

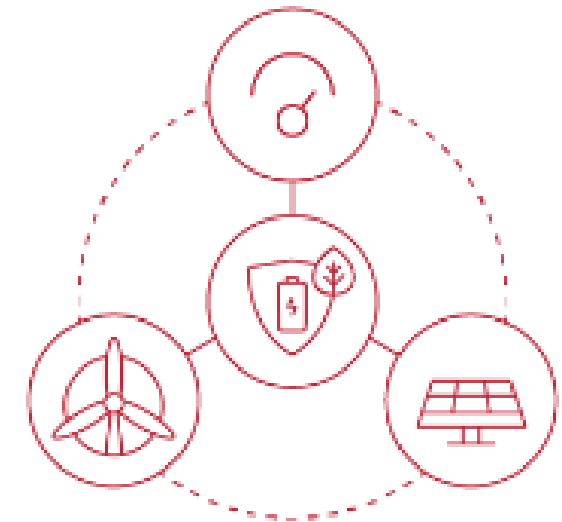


# Fire Suppression for Li-ion Batteries

IESS 2019

Chennai, India

September 2019



# Discussion Points

- Lithium ion batteries are being used in ground, aviation, space, sea, etc. applications in various sizes. They have been introduced in recent years into the utility/stationary energy storage industry
- Tens of thousands to billions of cells manufactured for different types of applications from portable consumer equipment to large stationary ESS.
- The biggest challenge is to **screen and match** every individual cell.
  - Typical COTS and some custom battery manufacturing process does not include cell screening and matching
  - Cells are assembled into batteries in the ‘as received’ condition at lower SOC (typically 40%)
- Concerns arise regarding the safety of these cells and batteries that are shipped as well as used in the field. Are cells or assembled batteries **tested under relevant stringent** conditions before they are transported or sent out into the field?
- In recent years, the Shipping/Transportation industry is facing major challenges in shipping lithium-based cells and batteries.

# Discussion Points

- Lithium-ion battery fires are catastrophic and propagate rapidly as the cells contain a highly flammable liquid electrolyte. Batteries that are typically at high states of charge ( $> 50\%$  SOC) are more prone to go into flames and propagate rapidly as there is more energy than at SOC less than 30%.
- Due to the nature of the fire and its rapid propagation, fire suppression methods are more challenging.
- Battery use in India is in a unique position as it was recently introduced into the automotive and grid stationary energy storage sectors.
- However, fire suppression methods are not fully understood in order to train the first responders who will need to deal with a battery fire be it automotive or grid energy storage batteries.

# Discussion Areas

**Areas of Concern** where fire suppression may be encountered:

- Manufacturing facility
- field use
- transportation
- recycling and disposal

**Studies** on Fire Suppression of Li-ion Batteries

- Not many studies are found in the literature

**Types of Suppressants** studied

- Fire suppressants that have been studied: water, CO<sub>2</sub>, N<sub>2</sub> – ambient and cold, K<sub>2</sub>CO<sub>3</sub> containing fire suppressants (heavy smog), foam
- Studies by various organizations and government agencies have shown that water is the best suppressant for li-ion fires. However, with the size of the batteries growing at this time, high voltage arcing and safety are a major constraint to the use of water as a suppressant.

# Discussion Areas

## **Challenges** with Suppressing Li-ion fires

- A major concern with li-ion systems is that the suppressant needs to reach the area of fire initiation and also be able to cool down all the cells that have had heat transferred from the initiation area.
- Complete cooling is the only way to suppress a li-ion fire. If not, the fire will fester and reignite with full vigor and cause propagation and damage.
- Accessibility of cells inside batteries for the suppressant to cool it down.
- Mitigation of fires and/or mitigation of propagation of a fire.

## **Training** for First Responders and Fire Fighters

- However, fire suppression methods are not fully understood in order to train the first responders who will need to deal with a battery fire be it automotive or grid energy storage batteries.

## **Major Gaps**

- Gaps in understanding and establishing methods of fire suppression
- Establishing regulations and standards for fire fighting

## **Next Steps**

- Research and Development of methods and products
- Collaborations between research organizations and industry