



**SOMPO INTERNATIONAL**

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# Green Fire Safety Issues

An Insurer's View



Mark Redding  
17<sup>th</sup> May 2023



**Not a Doctor**  
(or a Professor)

# Insurance Lesson: Regulation versus Resilience

**Government Objective**

Life safety of the population

Government does not care if your building burns down

**Insurer Objective**

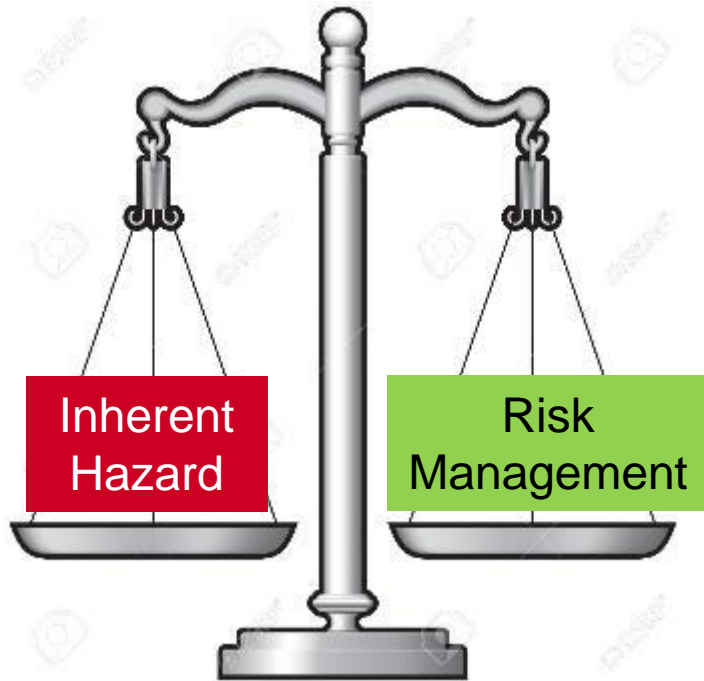
Commercial PROFIT

Insurers DO care if your building burns down

**INEVITABLE CONCLUSION:** Insurers are nicer than Politicians and Civil Servants

**AND...** You should listen to your Insurer

# Risk Selection – a commercial decision



Individual risk selection but based on a foundation of

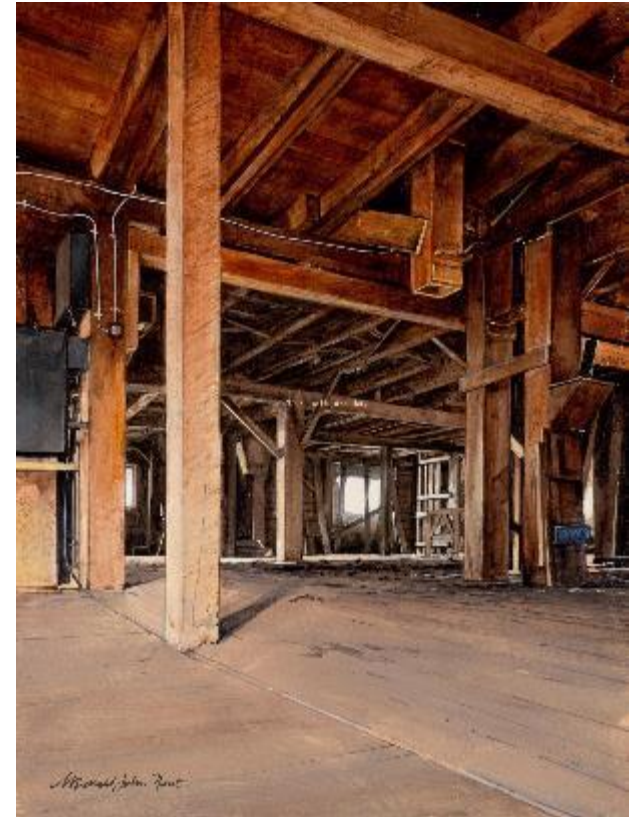
History (1681) and  
Statistics (340 years)  
Personal experience (30+years)

If we don't fully understand it we are far less likely to insure it

# Do we remember the past?

In the 1800's sprinklers were brought in to protect wooden floors in mills

**In the UK we seem to have forgotten again**



# Do we learn from the past?

## Timber



The Insurer  
never forgets

## Polystyrene



# Risk Selection

## What do we like?

- Separation
- Compartmentation
- Resilient materials
- Active fire protections

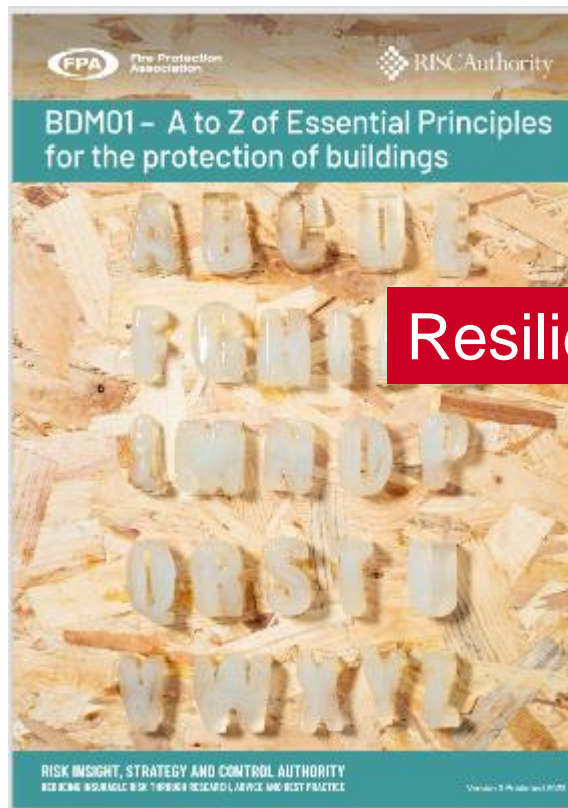
## What do we need?

- Third party certification
- Reference standards (fire testing)
- Quality assurance
- Evidence and documentation



# Insurer Essential Principles

*Not to design and build down to the “life safety before collapse” objective but rather insist upon resilience, beyond Building Regulations.*



## Resilient Buildings

RIBA Plan of Work 2020	Principles	Description	Phase
Work Stage 0 Strategic Definition	A	Strategically Assess Resilience	1 Undertake Early Consultation
	B	Engage Insurers Early	
Work Stage 1 Preparation and Briefing	C	Support Firefighting Operations	2 Prevent Fire Starting
	D	Maximise Non-Combustibility	
	E	Anticipate Arson Attempts	
Work Stage 2 Concept Design	F	Monitor Building Services	3 Lower Property Loss
	G	Address Occupational Issues	
	H	Extend Structural Stability	
	I	Reduce Fire Severity	
Work Stage 4 Technical Design	J	Control Compartment Cavities	4 Enhance Design Robustness
	K	Separate External Openings	
	L	Resist Fire Ingress	
	M	Expect Adverse Weather	
	N	Minimise Consequential Damage	
Work Stage 5 Manufacturing and Construction	O	Facilitate Simple Repair	5 Check Construction Achieved
	P	Plan Salvage Operations	
Work Stage 6 Handover	Q	Follow Identified Standards	6 Improve Facilities Management
	R	Provide Reliable Detection	
Work Stage 7 Use	S	Complete Performance Tests	6 Improve Facilities Management
	T	Procure Quality Materials	
	U	Require Competent Work	
	V	Verify Recorded Information	
Work Stage 7 Use	W	Manage Fire Safety	6 Improve Facilities Management
	X	Action Statutory Assessments	
	Y	Keep Maintenance Commitments	
	Z	Critically Review Experience	

# Sustainability v Resilience Challenge



versus



- **Resilience** and **Sustainability** silos
- **Pace of innovation:** new materials and systems not adequately tested or understood

A **SAFR** (Sustainable And Fire Resilient) approach to building regulation and design is advocated

*NFPA Fire Safety Challenges of 'Green' Buildings and Attributes October 2020*



# Green 'Sustainable' Attributes

Material / System / Feature	Material / System / Feature	Material / System / Feature
<b>Structural Materials and Systems</b>	<b>Exterior Materials and Systems</b>	<b>Alternative Energy Systems</b>
- Lightweight engineered lumber	- Structural integrated panel (SIP)	- PV roof panels
- Lightweight concrete	- Exterior insulation & finish (EIFS)	- Oil-filled PV panels
- FRP elements	- Rigid foam insulation	- Wind turbines
- Plastic lumber	- Spray-applied foam insulation	- Hydrogen fuel cells
- Bio-polymer lumber	- Foil insulation systems	- Battery / energy storage systems
- Bamboo	- High performance glazing	- Cogeneration systems
- Phase-change materials	- Low-emissivity & reflective coating	- Wood pellet systems
- Nano materials	- Double-skin facade	- Building integrated photovoltaics
- Vegetative roof systems	- Bamboo, other cellulosic	- Solar radiance concentration
- Extended solar roof panels	- Bio-polymers, FRPs	<b>Facade Features</b>
- Mass timber (e.g., CLT)	- Vegetative roof systems	- Area of glazing
- Additive manufacturing / 3-D printing	- PVC rainwater catchment	- Area of combustible material

- Conventional timber
- Modern insulations
- Natural materials
- Building systems
- Electricity generation
- Alternative power sources

*“Sustainability arguably does not embrace fire safety, in particular fire resiliency”*

## NFPA Fire Safety Challenges of 'Green' Buildings and Attributes October 2020

- Bio-polymer wall / finishes	- Building integrated carbon capture	- Extent (area) of lawn
- Bamboo walls / finishes	- Organic insulation	- Water catchment / features
- Wood panel walls / finishes	- Composite window framing material	- Vegetation for shading
- Bio-filtration walls	- Mass timber & timber facade systems	- Building orientation
- Glass walls	- Ultra-High Performance Concrete	- Increased building density
- FRP flooring	- Additive manufacturing / 3-D printing	- Localized energy production
- Bio-polymer flooring	- Hempcrete	- Localized water treatment
- Bamboo flooring	<b>Building Systems</b>	- Localized waste treatment
- Interior vegetation	- Natural ventilation	- Reduced water supply
- Skylights	- High volume low speed fans	- Hydrogen infrastructure
- Increased acoustic insulation	- Refrigerant materials	- Community charging stations
- Reflecting panels / solar tubes	- Grey-water for suppression	- EES fuel loads / hazards
- Mass timber (e.g., CLT)	- Rain-water for suppression	- EV fuel load / hazards / chargers
<b>Interior Space</b>	- On-site water treatment	- Propane vehicle hazards
- Tighter construction	- On-site waste treatment	- Fuel cell vehicle hazards
- Higher insulation values	- On-site cogeneration	- Bicycle storage impact exits
- More enclosed spaces	- High reliance on natural lighting	- Reduced FD apparatus access
- More open space (horizontal)	- Heat pumps	- Denaturation / fire spread
- More open space (vertical)	- Interior EV charger	- EV chargers on building exterior

- Low carbon materials
- Innovative materials
- Internet of Things
- Living walls and roofs

*NFPA Fire Safety Challenges of 'Green' Buildings and Attributes October 2020*



# Green Utopia or Insurance Nightmare?

- CLT (wooden structure)
- Living roofs (combustible membranes / insulation and vegetation)
- Green walls (see above)
- Irrigation systems
- PV panels, inverters and batteries
- Electric charging points (inverters, batteries etc)
- Bike and scooter charging



## How do we:

- Compartmentalise?
- Protect the structure?
- Manage the fire risk?
- Manage the occupants?
- Dry out the building?

# “AN” insurer view

1. Out of Scope
2. Materials
  - we understand
  - we don't understand
3. Building systems
4. Resource conservation and power generation
5. Technology



# 1. Out of Scope

- Waste recycling
- Waste to energy
- Biomass (anaerobic digestion)
- Hydrogen
- Other alternative vehicles, ethanol vehicles and fuel cells



ACCEPTABLE SUBJECT TO HIGH STANDARDS OF PROTECTION AND MANAGEMENT



WATCHING BRIEF ON HYDROGEN



# 2. Materials: testing challenges

EN Standard	Material Class	Test Method	Commentary	Additional Evidence
EN 10242-1	Structural steel	EN 10242-1	...	...
EN 10242-2	Structural steel	EN 10242-2	...	...
EN 10242-3	Structural steel	EN 10242-3	...	...
EN 10242-4	Structural steel	EN 10242-4	...	...
EN 10242-5	Structural steel	EN 10242-5	...	...
EN 10242-6	Structural steel	EN 10242-6	...	...
EN 10242-7	Structural steel	EN 10242-7	...	...
EN 10242-8	Structural steel	EN 10242-8	...	...
EN 10242-9	Structural steel	EN 10242-9	...	...
EN 10242-10	Structural steel	EN 10242-10	...	...
EN 10242-11	Structural steel	EN 10242-11	...	...
EN 10242-12	Structural steel	EN 10242-12	...	...
EN 10242-13	Structural steel	EN 10242-13	...	...
EN 10242-14	Structural steel	EN 10242-14	...	...
EN 10242-15	Structural steel	EN 10242-15	...	...
EN 10242-16	Structural steel	EN 10242-16	...	...
EN 10242-17	Structural steel	EN 10242-17	...	...
EN 10242-18	Structural steel	EN 10242-18	...	...
EN 10242-19	Structural steel	EN 10242-19	...	...
EN 10242-20	Structural steel	EN 10242-20	...	...

## Global Standards of Fire

### Combustibility tests

### Resistance to fire

### Flame

### Interpretation of Results

### Supplier Obfuscation

### SOMPO INTERNATIONAL

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**Fire tests on composite panels**

- EN 13501-1:2018
- EN 13501-2:2018
- EN 13501-3:2018
- EN 13501-4:2018
- EN 13501-5:2018
- EN 13501-6:2018
- EN 13501-7:2018
- EN 13501-8:2018
- EN 13501-9:2018
- EN 13501-10:2018
- EN 13501-11:2018
- EN 13501-12:2018
- EN 13501-13:2018
- EN 13501-14:2018
- EN 13501-15:2018
- EN 13501-16:2018
- EN 13501-17:2018
- EN 13501-18:2018
- EN 13501-19:2018
- EN 13501-20:2018
- EN 13501-21:2018
- EN 13501-22:2018
- EN 13501-23:2018
- EN 13501-24:2018
- EN 13501-25:2018
- EN 13501-26:2018
- EN 13501-27:2018
- EN 13501-28:2018
- EN 13501-29:2018
- EN 13501-30:2018
- EN 13501-31:2018
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- EN 13501-38:2018
- EN 13501-39:2018
- EN 13501-40:2018
- EN 13501-41:2018
- EN 13501-42:2018
- EN 13501-43:2018
- EN 13501-44:2018
- EN 13501-45:2018
- EN 13501-46:2018
- EN 13501-47:2018
- EN 13501-48:2018
- EN 13501-49:2018
- EN 13501-50:2018

## 2. Materials we understand - polystyrene

- Composite panels
- Roof insulation (inverted roofs)
- Green roofs
- Structural insulated panels (SIPs)
- External insulation (ETICs)
- Insulated concrete formwork (ICF)



*Leipzig Fire Tests*

**MARGINALLY ACCEPTABLE IN VERY SPECIFIC CIRCUMSTANCES**



*SIPs*



*ICF*



*ETICs*

## 2. Materials - recycled

- Insulation e.g.
  - glass foam
  - plastics
  - textile fibres
- Circular Steel

CONSIDER IMPACTS ON INHERENT DEFECTS LIABILITY INSURANCE

LIKELY TO BE ACCEPTABLE SUBJECT TO

- TRACEABILITY
- TESTING
- UKAS ACCREDITED TEST HOUSES
- DOCUMENTATION AND RECORDS

The screenshot shows the 'circular ecology' website with the tagline 'Making A Difference Together'. The main heading is 'Embodied Carbon - The ICE Database'. The text explains that embodied carbon is the amount of carbon (CO<sub>2</sub> or CO<sub>2</sub>e) emitted to produce a material, measured from cradle to factory gate. It also mentions that the ICE Database provides embodied carbon data for building materials and construction products, and that the UK's Intergovernmental Panel on Climate Change (IPCC) is the primary source for carbon emission factors.

The screenshot shows the 'Circular Steel' website with the tagline 'ALL ABOUT STEEL REUSE'. The text below the heading reads: 'Welcome to Circular Steel, where industry experts and thought leaders collaborate to create a more circular steel industry.'

## 2 Materials we (I) don't understand

- **Low carbon emission concrete** - fire safety challenges, in particular when it is very low porosity
- **Ultra-high performance concrete** - very little testing under load; challenges with spalling
- **Carbon-reinforced concrete** - steel - fire performance
- **Hempcrete** - bearing - be used as load-
- **Interactive polymer concrete** - hanging material
- **Natural organic insulation** (e.g. reeds, bagasse cattail, corn cob, cotton, date palm, durian, oil palm fiber, pineapple leaves, rice, sansevieria fiber, sunflower and straw)

**MAY BE ACCEPTABLE SUBJECT TO**

- SUITABLE APPLICATION

- IMPROVED INSURER UNDERSTANDING

- ACCREDITED TESTING

- DOCUMENTATION AND RECORDS





### 3. Building Systems - Façade Challenges - example

#### Five different types of cladding

- Non-combustible board and metal stud detail changed during construction to bitumen impregnated softboard (Class F) on timber frame

- Rendered EPS, ACM; HPL; PIR insulation (Class E)

ACCEPTABILITY SUBJECT TO **(CONFIRMED)** ABSENCE OF COMBUSTIBLE ELEMENTS AND **VERIFIED** CONSTRUCTION DETAILS

- Cavi

1. Sto Rend
2. EPS (Class E) & 200mm Mineral Wool (Class A1) Fire Barriers to floor levels and above windows
3. Versapanel Sheathing Board (Class B)
4. Timber Frame with mineral wool insulation
5. 2 layers of Fireboard Lining (60 mins fire rating)



1. 102.5mm Facing Brickwork
2. 50mm Cavity
3. 40 mm Kingspan TW55 PIR Cavity Insulation (Class E)
4. 15mm Bitroc Sheathing Board (Class F)
5. Timber Frame with mineral wool insulation
6. 2 layers of Fireboard Lining (60 mins fire rating)

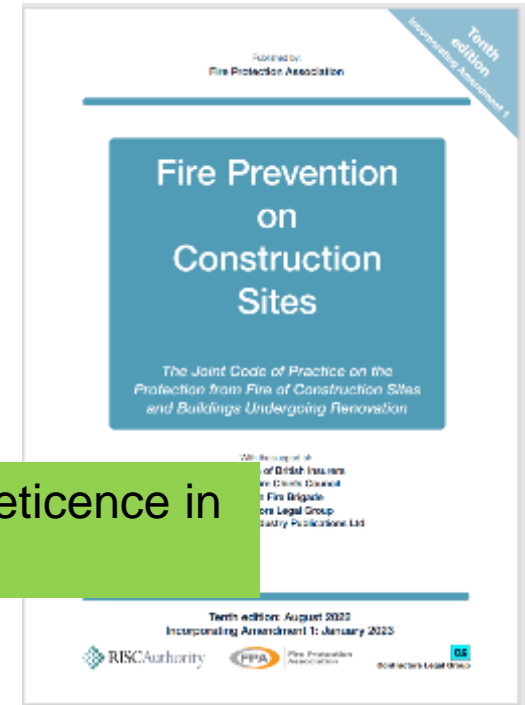
1. 8mm Trespa Meteor High Pressure Laminate (HPL) Panel (Class D)
2. 40mm Ventilated Cavity
3. 60mm Kingspan K15 PIR Cavity Insulation (Class C)
4. 15mm Bitroc Sheathing Board (Class F)
5. Timber Frame with mineral wool insulation
6. 2 layers of Fireboard Lining (60 mins fire resistance).
7. Open grille steel balconies

- inaccurate as-built drawings
- Limited product information
- Intrusive survey required

### 3. Building Systems - lightweight timber frames

- Resistance completely dependent on the correct application of fire-resistant materials
- Very heavy reliance on the quality of the workmanship
- Only required to resist a fire starting from the inside

Houses likely to be fine. There may be a degree of reticence in insuring large timber framed structures



### 3. Building Systems - Modular Construction

- Large variety of systems and material combinations
- Absence of large scale fire testing
- Treatment of voids is critical
- Enhance
- **Documentary and on-site evidence of workmanship standards**
- **If it is already built how can insurers make a valid judgement?**

**MAY BE ACCEPTABLE SUBJECT TO INSURER INVOLVEMENT IN DESIGN AND CONSTRUCTION**

**(AND THE MATERIALS USED)**



### 3. Building Systems – Cross Laminated Timber (CLT)

- Fire testing still relatively limited
- Ability to withstand burn-out unproven
- Structure continues to add to the fire load once the “test fails”
- Reliant on
- Exposed timber is aesthetically desired
- Partial replacement will be a challenge

**MAY BE ACCEPTABLE SUBJECT TO INSURER INVOLVEMENT, AN APPROPRIATE LEVEL OF MITIGATION AND LIMITATION OF VALUES AT RISK**

*“Massive timber building designs are being proposed of a form and at a construction scale that is running ahead of current scientific understanding, testing and research”*



- Potential mitigations**
- Separation
  - Compartmentation
  - Active protection
  - NC insulation
  - NC facades
  - Water management

### 3. Building Systems - Green Roofs

- Vegetation, roof insulation, membranes and geotextiles are made from combustible materials.
- Minimal fire testing on green roofs
- The risks can be managed by:
  - prevent
  - avoidin
  - creating effective fire breaks
  - reducing the organic content of the growing medium
  - increasing the non-combustible content of the growing medium



ACCEPTABILITY LIKELY TO BE DEPENDENT ON A PARTICULAR INSURER'S EXPERIENCE (AND PERCEPTION) AND PROPORTION OF ROOF COVERED

Fire Performance of Green Roofs and Walls

Page 12 of 12  
Department of Construction, Local Government



### 3. Green Walls

- Combustible materials; plastic membranes, irrigation systems, planting modules, and plant material.
- Fire risk may be influenced by weather changes and maintenance standards.
- Fairly standard **ACCEPTABILITY LIKELY TO BE DEPENDENT ON A PARTICULAR INSURER'S EXPERIENCE (AND PERCEPTION)**
- Testing and certification methods for the approval of these cladding systems are considered inappropriate



*mandarin Oriental fire is believed to have been caused by the by-product of arc welding landing on the felt lining of the planting facade.*

FPA Fire Protection Association | RISC Authority

#### Green Wall Design and Maintenance Guide

**Background**  
Green walls are a sustainable building solution that provides many benefits. They improve air quality, reduce noise, and enhance the aesthetic appeal of buildings. However, they also present unique challenges, particularly in terms of fire safety. This guide provides essential information for designers and building owners to ensure that green walls are safe and effective.



**Key Considerations**  
When designing a green wall, it is crucial to consider the fire risk. Key factors include the materials used, the irrigation system, and the maintenance requirements. It is essential to ensure that the green wall does not become a fire hazard and that it can be safely maintained.

# Materials and Systems - Insurance summary

- Credible fire testing is critical
- Insurer reticence in the absence of detailed information and **independent accreditation**
- **Defects liability insurance cover may be a challenge**
- **Property cover may be a challenge without full disclosure**

***A lack of historic data is a challenge difficult to surmount in the short term***

## 4. Resources - Solar Photovoltaic (PV) Systems

- What are they being installed on?
- What are they made of - glass/glass or glass/foil
- Fire Service access
- Isolation
- Location of inverters
- Cabling and fire separation
- Space between the roof and the panel: flue and debris
- Maintenance



*Combustible root insulation*



*106 point checklist*



*17 point checklist*



## 4. Resources - Building Integrated Photovoltaics (BIPV)

- Enhanced inception hazard?
- External fire spread?
- Partial replacement
- Insurance placement (loss estimates)



IN THE WORDS OF DONALD RUMSFELD  
**“A KNOWN UNKNOWN”**  
INSURERS MIGHT ASSUME THE WORST

## 4. Resources – (small scale) battery charging

- Counterfeit equipment
- Faulty equipment
- Damaged equipment
- Overheating / over-cooling
- Overcharging
- Over-discharging



HOW DO WE MANAGE THE RESIDENTIAL RISK?

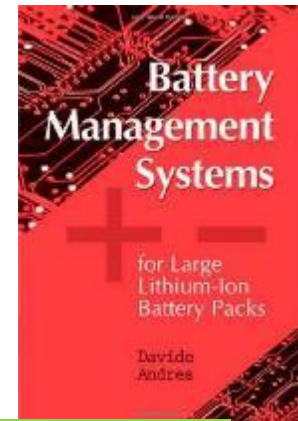


## 4. Resources - vehicle charging

- Located outside
- Located inside
  - Access for fire fighting
  - Fire segregation and separation
  - Fire protections
  - Ventilation
- Spatial separation
- Protection against damage
- Signage
- Appropriate electrics and protection



## 4. Resources – commercial battery use / storage



EACH SITUATION JUDGED ON ITS MERITS

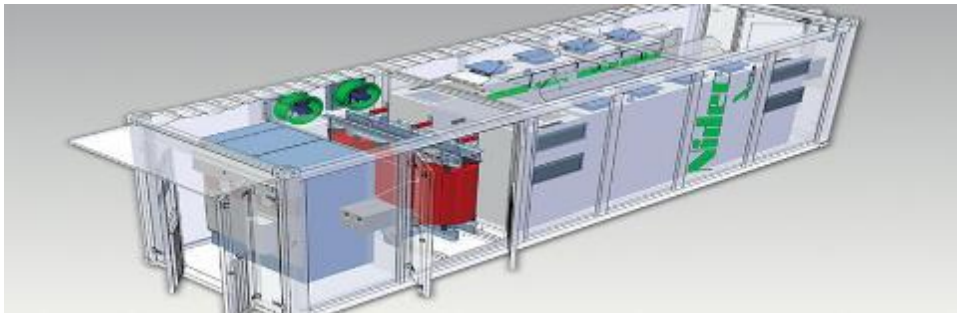


## 4. Resources - Energy Storage Systems

- Location
- Fire compartmentation
- Monitoring and BMS
- Isolation
- Fire protections
- Explosion / pressure venting



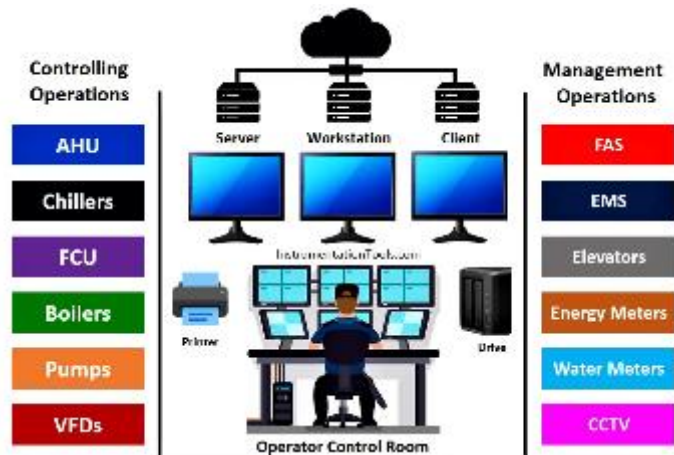
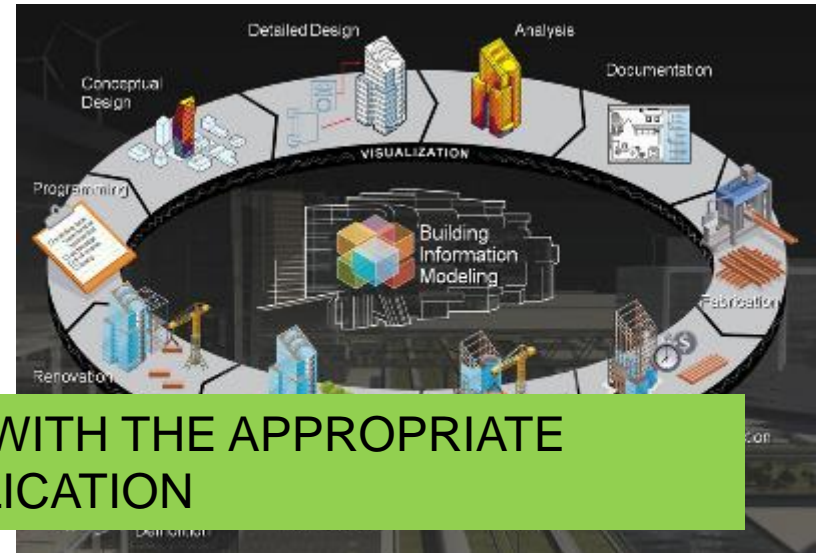
ACCEPTABLE IF GUIDANCE AND PROTECTION STANDARDS ADHERED TO



# 5. Technology

- Building Information Modelling (BIM)
- Building Management Systems (BMS)
- Internet of Things (IOT)
- Plant monitoring
- Water use monitoring

HIGHLY BENEFICIAL WITH THE APPROPRIATE APPLICATION



# In Summary

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- **Early insurer engagement** (professional indemnity, construction, defects liability, building and contents)
- Fire safety needs to be considered early in the green **design process** (products, systems and fire service issues)
- Better provision of **information** – better insurance terms
- Better granularity and comparability in **incident reporting**
- More robust and **appropriate testing regimes** (integration of green and fire-safe agendas)
- **More research** is required on PV-systems, various façade systems, mass and high-rise wood construction, densification, energy storage systems, renovation practices and the use of recycled materials NFPA Fire Safety Challenges of 'Green' Buildings and Attributes October 2020
- Advancement of **SAFR** (Sustainable And Fire Resilient) approach to building regulation and design

