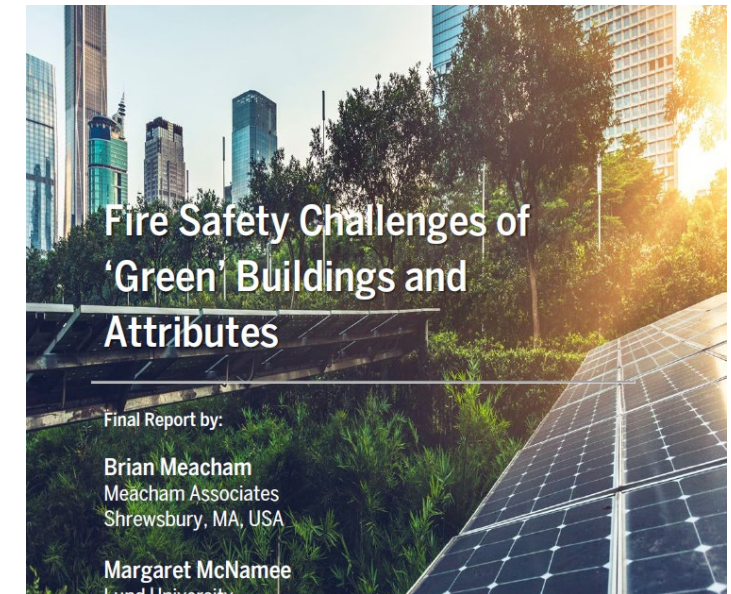


# Sustainable fire safety - an oxymoron or simply common sense?

Professor Margaret McNamee, Fire Safety Engineering, Lund University





## Background

- 2019 Fire Protection Research Foundation (FPRF) commissioned a Research Roadmap to investigate the Environmental Impact of Fires
- 2020 launched update of investigation of Green buildings and attributes including the concept of SAFR-Buildings
- 2021 launched a joint project with FPRF and French National Funding to create a database of existing fire emission factors (EF), develop a limited number of new EFs, and investigate scaling between different test methods
- **Special thanks to co-authors:** Guy Marlair and Benjamin Truchot (INERIS), Brian Meacham (Meacham Associates), and Joakim Åström (LU)

# Societal Challenges

- that fire research can help address

- Population growth, urbanization and globalization
- Climate change, resiliency and sustainability
  - Sustainable fire safety key





# Climate change, resiliency and sustainability

- Key messages from IPCC 6<sup>th</sup> Assessment reports:
  - Human influence on the climate system is clear
  - Human induced climate change is already here
  - The present scale of disruption of our climate is unprecedented and will continue
  - Global warming is likely to continue and will take a long time to reverse (if ever)
  - We can expect increasing weather volatility in the future



Flooding in Germany, 2021

Source: By Bärwinkel,Klaus-Own work, CC BY-SA 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=107579247>

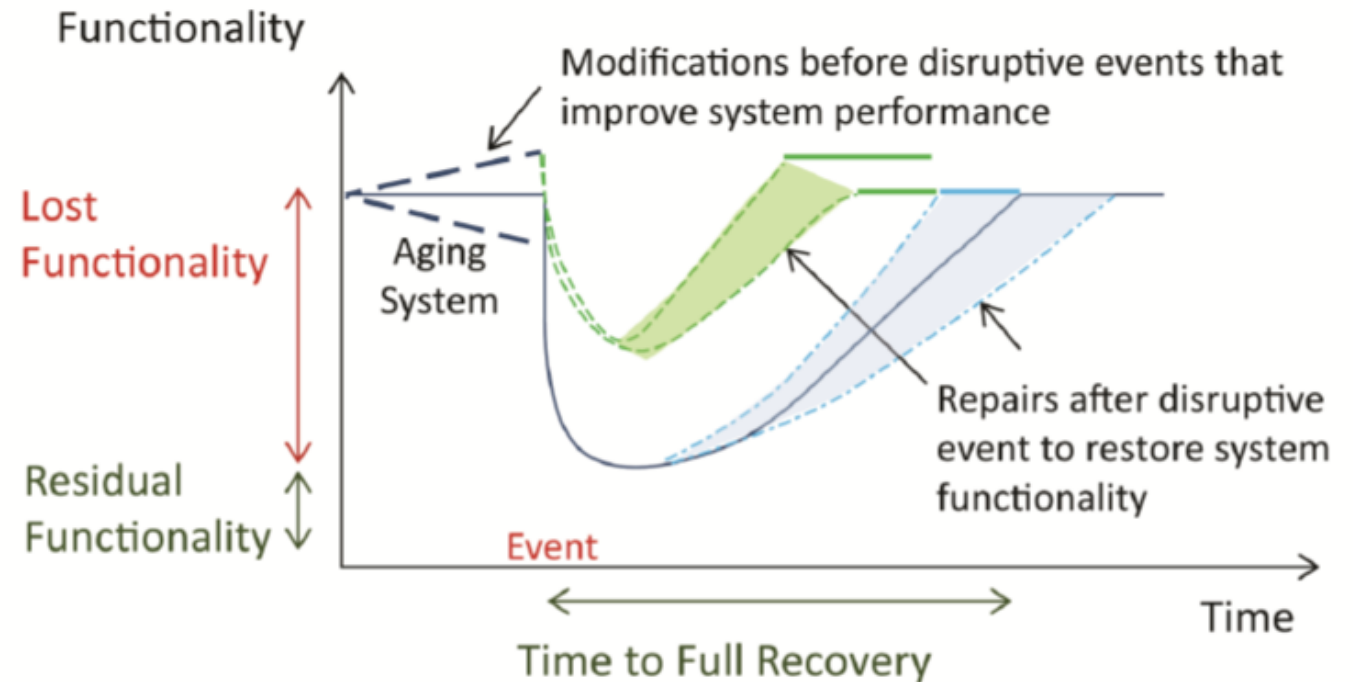


Wildfire in Greece , 2021

Source:  
<https://www.theguardian.com/world/2021/aug/09/wildfires-rage-Greece-Italy-eu-mounts-firefighting-operation-evacuations-destruction-southern-europe>

# Climate change, **resiliency** and sustainability

- Ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events
- Resiliency in built environment – buildings that are able to withstand the ‘typical’ and ‘extreme’ loading



Meacham, B.J. (2018). *Building Community Resilience through Modern Model Building Codes*, ICC, Washington, DC.

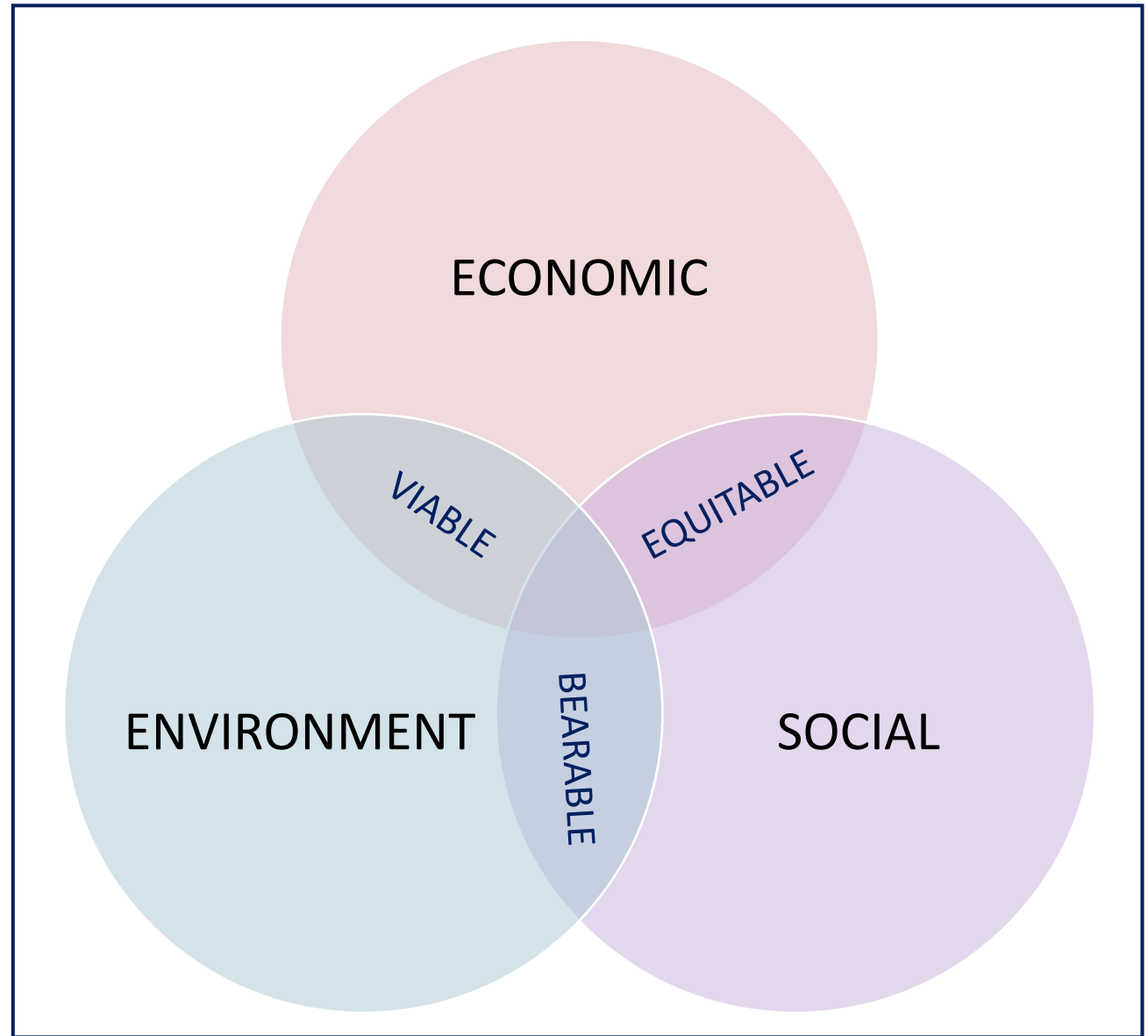
## Climate change, resiliency and sustainability

- A sustainable society meets our present needs without compromising the ability of future generations to meet their needs

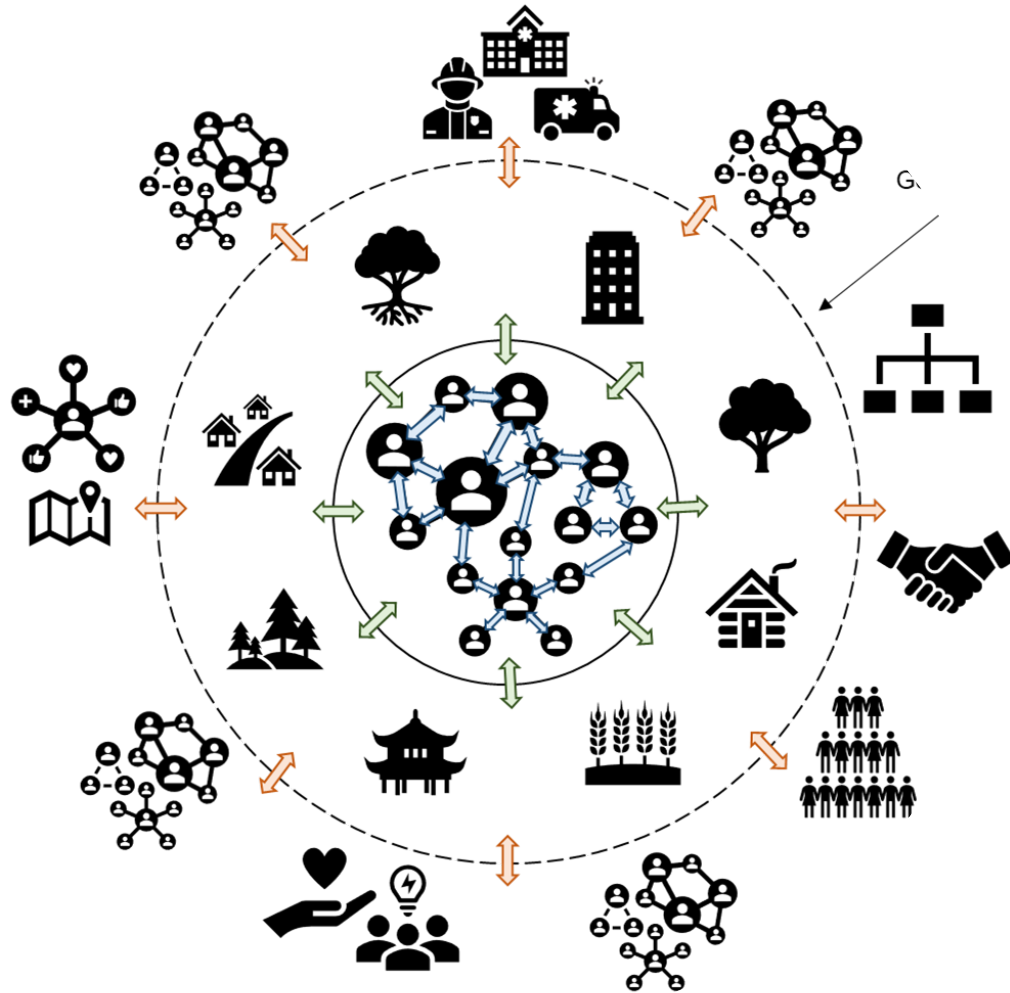
(Brundtland Report, 1987)

- Economic, social and environmental issues tend to be dealt with separately. They are different dimensions of sustainability and need to be considered together.

(Agenda 21, 1992)

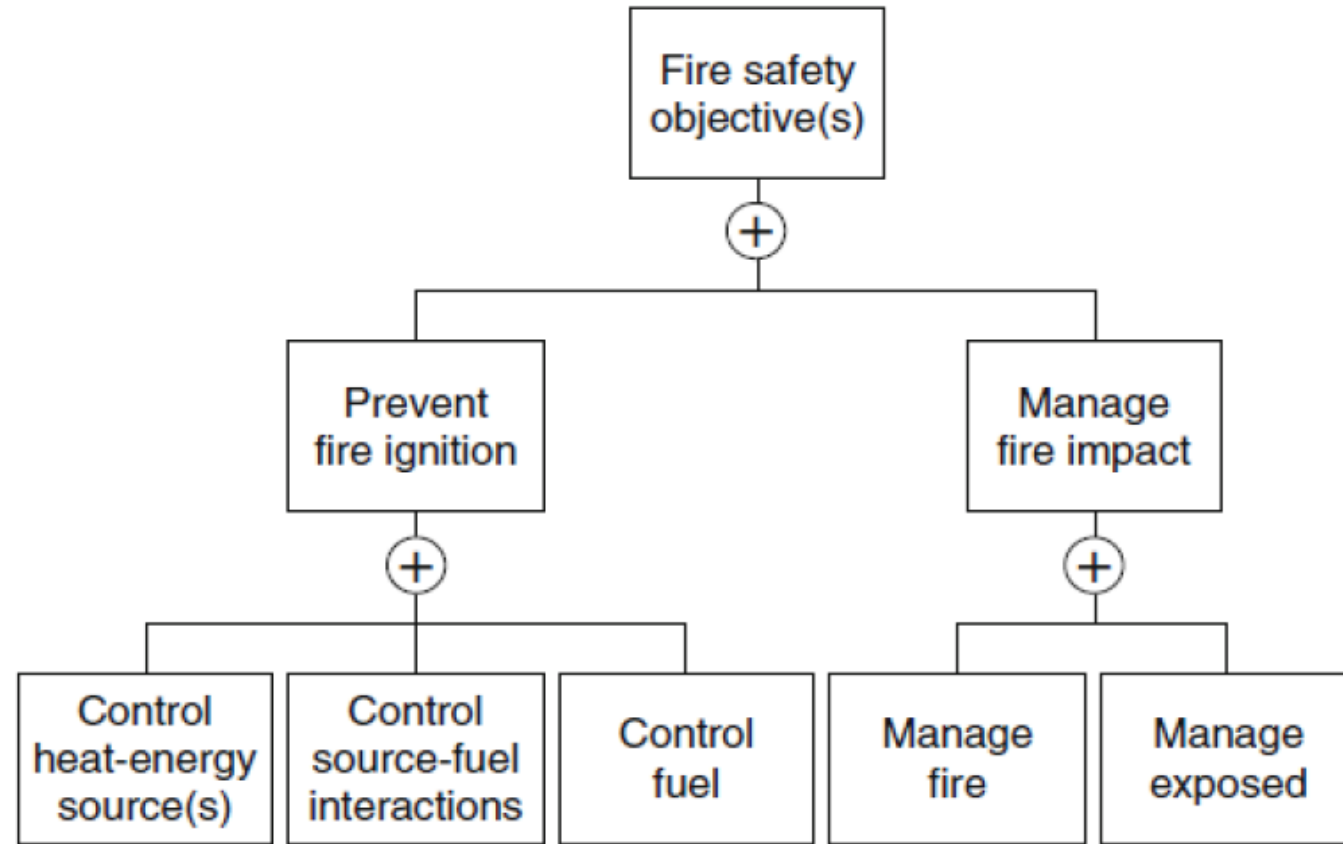


# Connections which Create the Ecosystem



- Innovations do not occur in a vacuum – people and their connections provide the context for regulators, innovators and users
- Historical regulatory requirements
- Modern societal challenges prompt extraregulatory responses
- Contextual understanding of the communities and how to foster sustainable safety and resilience is key to being ahead of the curve
- Understanding drivers of change (e.g. zero energy buildings) helps prepare for safe AND sustainable solutions

# Fire Resilience Strategies for Buildings



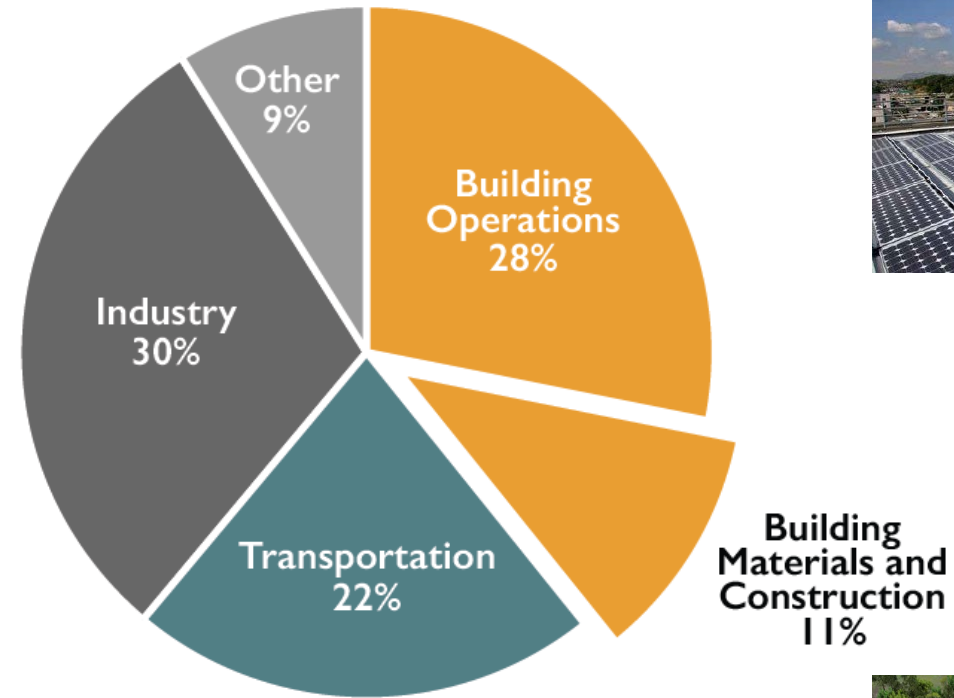
NFPA 550 (2017). Fire Safety Concepts Tree. NFPA. Quincy. MA



# Sustainability objectives for buildings

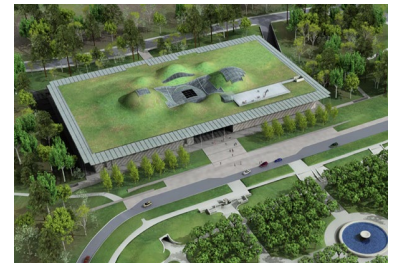
- Reduce energy from fossil fuel sources
- Reduce construction materials, *make sustainable material choices*
- Reduce transportation
- Reduce industry waste

Global CO<sub>2</sub> Emissions by Sector



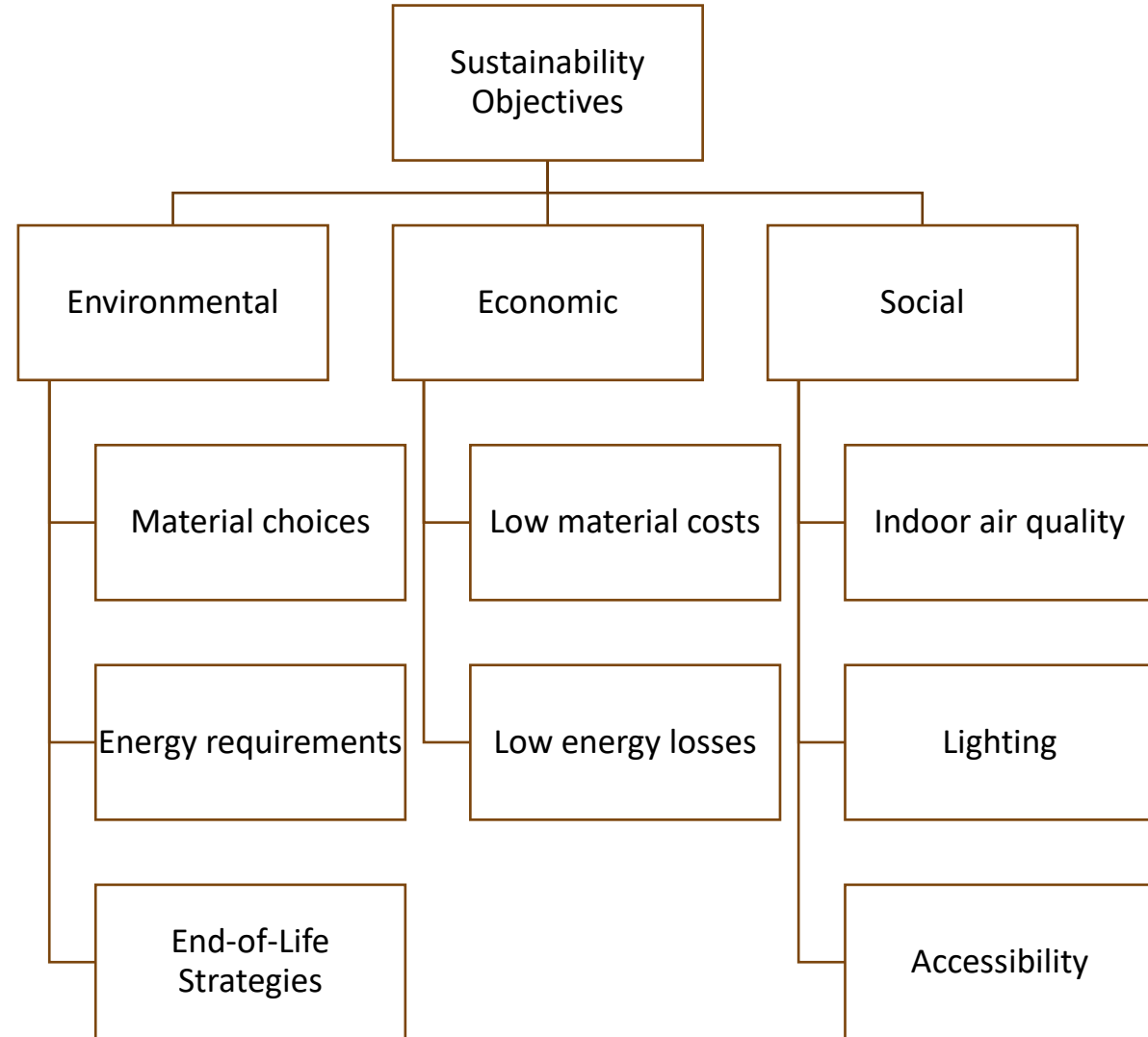
Source: © 2018 2030, Inc. / Architecture 2030. All Rights Reserved. Data Sources: UN Environment Global Status Report 2017; EIA International Energy Outlook 2017

<https://architecture2030.org/new-buildings-embodied/>



# Sustainability Strategies for Buildings

Similar thinking to  
the NFPA 550 Fire  
safety concepts tree



# Extraregulatory initiatives

## -- Green certification systems



WGBC has >50 rating tools



Smart Green Building  
Australia



CERTIFIED BY





# What the Media Tells Us



Grenfell Tower Fire (Natalie Oxford, 2017)

This file is licensed under the Creative Commons Attribution 4.0 International license (<https://creativecommons.org/licenses/by/4.0/deed.en>). Photo downloaded from [https://commons.wikimedia.org/wiki/File:Grenfell\\_Tower\\_fire.jpg](https://commons.wikimedia.org/wiki/File:Grenfell_Tower_fire.jpg)



Warehouse Fire, Delanco, NJ  
(Courtesy of New Jersey State Fire Marshal Office)



Fire in Timber Frame Apartment Building Under Construction  
(Source: Captain John Bonadio, Waltham Fire Department, as published at <https://www.enr.com/articles/42484-what-local-officials-want-to-do-about-wood-frame-building-fires-in-massachusetts>), Courtesy of Waltham, Massachusetts Fire Department)



# Sustainable and Fire Resilient Buildings (SAFR-Buildings)

- There is clearly a need for, and benefits of, healthy and safe buildings
- Sustainability and resiliency are *equally important* concepts for meeting these societal needs
- SAFR-Building mindset can avoid potentially competing objectives for better overall societal benefit

# What do we mean by buildings?

- 80% of building stock projected in 2050 is already built
- 1% new buildings per year
- 1-2% of existing buildings renovated per year
- Need up to 5% renovation rate to reach climate goals
- Need to consider both NEW and EXISTING SAFR-Buildings



Pudong, Shanghai, China

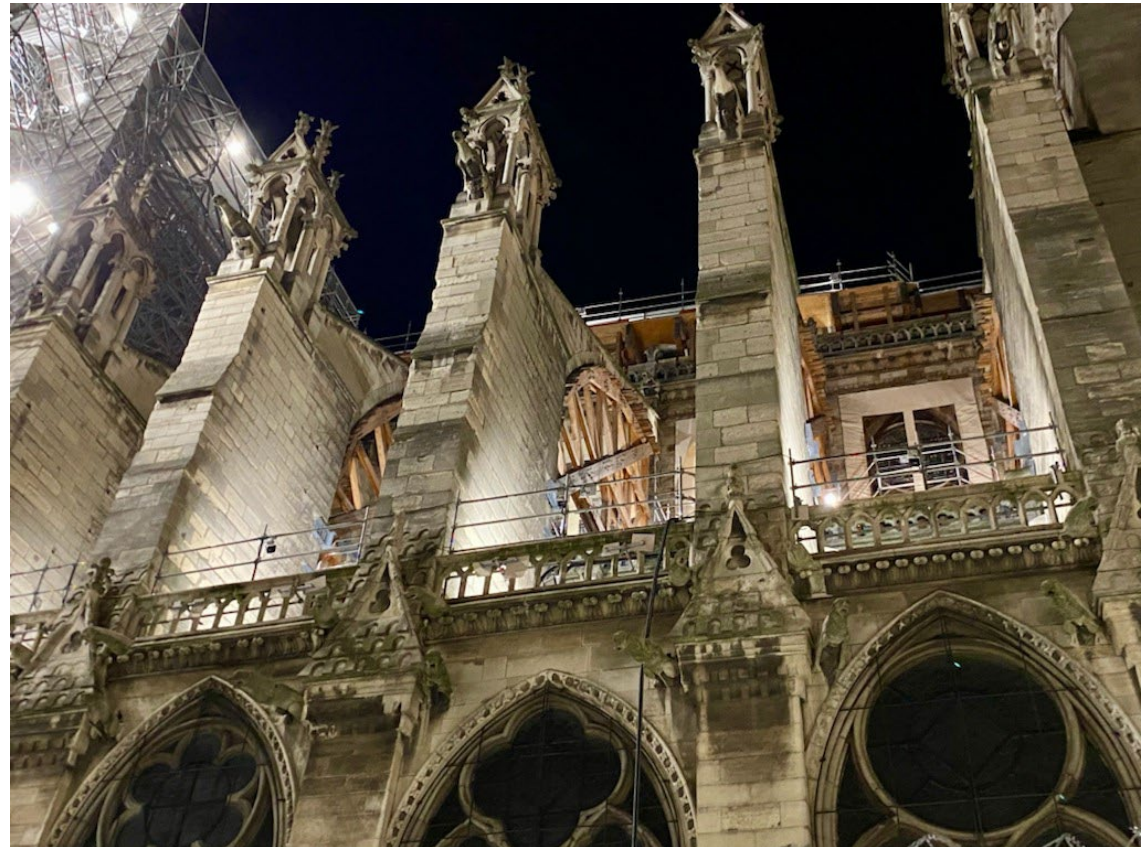
(Source: Wikimedia CC BY-SA 4.0)

# Renovation of existing buildings



**Notre Dame, April 2019.**

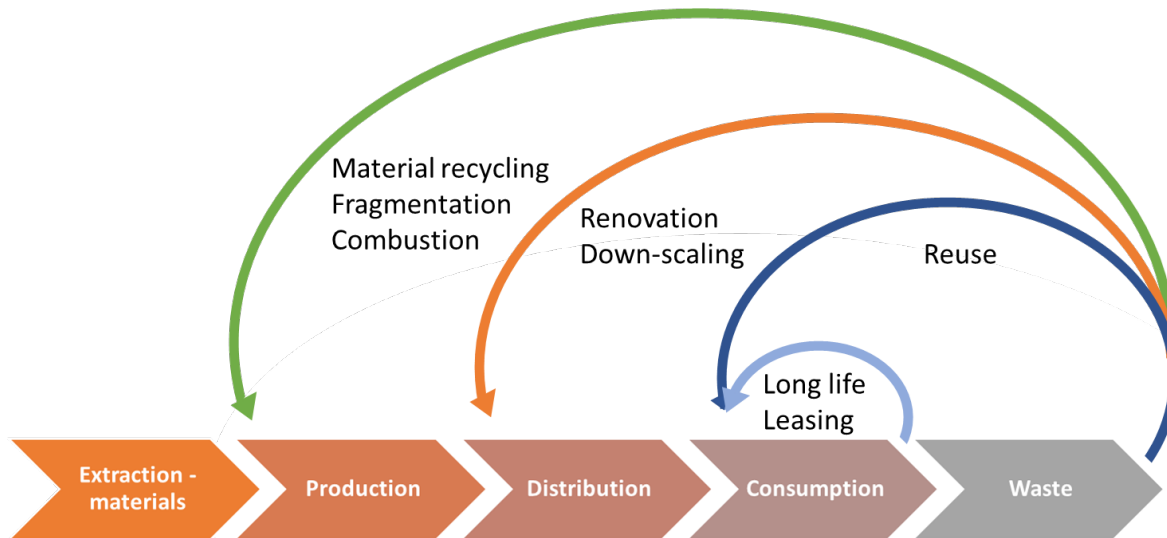
Source: Wikimedia Commons



**Notre Dame, August 2021.**

Photo: Robert McNamee

# Sustainable business models – need to be safe

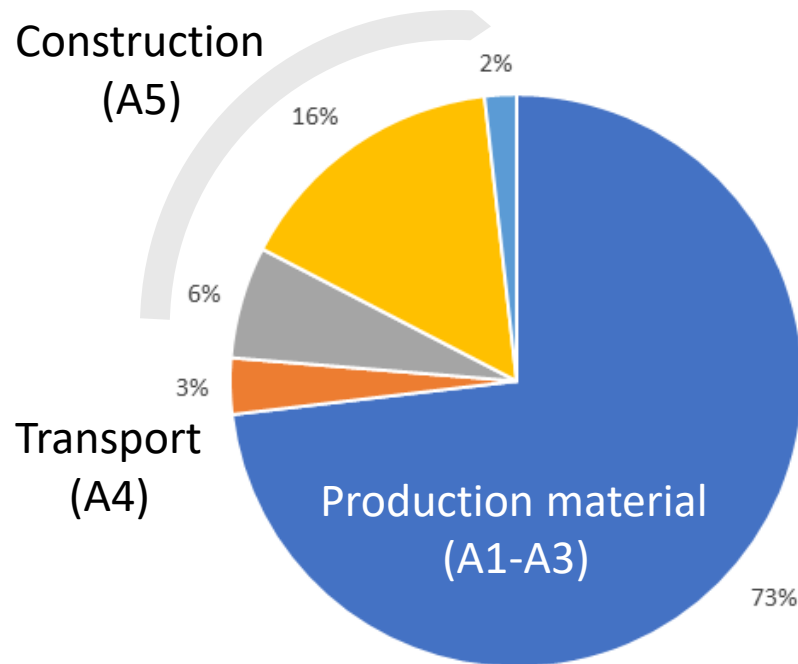


Linear vs. Circular Economy

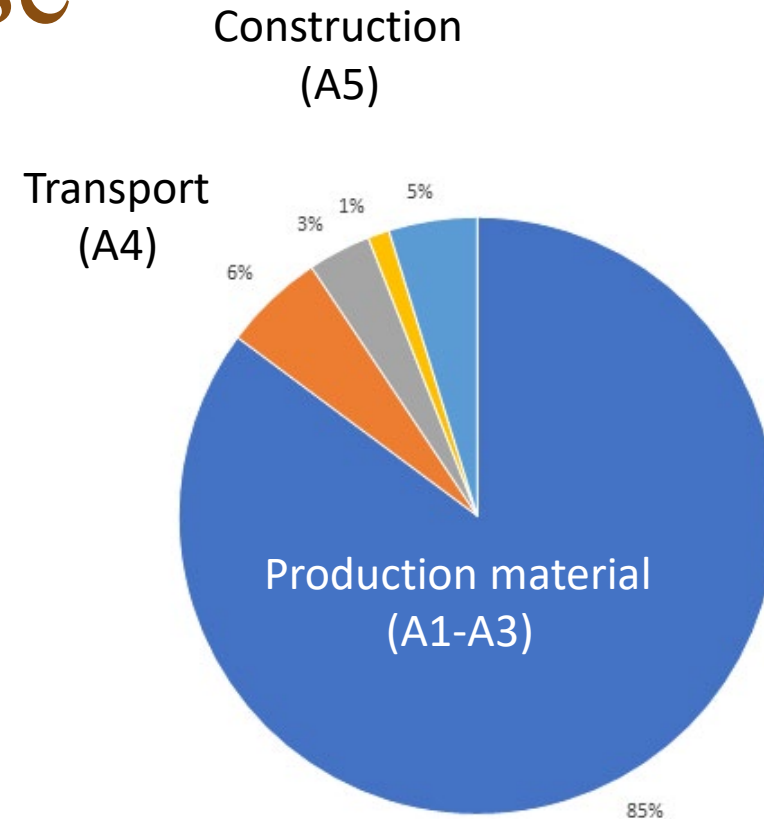
- Increasing circularity requires new ways of dealing with past fire safety products, materials and practices
- Second hand markets are growing and professionalising



# Recycling and Reuse



Wooden building



Concrete building

Calculated according to EN 15798

(Source: McNamee, M., Göras, T., Wetterqvist, C., Lundh, K., Blomqvist, P., & Blomqvist, S. (2021). *Hållbar hantering av byggavfall, återbruk av brandklassade produkter* [Research Report](2021:7). Brandforsk.

<https://www.brandforsk.se/?projekt=hallbar-hantering-av-byggavfall-aterbruk-av-brandklassade-produkter>)



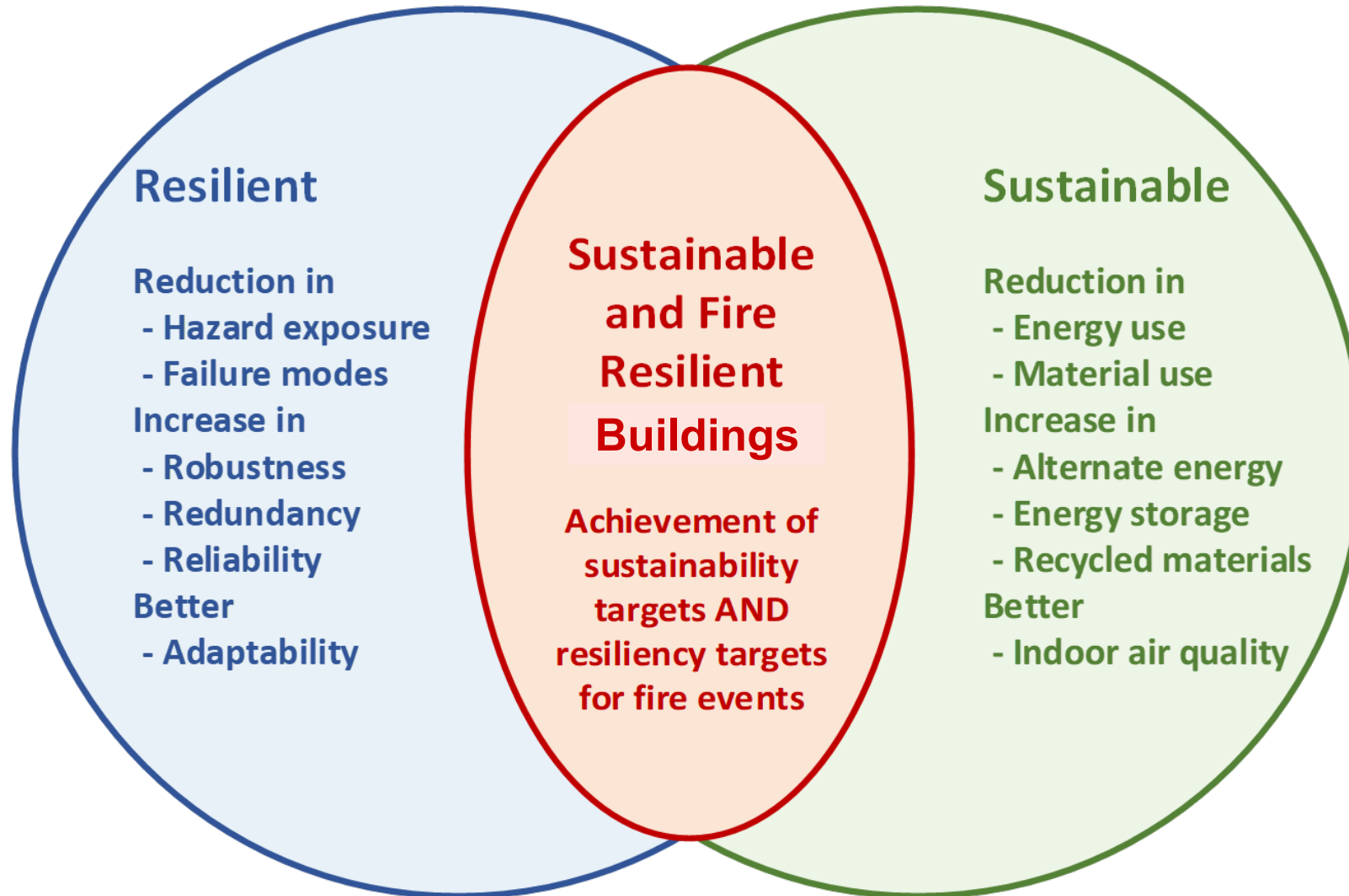
# The future of buildings is green!

- “A ‘green’ building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. ‘Green’ buildings preserve precious natural resources and improve our quality of life.” (WGBC)

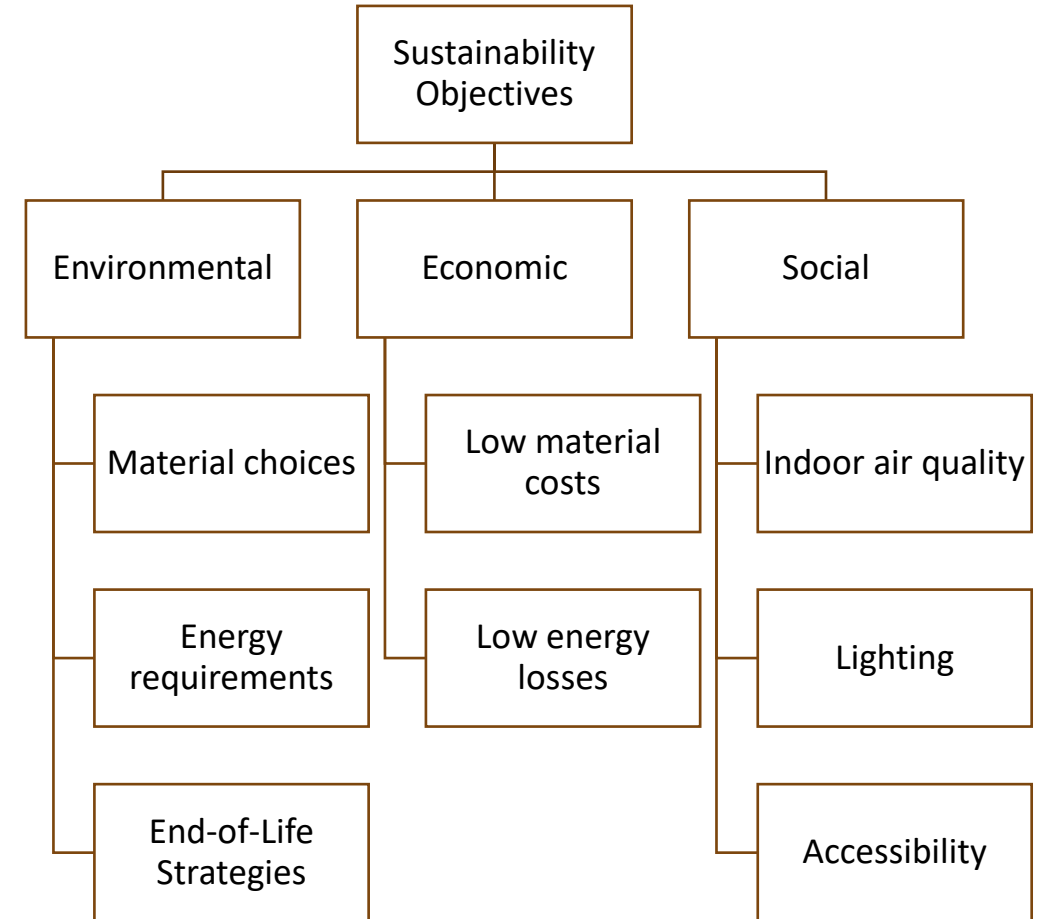
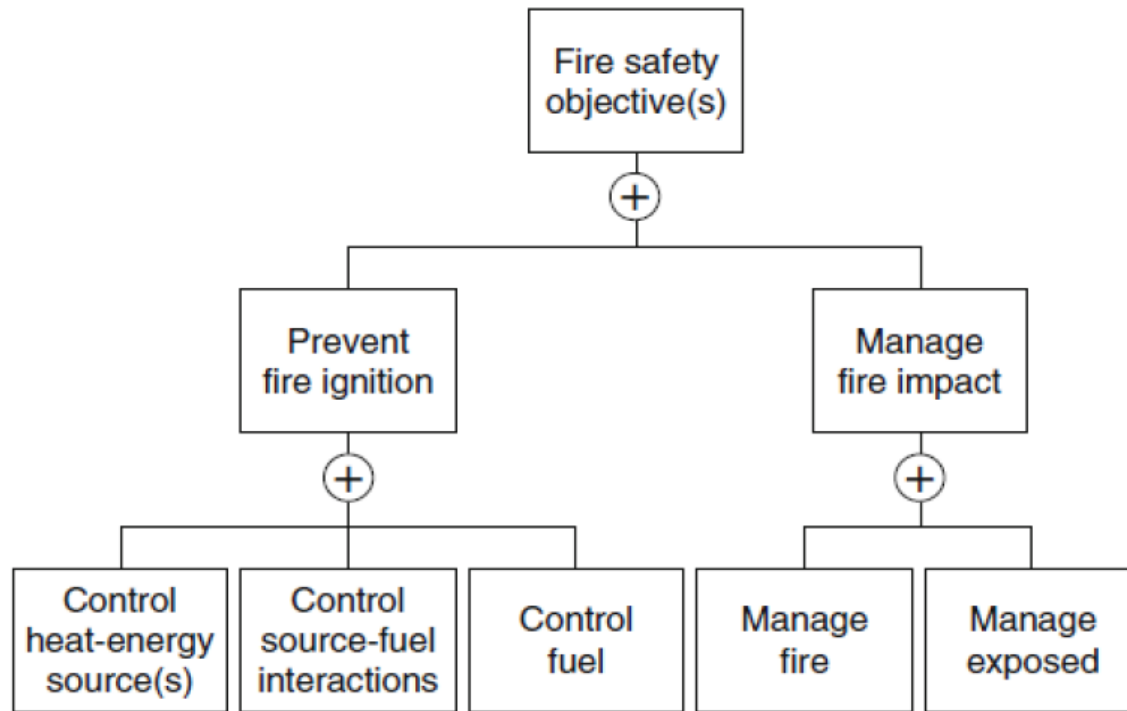




# Design strategies

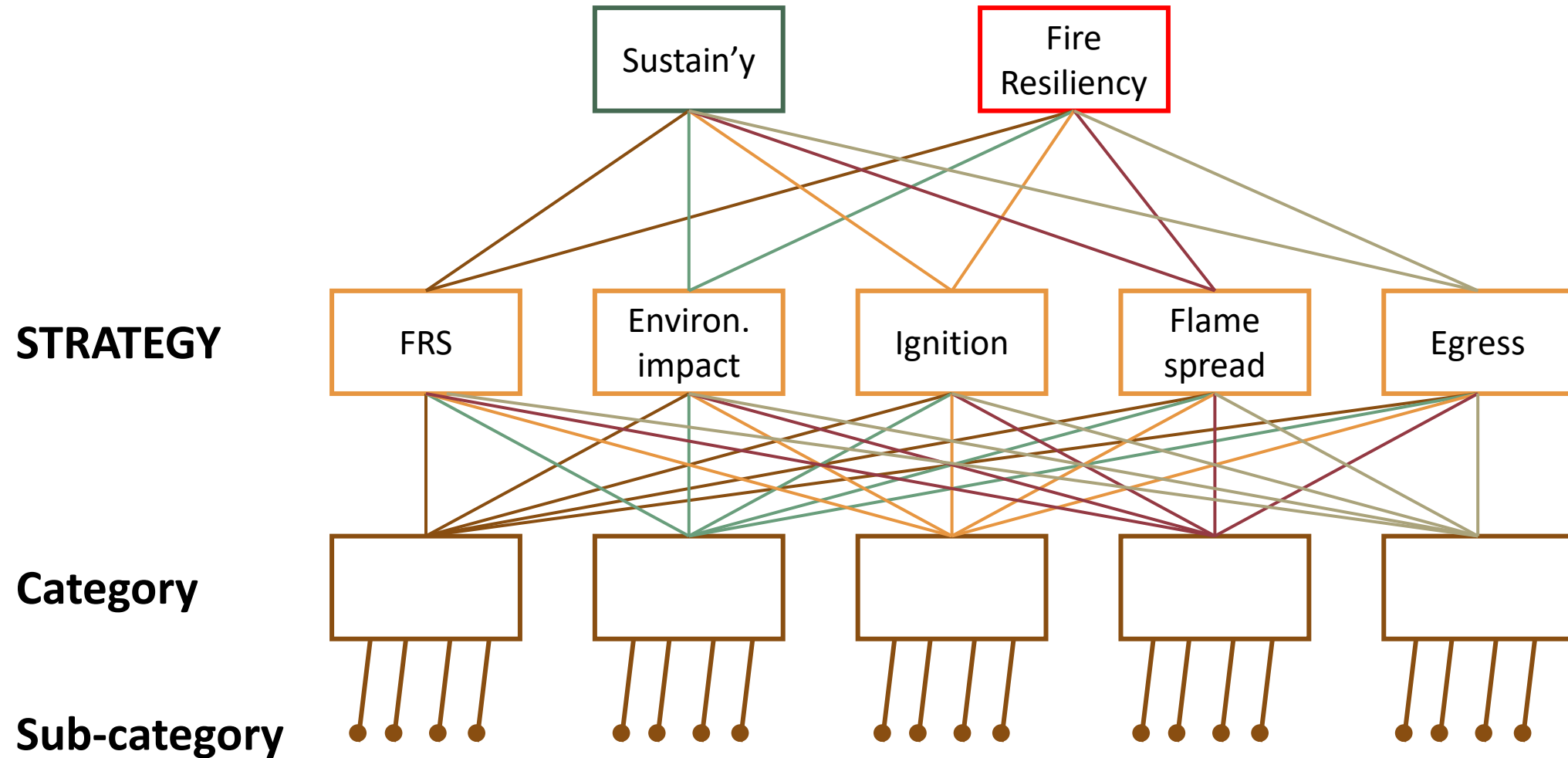


# SAFR-Building Strategies





# The devil is in the detail!



# Holistic thinking for sustainability and safety

- Balancing risk & performance in terms of
  - societal objectives (to create modern, sustainable buildings);
  - the attributes of the buildings (materials, systems and design features); and,
  - control mechanisms that are put in place to ensure that these buildings safe (regulations, standards and guidelines).



Meacham, B.J. and M.M. McNamee, *Fire Safety Challenges of 'Green' Buildings and Attributes*. Research Report, 2020, Fire Protection Research Foundation: Quincy, USA.

# Achieving sustainable fire safety

- If we do not consider the impact of fires and fire safety on the environment as a fundamental aspect of sustainability we risk fixing one problem while creating another
- All facets of sustainability need to be considered as part of the SAFR-Building concept, i.e. solutions must be economically palatable to be bearable, ecologically viable to be acceptable and socially equitable to create lasting positive change
- Fire safety can be an enabler of innovation if we leverage the multifaceted approach given by consideration of sustainability
- Context is key!



Source: Brian Meacham (2020)



<https://greystarenews.com/events/business/corporations-are-leading-us-solar-surge/>

<http://abclocal.go.com/wpvi/gallery?section=news/local&id=9226626&photo=1>

Brian J. Meacham  
Margaret McNamee *Editors*

# Handbook of Fire and the Environment

Impacts and Mitigation

## New Handbook of Fire and the Environment

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- Raise awareness about environmental impacts of fire and fire suppression, primarily within the fire engineering and firefighting communities, but also within the environmental engineering and planning disciplines.
- Provides readers with a fundamental understanding of the problem and its magnitude and includes a set of tools and methods for assessing environmental, social and financial impacts, and for identifying and selecting appropriate mitigation options.
- Presents previously unavailable material on identification, assessment and mitigation of environmental fires

<https://link.springer.com/book/10.1007/978-3-030-94356-1>



# THANK YOU!

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