optimum whole-life performance within an acceptable risk envelope.

13. Five decision gates

Gate 1: Is there a sound commercial case?

The objective, energy profile, projected savings, assumptions and lifecycle costs are credible.

Gate 2: Is the facility suitable?

The roof, structure, building fabric and proposed equipment locations are appropriate.

Gate 3: Can the system be safely integrated?

Electrical protection, cable routes, fire strategy, access and emergency arrangements form one coherent design.

Gate 4: Can the organisation operate it?

Monitoring, maintenance, incident response, documentation and responsibilities are defined and funded.

Gate 5: Is the residual risk acceptable?

The building owner, occupier, insurer and relevant stakeholders understand what remains after controls are applied.

| A project may be technically feasible and financially attractive but still not be ready for investment approval.

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14. Before you commit

Ten questions for decision-makers

1. What business outcome is the system intended to deliver?
2. Is the roof suitable for the complete expected operating life?
3. What is the roof construction, including its insulation and fire performance?
4. How does the design interact with fire compartments, rooflights, smoke vents and access routes?
5. Where will DC cables, inverters, isolators and batteries be located?
5. What remains electrically live after normal and emergency shutdown?
7. How will faults be detected, communicated, investigated and resolved?
3. Has the building's fire-risk assessment been reviewed to reflect the proposal?
3. Have the insurer, facilities team and relevant specialists reviewed the design?
3. Who owns the system's safety, monitoring, maintenance and documentation after handover?

Warning signs

Pause the decision if:

- The quotation was prepared without understanding the building.
- Nobody has established the roof construction.
- The roof life is shorter than the expected PV life.
- The design does not show cable routes.
- The array ignores compartment boundaries or emergency access.
- The installer cannot explain what remains live after shutdown.
- The battery location was selected mainly for convenience.
- The insurer will only be informed after installation.
- Monitoring is included but nobody owns the alerts.
- Maintenance is described as unnecessary.
- Product safety features are being presented as the complete fire strategy.
- Backup is promised without a defined operating and protection design.

15. Product, installation and whole-system assurance

Product view	Installation view	Owner's Engineer view
Is the equipment compliant?	Has it been installed correctly?	Is the complete facility risk understood and acceptable?
What safety features does it include?	Does the work conform to the design?	How does it interact with the building and operations?
What is the warranty?	Has it been tested and commissioned?	Who owns performance, risk and response throughout its life?

Product compliance is essential. Installation quality is essential. Neither, on its own, proves that the complete operational system is appropriate for the customer.

16. The Owner's Engineer approach

The Owner's Engineer represents the customer's complete interest across commercial, technical, operational and risk decisions.

The role is not to promote the largest possible system or to obstruct a worthwhile investment.

It is to establish whether the proposed solution:

- Is appropriate for the facility
- Integrates safely with the building
- Reflects the organisation's operational priorities
- Addresses insurer and stakeholder requirements
- Can be maintained throughout its life
- Delivers a defensible, risk-adjusted commercial outcome

The Owner's Engineer asks the questions that sit between disciplines:

- Is the system compatible with the roof and fire strategy?
- Have electrical and fire risks been considered together?
- Does the layout support maintenance and emergency access?
- Are product safety functions reflected in site procedures?
- Are insurer requirements incorporated into the design?
- Who owns monitoring and maintenance after handover?
- What happens when equipment fails or the building changes?
- Is the projected return still attractive after lifecycle and risk-control costs?

The best solution is not necessarily the installation with the greatest capacity, the largest battery or the shortest headline payback.

It is the solution that creates value while keeping the whole facility's residual risk understood, managed and

acceptable.

That is the Owner's Engineer approach.

Speak to Pretium Synergy

Pretium Synergy helps commercial customers assess, design and deliver solar PV, battery storage and wider energy infrastructure around how their facilities actually operate.

Our approach brings the commercial case, technical design, installation, fire and operational considerations into one coherent decision.

Pretium Synergy

Renewable Energy Transition — done properly.

Commercial solar, energy storage and energy infrastructure scoped to how your site operates.

Arrange an initial facility discussion: <https://pretiumsynergy.co.uk/contact-us>

Visit: <https://pretiumsynergy.co.uk/>

Commercial solar: <https://pretiumsynergy.co.uk/commercial/solar-pv>

Important note

This guide is intended to support informed discussion and project planning. It is not a substitute for a site-specific fire-risk assessment, structural assessment, electrical design, insurer review or other competent professional advice. Requirements will depend on the building, its use, location, proposed equipment and applicable standards and regulations.