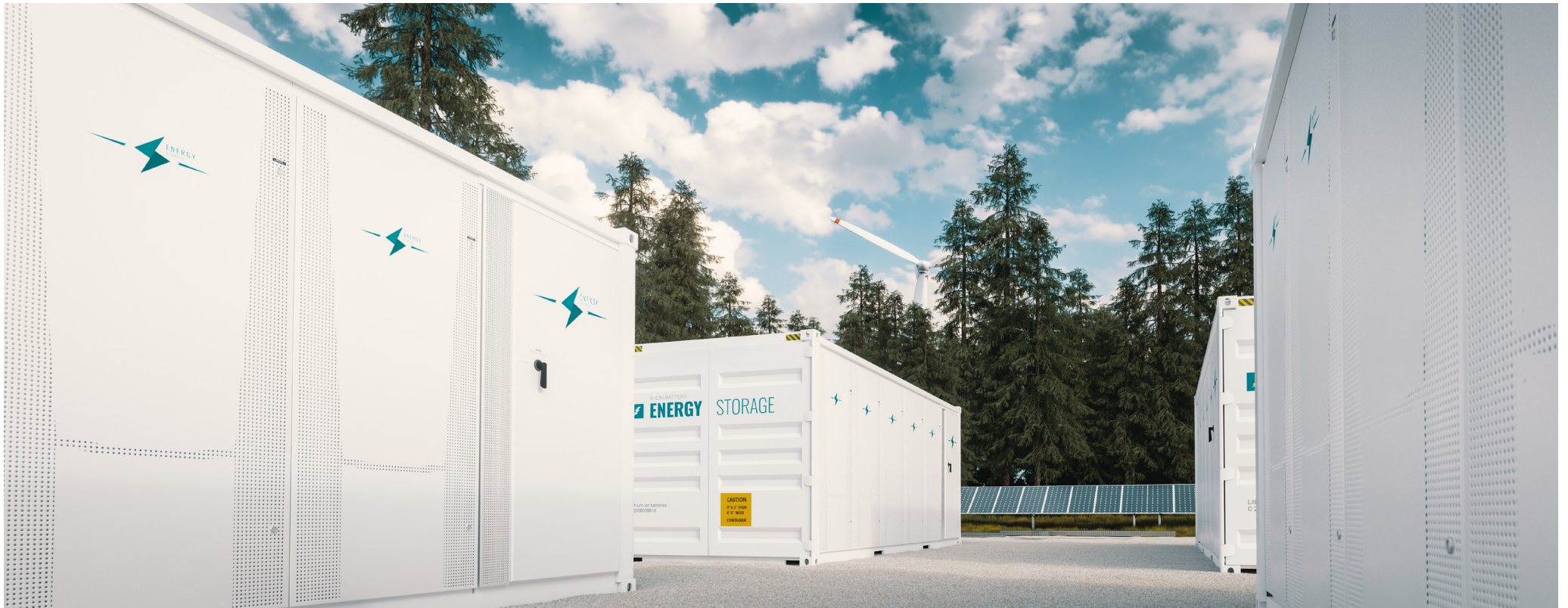


# HOW TO LOWER INSURANCE RISK FOR LI-ION BATTERY STORAGE SYSTEMS

## THE INSURER'S GUIDE TO LI-ION TOWER ADVANCED DETECTION





## INTRODUCTION

Lithium-ion (Li-ion) battery energy storage systems (BESSs) are critical to the ongoing transition to a net zero economy. While offering a more environmentally conscious energy source, the fire risks associated with Li-ion technology pose challenges to the large-scale adoption of BESSs, particularly in densely populated environments.

This guide examines how Li-ion Tamer® advanced detection technology from Xtralis can reduce insurance risk and liability with Li-ion BESSs while eliminating costly false positives and adding a layer of remote system monitoring. This new approach to fire safety can help protect insurance companies against probable maximum loss (PML) with greater confidence.

Insurers who have an increased understanding of advanced fire prevention solutions will be ahead of their competition in new policy development, risk and liability assessment, and create a safer energy storage market.

## 1. UNDERSTANDING BESS: AN ESSENTIAL COMPONENT OF A LOW CARBON ECONOMY

During the 2021 United Nations Climate Change Conference, countries around the world pledged to achieve net zero by 2050.<sup>1</sup> BESSs have a major role to play in that agreed transition to a low-carbon economy. According to the International Energy Association (IEA), battery storage capacity rose by 50% in 2020, reaching a record-high 5 GW, and to achieve net zero by 2050, global capacity will need to expand 35-fold to 585 GW by 2030.<sup>2</sup>

Lithium-ion is presently the most widely used battery chemistry. Not only is it the preferred battery technology for consumer devices and electric vehicles (EVs) but also it currently dominates the stationary BESS market. The IEA estimates that Li-ion accounted for 93% of new energy storage capacity installed in 2020 (up from 71% in 2015).<sup>3</sup>



Figure 1:  
Multi-cabinet  
utility-grade  
BESS



Figure 2:  
Containerized  
behind-the-  
meter BESS



Figure 3:  
Indoor BESS



## 2. RECOGNIZING THE FIRE DETECTION CHALLENGES IN LI-ION BESS AND WHY IT MATTERS TO INSURERS

Various abuse factors, such as internal damage to a Li-ion cell as well as over-voltage and over-charging can cause a battery's temperature to rise. This can lead to an exothermic reaction known as thermal runaway that manifests itself as smoke, fire and explosions. Thermal runaway is the single biggest risk to BESS property insurers and asset owners, as propagation can lead to increased replacement costs (RC), potential property salvaging, or to the total loss of a project. After extensive research, the Li-ion Tamer team identified the first signs of thermal runaway and used that vital information in the creation of the Li-ion Tamer, the only advanced sensor that can detect electrolyte vapors and be compatible with any system.

A recent UL Firefighter Safety Research Institute study showed that<sup>4</sup> battery electrolyte solvent vapors, also known as off-gases, are released in the initial stages of battery failure that precede thermal runaway. These vapors include various volatile organic compounds (VOCs), which may be flammable, explosive, as well as toxic. Detecting these gases is key to preventing thermal runaway fires. Unfortunately, traditional technologies such as battery management systems (BMSs) and smoke and gas detectors are not capable of detecting these early stage vapors.

As conventional monitoring and smoke detection systems cannot detect these early electrolyte battery vapors, they are unable to identify the early signs of battery failure. By the time these systems activate, thermal runaway is either imminent or underway meaning fire is likely to spread to other cells. Thermal runaway is a major concern for insurance companies that have policies with BESS customers as 100% loss scenarios become more likely and valued policies paid out.

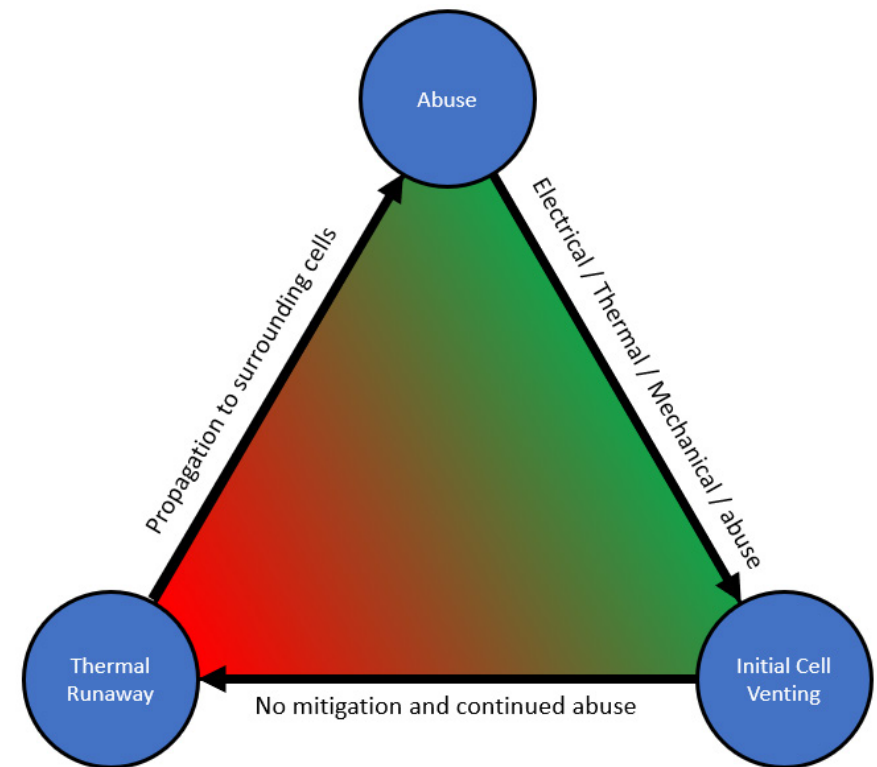


Figure 4: Causes and consequences of thermal runaway in Li-ion BESS

### 3. LOWERING BESS INSURANCE RISK WITH EARLY DETECTION AND AUTOMATED REMOTE RESPONSE

The ability to lower risk and prevent a PML scenario largely depends on reliable early detection and efficient suppression and containment. Li-ion Tamer provides BESSs the earliest possible detection and automated response capability, without requiring any intervention from operators on site. This means damage to the BESS facility and potential disruption to the power grid are minimized, which will also lower the liability of the insured.

Whether installed in a remote, unmanned facility or a battery room inside a high-rise building, Li-ion Tamer works to prevent potential fire threats from spreading further than the affected battery or rack, which increases system reliability. Damaged parts can be repaired or replaced promptly without costly energy supply interruptions.

Here's how the automated remote response process works:

1. Li-ion Tamer sensor detects the presence of VOCs triggering an early warning to the BMS
2. BMS system immediately shuts off all power to the affected cell, electrically isolating the battery
3. Troubled cell is identified and replaced, with no additional damage to the overall system and with no additional suppression triggered

Evidence shows that Li-ion Tamer is highly effective in detecting, isolating and mitigating fire threats early – before they escalate to a thermal runaway event.

In 2019, DNV-GL conducted a comparative analysis of different battery monitoring technologies to assess their effectiveness in detecting thermal runaway.<sup>5</sup>

As Table 1 illustrates, the tests show that Li-ion Tamer was the only sensor that activated before thermal runaway. On average, Li-ion Tamer detects VOCs more than six minutes before thermal runaway.

Perhaps more importantly, testing showed how the electrical isolation measures initiated by Li-ion Tamer were effective in preventing thermal runaway.

	Off-Gas Release	Off-Gas Sensor	Thermal Runaway	Cell Voltage	LEL Sensor
<b>Average time of occurrence relative to thermal runaway (seconds)</b>	-381	-371	0	+7	+28

Table 1: Average responses from sensors in cell level tests (source: DNV)



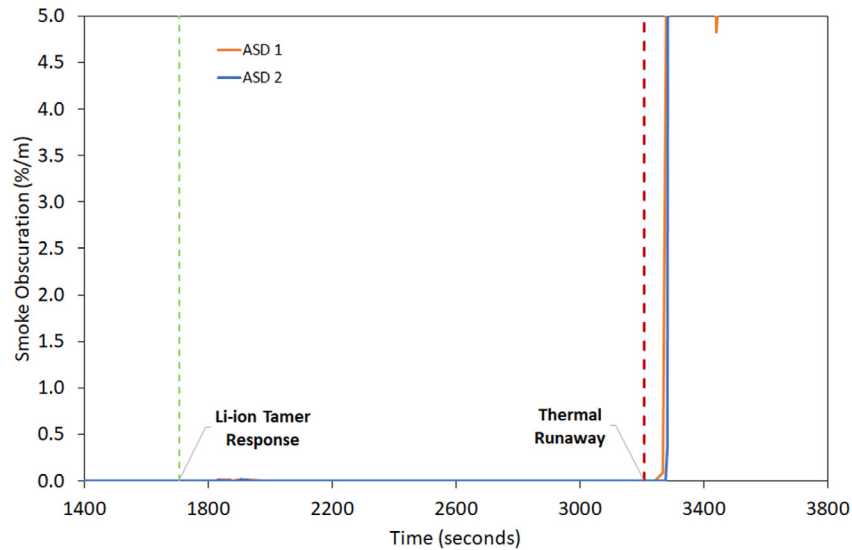


Table 2: Li-ion Tamer and ASD response (Thermal Runaway noted by perforated red line) (Source: Xtralis)

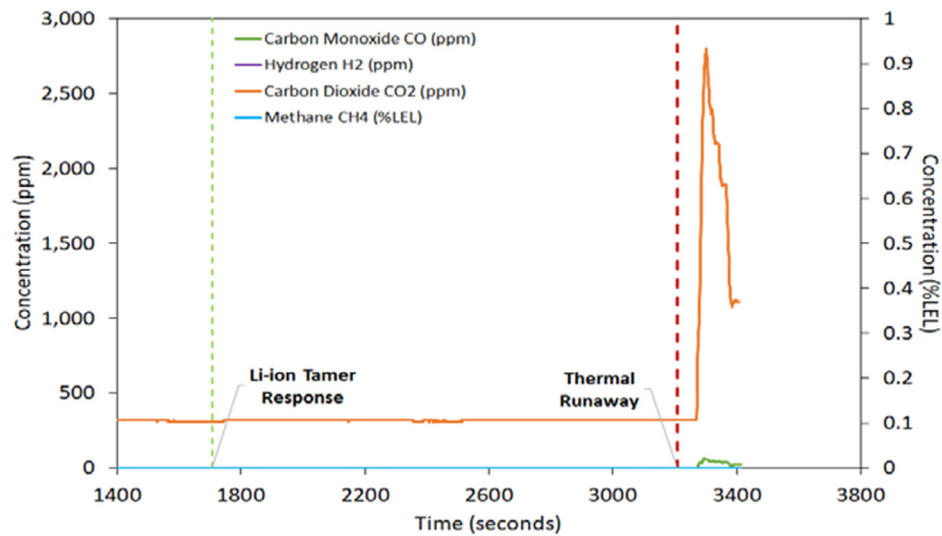


Table 3: Li-ion Tamer and Gas Detectors (AGD) response (Thermal Runaway noted by perforated red line) (Source: Xtralis)

Further testing conducted by Xtralis in 2021 corroborated the DNV-GL report as its investigation also compared the performance of Li-ion Tamer with aspirated smoke detection (ASD) and aspirated gas detection (AGD) technologies.

Tables 2 and 3 show that Li-ion Tamer proved to be the fastest and most effective in detecting the early signs of thermal runaway providing the BMS with a 25-minute warning.





#### 4. AVOIDING FALSE POSITIVES

False alarms, or false positives, can result in unwanted system shutdowns, downtime, and damage due to aggressive automated suppression methods. These catastrophic suppression activation incidents, if not lessened, can result in unneeded real property damage, increased liability for the insured, and RC payouts.

Fire suppression methods such as foam injection or sprinklers are a BESS's last line of defense against fire. If fire suppression is accidentally triggered by a false positive, it can cause unnecessary damage to the BESS and hefty insurance claims.

By design, Li-ion Tamer warns of cell failure before fire suppression is needed saving property and decreasing the BESS' liability and risk. The affected area can be isolated instead of activating foam injection or sprinklers. Hence, the costs of recovering from cell failure are significantly lower and so are insurance claims.

Li-ion Tamer implements false-positive prevention using reference sensors at suitable locations in the battery installation. These sensors are positioned to detect any alien vapors that may enter a battery compartment from outside. If the same vapor is detected at the reference sensor and the battery sensor, it can be prevented from triggering an alarm.

Figure 5: 40ft Containerized BESS



Figure 6: solar power plant BESS



Figure 7: commercial facility battery room

## 5. LESSENING COMPATIBILITY ISSUES

Li-ion Tamer is a versatile solution that accommodates a vast range of lithium-ion battery systems. For the insured, Li-ion Tamer's compatibility with those systems will significantly reduce their risk, which can lead to lower premiums.

The sensors work effectively and provide maximum flexibility in terms of number, position and orientation. The Li-ion Tamer system is easy to integrate into an existing BESS, or new BESS, as it can be adapted to the rack layouts of all the leading manufacturers.

Li-ion Tamer's flexible configuration options, including digital outputs and Modbus, make it compatible with any BMS, making it a safe choice for not only the insured but also insurers.

Figures 5-7 provide real-life examples of different types of BESS applications featuring Li-ion Tamer.



## CONCLUSION

The market for utility-grade and behind-the-meter BESSs is forecast to grow strongly as the push to increase renewable sources of electricity gains strength. The insurance companies underwriting energy storage projects will be critical to the success of this expansion.

No matter the location of the BESS, fire safety is of paramount importance. Li-ion Tamer's advanced electrolyte vapor sensor enables the early detection and prevention of thermal runaway is an optimum choice for BESSs - and the power grid that relies upon them - to operate safely with a reduced risk of possible maximum losses.



<sup>1</sup> UN Climate Change Conference 2021, COP26 Goals, November 2021 [Accessed November 8, 2021]

<sup>2</sup> IEA, Energy Storage, November 2021 [Accessed November 1, 2021]

<sup>3</sup> IEA, Energy Storage, November 2021 [Accessed November 1, 2021]

<sup>4</sup> UL, UL 9540A Installation Level Tests with Outdoor Lithium-ion Energy Storage System Mockups, April 12, 2021 [Accessed November, 11 2021]

<sup>5</sup> DNV-GL, Technical Reference for Li-ion Battery Explosion Risk and Fire Suppression, 2019

## ABOUT XTRALIS



Xtralis is a leading global provider of powerful solutions for the very-early and reliable detection of smoke, fire and gas threats. Our technologies help prevent disasters by giving users time to respond before life, critical infrastructure or business continuity is compromised.

We protect highly valued assets and infrastructure belonging to the world's top governments and businesses.

**To learn more, please visit us at [www.xtralis.com](http://www.xtralis.com)**