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Cost optimum methodology within the EPBD

Monitoring of Art. 5 implementation progress – cost effectiveness of measures.

CA EED WG Session 2, Friday, 18 March 9:00 – 10:30

The Haag, the Netherlands

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Agenda

- EPBD and the cost optimum methodology
- Cost-optimal contra cost-effective measures
- Implication of cost-optimal calculations – Danish example
- Total assessment of MSs cost-optimal calculations

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Cost optimum methodology within the EPBD

- The Energy Performance of Buildings Directive, (EPBD, Directive 2010/31/EU) and particularly Article 4.1 recital 14, obliges Member States (MS) to "*assure that minimum energy performance requirements for buildings or building units are set with a view to achieving cost-optimal levels*"
- MS shall apply a methodology, at national or regional level, of calculation of the energy performance of buildings
- MS shall take the necessary measures to ensure that minimum energy performance requirements for new and existing buildings that undergo major renovation are set

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Regulation and Guidelines

- Cost-optimal level is specified in Art. 2.14 of the EPBD recast as "*the energy performance level which leads to the lowest cost during the estimated economic lifecycle*" under two different perspectives: *financial* (looking on at the investment itself at building level) and *macro economical* (looking at the costs and benefits of energy efficiency for the society as a whole)
- MSs must report on the comparison between the minimum energy performance requirements and calculated cost-optimal levels using the Comparative Methodology Framework
- To support MSs in calculating the cost-optimal levels, the EU published **Regulations** for the Comparative Methodology Framework (Commission Delegated Regulation, 244/2012) and accompanying **Guidelines** (2012/C 115/01)

- All documents are available at the European Commissions web site: http://ec.europa.eu/energy/efficiency/buildings/buildings_en.htm

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Guidelines for calculations

- *Establish at least nine reference buildings* – one for new buildings and two for existing buildings subject to major renovation - for single-family, multi-family, and office buildings respectively
- *Define packages of energy efficiency measures* to be applied to these reference buildings
- *Assess the primary and final energy needs* of the reference buildings and the impact of the applied improvement measures
- *Calculate the life cycle cost* of the building after energy efficiency measures are implemented, by applying the principles outlined in the comparative methodology framework
- *Derivate a cost-optimal level* of EP for reference buildings

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Calculations

- The cost optimum methodology is technologically neutral and does not favour one technological solution over another
- It ensures a competition of measures/ packages/ variants over the estimated lifetime of a building or building element

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Calculations

- For any reference building, a number of variations on packages of energy saving measures must be calculated in order to identify the cost-optimal level
- There is a large diversity in the number of calculations carried out in different MS
- The Flemish region of Belgium used random variations of energy saving measures and calculated more than 100,000 combinations for each reference building
- Other MSs have calculated selected, among logical packages, variation of energy saving measures, and have thus limited the number of calculations significantly

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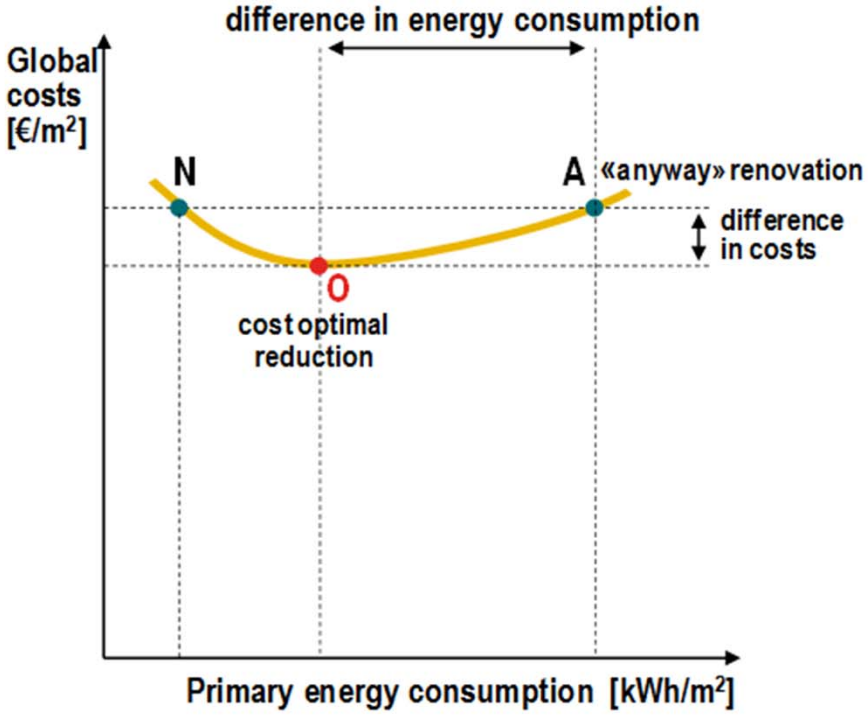
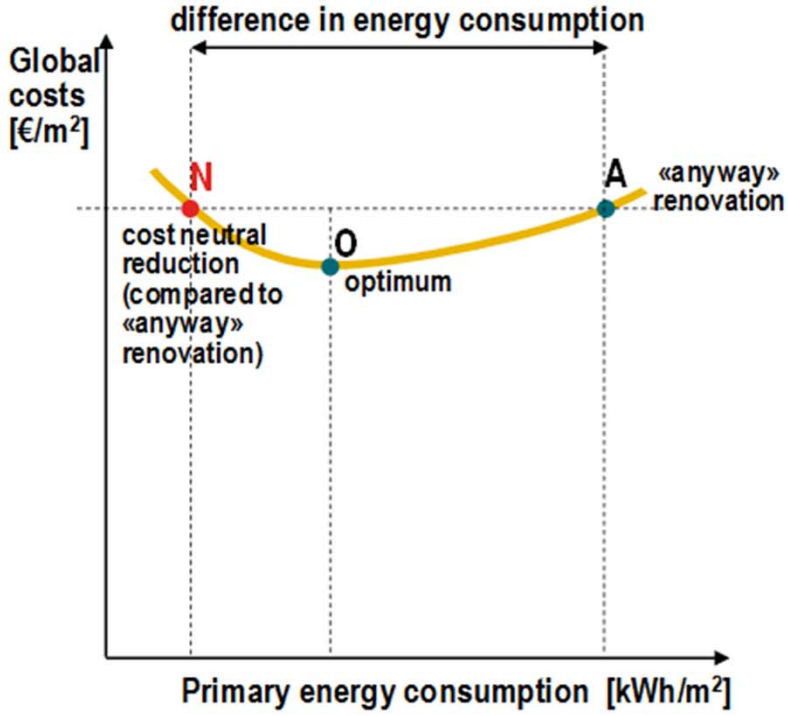
Global cost curve after renovation





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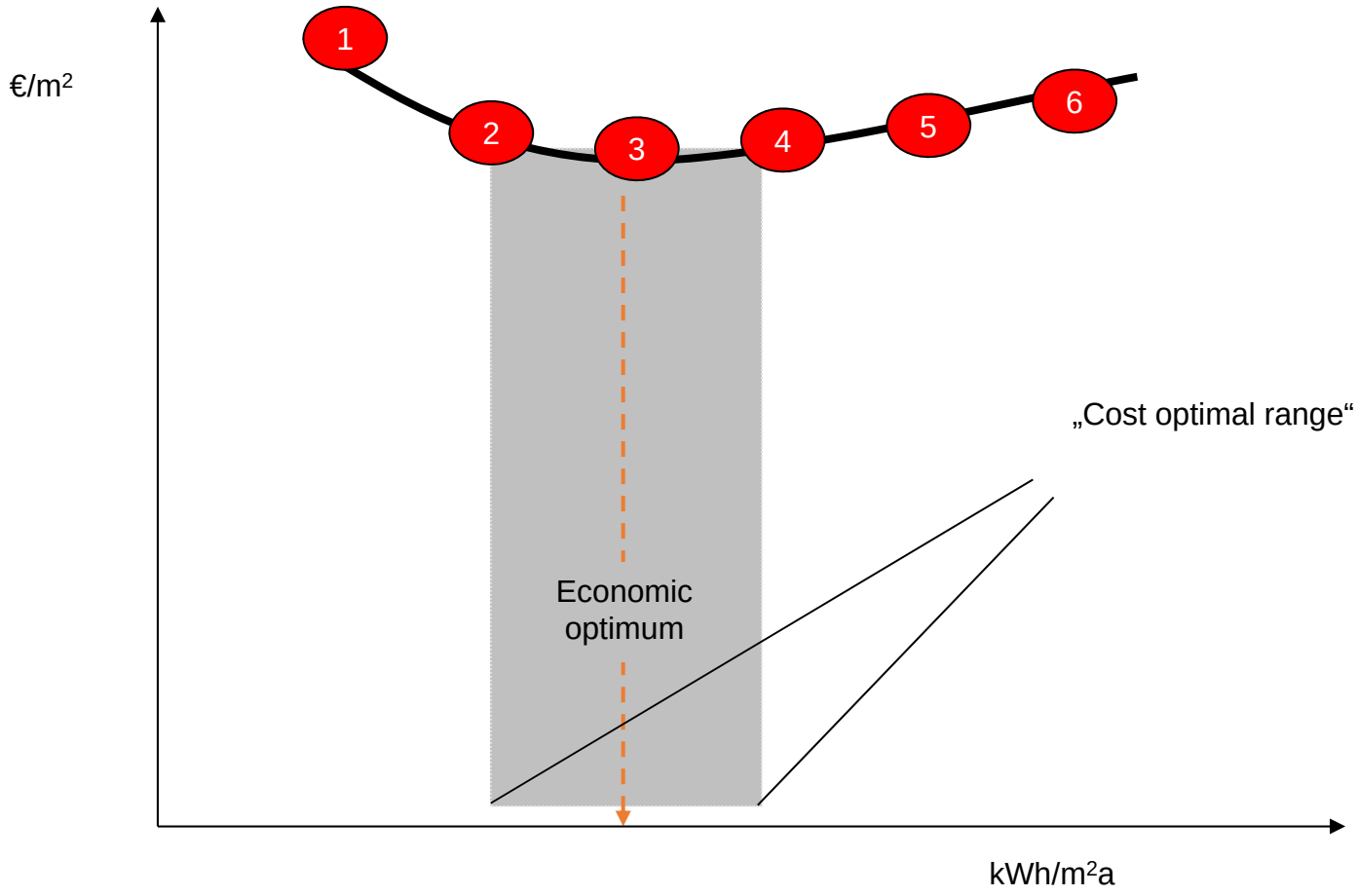
Derivation of cost-optimal level



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Cost-optimal level

- A minimum of 10 variants per reference building must be calculated in order to identify the cost-optimal level, but somewhere between 20 and 40 variants seems to be the ideal number in order to more clearly identify the cost-optimal level
- Many MSs find a cost-optimal range of measures by combining the building envelope and the technical systems rather than an individual optimal point
- The cost-optimal level is often defined at the lower end of the range to ensure the lowest possible energy consumption within the optimal range of costs

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Cost-optimal level

- MSs have calculated their cost-optimal levels of minimum energy performance requirements and compared the results of this calculation to the minimum energy performance requirements in force
- If this calculation demonstrated a deviation from the requirements larger than 15%, MS shall take action to modify the requirements
- Many MS have experienced that one or more building types have more lax energy performance requirements (more than 15% difference) than the calculated cost-optimal level

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Primary energy demand fulfilling the Danish Building Regulations 2010

Building type	Heat supply	Primary energy, kWh/m² a		
		BR 10	BR 15	2020
Single family house	District heating	57,9	37,9	29,5
	Heat pump	49,7	25,7	21,5
Multifamily house	District heating	48,4	34,3	29,7
Office building	District heating	67,9	43,5	32,5

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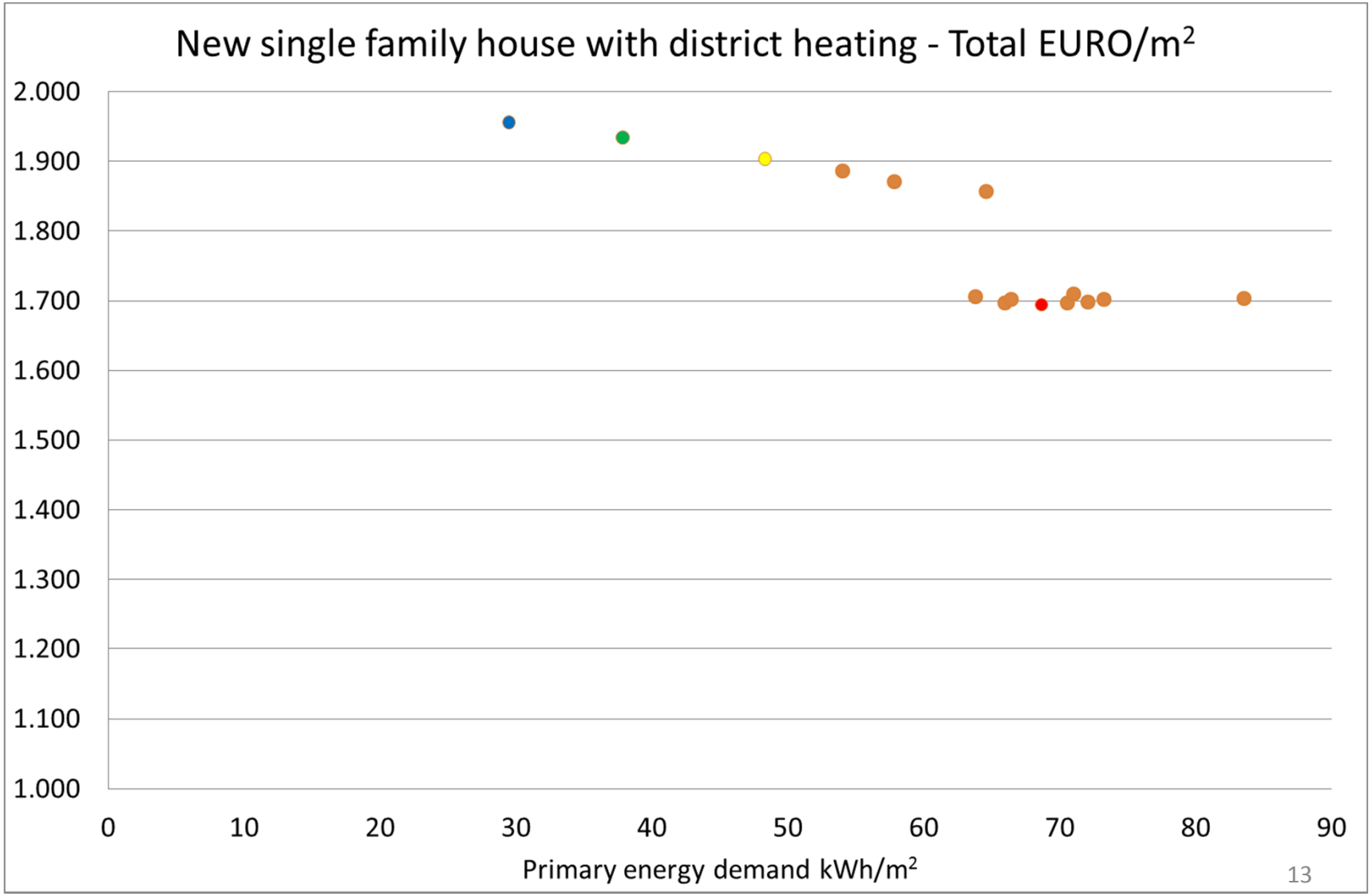

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Danish example

For each measure the energy saving and the energy cost saving are calculated

Two types of economical evaluations are performed:

- Simple pay back
- Net present value (NPV)

The simple pay back is used to evaluate the benefit of the individual measure when compared to the expected service life time

The simple pay back gives a simple overview, but can't be used to evaluate a package of measures

To be able to evaluate a package of measures the net present value is used

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Cost-optimality of the energy requirements in the Danish Building Regulations 2010

Building type	Heat supply	Cost-optimal kWh/m² year	Deviation to cost-optimal, %		
			BR 10	BR 15	2020
Single family house	District heating	68,7	- 15,7	- 44,9	- 57,0
	Heat pump	51,1	- 2,8	- 49,8	- 58,0
Multifamily house	District heating	53,6	- 9,2	- 36,1	- 44,7
Office building	District heating	51,7	31,2	- 16,0	- 37,3
Weighted average	DK mix		2,8	- 34,4	- 48,8

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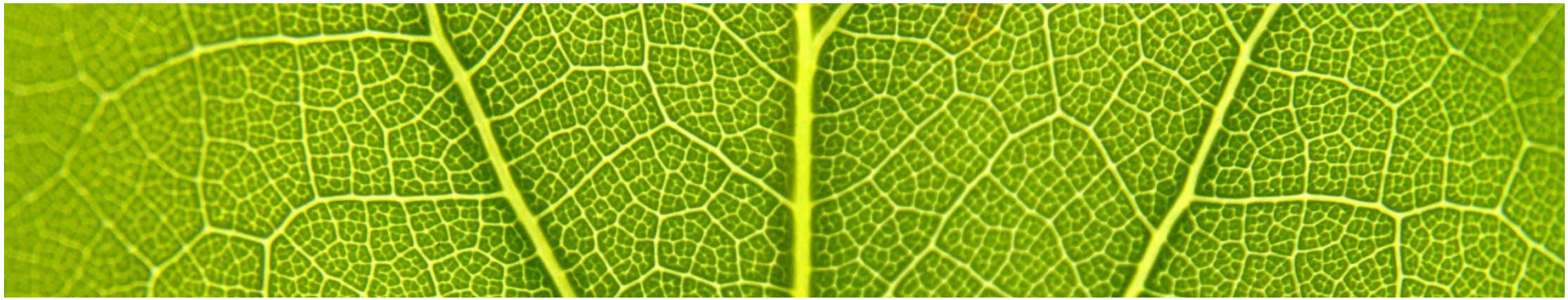
Danish results

- The gap is shown as percentage of the cost-optimal level of requirements in kWh/m² per year primary energy inclusive renewables
- Only the relevant heat supply sources in relation to Danish heat plans are included in the calculations
- PV is not always cost beneficial today, but often in offices and houses heated by heat pumps. When costs decrease, the cost-optimal level will move significantly towards lower primary consumption
- The component requirements for existing buildings are in nearly all cases tighter than the point of cost optimum
- http://www.sbi.dk/miljo-og-energi/energibesparelser/cost-optimal-levels-of-minimum-energy-performance-requirements-in-the-danish-building-regulations

ECOFYS

sustainable energy for everyone



The assessment of cost optimal calculations undertaken by the Member States in the context of art. 5 of Directive 2010/31/EU on the Energy Performance of Buildings

Results and recommendations for guideline

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Scope of the project

Support the Commission in

- assessing the compliance with Art. 4 and 5 of the EPBD recast and the delegated Regulation (No. 244/2012)
- evaluating the plausibility of
  - the input parameters and the calculated cost-optimal levels
  - the plan to reduce the gap or the justification of the gap (if there is a gap)
- preparing clarification requests about the national/regional report(s)
- writing the report on progress of MS in reaching cost-optimal levels
- improving the guidelines

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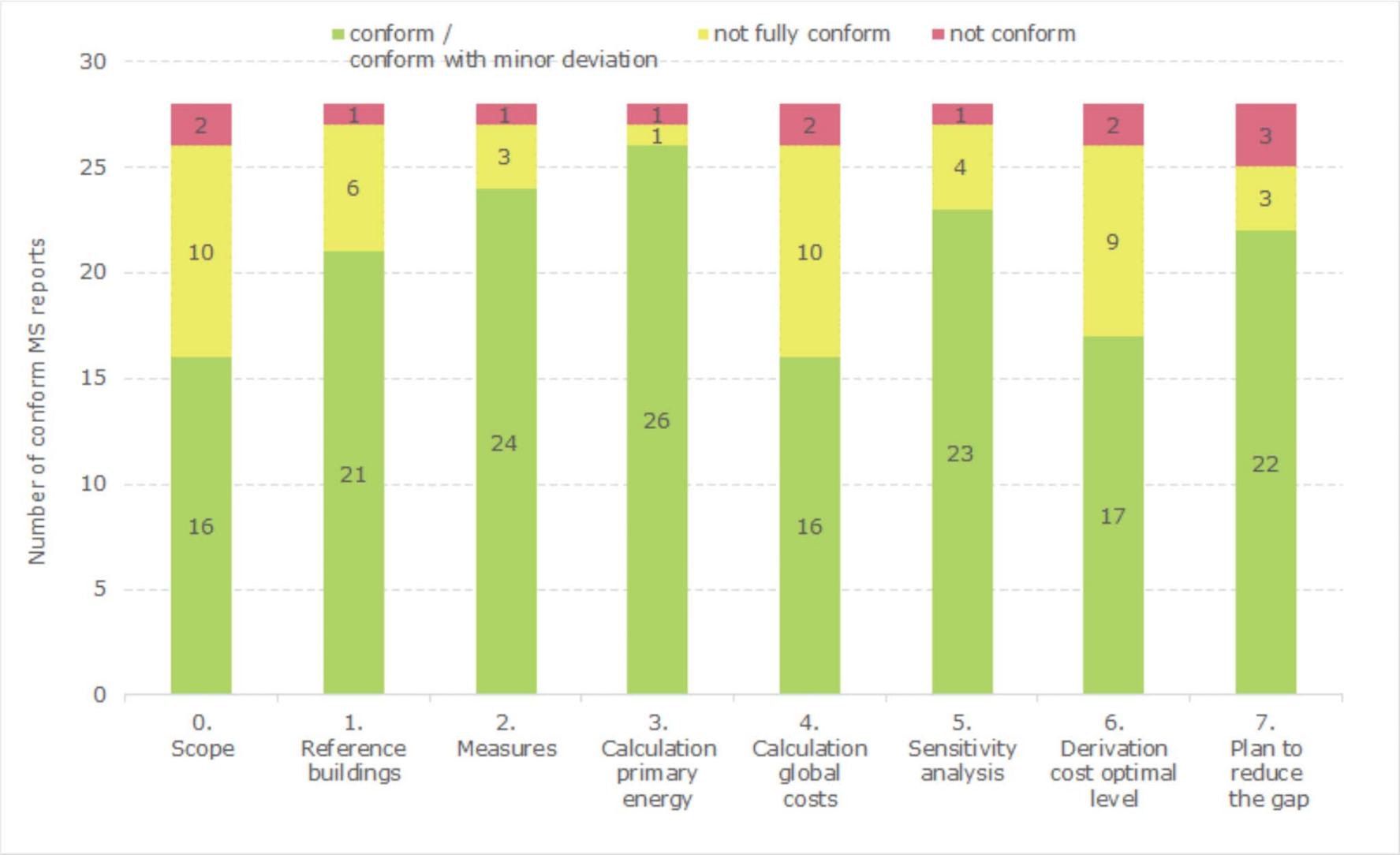
Conformity with article 4, 5



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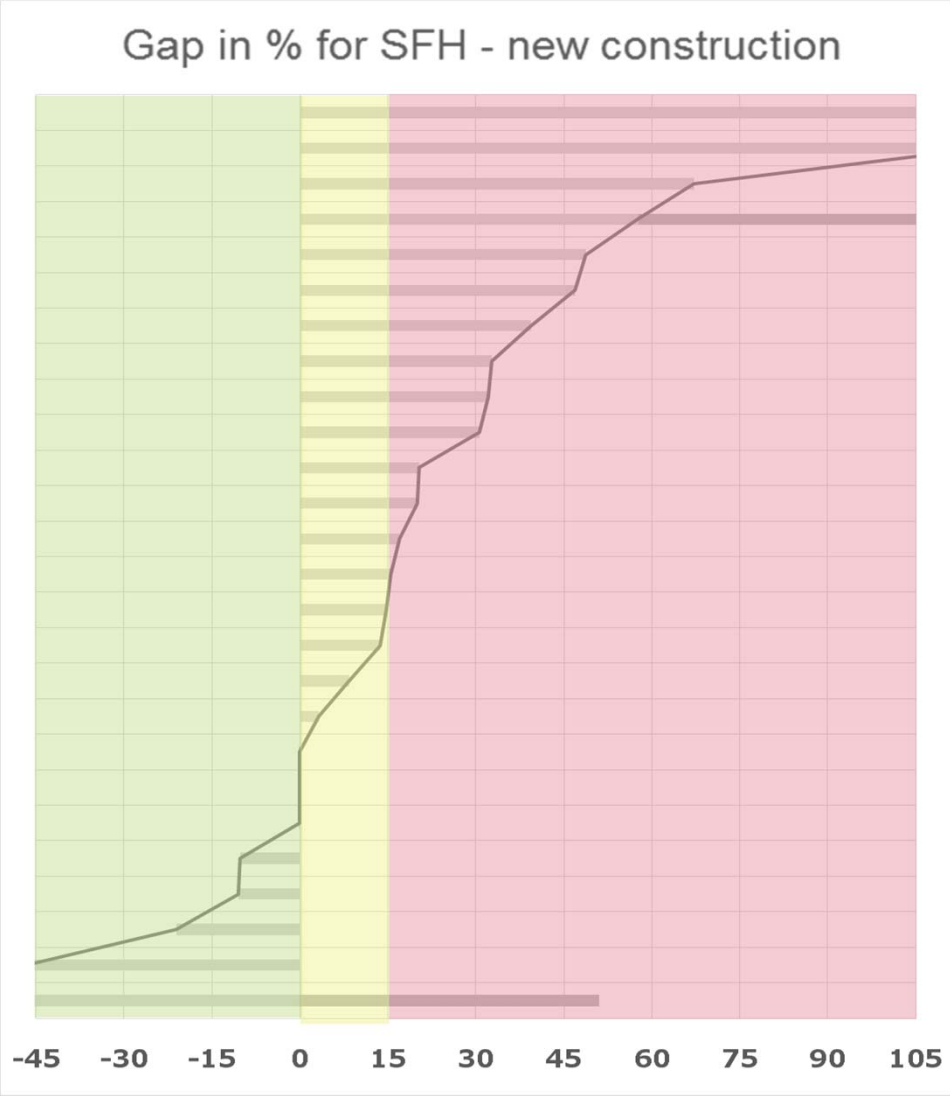
Gap analysis



- About 2/3 of the MSs results reveal improvement potential
- About half of the MS have a gap >15%
- Similar picture for renovation – building and component level (wall, roof) and for different reference cases (MFH, Office)
- Many MSs show different gaps for different requirements
- Less frequent: similar gaps for all requirements

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Recommendations for Guidelines

Improvement of guidelines may create more clarity on some issues, especially

- *Scope*: renovation case - building & component level
- *Measures, variants and packages*
  - nZEB variants should be developed and clearly described
  - the component level should be calculated with different and commonly used energy supply systems
- *Sensitivity analysis*: one of the two different discount rates shall be 3 % expressed in real terms for the macroeconomic perspective
- *Average gap*: recommend to calculate an average gap for the reference buildings within a category (=new building or renovation of SFH, MFH, non-residential buildings)
- *Reporting:* Provide a clear standard reporting structure, adapt and integrate tables of Annex III of the delegated regulation – in the 2nd round of cost-optimal reports the burden can probably be reduced by updating only input parameter subject to change (mainly financial and technology development)