

# Fifty Shades of Building Science

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“A significant achievement of the first industrial age was the emergence of building science, particularly the elastic theory of structures. With it, mathematical models could be used to predict structural performance with considerable accuracy, provided there was adequate quality control of the materials used ... Euler’s theory of column buckling (1757), ... English scientist Thomas Young’s modern definition of the modulus of elasticity ... Louis Navier ... theory of beams ... forces from Newton’s laws of motion ...”

*Encyclopædia Britannica*



// Building science is a field of knowledge that draws upon physics, chemistry, engineering, architecture, and the life sciences. Understanding the physical behavior of the building as a system and how this impacts energy efficiency, durability, comfort and indoor air quality is essential to innovating high-performance buildings.

*WBDG, NIBS*



// “Building science provides the language, framework, and systems thinking to make our buildings resource-efficient, comfortable, and durable in a changing environment with ever-increasing demands for efficiency and durability.”

*Peter Yost, BuildingGreen*

// Building science is defined as ...

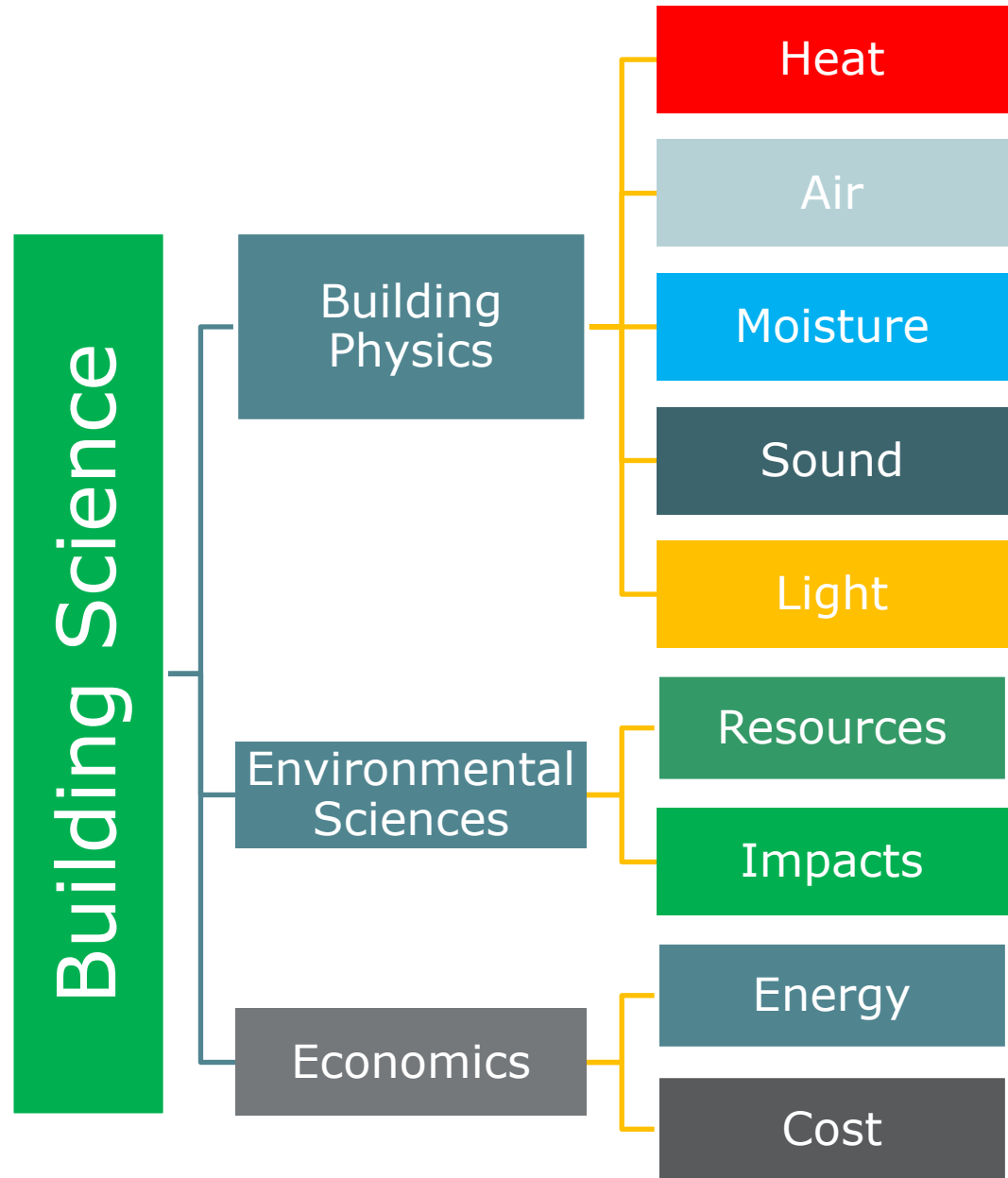
... ?"

*U.S. Department of Energy*

- Race to Zero
- Guidelines for Building Science Education
- Building Science Education Solution Center
- Building America Solution Center



## Definition - Differentiation



## □ Sources:

- Published *Competition Guide* documents by DOE
- Published presentations of winners only

## □ Limitations:

- No second-place winners
- No (public) access to *Technical Volume I* over all years

## Meta Analysis Terms

- Building Science
- Durability
- Resiliency
- Control
- Control (not system)
- Control layers
- Air
- Moisture
- Hygrothermal
- Thermal bridging
- Lighting
- Noise (or acoustic)

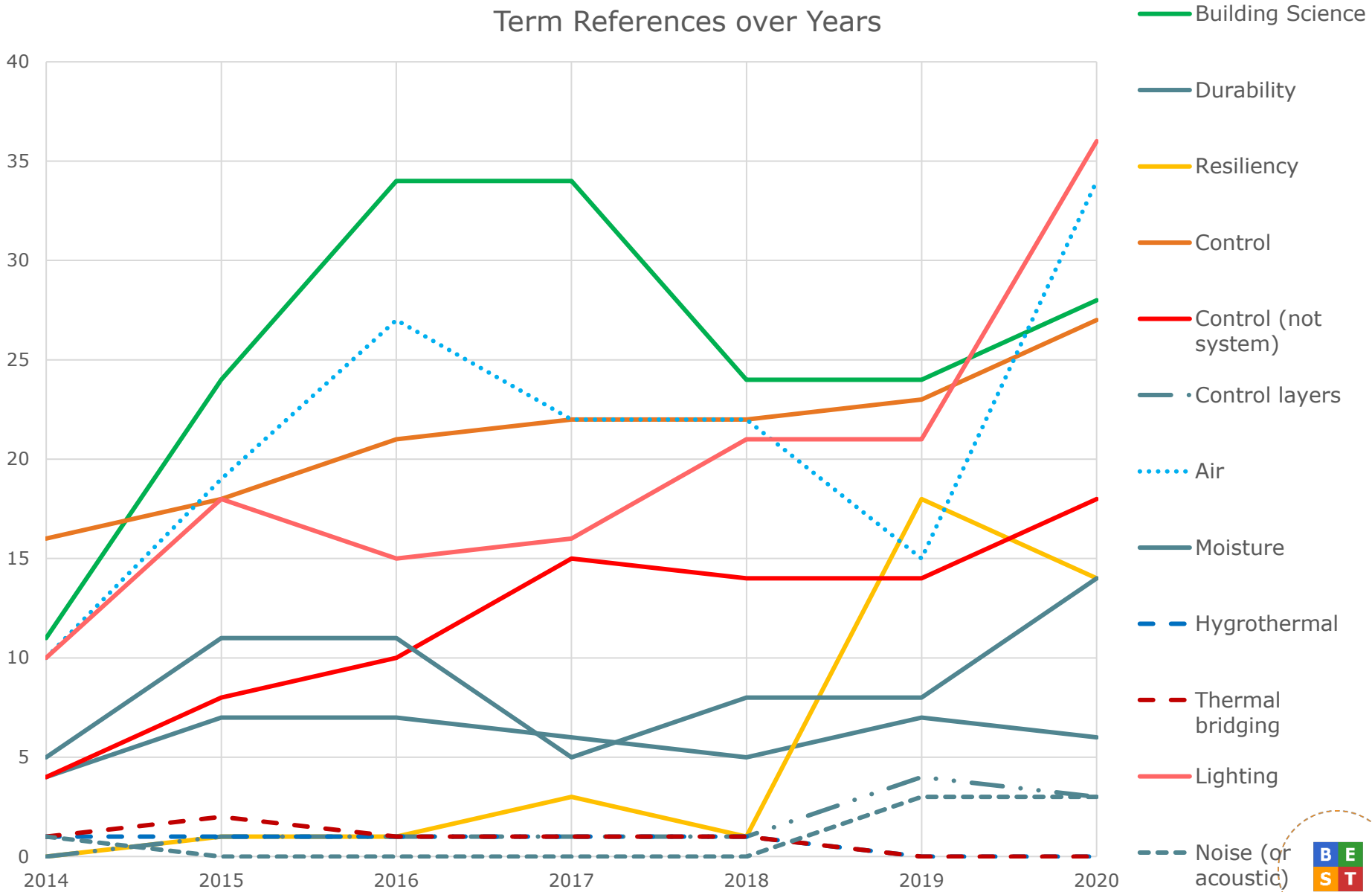
## Content Analysis Topics

- Heat
- Air
- Moisture
- Light
- Acoustics
- Control Layers
- Durability

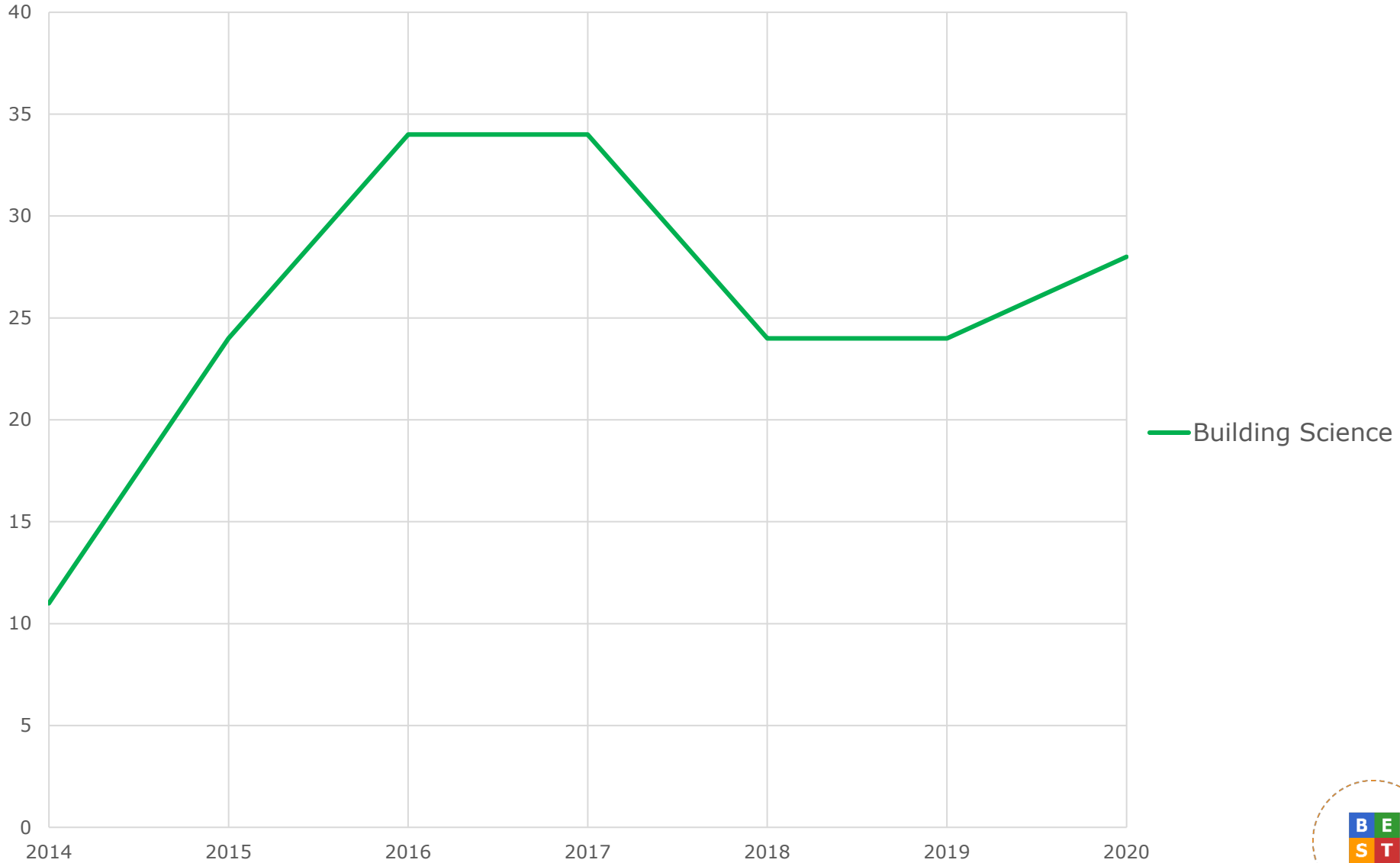


# Guideline Meta Analysis

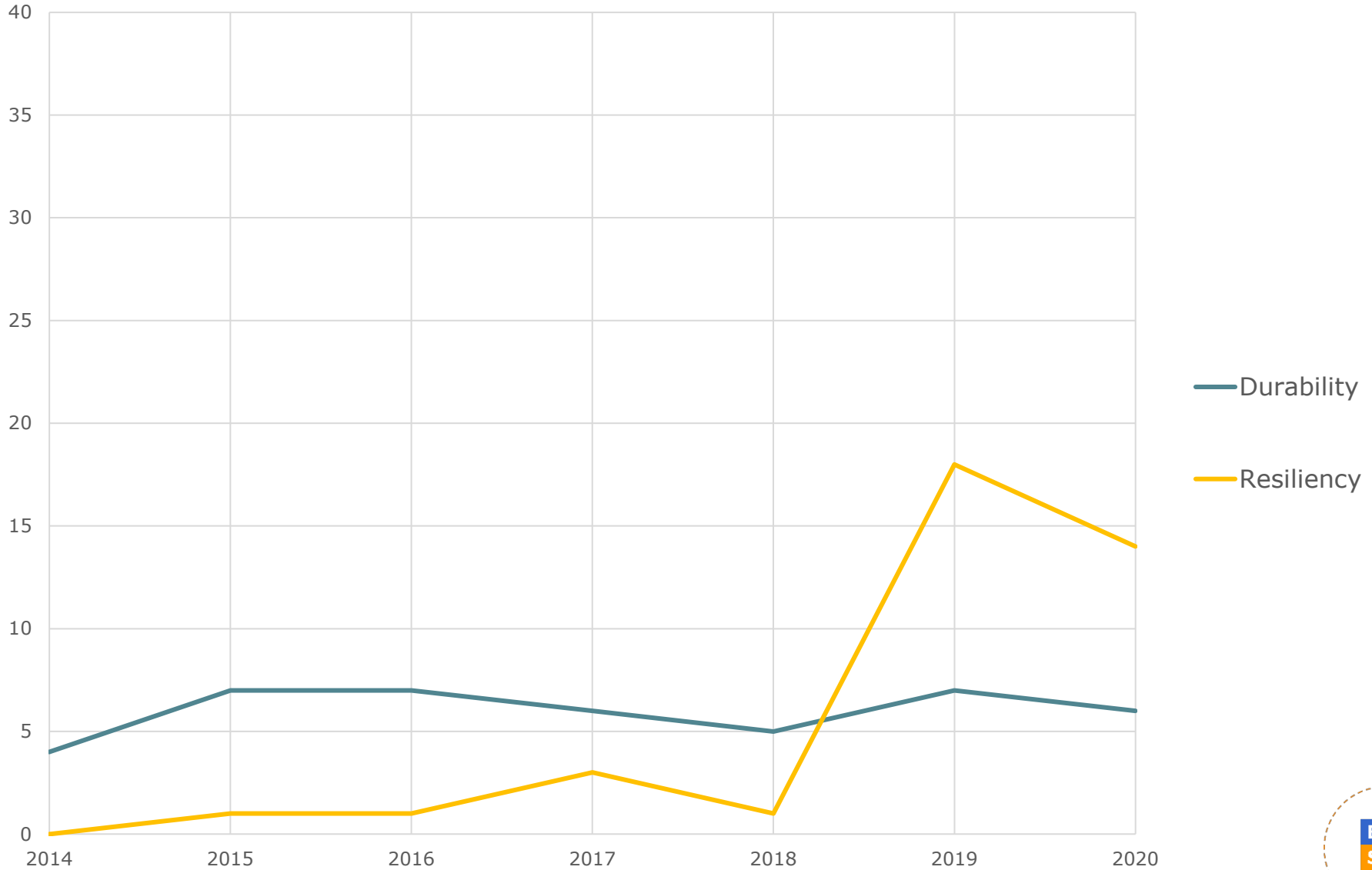
Term References over Years



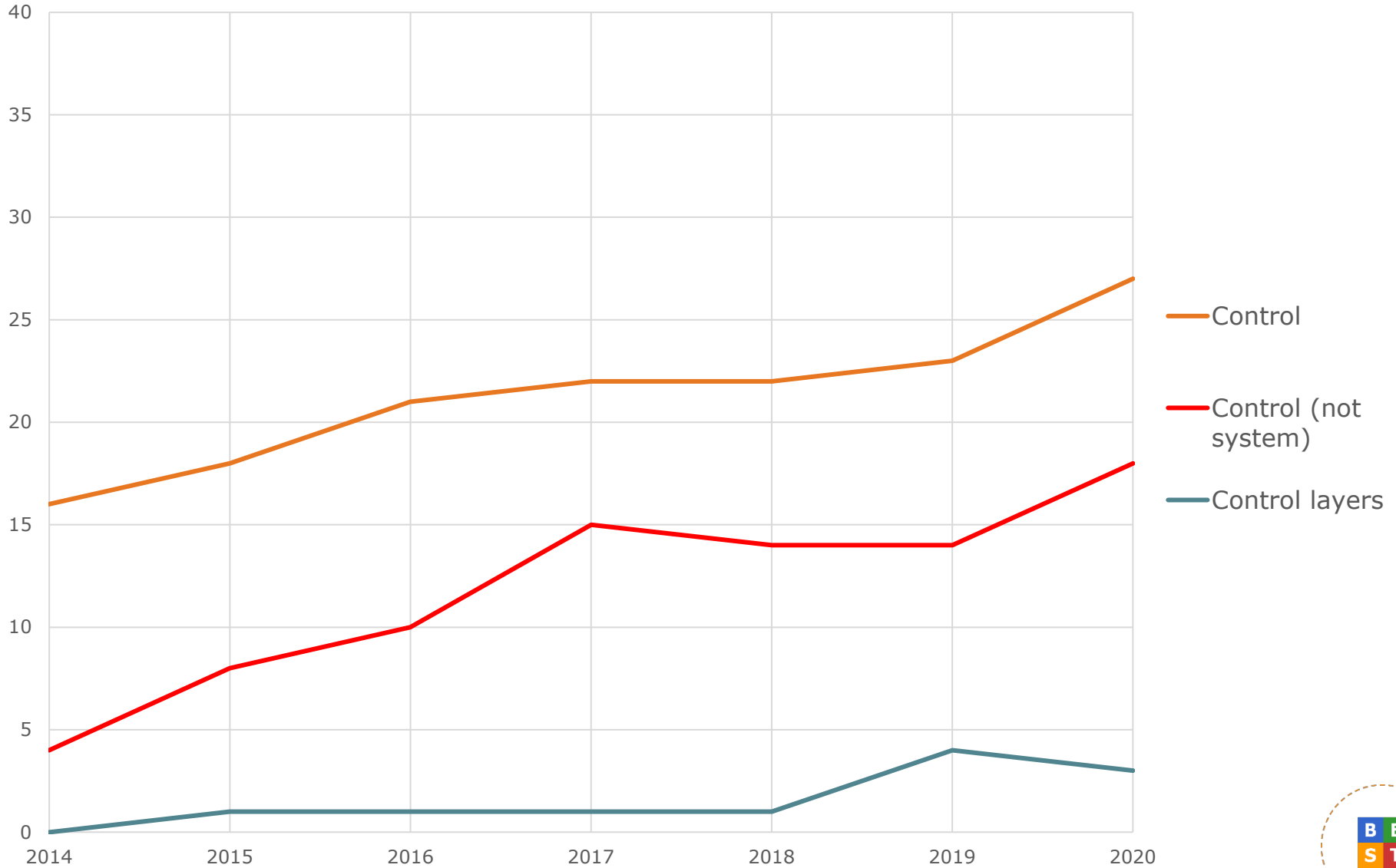
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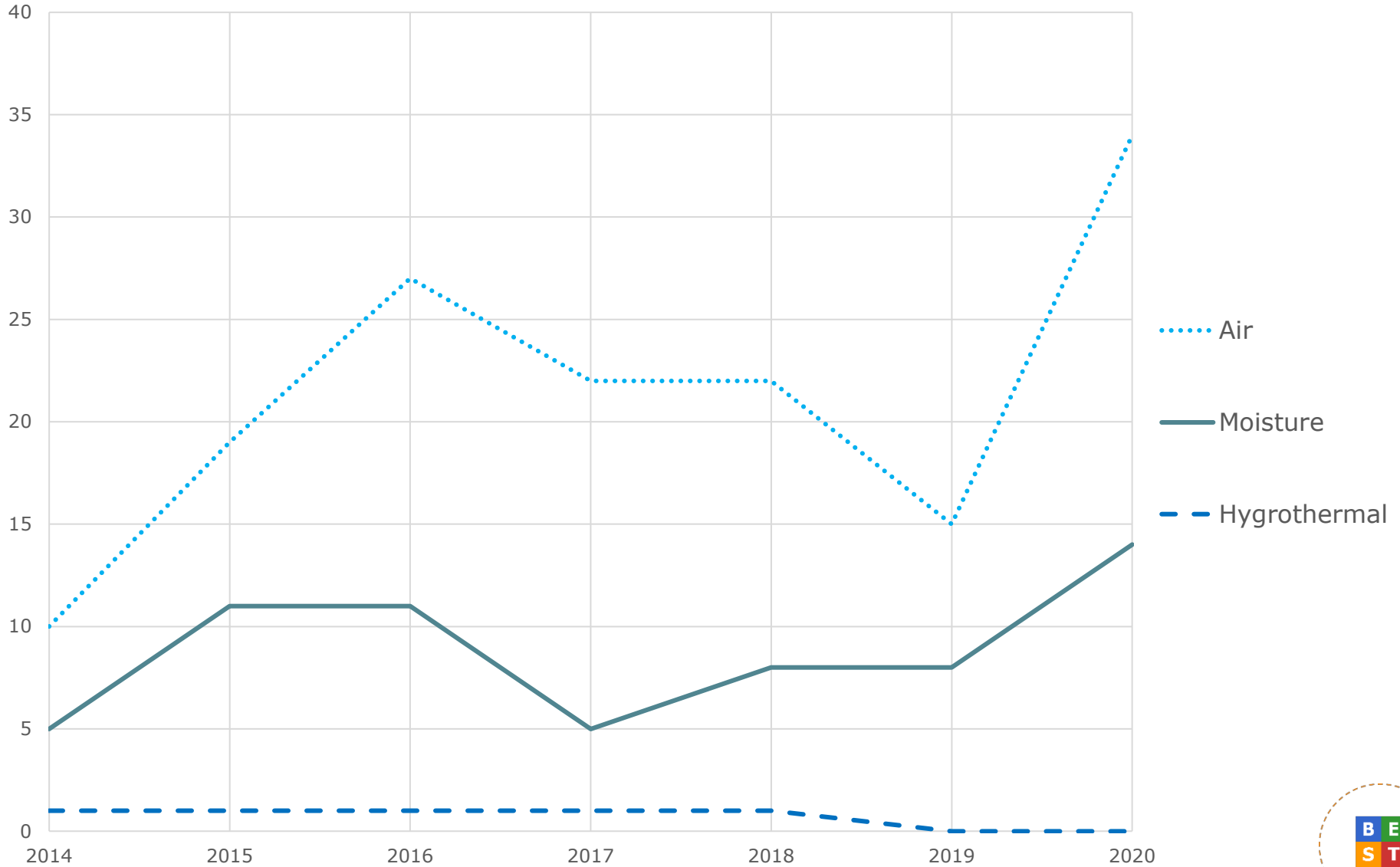
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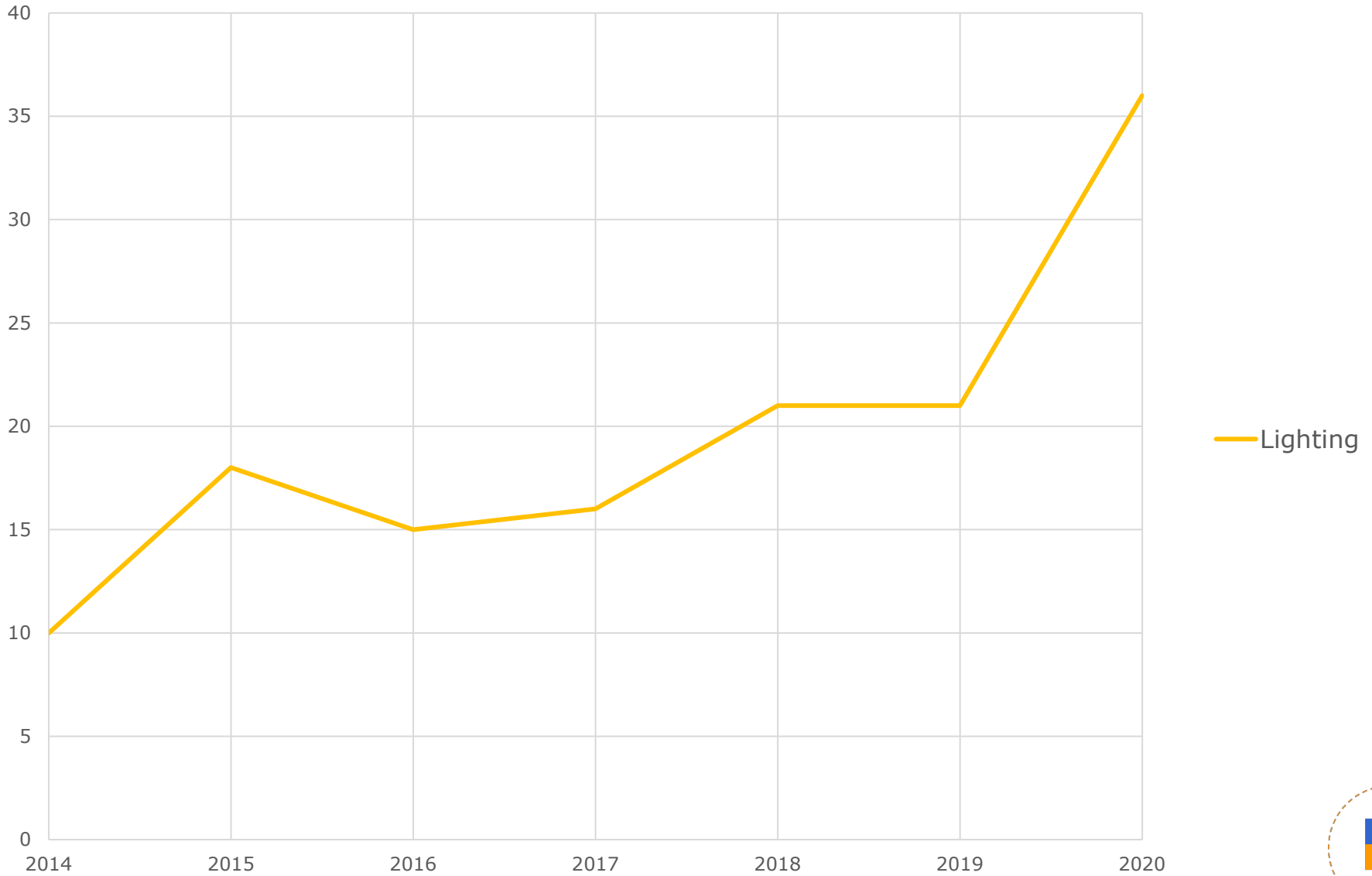
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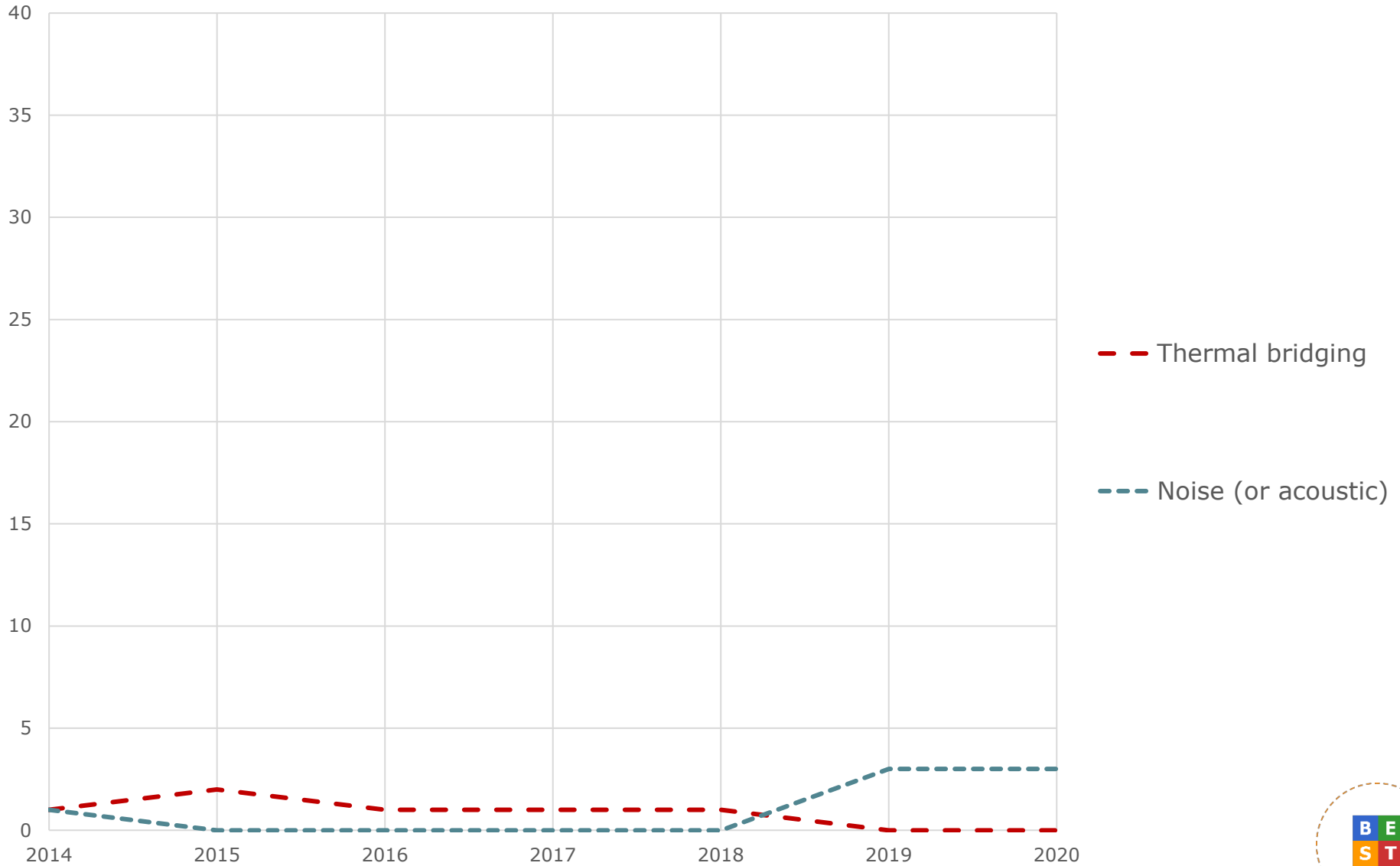
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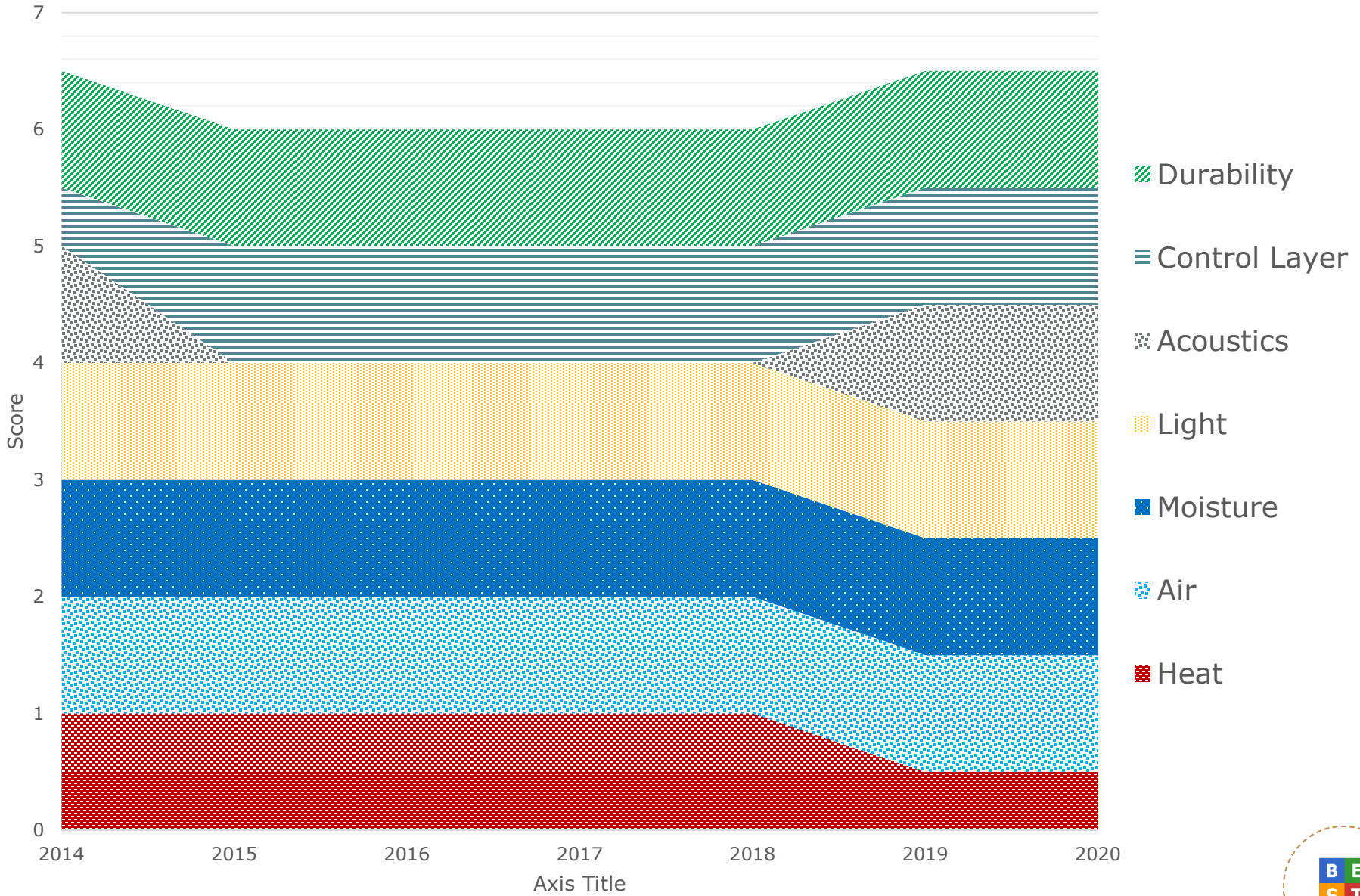
Term References over Years



Term References over Years



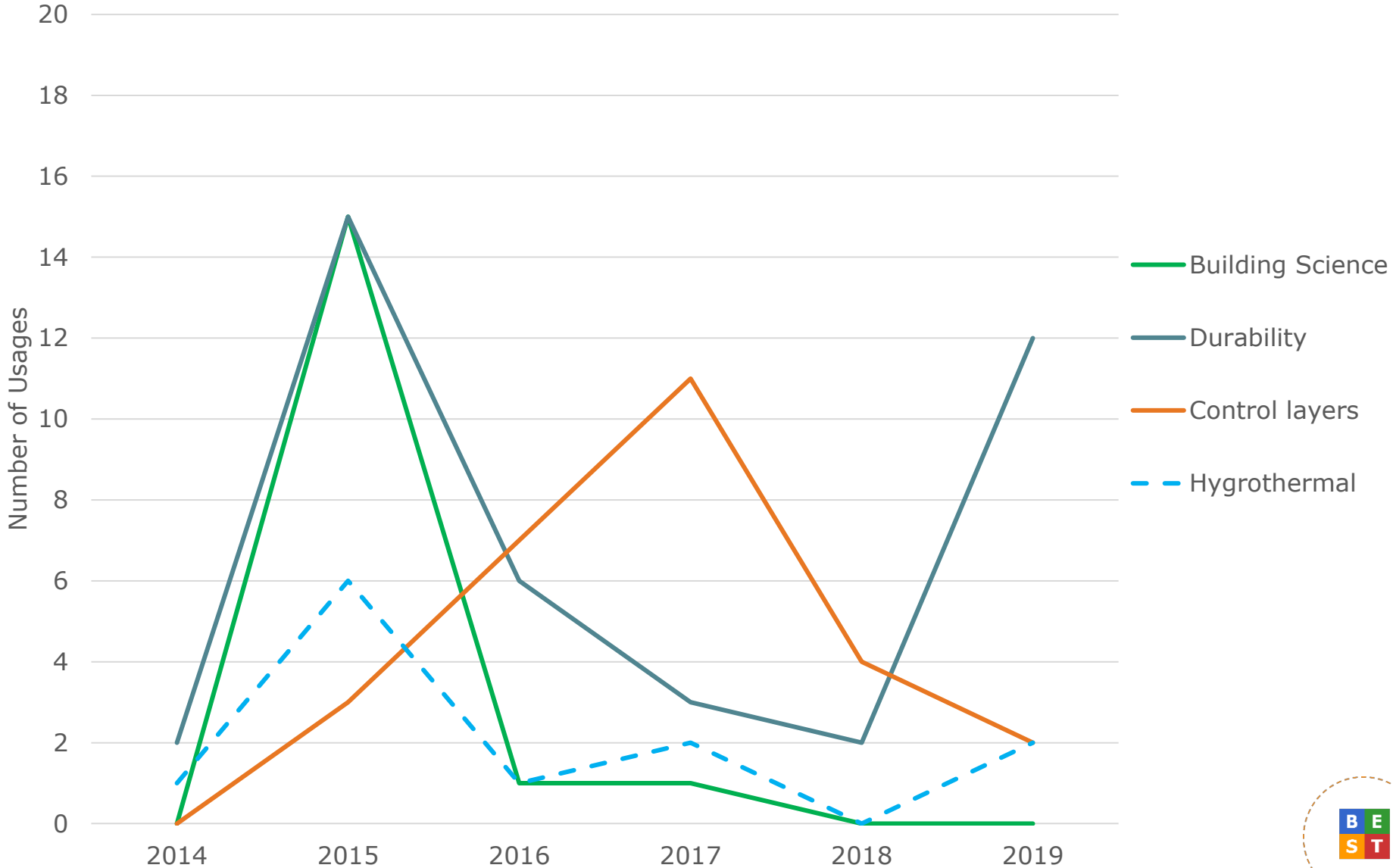
# Guideline Content over Years



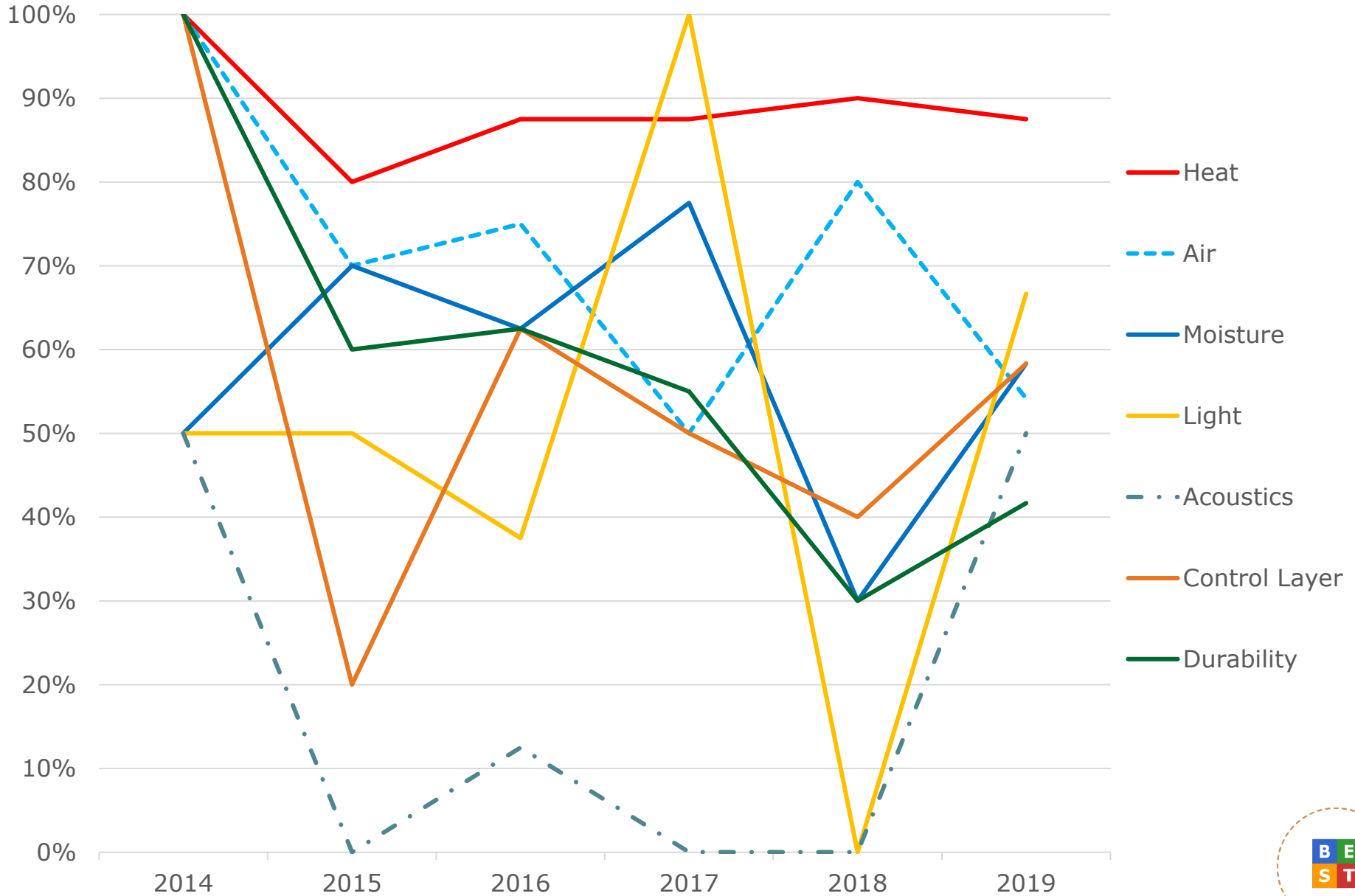


# Meta Analysis - Winners

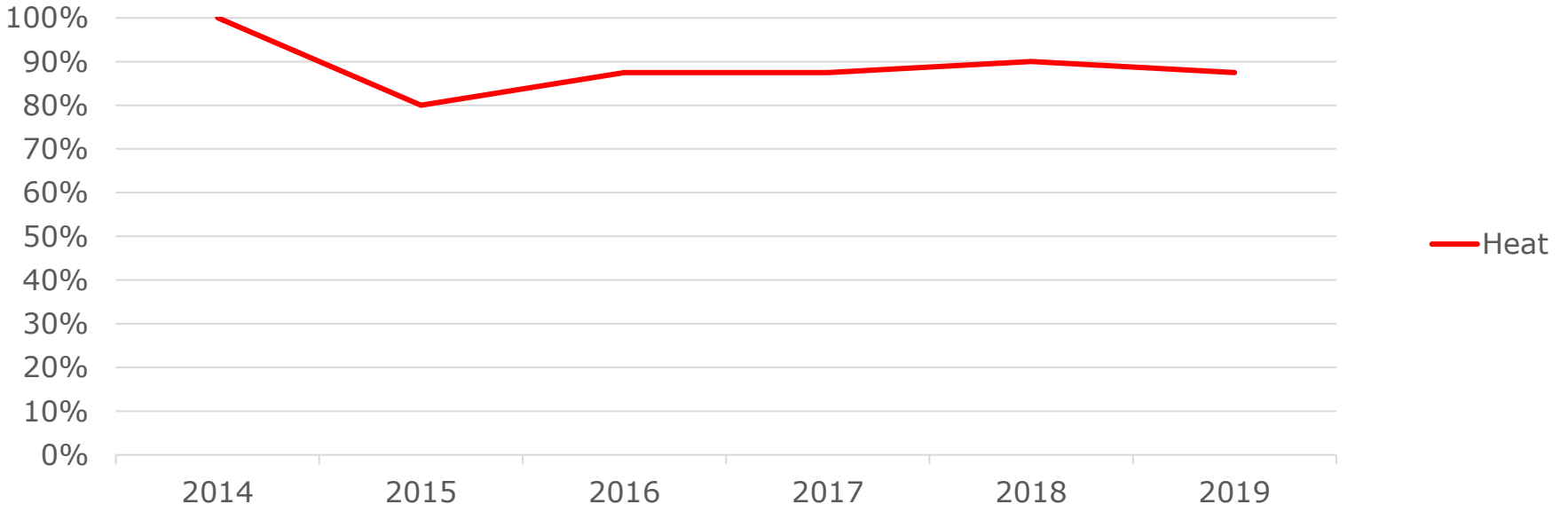
Use of Terms by Winners



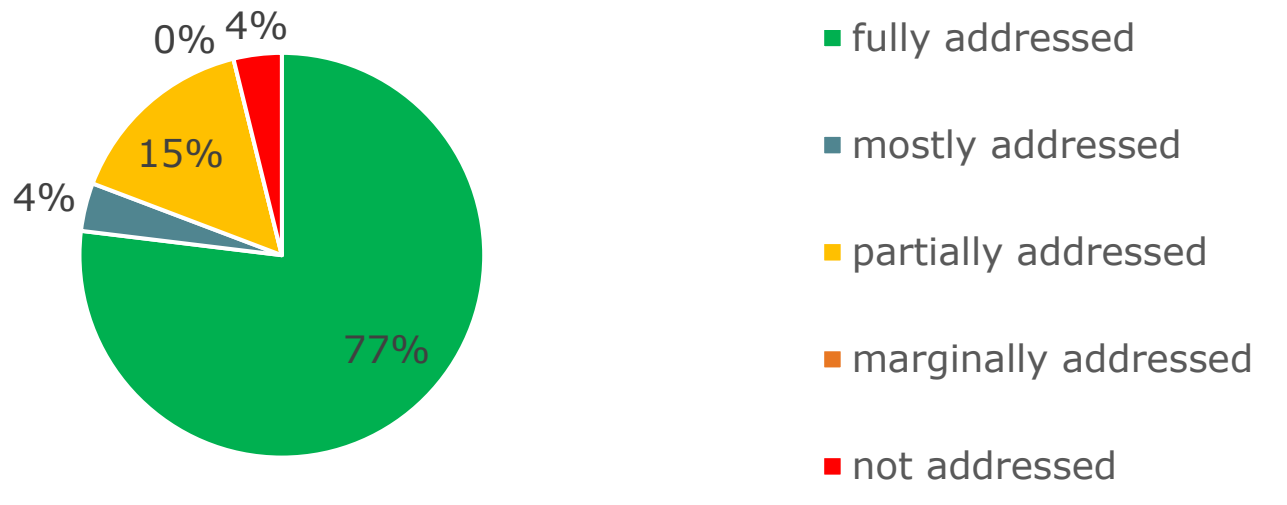
# Content Analysis - Winners



# Content Analysis – Thermal Control

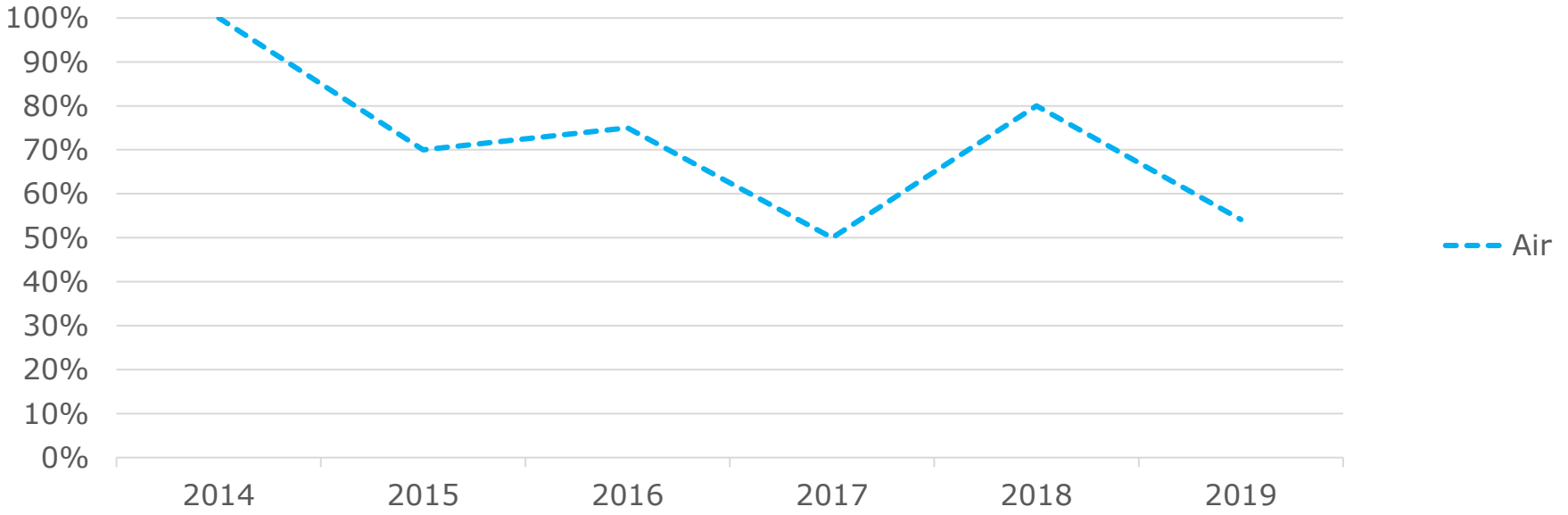


Heat

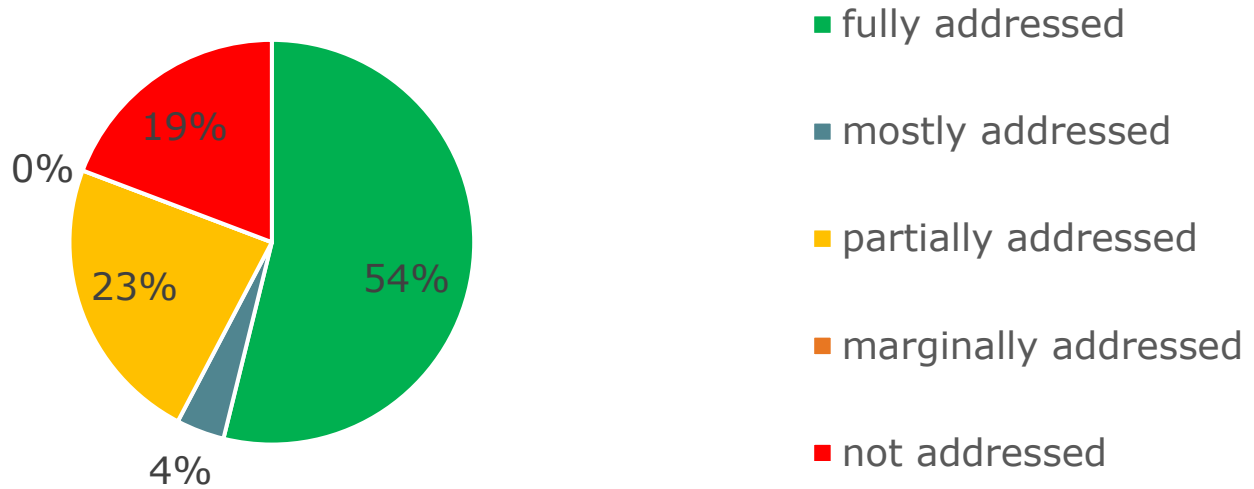


- fully addressed
- mostly addressed
- partially addressed
- marginally addressed
- not addressed

# Content Analysis – Air Control



Air



■ fully addressed

■ mostly addressed

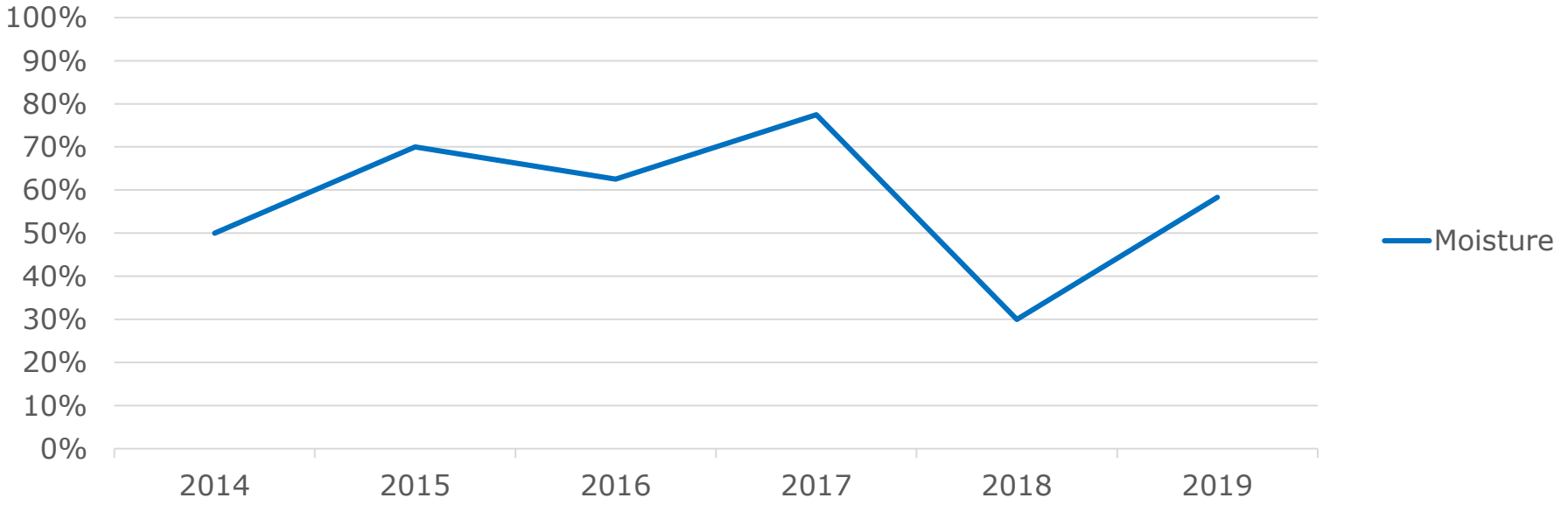
■ partially addressed

■ marginally addressed

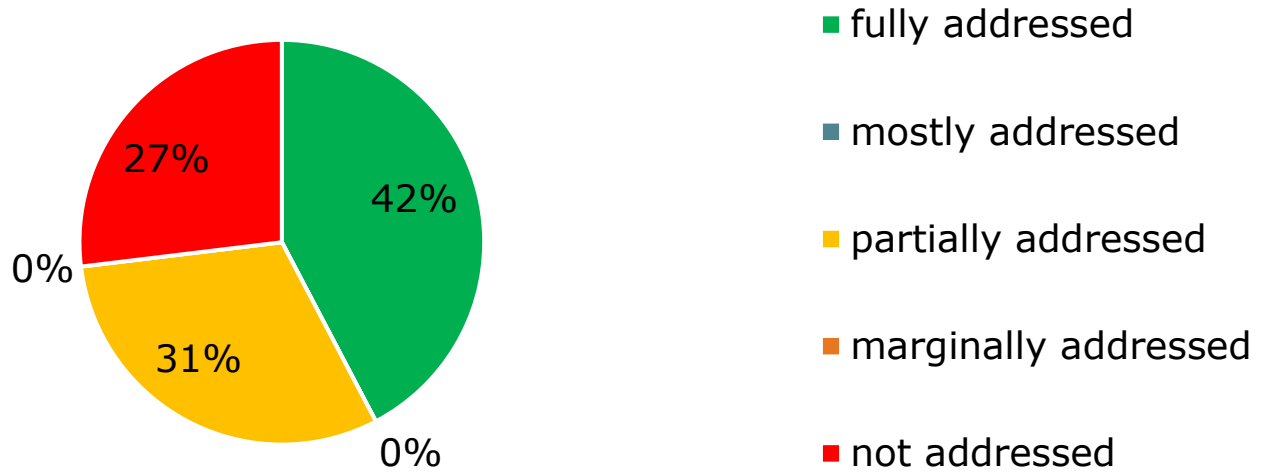
■ not addressed



# Content Analysis – Moisture Control



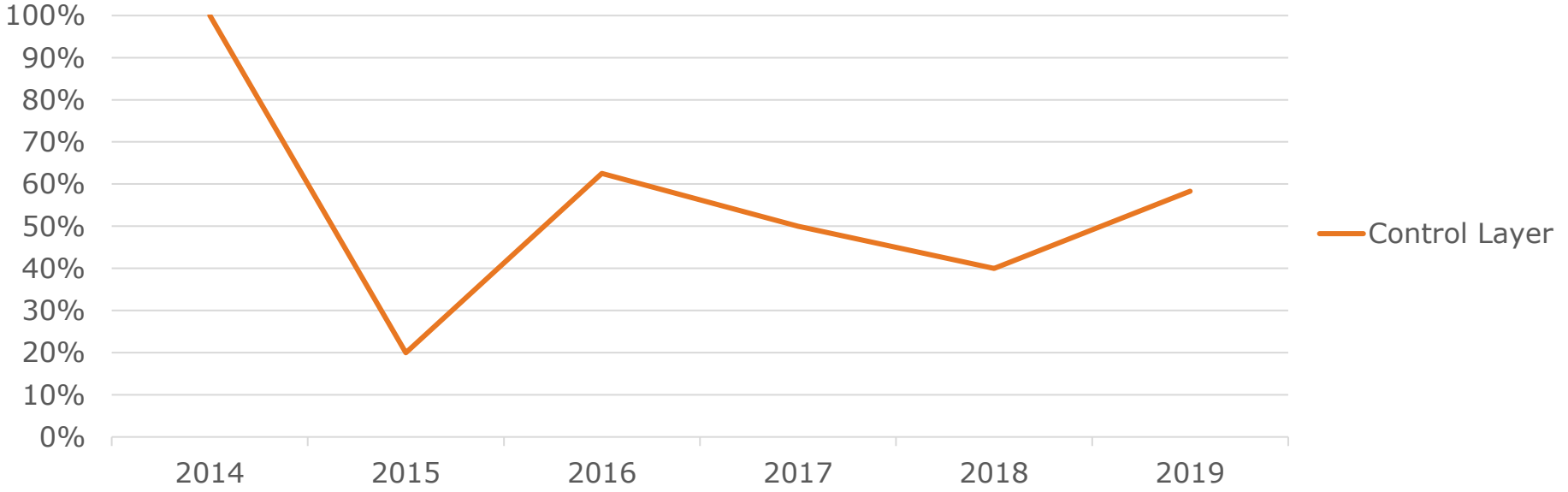
Moisture



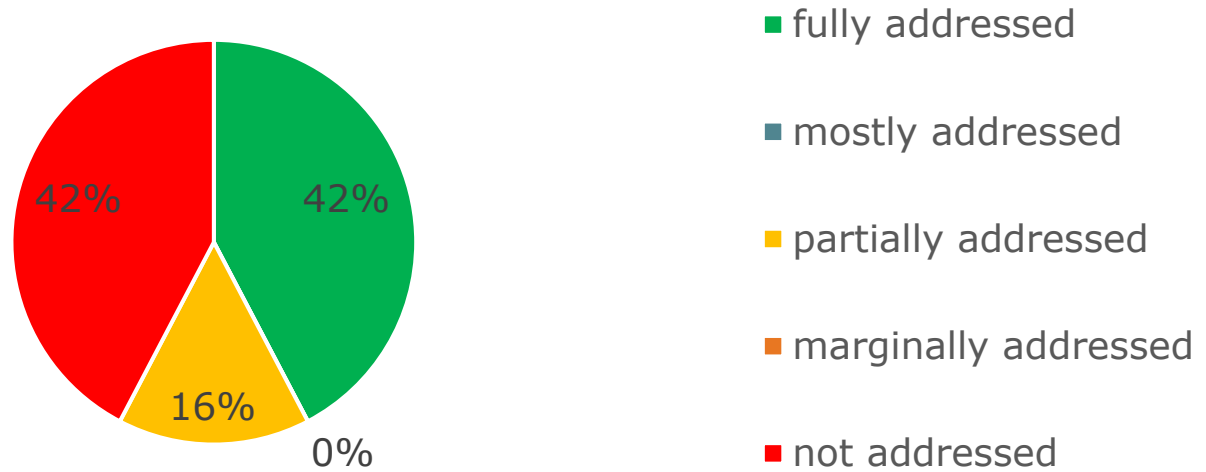
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# Content Analysis – Control Layers



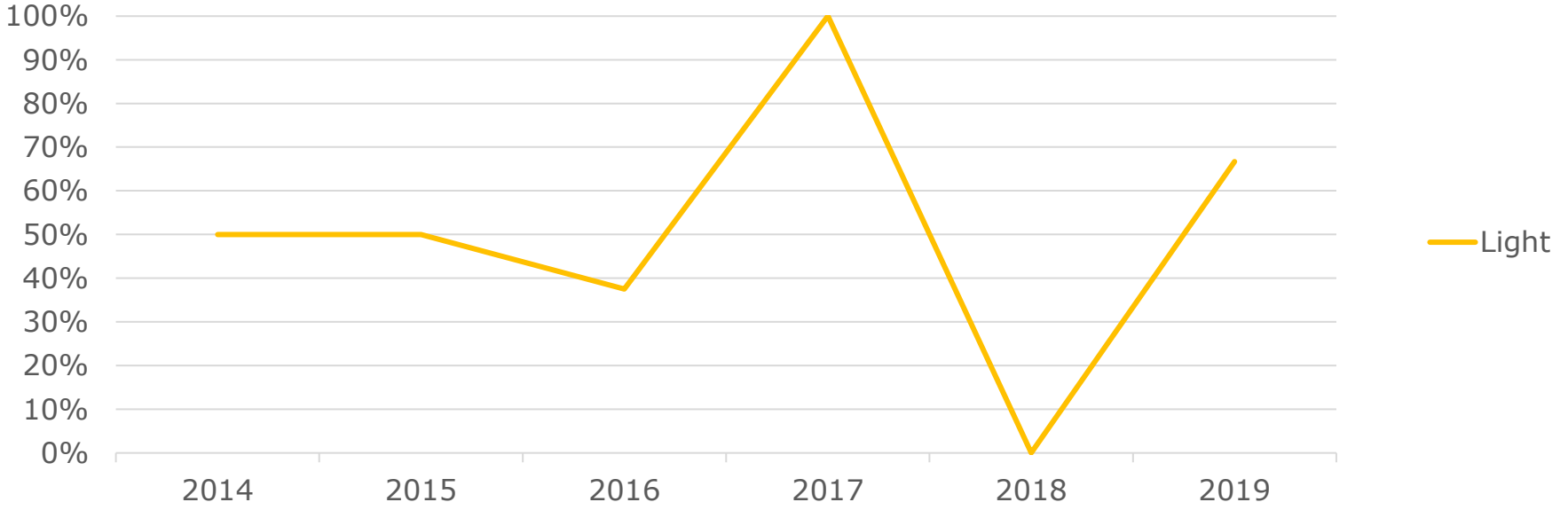
Control Layers



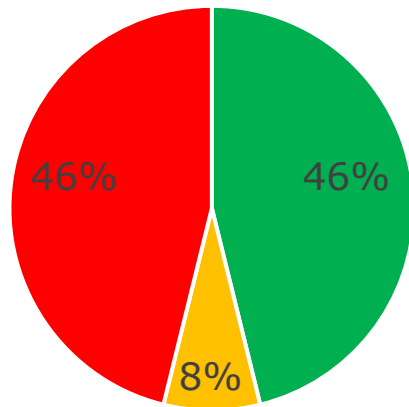
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# Content Analysis – Light



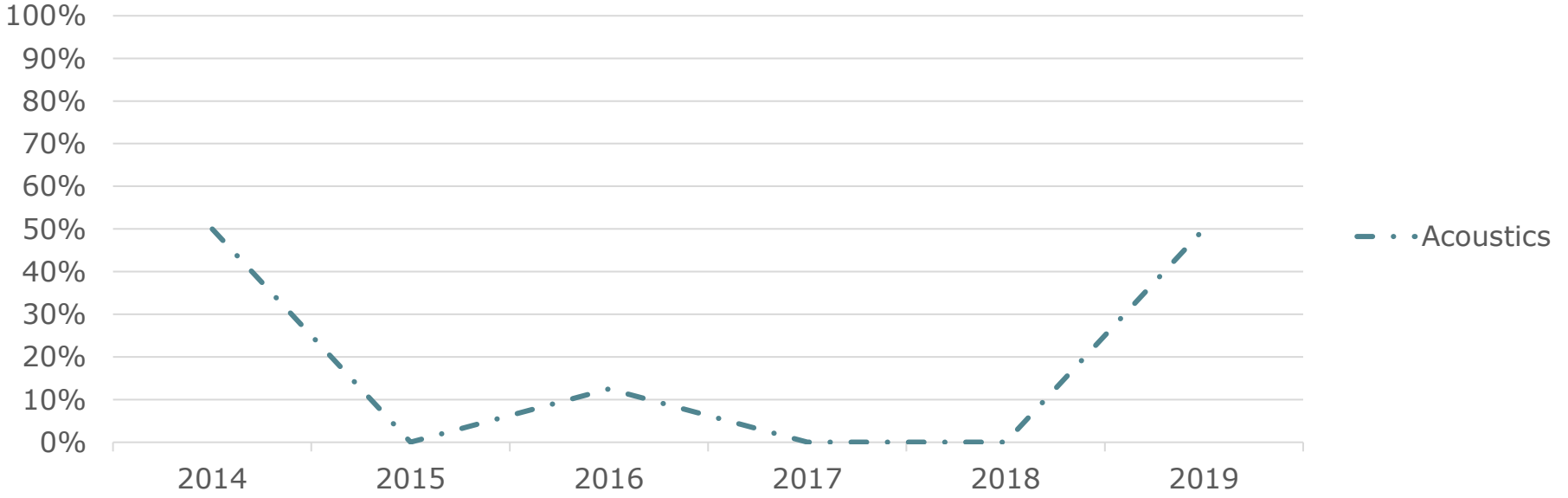
Light



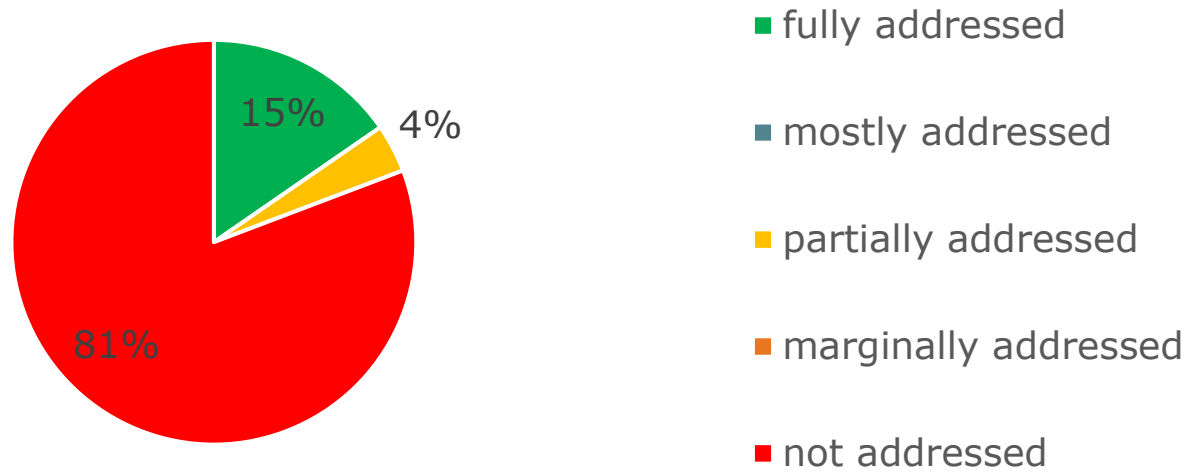
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# Content Analysis – Acoustics

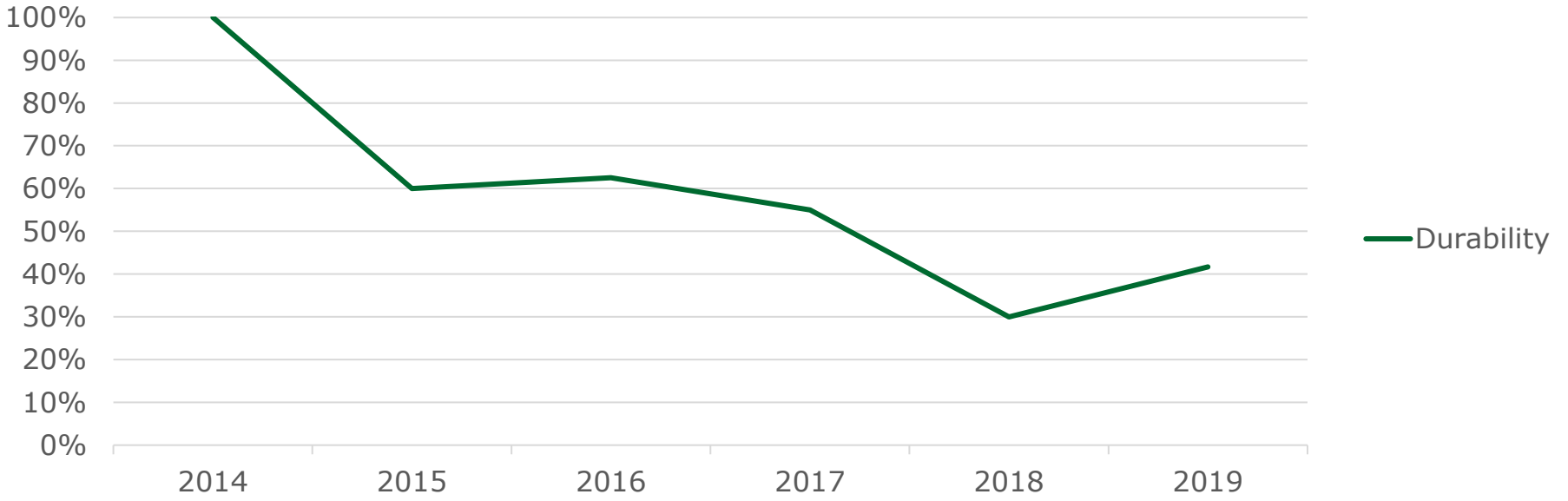


Acoustic

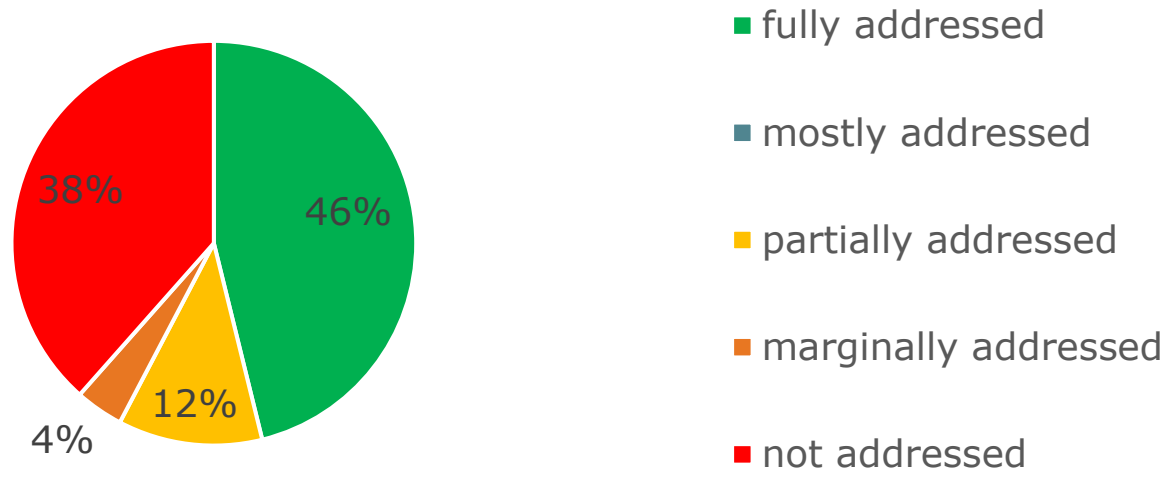




# Content Analysis – Durability



Durability

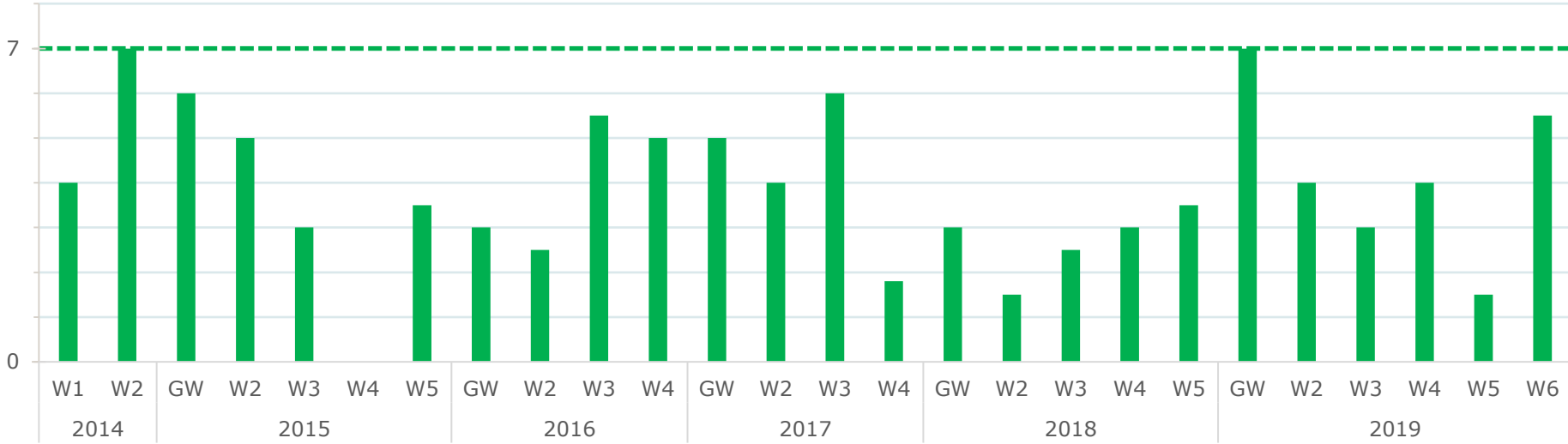


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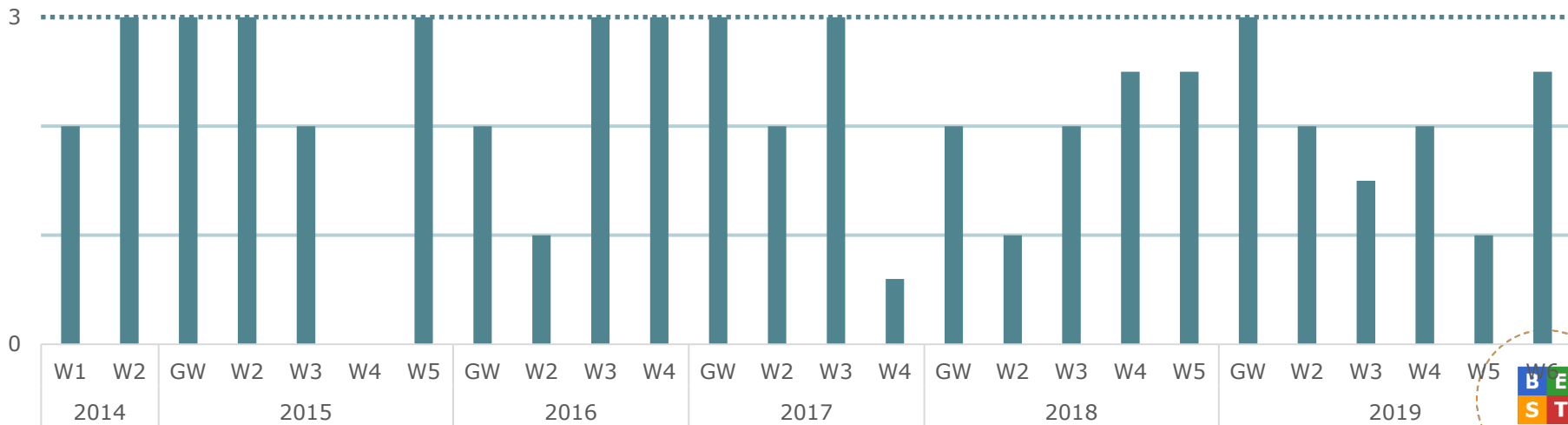


# Total Score vs. HAM Score

Total Score



HAM Score



## □ Guidelines

- Overall provide a good coverage of all topics
- Acoustics disappeared and appeared again (yay!)
- Could be improved in terms of specific requirements
  - Moisture control compliance (in lack of a code)
  - Thermal bridging evaluation requirements

## □ Submissions

- Overall ok, but some slip through
- Could be improved – question is how ...

## □ Some Options

- Go/no-go decision points in submissions
- Building science training for reviewers
- ... others?

