

2nd Working Group meeting for the Resource Efficient Buildings study

30th November 2016

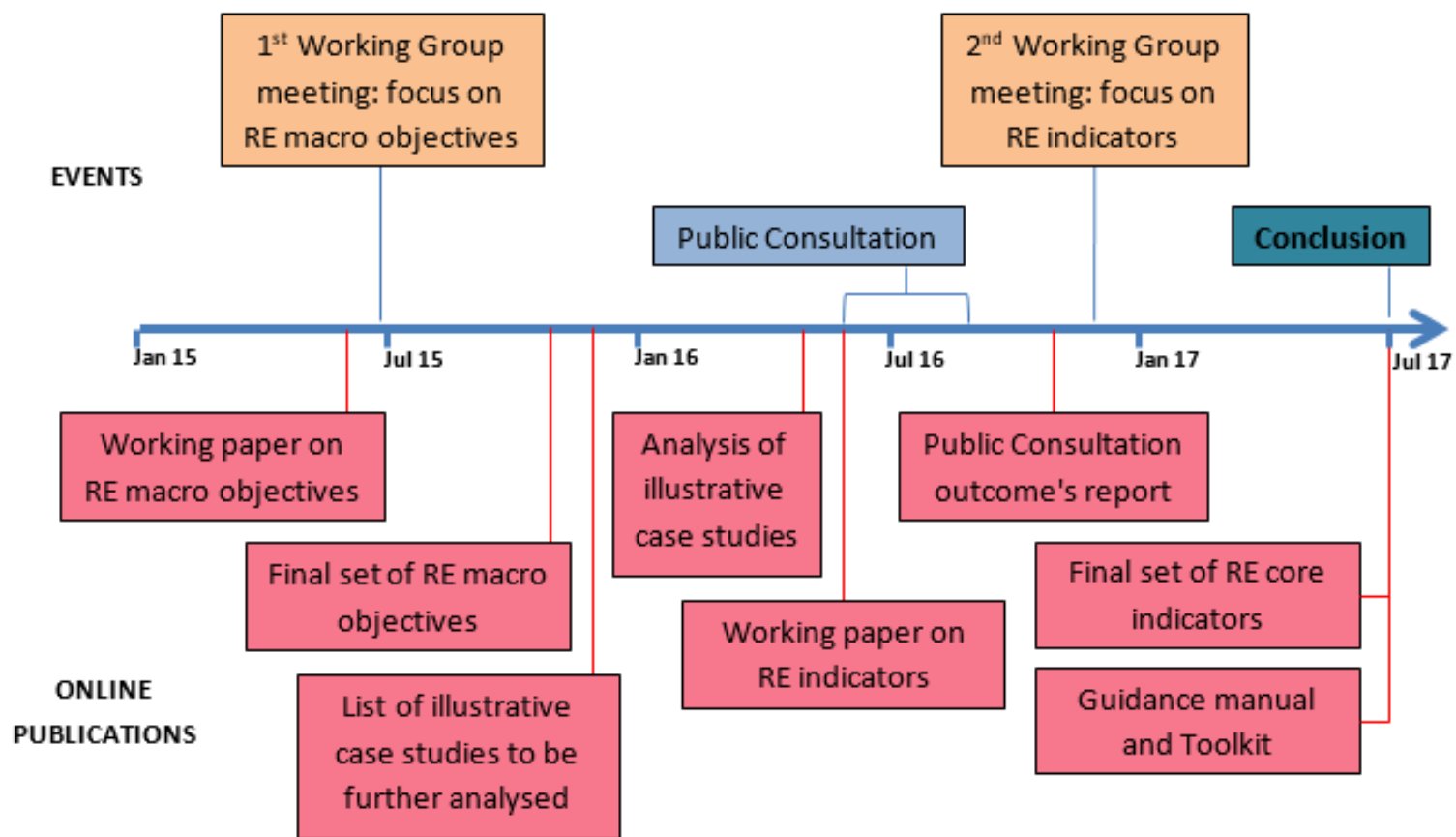


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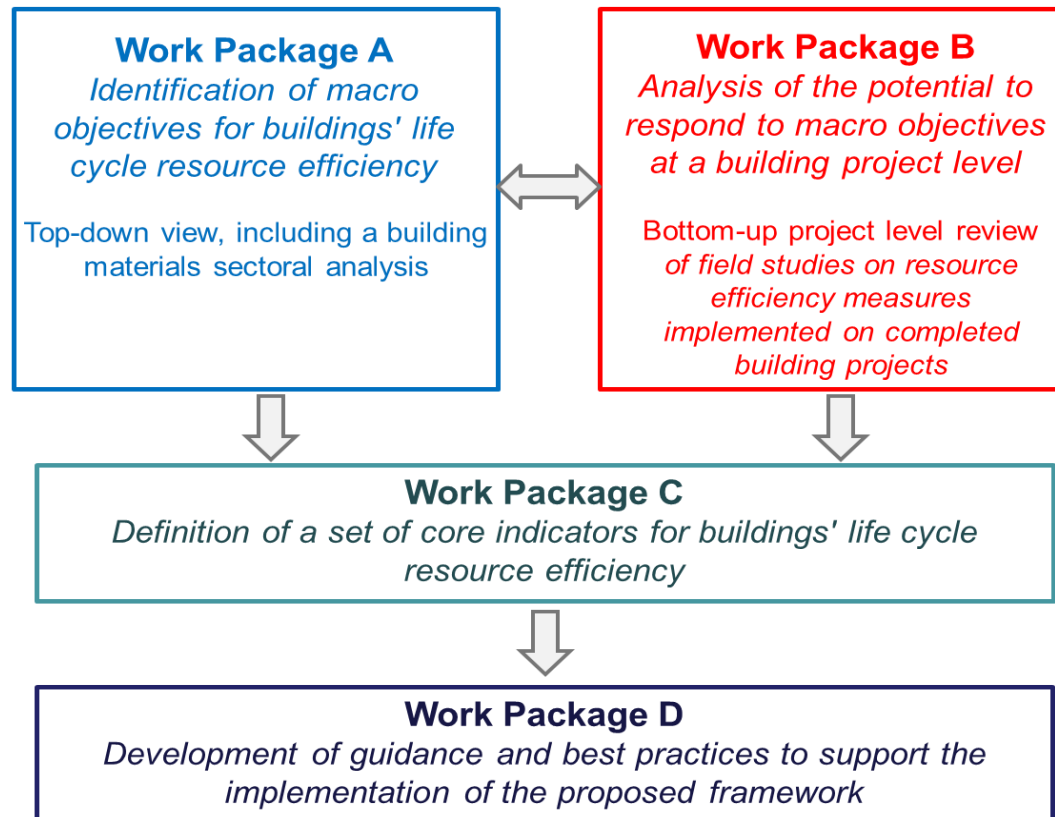


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Work programme and objectives for the day



Four main Work Packages in the study







Work package A

What is a macro-objective?

‘An environmental, resource efficiency or functional performance aspect of significance to the lifecycle environmental performance of buildings at EU level.’

EU policy objective > Sector macro-objective > Project-level indicator

Underlying principle: buildings shall provide comfortable, healthy and productive spaces for people to live and work in, now and into the future.

Final set of macro-objectives set the scope for identification of the indicators.



Work package A

Macro-objectives scope and definition

Building scope: Office and residential buildings, new-build and at the point of renovation

'Life cycle environmental performance' (three macro-objectives)

B1. Greenhouse gas emissions from building life cycle energy use

B2. Resource efficient material life cycles

B3. Efficient use of water resources

'Quality, performance and value' (three macro-objectives)

B4a. Healthy and comfortable spaces

B5. Resilience to climate change

B6. Optimised life cycle cost and value



Work packages B/C evidence gathering

'Field studies' (primary evidence)

- ✓ Professional experience setting performance requirements and using indicators.
- ✓ Technical research to identify methods for measuring/monitoring performance.

'Cross-check' (primary and secondary evidence)

- ✓ Public sector initiatives: including building permitting and planning requirements.
- ✓ Assessment and reporting schemes: Operational experience from running and using major multi-criteria certification schemes and investor reporting tools.
- ✓ Technical studies: Synthesis of experience/expertise in order to propose or refine performance measurement tools, metrics and guidance.
- ✓ Standards and harmonisation initiatives: Projects supporting harmonisation and uptake of performance measurement and reporting tools.
- ✓ Collaborative EU projects: Shared experience and outcomes.

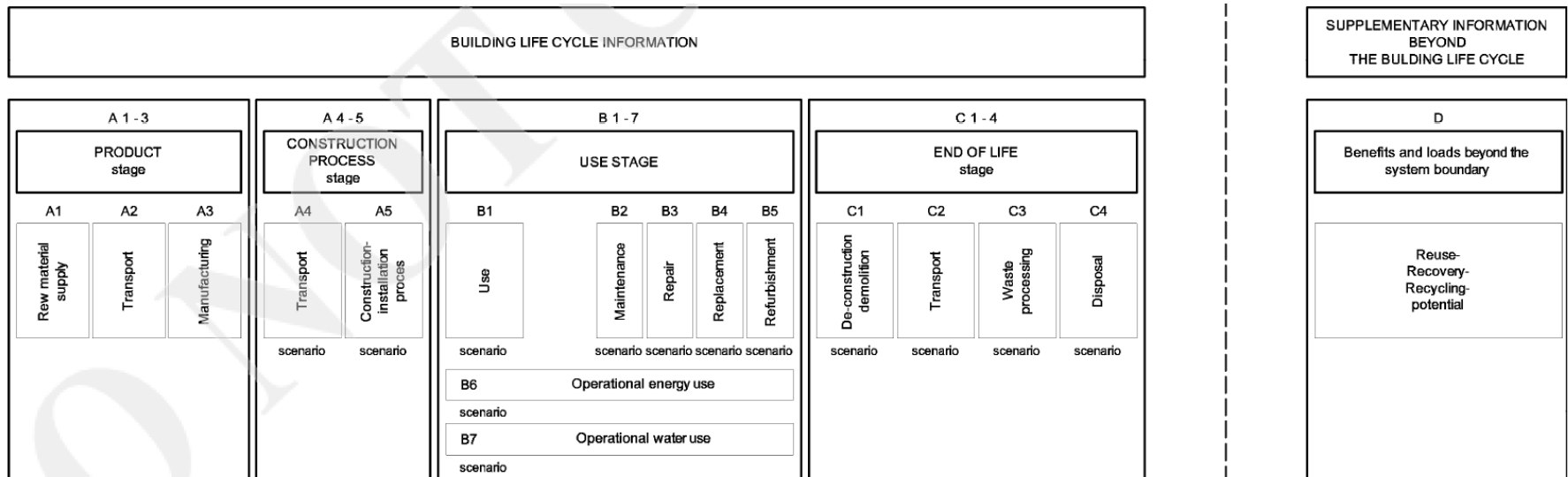


Definition of a ‘performance indicator’

‘A specific and measurable aspect of a building’s performance that can be used to support performance comparisons, benchmarking and target setting.

Performance improvements measured by an indicator shall contribute to achievement, overall or in part, of the macro-objective that the indicator is associated with.’

CEN/TC 350 Life cycle stages

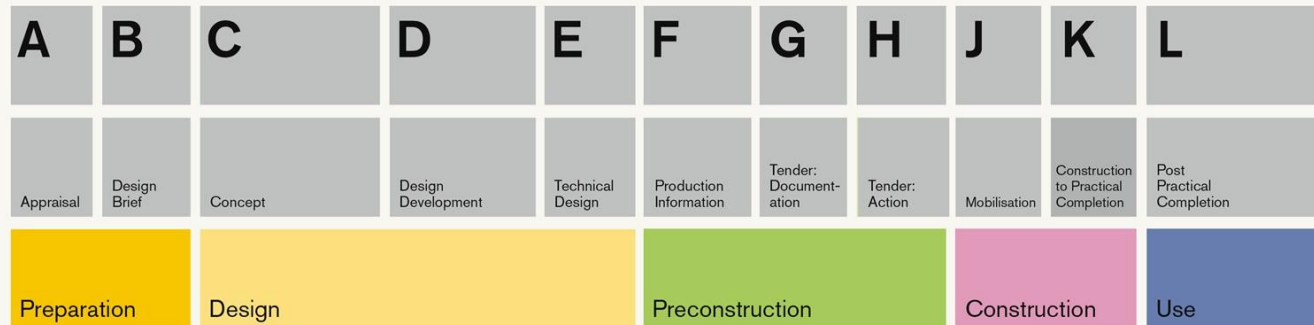


Typical project stages (RIBA)

RIBA Plan of Work 2013 compared with RIBA Outline Plan of Work 2007



RIBA Outline Plan of Work 2007





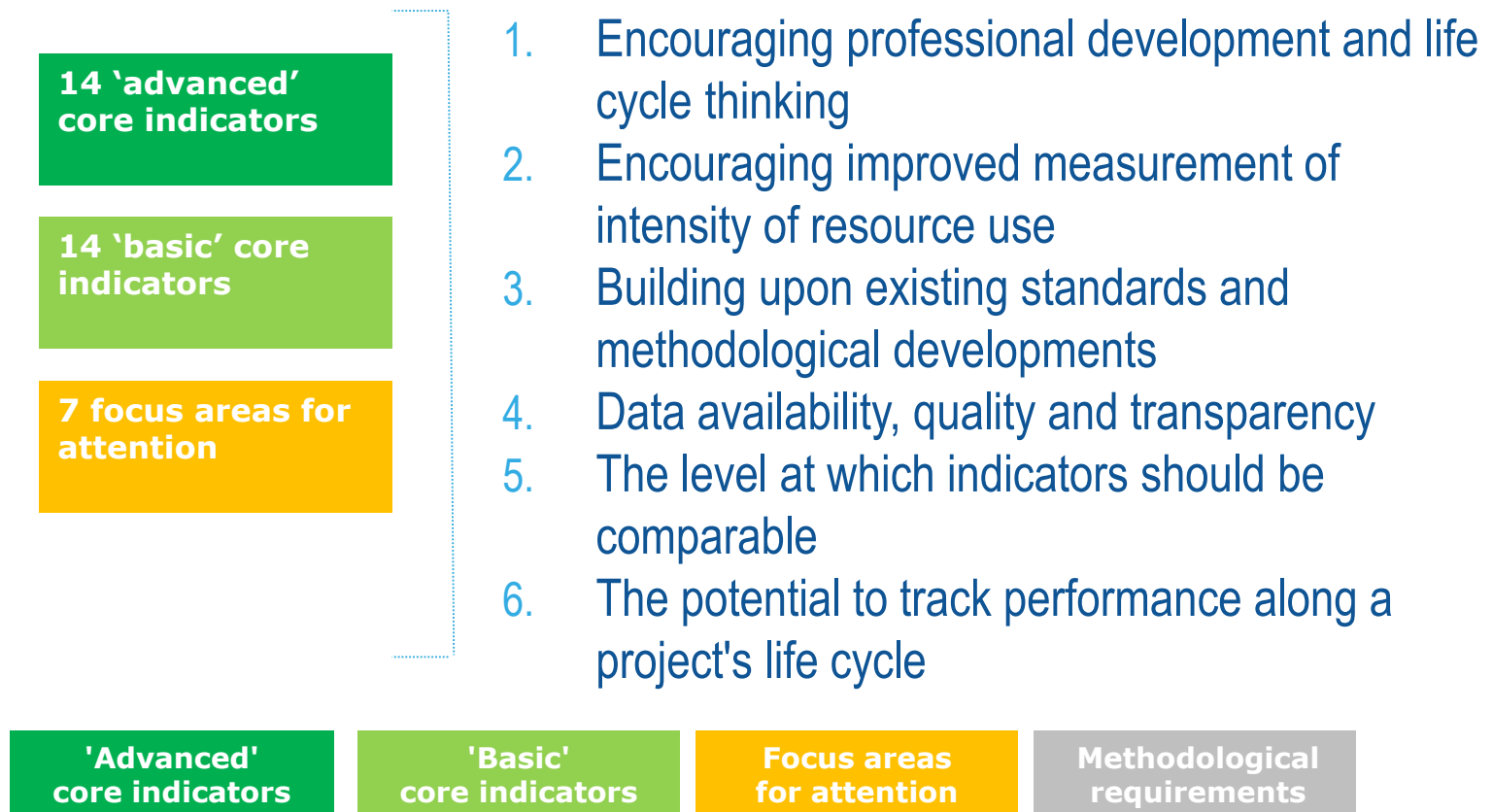
What makes a suitable indicator?

- Broadly applicable (*with ref. to building types*)
- From design to actual performance
- Accessible and understandable
- Readily available and accepted
- Comparable (*as a minimum = project and local level*)
- Easily verifiable

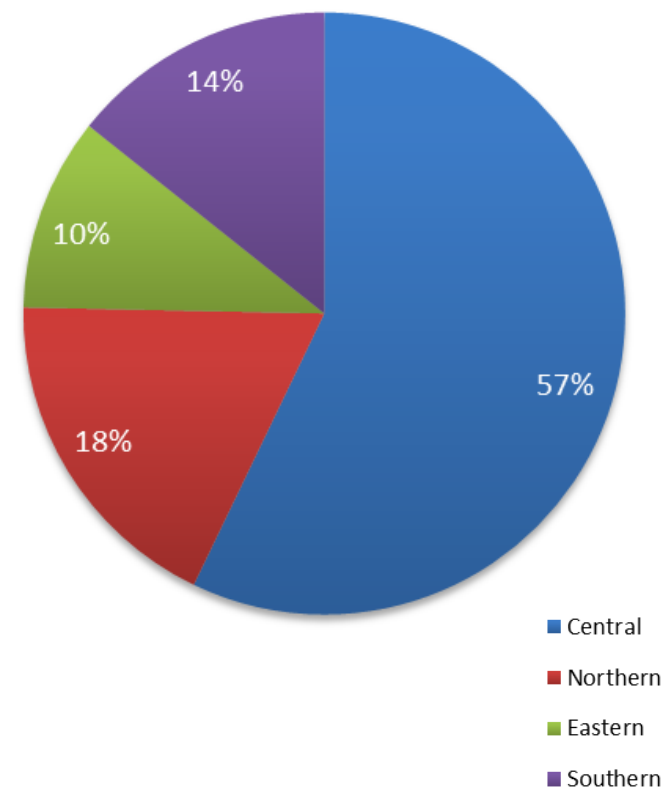
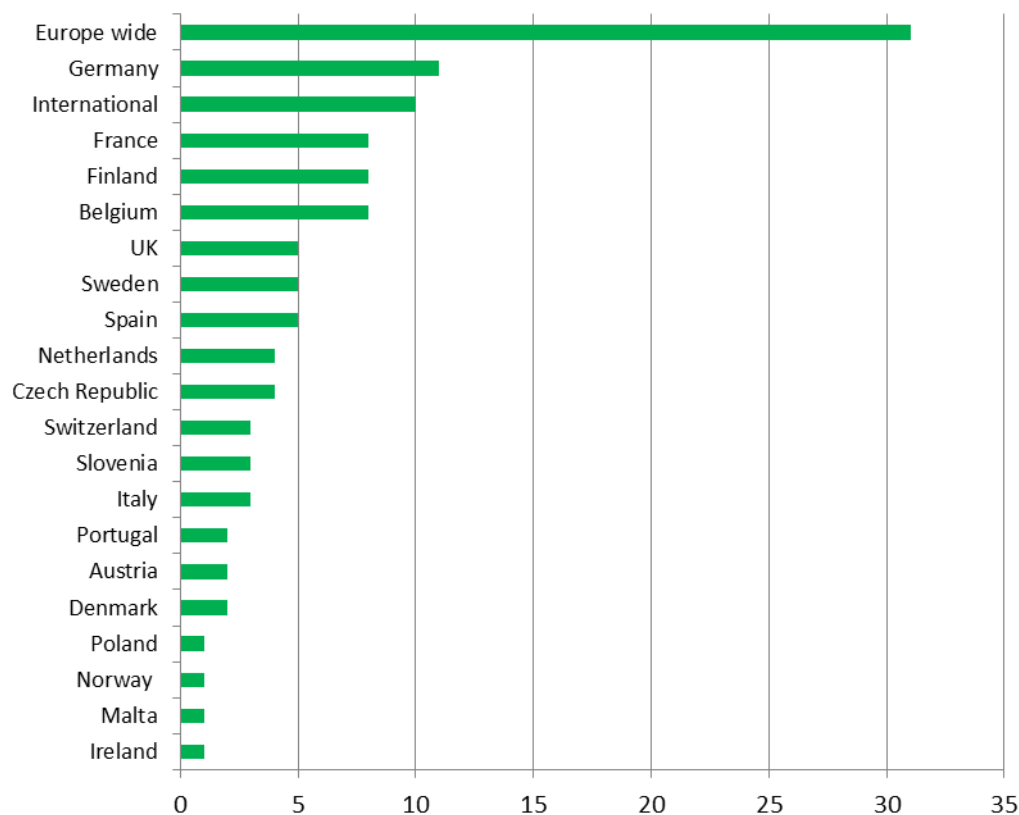
Other aspects?

- ✓ Public sector policy friendly
- ✓ Accounts for trade-offs

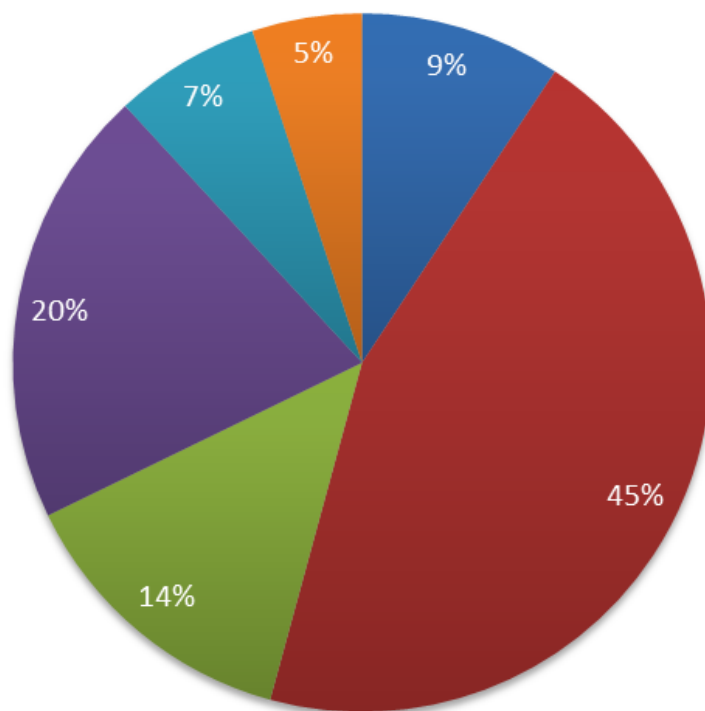
First framework and core indicators proposal



June – Oct 2016 public consultation response



Public consultation response



- Client side (public and private property owners and investors, property valuers)
- Contractors and supply chain (construction and demolition, product manufacturers, trade associations)
- Design team members (architects, engineers, environmental/energy consultants)
- Performance and standards (assessment schemes, standardisation bodies, research institutes)
- Public authorities (local, regional and national authorities)
- Supporting role (advocacy groups, NGO, consumer organisations)

3.1 Structure of the framework and integration of a life cycle approach

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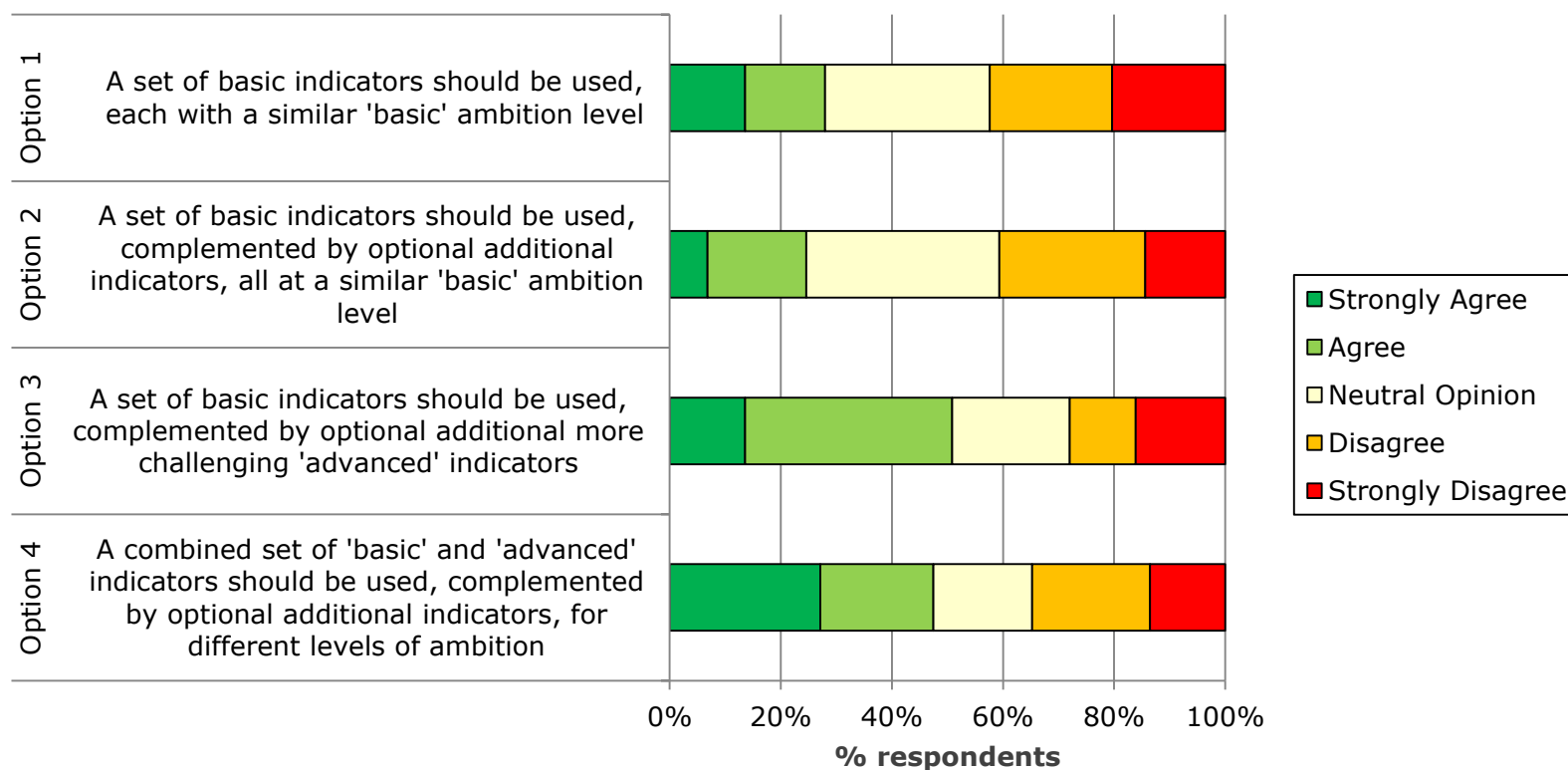
Consultation proposals

Horizontal themes for how the framework could work

1. Encouraging professional development and life cycle thinking
2. Encouraging improved measurement of intensity of resource use
3. Building upon existing standards and methodological developments
4. Data availability, quality and transparency
5. The level at which indicators should be comparable
6. The potential to track performance along a project's life cycle

Consultation results

Q2.1 Opinions on different indicator frameworks





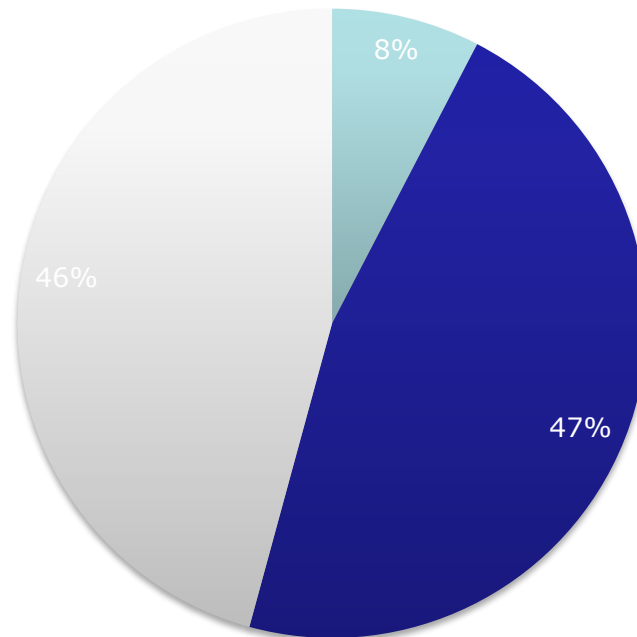
Consultation results

Q2.1 Open responses

- Call for an **LCA-based or LCA/LCC-based** 'core' approach
 - With simplified reporting, recognising basic and advance impact categories
 - With other indicators to measure 'direct' building performance
- A core framework based on the **three pillars of sustainability**
 - Start with 'core' relating to energy, environment and indoor climate
- **A limited number of 'basic' or 'fit for purpose'** indicators
 - 2-3 with advanced only where they add value
 - Options for different ambition levels

Consultation results

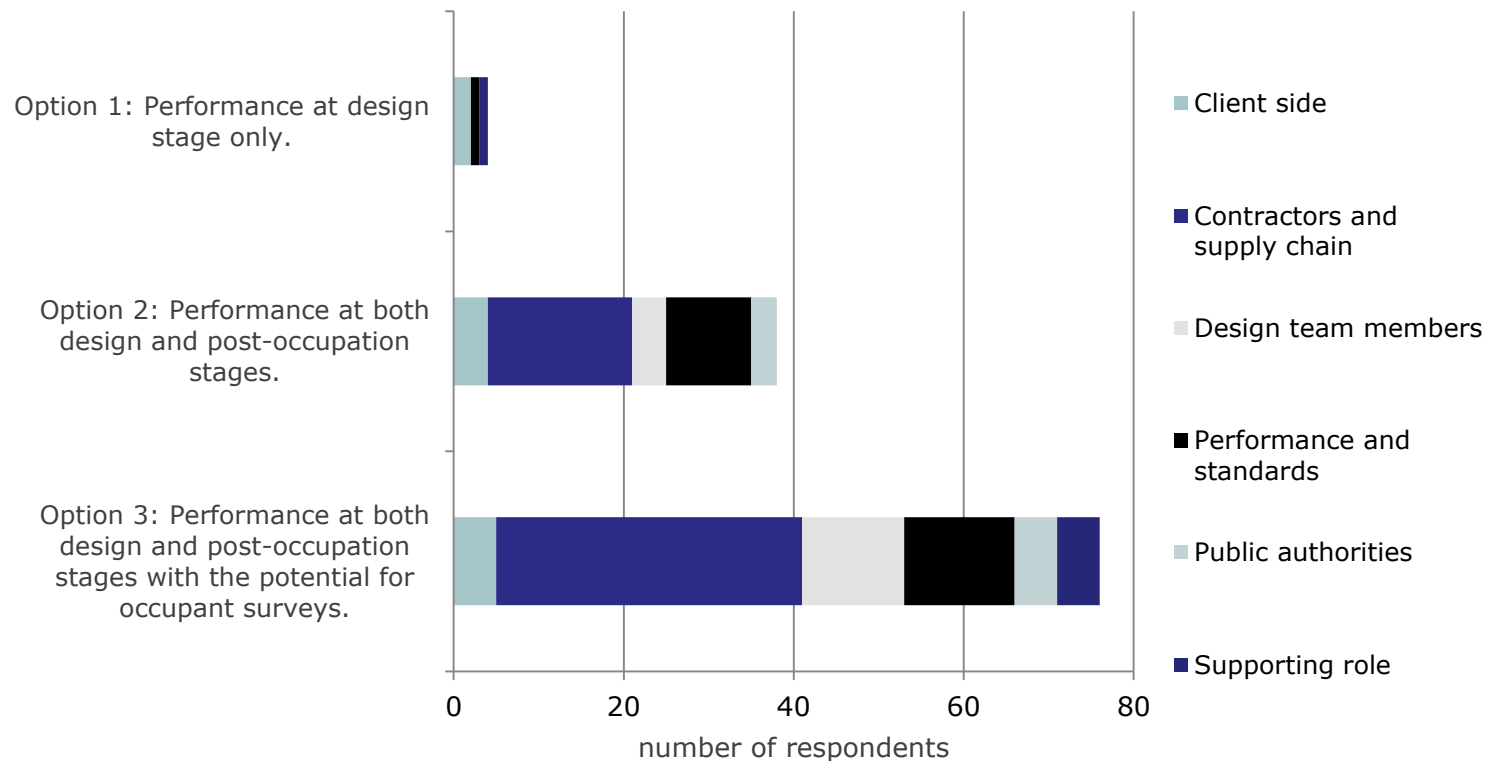
Q2.3 Requiring different levels of expertise



- Option 1: Only a basic level of expertise should be required for all indicators under each macro-objective.
- Option 2: Potentially only some indicators under each macro-objective could require a greater level of expertise, so as to encourage market leaders.
- Option 3: All macro-objectives should have a combination of indicators requiring a basic and a greater level of expertise.

Consultation results

Q2.9 Tracking of performance along project stages





Consultation results

Q4.1.1 How should the framework work?

1. 'Basis for the framework'
 - Based on/embedded in an LCA approach
 - Alignment with CEN/TC 350 standards
 - Integration within existing building assessment schemes
2. 'Orientation of the framework'
 - Use at national level by Member States
 - Towards investor and occupier asset manager decision-making processes
3. 'How it should work'
 - Comprehensible and easy to use for performance measurement by all actors
 - Based on common calculation methods and existing indicators
 - Can measure performance/drive improvement from design through to completion and occupation



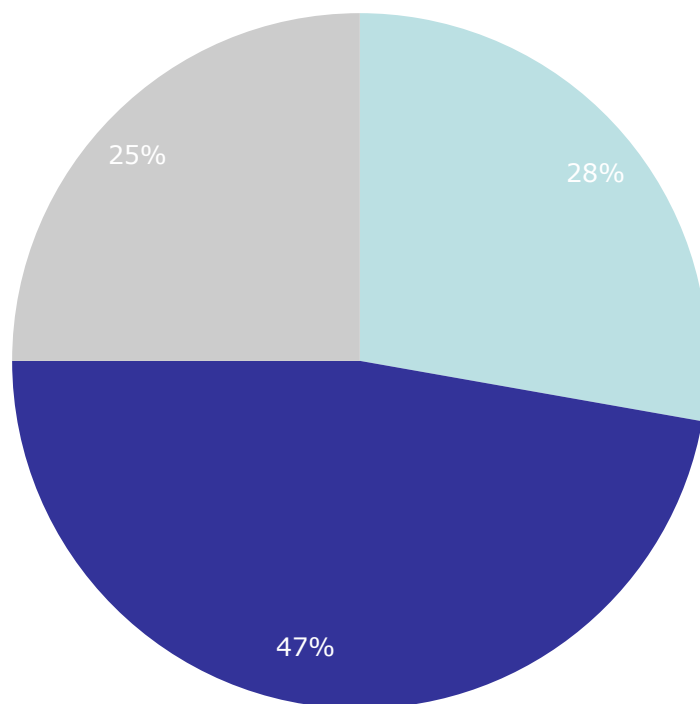
Consultation results

Q4.1.1 How should the framework work?

4. 'It's role as a professional tool'
 - Supports like-for-like comparisons of building performance (2)
 - Takes into consideration project size (2)
 - Reference performance values provided to support comparability (2)
 - Manages the complexity of LCA with user friendly interfaces (1)
 - Actors implement simplified indicators and processes first (1)
 - Supports the optimisation of designs (1)

Consultation results

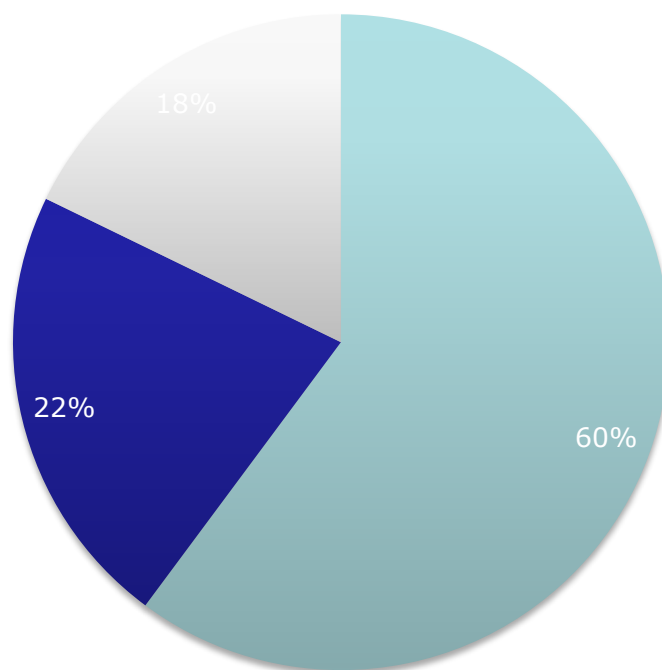
Q3.5 What form should reporting on a full LCA take?



- Option 1: Confirmation that a full LCA has been carried out according to EN 15978.
- Option 2: Provision of results for the impact categories listed in EN 15978.
- Option 3: Provision of results for the impact categories listed in EN 15978, together with results for some additional impact categories.

Consultation results

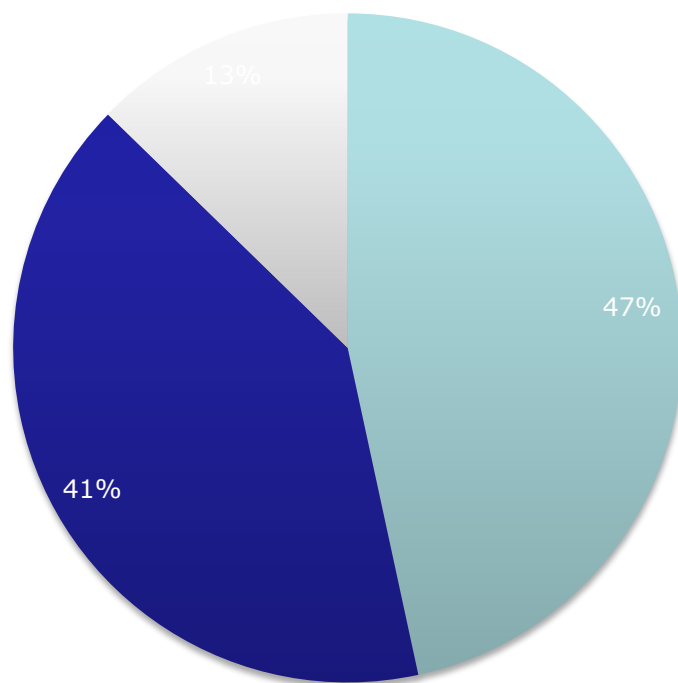
Q2.5 Life cycle stage reporting for GWP, LCA and LCC



- Option 1: The life cycle stage boundaries set out in standards should not be narrowed.
- Option 2: Life cycle stage boundaries may be narrowed only where significant trade-offs do not occur.
- Option 3: Life cycle stage boundaries may be narrowed only when stages omitted are of low environmental significance overall.

Consultation results

Q2.6 Building component scope for GWP, LCA and LCC



- Option 1: The building component scope set out in standards should not be narrowed.
- Option 2: The building component scope may be narrowed to focus on significant hot spots along the life cycle.
- Option 3: The building component scope may be narrowed to reflect data quality and availability.



Structure and relation to life cycle and project stages

Proposed approach (1)

- The framework shall consist of a set of core indicators that are either:
 1. Directly related to final performance aspects of a residential or office building, or
 2. LCA indicators that characterise environmental impacts or quantify input or output flows relating to resource use (according to EN 15978).
- The framework and each indicator will be communicated with a strong reference to relevant life cycle stages, and this approach to communication will be extended to life cycle costs as well.



Structure and relation to life cycle and project stages

Proposed approach (2)

The core indicators will have the following supporting documentation:

- A calculation methodology which, where possible, shall be with reference to an existing standard(s) and/or EU policy instruments;
- Life cycle scenario tools which will provide users with the best available methods. Semi-quantitative standards and guidance to develop realistic scenarios for performance along the life cycle (see discussion point 2 for further details)
- A set of guidance notes that will help users understand the building project/life cycle relevance of each indicator, specify data collection/verification and identify focus points for attention in seeking to improve performance.



Structure and relation to life cycle and project stages

Proposed approach (3)

- With the aim of improving the link between design and actual performance, it shall be possible to report on the indicators at:
 1. Design stage (based on calculations),
 2. Completion stage (based on as-built drawings),
 3. Post-completion (based on commissioning and testing)
 4. Occupation (based on measured performance)
- Some respondents were strongly of the opinion that the framework as proposed did not focus enough on occupiers/end-users of buildings.
 - *include guidance on post-occupancy surveying to determine occupant/end-user occupant/end-user satisfaction?*



Structure and relation to life cycle and project stages

Questions

1. Is the overall structure and way the framework is proposed to work suitable?
2. Does it require any further improvement to address the needs of possible end-users?
3. How could the focus on occupiers/end-users be improved?



A framework based on life cycle assessment

Proposed approach (1)

- The aim of the framework as a whole shall be to encourage life cycle thinking by focussing attention on all four of the life cycle stages described in EN 15978:
 - Product (A1-3),
 - Construction process (A4-5),
 - Use stage (B1-7),
 - End of life (C1-4)
 - *Module D ('benefits and loads beyond the system boundary'),*
- Module D where possible *in conjunction* with scenarios for deconstruction, recyclability and re-use

The original indicator proposal 2.1 Cradle to grave LCA is proposed to become an overarching reporting option.



A framework based on life cycle assessment Proposed approach (2)

- Indicators that are LCA impact categories
- Indicators that relate to final building performance
 - these provide inventory data, modelling and assumptions that are required to subsequently carry out an LCA and/or to calculate Impact Categories
- Methods that can support qualitative descriptions of life cycle scenarios
 - These describe future scenarios influencing performance e.g. service life, design for disassembly and recycling, future climate change.

Proposed that all environmental indicators included in the framework shall contribute to, or be in their own right, LCA impact categories or parameters as specified in EN 15978.



A framework based on life cycle assessment

Proposed approach (3)

- Some proposals identified as being more qualitative and better suited to help describe/develop LCA scenarios:
 - Service life
 - Design for disassembly and recyclability,
 - Design for adaptability
- Guidance proposed to be developed based on best practice from, amongst other sources, DGNB, BREEAM Netherlands and ISO 15686-8.
- The potential to narrow the scope of building elements was supported in the consultation.
- Data gaps or problems of data quality shall be addressed in the reporting, which shall be transparent and shall penalise data of a low quality.

Revised core framework proposal



Overview of the revised framework proposal (1)

	Macro-objectives	Core indicators within the framework	LCA indicators directly related to the macro-objective
Life cycle environmental performance macro-objectives	Overarching reporting	Indicator 2.1. Cradle to grave LCA	EN 15978 environmental impact categories
		Reliability and data quality (supporting reporting on indicator 6.2)	Potentially based on ISO 14044 guidance and PEF data quality criteria
	MO1: Greenhouse gas emissions along the buildings life cycle	Indicator 1.1. Operational energy consumption	
		Reporting component 1.1a Total primary energy consumption (EPBD scope)	Primary energy (renewable and non-renewable)
		Reporting component 1.1b Final energy consumption (EPBD scope)	
	MO2: Resource efficient material life cycles	Indicator 1.2. Operational and embodied GWP	GWP
		Indicator 2.1. Service life bill of materials	ADP (elements and fossil fuels)
	MO3: Efficient use of water resources	Indicator 2.4. Construction and demolition waste	Waste categories (hazardous/non-hazardous), Output flows (re-use, recycling)
		Indicator 3.1. Mains drinking water consumption	Net use of fresh water
	Quality, performance and value macro-objectives	MO4: Health and comfortable spaces (initial focus on indoor air quality)	Indicator 4.1. Airborne pollutant levels
Reporting component 4.1a. Quantitative airborne pollutant levels (listed substances)			
Reporting component 4.1b. Qualitative airborne pollutant levels (mould)			
MO5: Resilience to climate change (initial focus on overheating and thermal comfort)		Indicator 4.2 Indoor air class (ventilation, CO ₂ and relative humidity)	
		Indicator 5.1. Occupant thermal comfort	
		Indicator 5.2a. Additional cooling energy required	Primary energy (renewable and non-renewable)
MO6		Indicator 5.2b.Green factor (cooling effect of green features)	
	Indicator 6.1 Life Cycle Costs		
		Reporting component 6.1a. Utility costs	
		Reporting component 6.1b. Acquisition and maintenance costs	
		Indicator 6.2 Value and risk factors	
		Supporting guidance (with reference to preferred standards and methodologies)	
	Life cycle scenario tool 1	Design and service life	With reference to EN 15978
	Life cycle scenario tool 2	Design for adaptability (B5)	
	Life cycle scenario tool 3	Future climate change (C6)	
	Life cycle scenario tool 4	Design for deconstruction, recyclability and re-use (C1)	

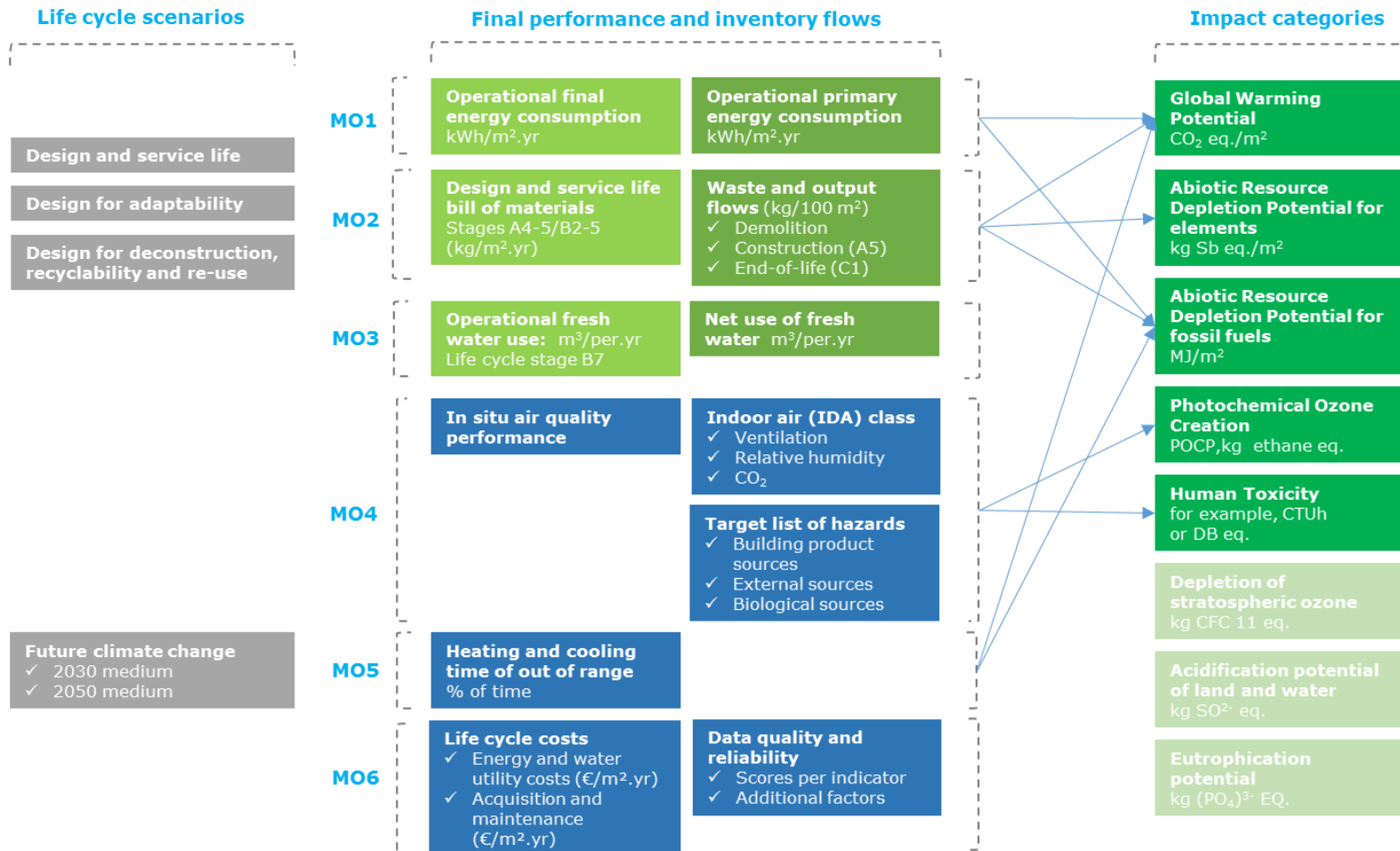
Colour code key:

- Moved to become overarching indicator
- New indicator or reporting component
- Renaming of indicator
- Merged with another indicator
- Moved to become a 'life cycle scenario'
- Discontinued or to be addressed in guidance for another indicator

Colour code key:

	Moved to become overarching indicator
	New indicator or reporting component
	Renaming of indicator
	Merged with another indicator
	Moved to become a 'life cycle scenario'
	Discontinued or to be addressed in guidance for another indicator

Overview of the revised framework proposal (2)





A framework based on life cycle assessment

Questions

1. How could professionals be supported to become familiar with/start using LCA and its associated indicators?
2. Would the proposed guidance on life cycle scenarios be a useful tool to complement the indicators?
3. Should the framework encourage/support users to go beyond just reporting on indicator results?



Structure and relation to life cycle and project stages

Questions

1. Is the overall structure and way the framework is proposed to work suitable?
2. Does it require any further improvement to address the needs of possible end-users?
3. How could the focus on occupiers/end-users be improved?

3.2 Proposed approach to reporting and comparability

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Consultation proposals

Data quality and reliability

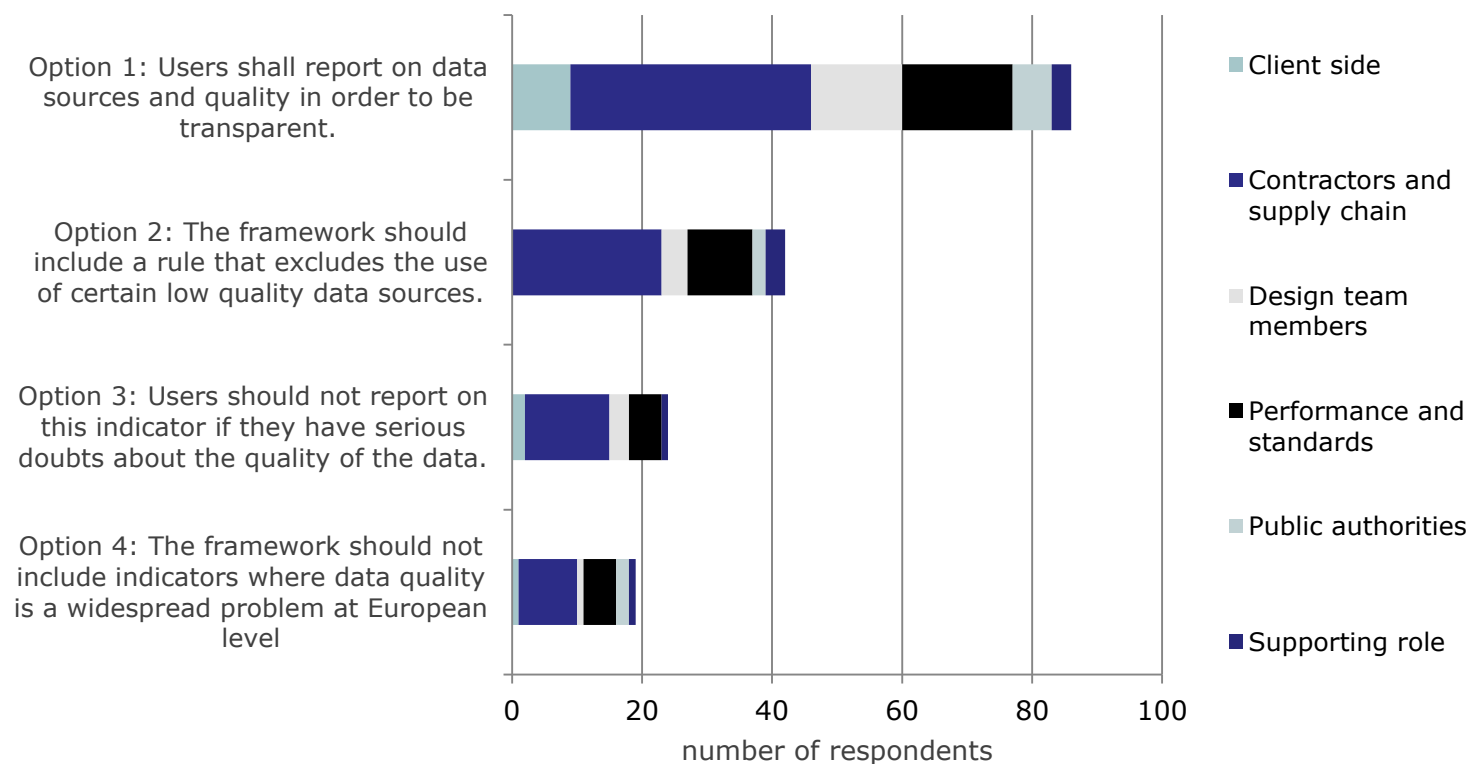
- Could be a potential barrier to uptake because of the perceived gaps;
- Complicate use of the indicator by requiring further data collection;
- Create problems for the comparability and meaningfulness of results.

Specific challenges for wider implementation across the EU

1. How users can be supported in member states where no databases or datasets are initially available;
2. The basis on which generic or unverified data can be used, in order to encourage design teams/clients to 'get started'; and
3. How variations in the quality of data, and the associated uncertainty, can be reflected in performance reporting.

Consultation results

Q2.7 Approach to data quality and availability





Data quality and reliability

Proposed approach (1)

- The framework will incorporate a 'graduated' approach
 - Simple through to more complex calculation methods and extended reporting,
 - In turn reflected in a rating of the quality/reliability of the reporting.
- Encourage modelling and calculations that as closely as possible reflects the local conditions and opportunities to achieve greater resource efficiency.
 - Local conditions: the 'regionalisation' of results
 - Intensity of resource use: additional units of normalisation



Data quality and reliability

Proposed approach (2)

Transparency and reporting on data quality and the reliability of calculation methods used as the basis for reporting

- 'Data quality and reliability rating' for each indicator could be used to encourage/reward more accurate calculations/modelling/reporting.
- Such a rating could indicatively be based on LCA guidance and methods:
 - ISO 14044
 - Product Environmental Footprint (PEF)
- The PEF provides a semi-quantitative method which rates various aspects of representativeness
- The ratings for each indicator could then provide useful information for investors and valuers as part of reporting on indicator 6.2.



Data quality and reliability Questions

1. Would the 'graduated' approach described be an appropriate way to resolve the issue of 'basic' versus 'advanced' indicators?
2. What should be the key aspects of reliability and data quality which should be reported on/rated?
3. Could current approaches to the evaluation/reporting of data quality used in LCA be suitable for such a 'reliability and quality rating'?



Consultation proposals

Comparability

Many possible factors can introduce variations in building performance across the EU e.g. climate, costs, construction culture, raw materials and property markets.

How meaningful would it be to compare performance across the EU?

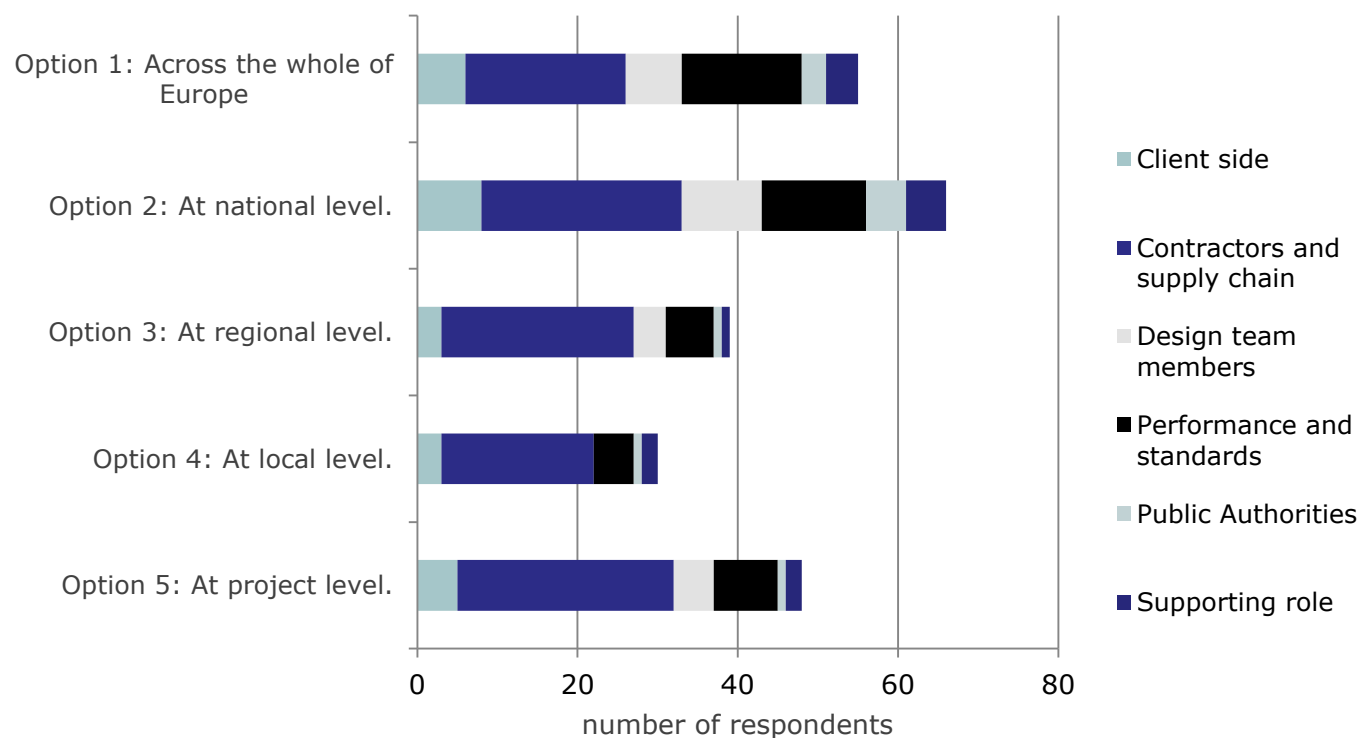
- Performance comparisons tend to be more meaningful at a project level, in a local property market, or across a property portfolio.
- At policy level or in the management of international portfolios there would be value at national or regional level.

Contextualise ('regionalise') or make comparisons based on fixed parameters?

- *For example*, typical water consumption patterns, the local costs of building materials

Consultation results

Q2.8 The level at which indicators support performance comparisons





Supporting comparability Proposed approach (1)

How can we support comparability on an absolute basis for functionally equivalent buildings at national and EU level?

- A number of **key terms** will need to be defined in order to support basic comparability e.g. internal floor area definition.
- **Assumptions and adjustments** for occupation related factors such as workplace density, occupancy, bed spaces and voids will need to be reported on.
- Potential to fix a series of **input parameters** so that local/regional factors are taken out of the calculations
 - *e.g. generic LCA inventory data or EPD ratings, energy costs, building element building element costs, service life, discount rate*



Supporting comparability Proposed approach (2)

How can we support comparability on an absolute basis for functionally equivalent buildings at national and EU level?

- The importance of 'like-for-like' reporting has been highlighted e.g. to reflect, for example,
 - functionally equivalent types of office (based on market 'segmentation')
 - residential property types and ownership structures
 - types of investments
- The use of reference, notional or 'mirror' buildings as described under EPBD regulations in Member States
 - highlighted by some stakeholders as providing a useful starting point for comparisons and performance optimisation.
 - Approach already used by some assessment schemes for LCA criteria



Supporting comparability Questions

1. How should the framework support comparability at EU and national level?
2. To what extent should some/all of the discussed aspects be addressed?
3. Do any standard EU-wide reference points exist for different types of office and residential buildings and their market segmentation?



Data quality and reliability Questions

1. Would the 'graduated' approach described be an appropriate way to resolve the issue of 'basic' versus 'advanced' indicators?
2. What should be the key aspects of reliability and data quality which should be reported on/rated?
3. Could current approaches to the evaluation/reporting of data quality used in LCA be suitable for such a 'reliability and quality rating'?

3.3 Life cycle environmental performance macro-objectives (1,2 and 3)

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B1: Greenhouse gas emissions from building life cycle *energy use*

Aim: minimise the total GHG emissions along a buildings lifecycle, with a focus on building operational energy use emissions and embodied emissions along the life cycle of a building.

What does this mean in practical terms?

- Estimation of Global Warming Potential based on CO₂ equivalent emissions ('carbon footprint analysis')
- Supporting focus on gaps in predicted and actual energy consumption in the use phase



Field study building clusters

- MacDonald residential masterplan (Paris, France): Operational energy use;
- Skanska Group (seven EU states): Operational energy use and carbon footprinting;
- Green Building Council Finland, Building Performance Indicator pilots: Design and measured energy use, carbon footprinting;
- ENSLIC (nine EU states): Embodied CO₂ emissions.

Cross-checks: EN standards, EU VCS status, national initiatives (HQE Performance), EU collaboration (Qualicheck), private experience (Sturgis CP)

First proposal (option 1)

1.1 Operational primary energy

Operational consumption

Indicator:
Primary energy
kWh/m².yr

Supporting activity

Quality assurance

Focus of attention:

- ✓ Air tightness
- ✓ Thermal integrity
- ✓ Commissioning

1.2 Life cycle CO₂ emissions

Operational and embodied GWP

Indicator:
kg CO₂eq/m².yr

Supporting activity

Design options

Focus of attention:

- ✓ Form and massing
- ✓ Structural design optimisation
- ✓ Building element service life
- ✓ Design for adaptability

Boundaries and scope

Residential buildings

Stages A1-3, B6, C3-4
Linked: B2-5, D

Office buildings

Stages A1-3, B6, C1-4
Linked: B2-5, D

Building elements

- ✓ Substructure
- ✓ Superstructure
- ✓ Envelope/facades
- ✓ Internal walls
- ✓ Floors and roof

If B2-5 required or a renovation project:
✓ Fit out and services

First proposal (option 2)

1.1 Operational primary energy

Operational consumption

Indicator:
Primary energy
kWh/m²

Supporting activity

Quality assurance

Focus of attention:

- ✓ Air tightness
- ✓ Thermal integrity
- ✓ Commissioning

1.2 Life cycle CO₂ emissions

Operational and embodied GWP

Indicator:
kg CO₂eq/m²

Supporting activity

Design options

Focus of attention:

- ✓ Form and massing
- ✓ Structural design optimisation
- ✓ Building element service life
- ✓ Design for adaptability

Boundaries and scope

Residential buildings

Stages A-C
Linked: D

Office buildings

Stages A-C
Linked: D

Building elements

- ✓ Substructure
- ✓ Superstructure
- ✓ Envelope/facades
- ✓ Internal walls
- ✓ Floors and roof
- ✓ Fit out and services

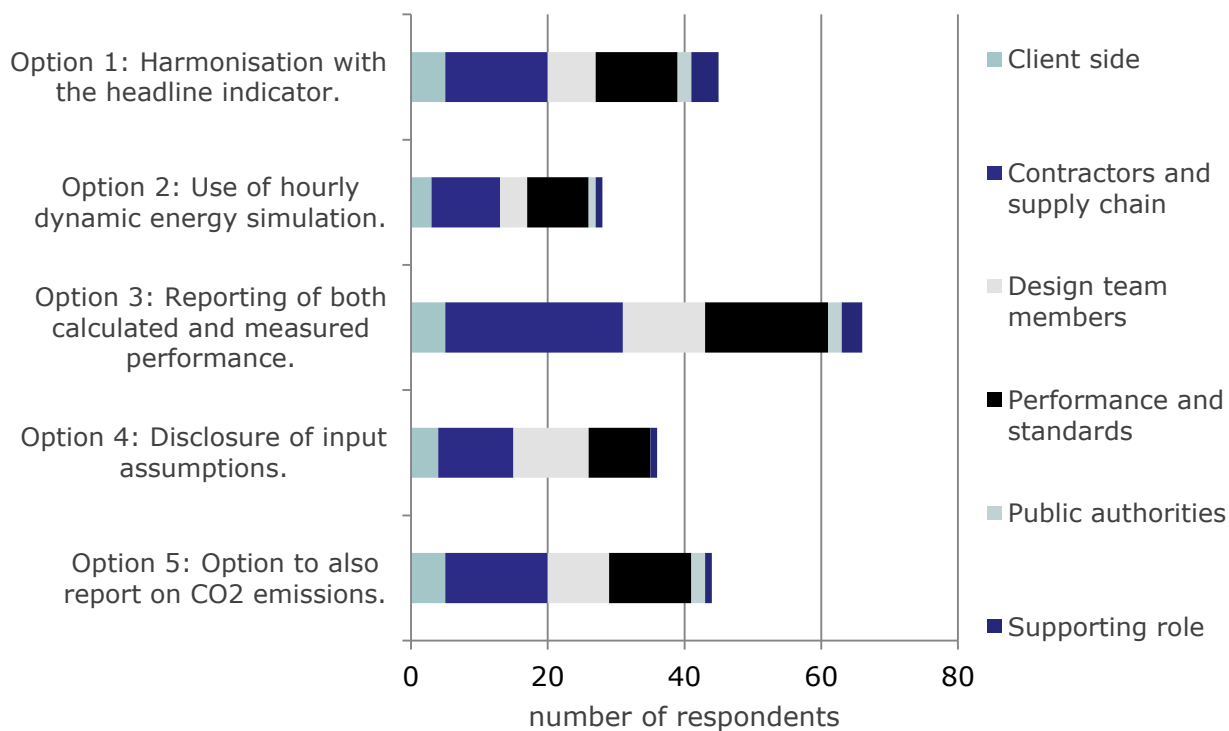
Consultation results

Q3.1/3.2 Overview by macro-objective and indicator

		Q3.1 Overall suitability	Q3.2.1 Simple, accessible and easy to understand	Q3.2.2 Readily accessible and accepted methodology, tools and units	Q3.2.3 Supports comparisons at project and local level	Q3.2.4 Easy and cost effective to verify
MO1	Indicator 1.1. Total primary energy consumption					
	Indicator 1.2. Operational and embodied GWP					
MO2	Indicator 2.1. Cradle to grave LCA					
	Indicator 2.2. Service life reporting					
	Indicator 2.3. Disassembly and recycling					
	Indicator 2.4. Construction and demolition waste					
MO3	Indicator 3.1. Mains drinking water consumption					
	Design for adaptability					

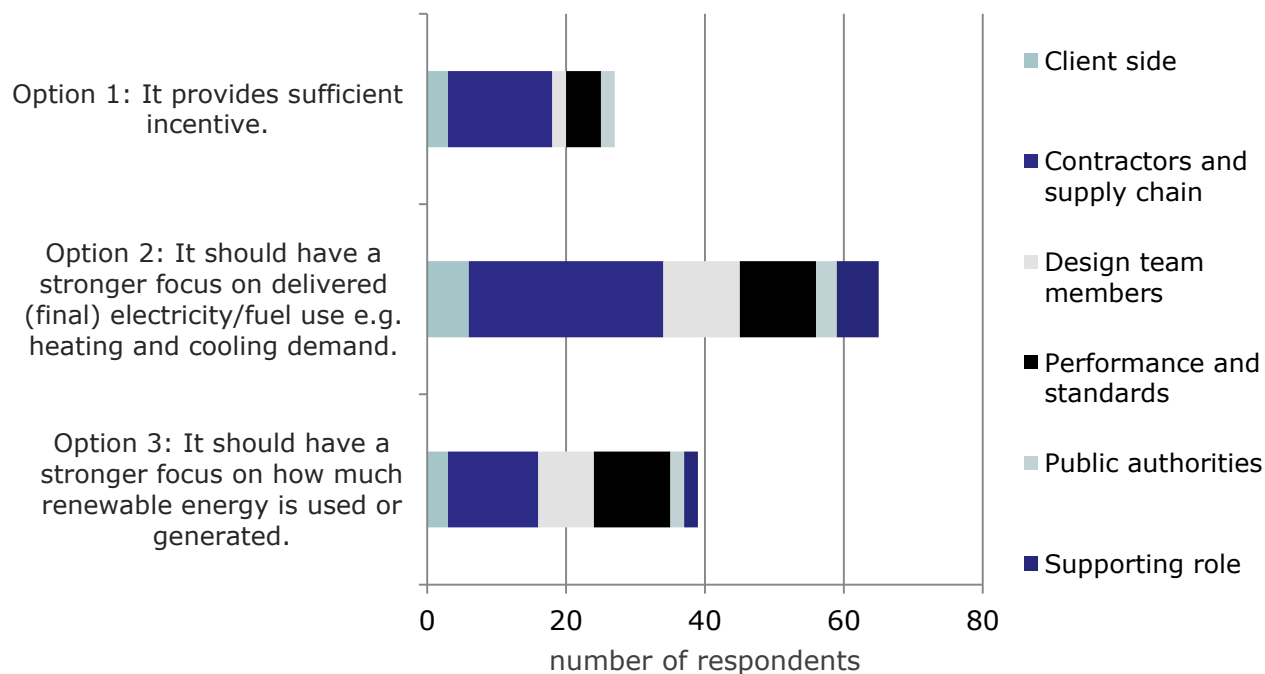
Consultation results

Q3.3 Alignment with the proposed EU Voluntary Certificate Scheme (VCS)



Consultation results

Q3.5 Incentive to design more resource efficient buildings





Findings following the consultation

Operational (use phase) energy use

- The macro-objective title excludes important emissions sources - *eg. cement production, refrigerant leakage.*
- **Final operational energy consumption** should be reported on – *i.e. heating, hot water, cooling, ventilation and lighting demand.*
 - This would also address the link to demand for cooling energy under indicator 5.2a
- Reporting should accommodate **existing EPBD NCMs**, many of which are steady state.
- **Compliant input data** is a more immediately important issue to address before moving on to dynamic simulations.

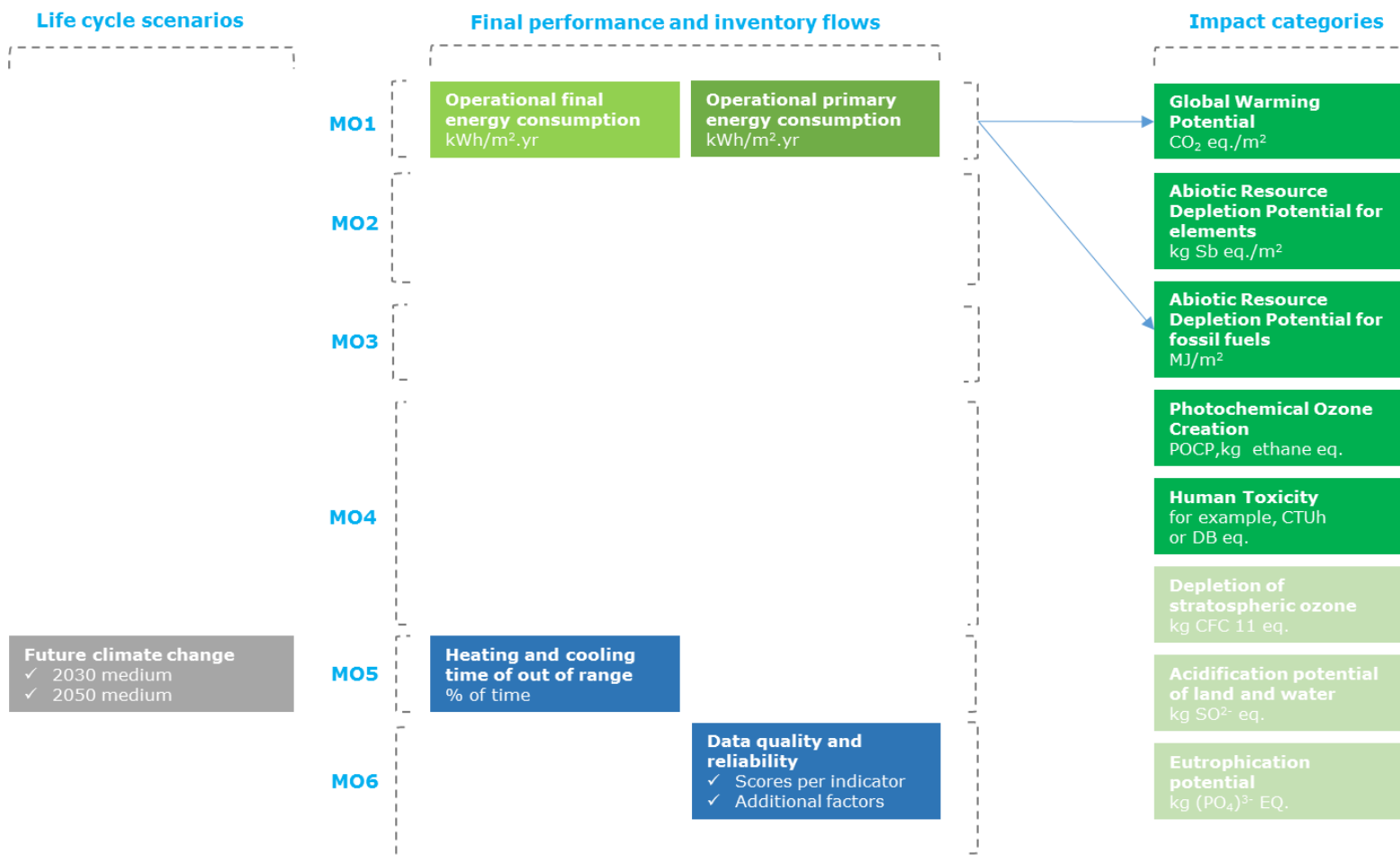


Findings following the consultation

Life cycle CO₂ eq. (GWP)

- All the life cycle stages should be reported on for 1.2 but questions have been raised about:
 - data availability for building services in particular, and
 - quality/meaningfulness of end of life scenarios that are used
- The potential to focus on hot spot building elements still exists, as the consultation findings were not as clear cut on this issue.

Overview of the revised framework proposal





Macro-objective B2: Resource efficient material life cycles

Aim: To optimise building design, engineering and form in order to support lean and circular flows, extend long-term material utility and reduce significant environmental impacts.

What does this mean in practical terms?

- Structural design for material efficiency
- Recycled/reused input material
- Construction and demolition waste minimisation
- Future design for adaptability and deconstruction



Field study building clusters

- IRCOW project: Construction and demolition waste, design for deconstruction and disassembly
- Ghandi/Hoogbouwplein: Design for adaptability, deconstruction and disassembly
- Resource efficient structural design: Concrete structural systems (with support from the Concrete Centre, UK)
- Re-use and adaptability of structures: Steel structural systems (with support from Eurofer)
- Design for deconstruction and re-assembly: 'Circular' buildings

Cross-checks: professional experience (Arup), methodologies (Singapore, DGNB, BREEAM, ICE), research (WRAP, Cambridge, VTT, MIT)

First proposal

2.1 Full LCA

Cradle to grave LCA

Indicator:

Design stage
options assessment

Supporting activity

Design options

Focus of attention:

- ✓ Form and massing
- ✓ Structural design optimisation
- ✓ Building element service life
- ✓ Design for adaptability

2.2 Building service life planning

Service life

Indicator: Building and components (years)

2.3 Deconstruction and recyclability

Deconstruction and recyclability score

Indicator: Aggregated scope for listed building components

2.4 Construction & demolition waste

a. Demolition stage

b. Construction stage

Indicator: kg/100m² and % landfill diversion

Supporting activity

Management options

Focus of attention:

- ✓ Selective demolition plan
- ✓ Reuse of major in situ elements
- ✓ Supply chain optimisation
- ✓ Waste segregation

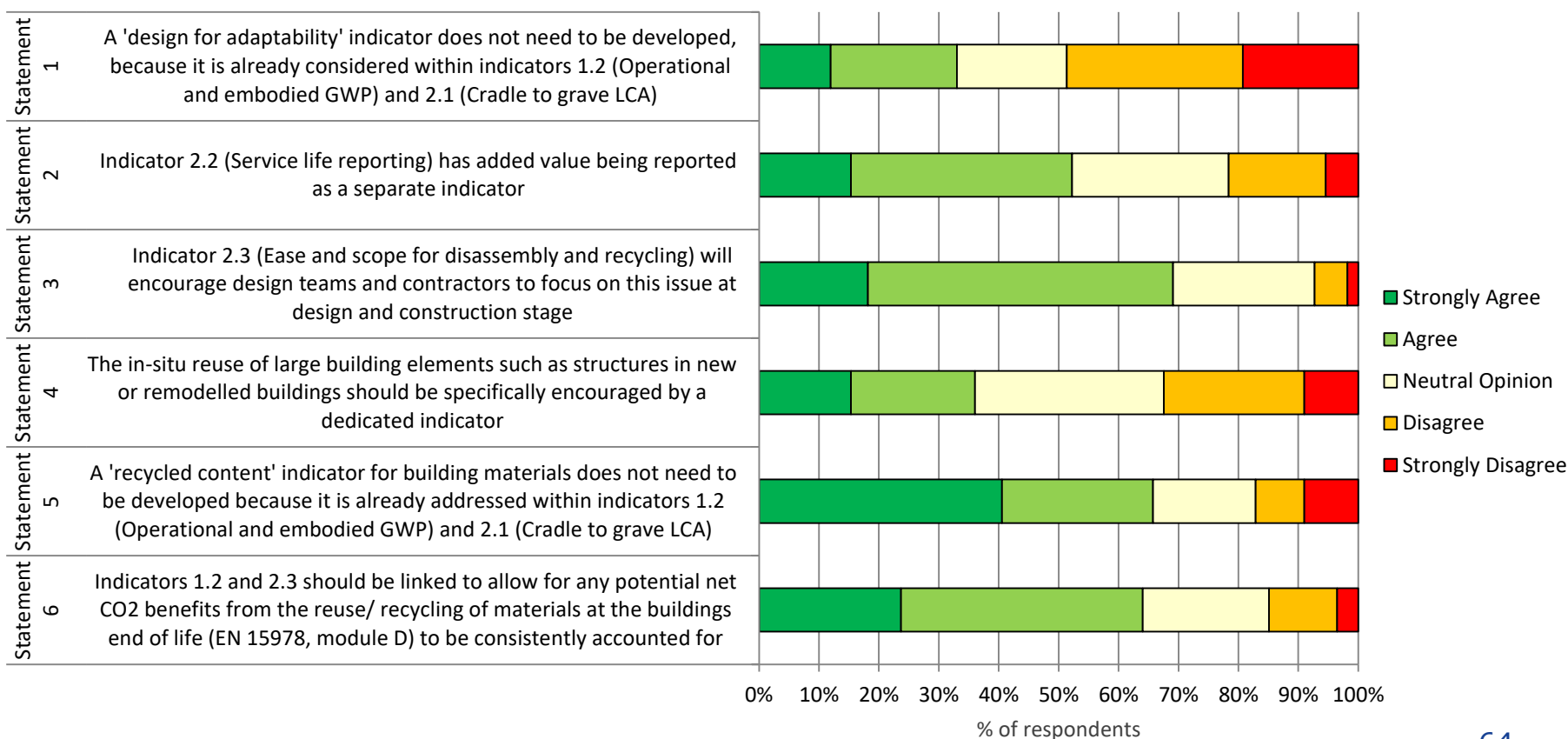
Consultation results

Q3.1/3.2 Overview by macro-objective and indicator

		Q3.1 Overall suitability	Q3.2.1 Simple, accessible and easy to understand	Q3.2.2 Readily accessible and accepted methodology, tools and units	Q3.2.3 Supports comparisons at project and local level	Q3.2.4 Easy and cost effective to verify
MO1	Indicator 1.1. Total primary energy consumption					
	Indicator 1.2. Operational and embodied GWP					
MO2	Indicator 2.1. Cradle to grave LCA					
	Indicator 2.2. Service life reporting					
	Indicator 2.3. Disassembly and recycling					
	Indicator 2.4. Construction and demolition waste					
MO3	Indicator 3.1. Mains drinking water consumption					
	Design for adaptability					

Consultation results

Q3.6 Certain aspects of indicators 2.1 – 2.4





Findings following the consultation

Resource efficient material life cycles (1)

- Overall view that some of the MO2 indicators would sit better within an **overall life cycle approach**
- The proposals '**deconstruction and recycling**' (indicator proposal 2.3) and '**design for adaptability**' (identified in WP2) would have value
 - *Methods of EN 15343-3/EN 16309, DGNB and BREEAM Netherlands*
- '**Deconstruction and recycling**' could be a useful complement to Module D of EN 15978 but should not prevent reporting.
- **Service life reporting** was considered useful by some stakeholders, but others saw it difficult (or not desirable) in practice to estimate/fix.
 - Guidance provided in ISO 15686-8 and EN 15978

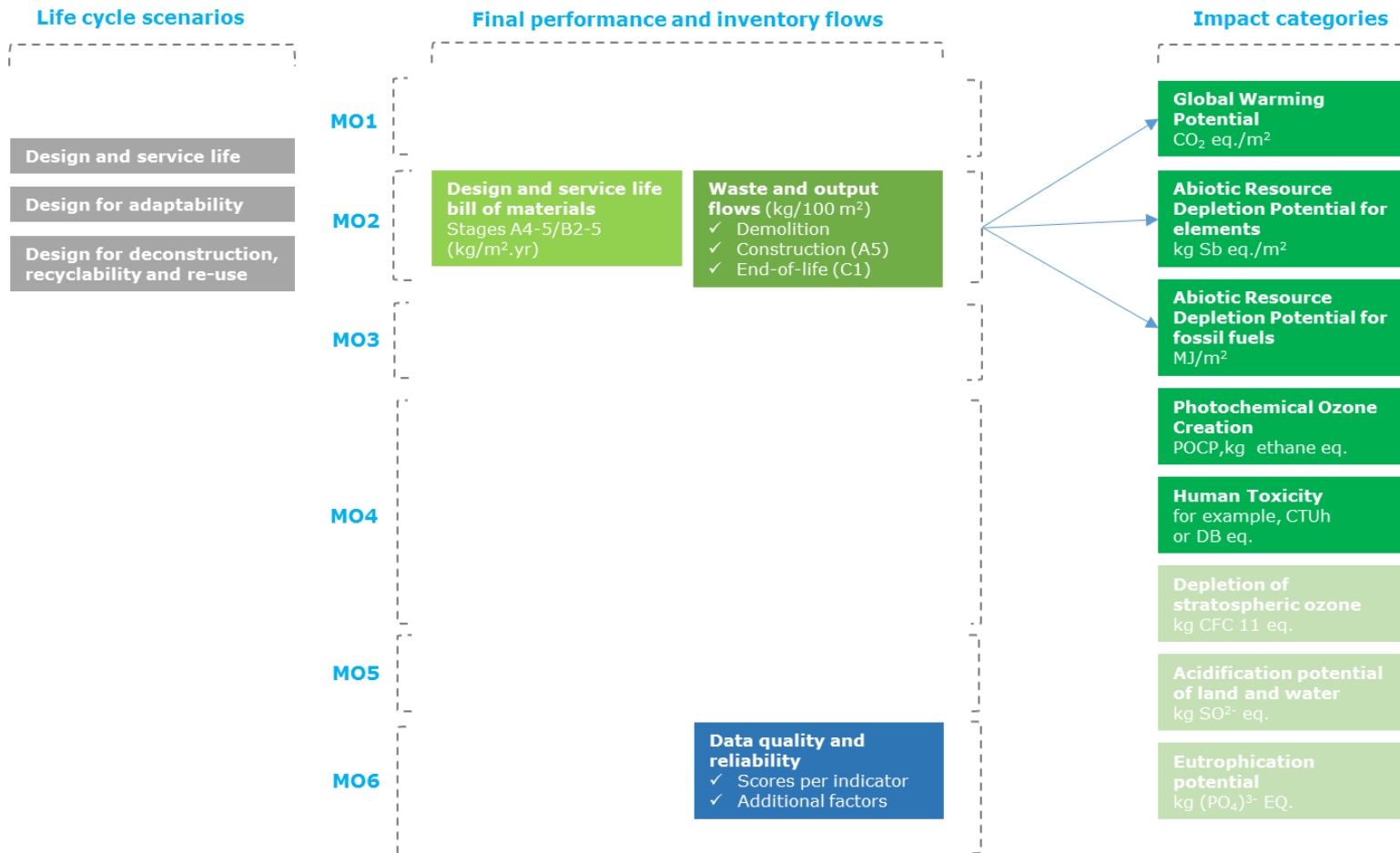


Findings following the consultation

Resource efficient material life cycles (2)

- Some stakeholders consider it essential to have a simpler indicator that encourages/engages with **structural engineers**
 - *e.g. a mass based indicator, or potentially the two abiotic depletion potential (ADP) LCA indicators, as long as it is always reported alongside GWP.*
- The potential to encourage the use of **Abiotic Depletion Potential (ADP)** was also suggested.
 - *This would complement the idea of input (inventory flow) data supporting calculation of impact categories.*

Overview of the revised framework proposal





Macro-objective B3: Efficient use of water resources

Aim: more efficient use of water resources, particularly in areas of identified long-term or projected water stress.

What does this mean in practical terms?

A focus on encouraging water efficiency measures in areas of water stress

This could include sanitary fittings, but also external uses and the potential to substitute potable water with lower grade sources



Field study building clusters

- ALTO offices – new-build and residential (France and Luxembourg): Operational water use
- ALTO residential – MacDonald masterplan (France): Operational water use

Cross-checks: Certification tools (BREEAM, VERDE, HQE), building regulations (England, Madrid)



First proposal

3.1 Operational mains water use

In water scarce areas

**Total mains water
consumption**
Indicator:
m³/person/day

Design options
Focus of attention:
✓ Metering
✓ Irrigation water
✓ Rain and grey water

Consultation results

Q3.1/3.2 Overview by macro-objective and indicator

		Q3.1 Overall suitability	Q3.2.1 Simple, accessible and easy to understand	Q3.2.2 Readily accessible and accepted methodology, tools and units	Q3.2.3 Supports comparisons at project and local level	Q3.2.4 Easy and cost effective to verify
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MO2	Indicator 2.1. Cradle to grave LCA					
	Indicator 2.2. Service life reporting					
	Indicator 2.3. Disassembly and recycling					
	Indicator 2.4. Construction and demolition waste					
MO3	Indicator 3.1. Mains drinking water consumption					
	Design for adaptability					

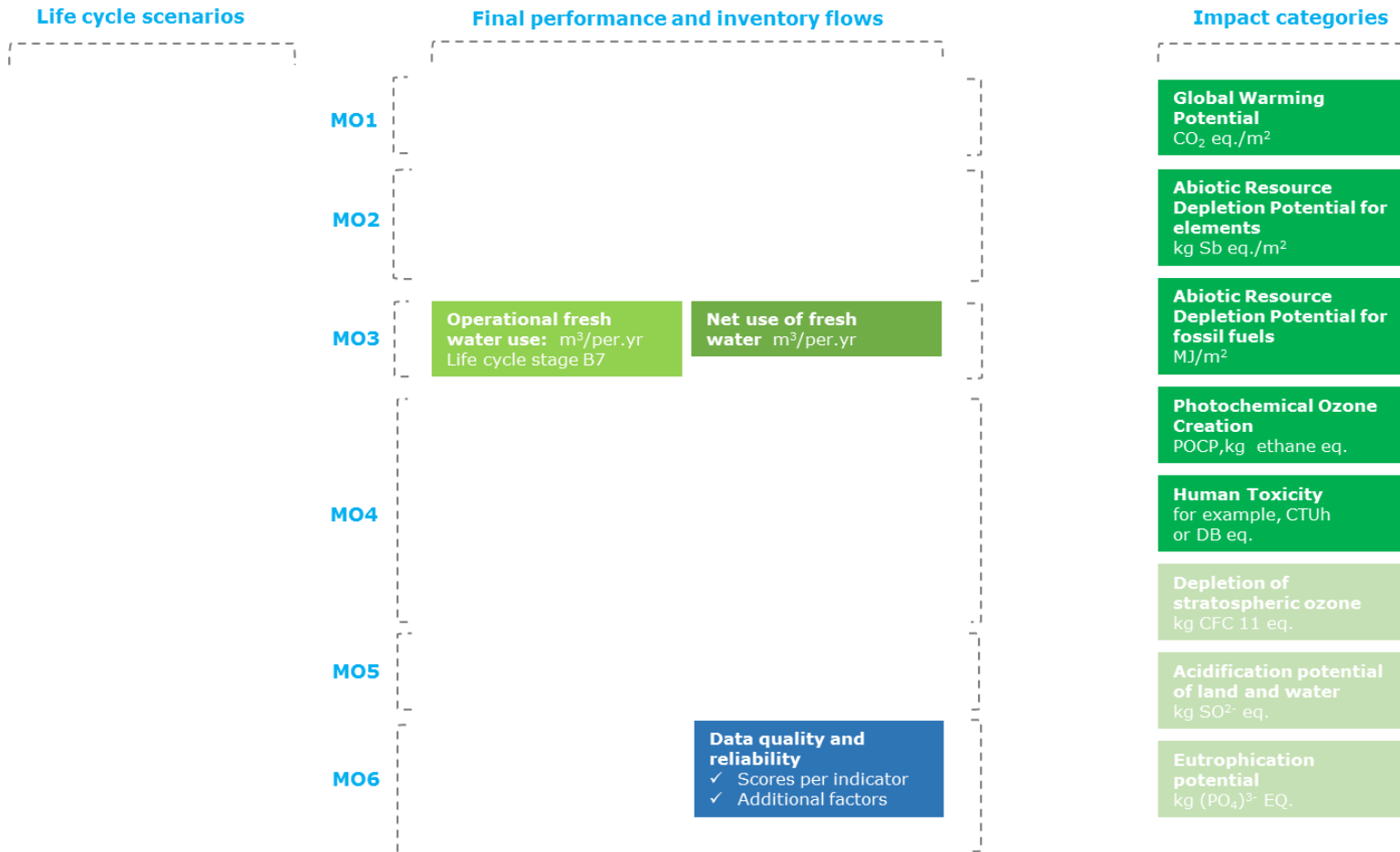


Findings following the consultation

Efficient use of water resources

- The **headline indicator** was supported
 - *Normalisation based on predicted building occupation,*
 - *Adjustments applied to calculated household water use to reflect MS variations.*
- Main challenge for the headline indicator will be the **calculation methodology**, which needs to be suitable for both offices and homes.
- **Regionalisation** could be linked to LCA methodologies and/or EEA and Eurostat datasets.
- Some stakeholders requested that the use of **rain water** and **grey water** should be reported on.
- A number of stakeholders requested that **embodied water** along the life cycle to be included.

Overview of the revised framework proposal



3.4 Quality, performance and value macro-objectives (4,5 and 6)

30th November 2016



Joint Research Centre
the European Commission's
in-house science service



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Macro-objective B4a: Health and comfortable spaces

Aim: To protect human health by minimising the potential for occupier and worker exposure to health risks resulting from the design, construction and renovation of buildings.

What does this mean in practical terms?

- ✓ Minimise occupant exposure to chemical hazards: ventilation intake and emissions from **building product sources**
- ✓ For the renovation of domestic properties, emissions from renovation materials, and the presence of damp and mould (**biological sources**)
- ✓ The potential for the exposure of workers installing or dismantling building materials



Field study building clusters

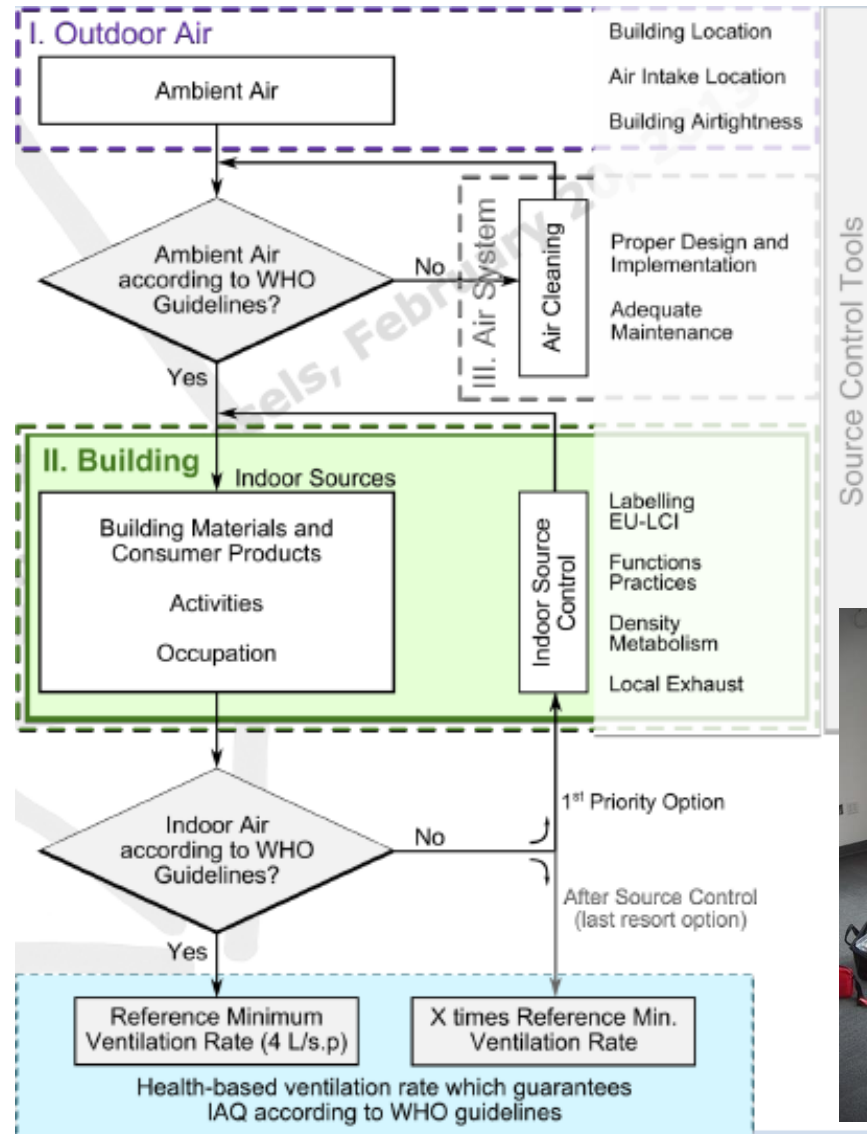
- ALTO Office projects – new-build and renovation (France and Luxembourg): Certification criteria
- OFFICEAIR: Pan-EU monitoring of influences on office air quality
- Clean air, low energy: Specification and monitoring of new-build projects
- Renovair: Specification and monitoring of housing renovation projects

Cross-checks

Collaborative EU projects (Healthvent), field studies (INSULAtE), housing regulation (UK), standards and harmonisation (ECom, Finland)



HealthVent framework



First proposal

4.1 Indoor air quality

Pollutant emissions

Quantitative reporting:

- ✓ CO₂
- ✓ Total VOCs
- ✓ Carcinogenic VOCs
- ✓ R-Value
- ✓ Formaldehyde
- ✓ Benzene
- ✓ Particulates (PM 2.5/10)

Qualitative reporting:

- ✓ Presence of mould

Supporting activities

a. Source control

Focus of attention:

- ✓ External air quality and filtration
- ✓ Interior finishes and tested emissions
- ✓ Control of humidity from source areas
- ✓ Thermal integrity of the building fabric









































b. Testing and inspection

Focus of attention:

- ✓ In situ quantitative post-completion testing
- ✓ HVAC commissioning and filter function
- ✓ Pre-renovation and post-occupancy mould inspection

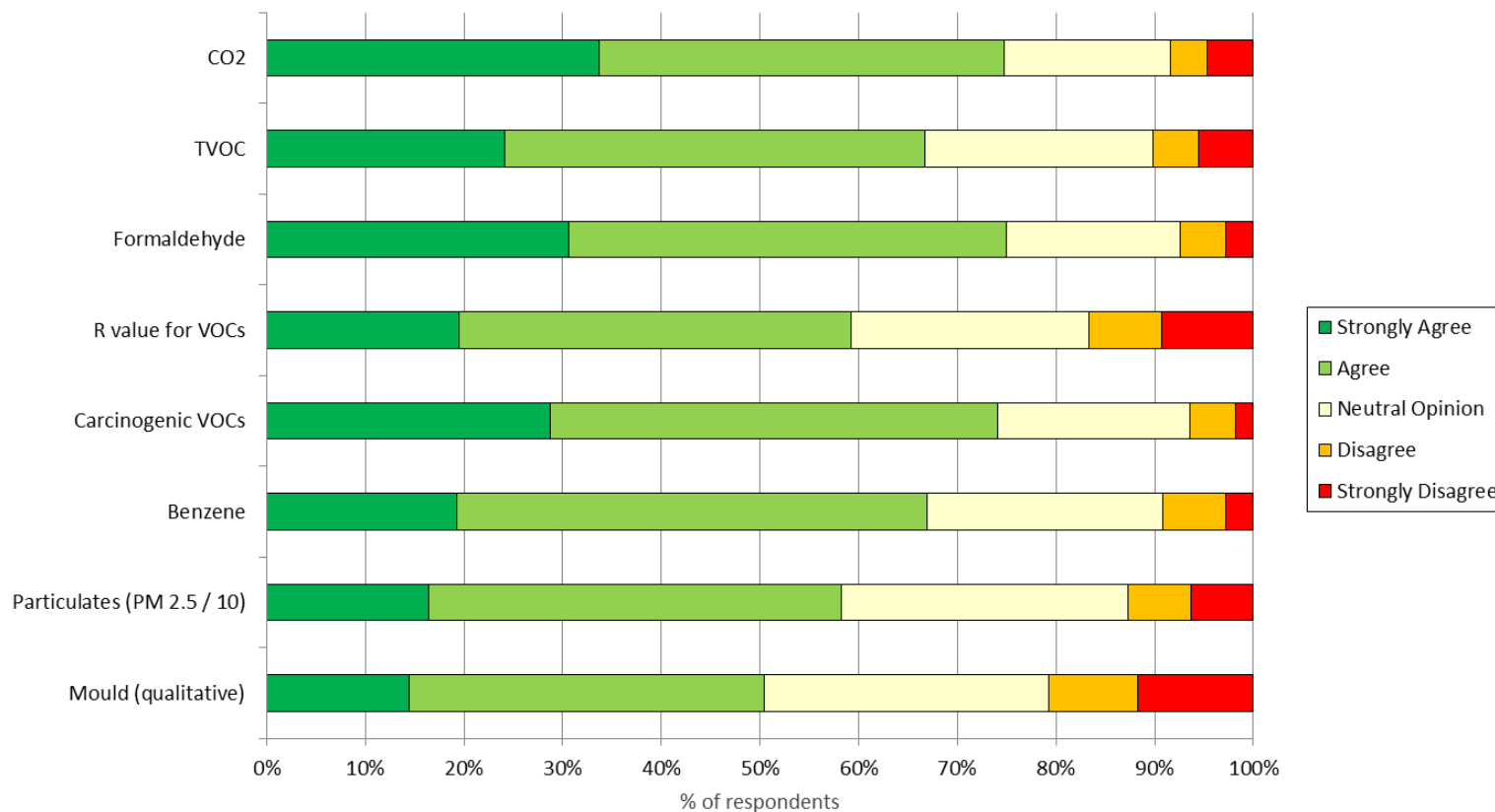
Consultation results

Q3.1/3.2 Overview by macro-objective and indicator

		Q3.1 Overall suitability	Q3.2.1 Simple, accessible and easy to understand	Q3.2.2 Readily accessible and accepted methodology, tools and units	Q3.2.3 Supports comparisons at project and local level	Q3.2.4 Easy and cost effective to verify
MO4	Indicator 4.1.Quantitative airborne pollutant levels					
	Indicator 4.1. Qualitative airborne pollutant levels (mould)					
MO5	Indicator 5.1. Risk of overheating					
	Indicator 5.2a. Additional cooling energy required					
	Indicator 5.2b.Green factor (cooling effect of green features)					
MO6	Indicator 6.1a. Long term utility costs					
	Indicator 6.1b. Long term acquisition and maintenance costs					
	Indicator 6.2.Value and risk factors					

Consultation results

Q3.10 Appropriateness of the pollutants list





Findings following the consultation

Aspects of indoor air quality and health (1)

- Indoor health and air quality represents **only one aspect** of 'health and comfortable spaces'.
- **Good quality indoor air** should somehow be reflected in the parameters measured – which could include O₂, ventilation and relative humidity
- **Health-based ventilation** should still somehow be considered alongside source emissions, but it take the focus away from source control.
- It was considered difficult to **directly relate source control and in-situ emissions**, as modelling is not well advanced in this area.



Findings following the consultation

Aspects of indoor air quality and health (2)

- **In-situ measurement** (pre-occupancy) was the main preference, in order to ensure that a building minimises risk and creates value for investors/owners based on real performance.
- **Source control** was still considered important, and is relevant as a focus for attention by design teams.
- Guidance should be provided on **typical internal fit out products** that are exposed to air and have the potential for emissions.

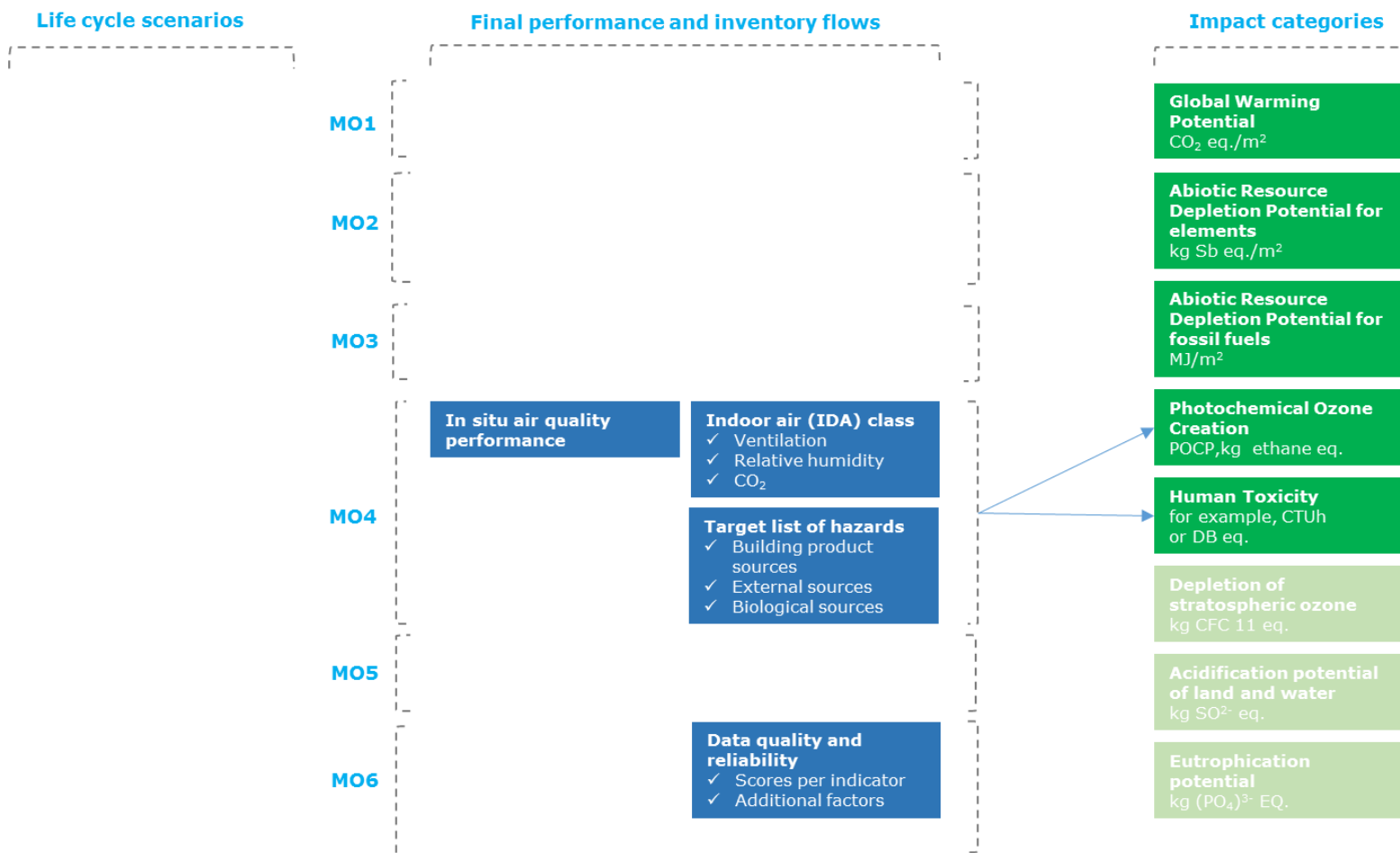


Findings following the consultation

Aspects of indoor air quality and health (3)

- Radon should be considered (where relevant as concentrations are related to geology).
- Semi Volatile Organic Compounds (SVOC) and carbon monoxide were also requested.
- R-value was supported by many stakeholders, although it appears complex to verify and feasibility for in-situ testing unclear.
- Mould evaluation was broadly supported, although the causes can be complex and may relate to occupant behaviours.
 - *Property assessment/rating methods (UK, Nordic Countries) require further attention, accepting that a standard method is not available.*
 - *The role of humidity was highlighted, and it was proposed that relative humidity should be reported on according to EN 15251.*

Overview of the revised framework proposal





Macro-objective B5: Resilience to climate change

Aim: the futureproofing of building thermal performance to projected changes in the urban microclimate, in order to protect occupier health and comfort.

What does this mean in practical terms?

- ✓ Minimise risks to future property values and make properties more attractive and comfortable for occupiers (biophilia, views)
- ✓ The tolerances of building designs to overheating will require modelling using future climate scenarios
- ✓ The potential of 'green infrastructure' and 'ecosystem services' to moderate temperatures around a building



Field study building clusters

- Design for Future Change: Office building adaptation modelling (UK)
- Knowledge for Climate: Residential building adaptation modelling (Netherlands)
- IDOM and New4Old: Office and residential building adaptation modelling and design (Spain)

Cross checks: sectoral tools (RICS), action research (Zero Carbon Hub), building permitting (BPIE), best practice (Berlin, Malmo, Southampton, Valencia)

First proposal

To include within **macro-objective 4**

5.1 Thermal comfort

Overheating risk assessment

Indicator:
(Adaptive) degree hours

Reported alongside **indicator 1.1**

5.2a Additional cooling demand

Overheating risk assessment (energy)

Indicator: Cooling primary
energy kWh/m².yr

Proxy indicator (where 5.2 not feasible)

5.2b Microclimate cooling benefit

Green factor

Indicator: Sum weighted cooling
effect for green features
on/around buildings

Macro-objective 5: Resilience to climate change



Consultation results

Q3.1/3.2 Overview by macro-objective and indicator

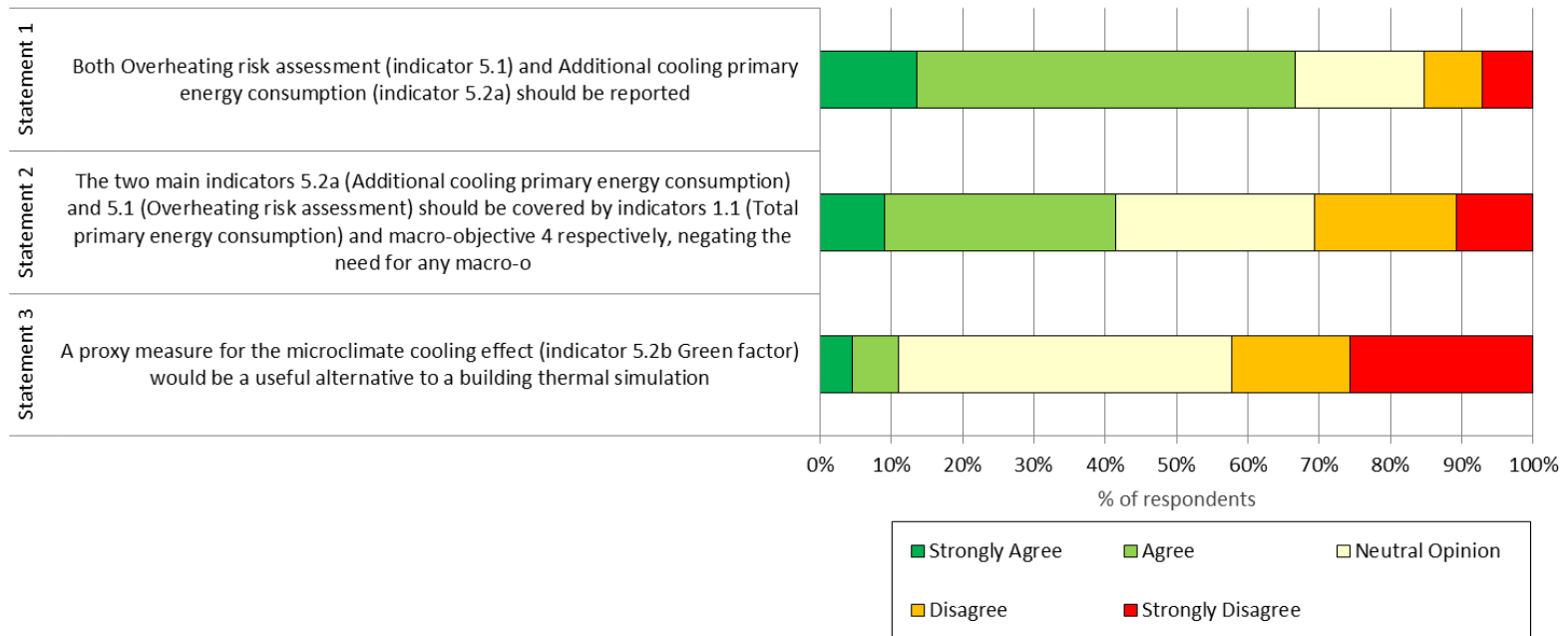
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	Indicator 4.1. Qualitative airborne pollutant levels (mould)	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
MO5	Indicator 5.1. Risk of overheating	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
	Indicator 5.2a. Additional cooling energy required	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
	Indicator 5.2b.Green factor (cooling effect of green features)	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
MO6	Indicator 6.1a. Long term utility costs	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
	Indicator 6.1b. Long term acquisition and maintenance costs	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
	Indicator 6.2.Value and risk factors	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>

Macro-objective 5: Resilience to climate change



Consultation results

Q3.12 Aspects of proposed indicators 5.1, 5.2a/b





Findings following the consultation

Aspects of thermal resilience (1)

- Need identified to emphasise that overheating and thermal comfort represent **only one aspect** of 'resilience to climate change'.
- The **retention of MO5 was supported**, but should be expanded to also address cooler climatic conditions in addition to overheating.
- The need for future meteorological datasets for 2030 and 2050 was not the subject of significant comment,
- The use of historic weather data for **worst case years** (e.g. heat waves causing excess deaths) was proposed as an alternative.



Findings following the consultation

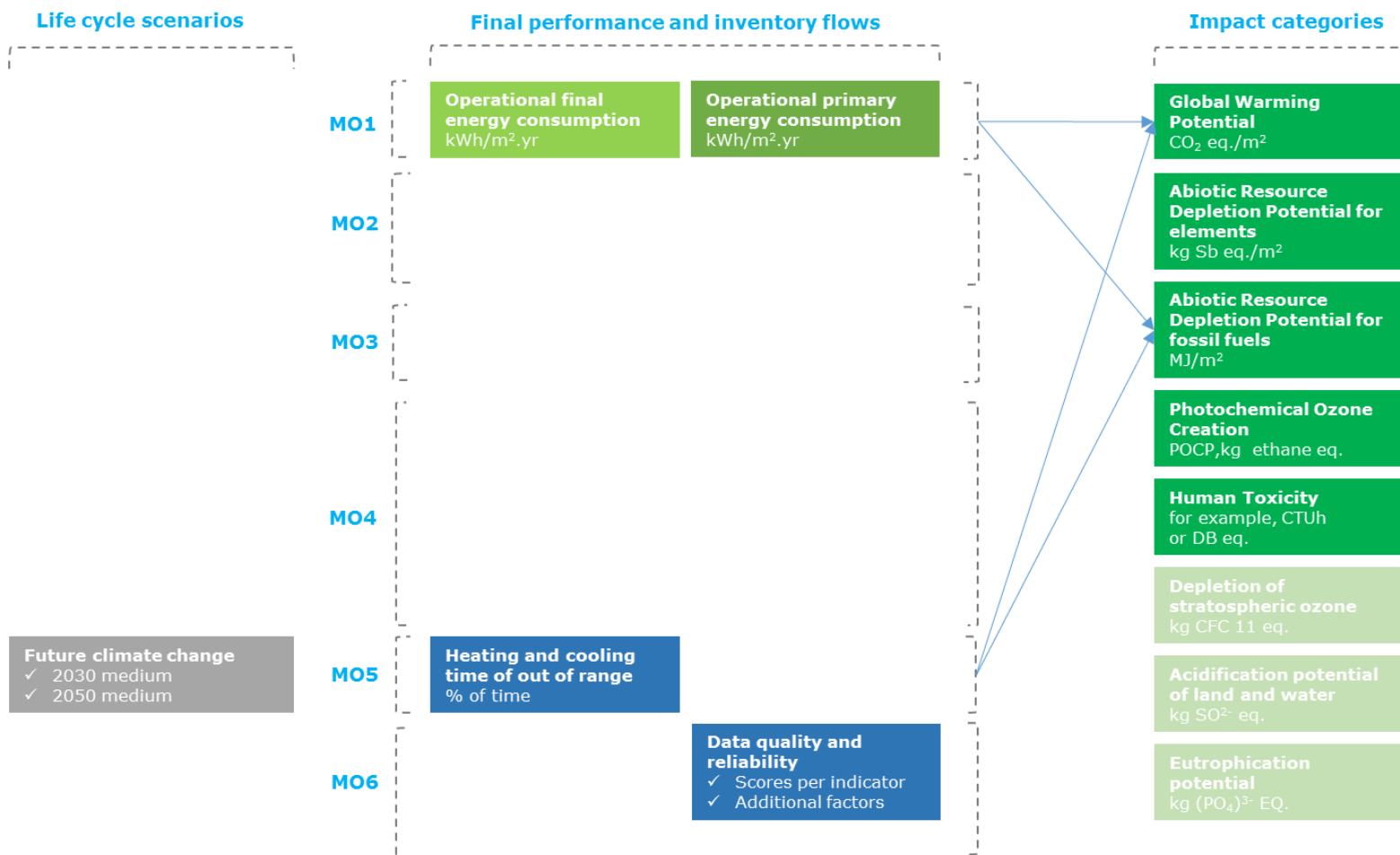
Aspects of thermal resilience (2)

- Indicator 5.1a 'Additional cooling energy required' was supported but the need for dynamic simulations is considered a **potential barrier**.
- 5.2b received a neutral or negative response in the consultation, but the concept of **taking account of green infrastructure in building energy modelling** could be supported
 - *Inclusion in building modelling was requested to be further investigated.*
- The **durability of external building materials** exposed to changing climatic conditions was also recommended as a focus for attention by some stakeholders.

Macro-objective 5: Resilience to climate change



Overview of the revised framework proposal





Macro-objective B6: Life cycle cost and value

Aim: the optimisation of the life cycle cost and value of buildings, inclusive of acquisition, operation, maintenance and disposal

What this mean in practical terms?

- ✓ Application of **Life Cycle Costing (LCC)** to buildings, and valuation methods to properties with higher environmental performance.
- ✓ In accordance with ISO 15686-5, potential to take into account 'intangible' **benefits** e.g. user comfort, amenity and productivity.
- ✓ The **potential for better environmental performance to be reflected in a property's value** at the point of carrying out due diligence, development appraisals, property market valuations and mortgage calculations.



Field study building clusters

- ALTO offices – new-build and renovation (France and Luxembourg): Life Cycle Costing
- LCC-Data: Pilot of Life Cycle Costing methodologies (five EU countries)
- IMMO-VALUE: Pilot testing of property valuation methods (three EU countries)

Cross-checks

Collaborative projects (REVALUE, RENOVALUE), reporting schemes (GRESB), action research (RICS, KIT, SB Alliance, UNEP, UK GBC)

First proposal

6.1 Life Cycle Costs

Boundary and scope

a. Utility costs

Indicator:
€/yr/m² (30/50 yrs)

Energy and water
Stages B6 and 7

b. Maintenance plan

Indicator:
€/yr/m² (30/50 yrs)

**30/50 year service
life cost plan**
Stages A5, B2-5

6.2 Creating value and managing risk

Data reliability

Value/risk factors

Indicator:
*Reliability of input data
used in calculations*

Data reliability related to:

- ✓ *Operating costs*
- ✓ *Indoor air quality*
- ✓ *Component lifespans*
- ✓ *Maintenance costs*
- ✓ *Comfort conditions*
- ✓ *Future adaptability
and resilience*

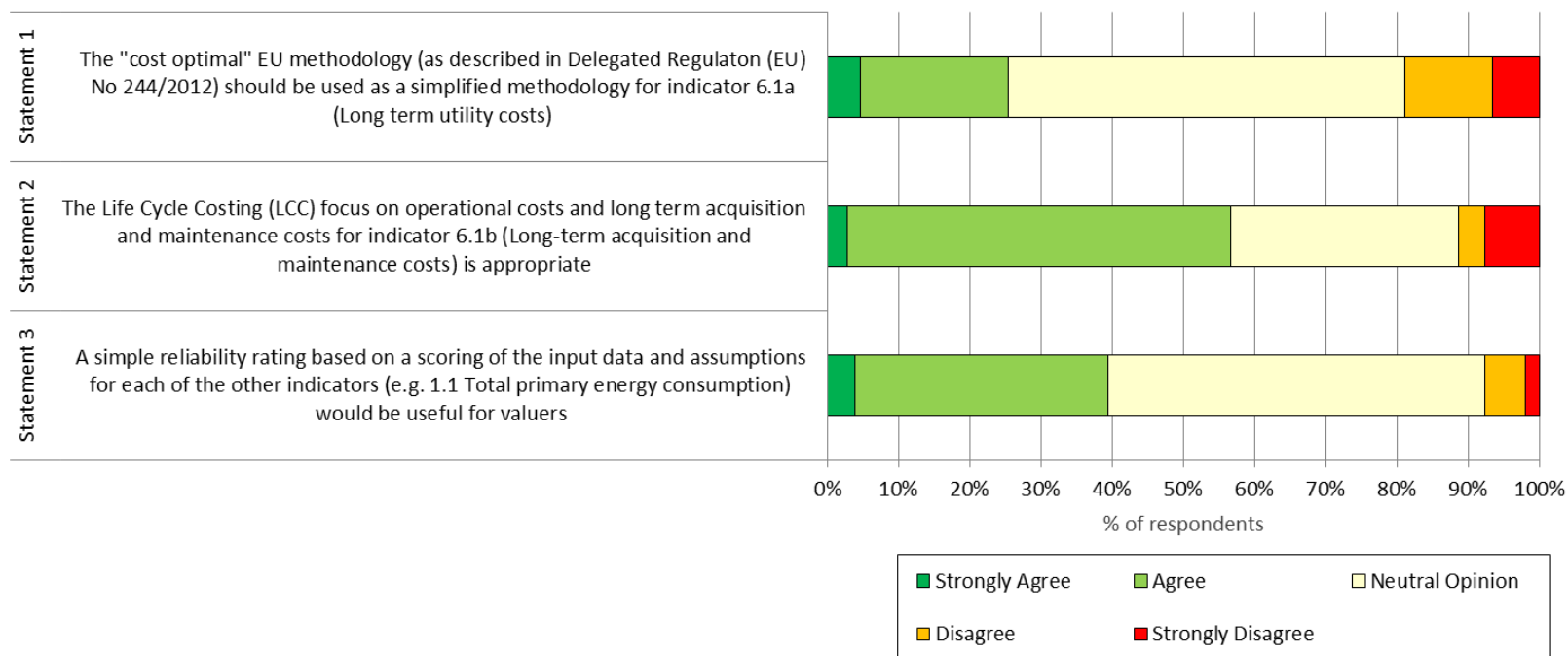
Consultation results

Q3.1/3.2 Overview by macro-objective and indicator

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	Indicator 6.1b. Long term acquisition and maintenance costs					
	Indicator 6.2.Value and risk factors					

Consultation results

Q3.13 Aspects of proposed indicators 5.1a/b, 6.2





Findings following the consultation

Aspects of life cycle costing (1)

- Bring together cost-based indicators 6.1a and 6.1b in order to provide an overall picture of costs.
- No specific comment on the proposal that **ISO 15686-5** should be the reference standard
 - *EN 15643-4/EN 16627 were referred to by some stakeholders.*
- In practice the **financial parameters** used will vary depending on the client/property owner's investment outlook and intended service life.
- **Strong regional differences in costs** (e.g. energy, water) might make such an indicator less useful, so this would need to be taken into account.



Findings following the consultation

Aspects of life cycle costing (2)

- The long time frames outlined in the proposals were not considered on the client side to be realistic.
- The time frames supported by the consultation respondents – offices 20-30 years, apartment blocks 30-50 years, individual houses 30 years - should be orientative not prescriptive.
- The potential to narrow the scope of building elements that shall be reported on was supported in the consultation.
- These building elements could be defined based on known problems with data availability, and/or those that clients focus on to optimise value (e.g. HVAC, facades).



Findings following the consultation

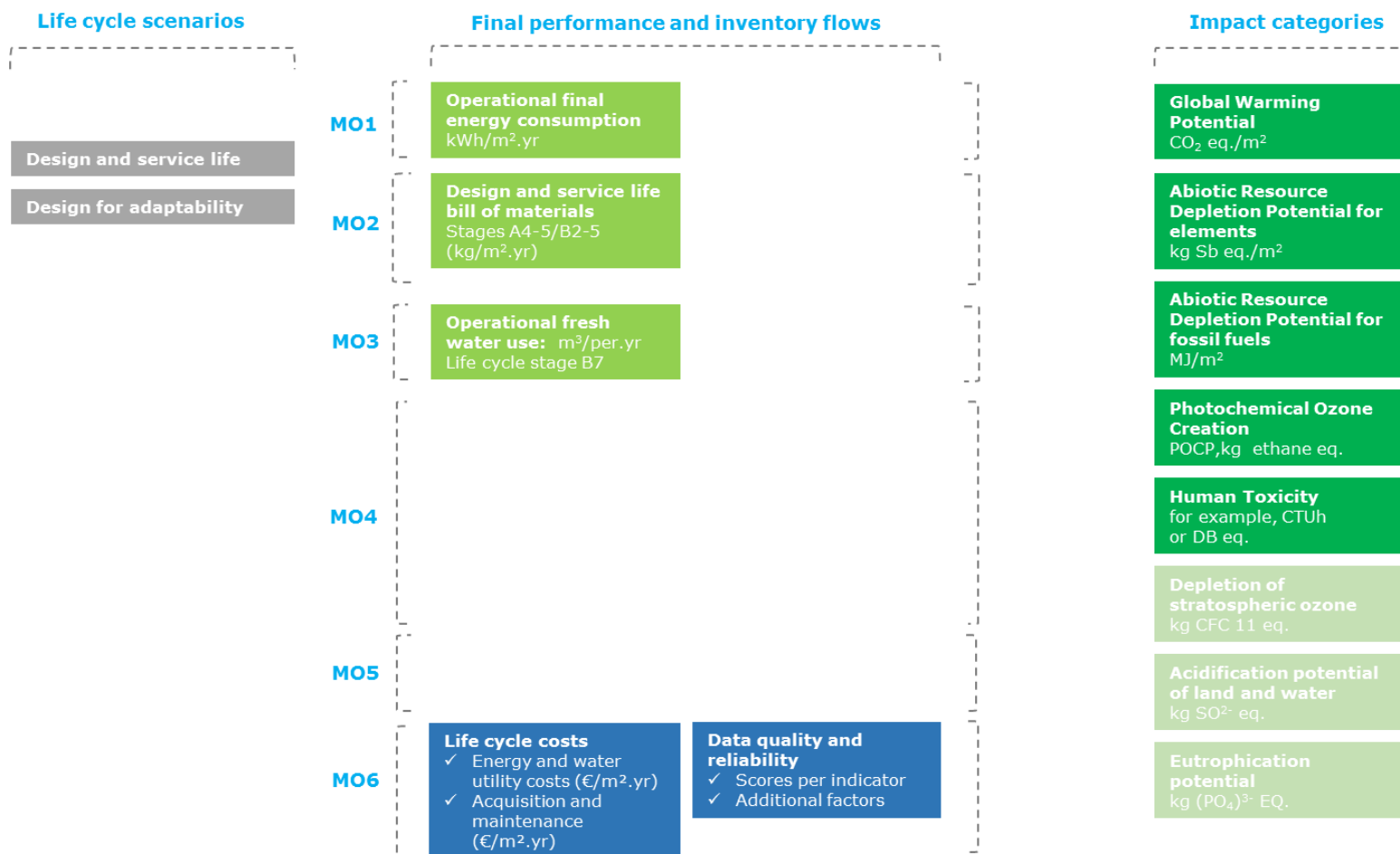
Aspects of valuation

- Indicator 6.2 on 'value and risk factors' was considered to be important by property valuation experts,
- It received a high neutral response, suggesting that the idea requires further discussion and development
- The proposed list of valuation factors should be expanded as it does not cover all relevant sustainability aspects that may impact on a property's value and risk profile.
- The absence of data/reporting on an indicator was highlighted as creating risk and should be scored negatively.
- Occupant satisfaction is a key area which could drive increased value.
- Verified information was considered of importance.

Macro-objective 6: Life cycle cost and value



Overview of the revised framework proposal



4. Introduction to the breakout sessions

30th November 2016



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7. Towards a common EU framework

30th November 2016



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Next steps following WG2

- Draft minutes of this meeting
- Comments to jrc-ipts-efficient-buildings@ec.europa.eu by **Friday 16th December**
- JRC commences drafting of methodology and guidance
- Involvement of SG1 and SG3

Final framework of indicators + toolkit of methodologies and guidance June 2017

Thank you for your attention

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Thank you



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