Implementing the cost-optimal methodology

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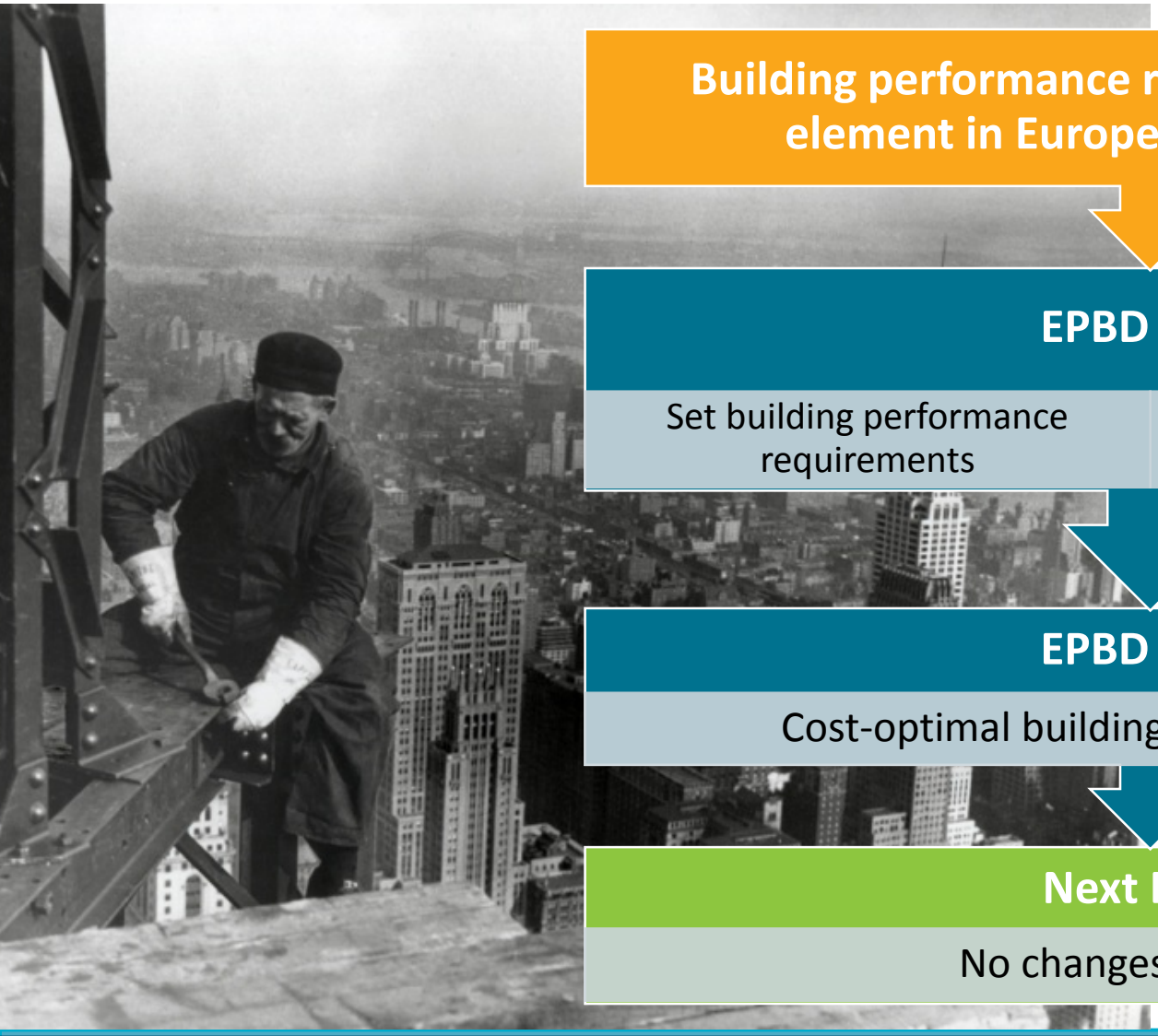
Building performance requirements … a brief history



Building performance requirements are a key element in European building codes

EPBD 2002

Set building performance requirements	No clarification on the ambition level

EPBD 2010

Cost-optimal building performance levels

Next EPBD

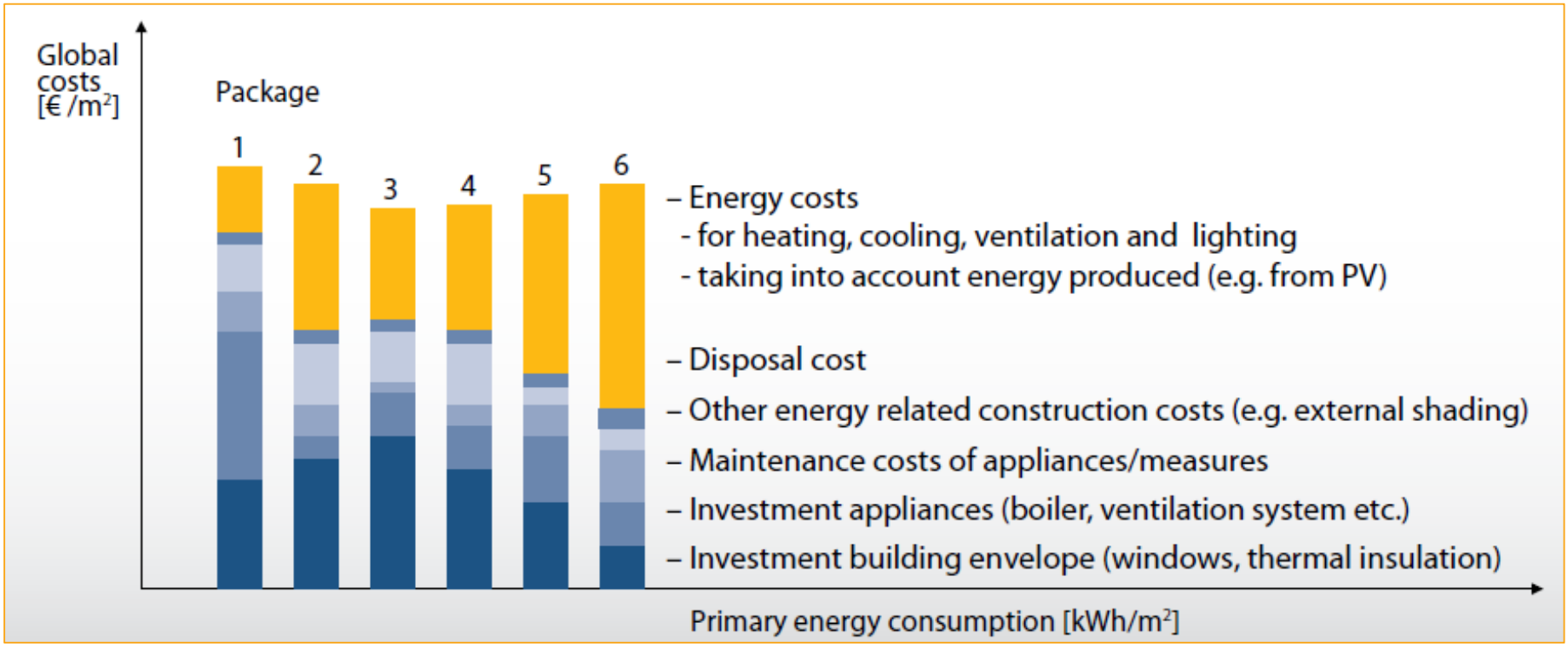
No changes expected

Setting energy performance requirements with the cost-optimal methodology

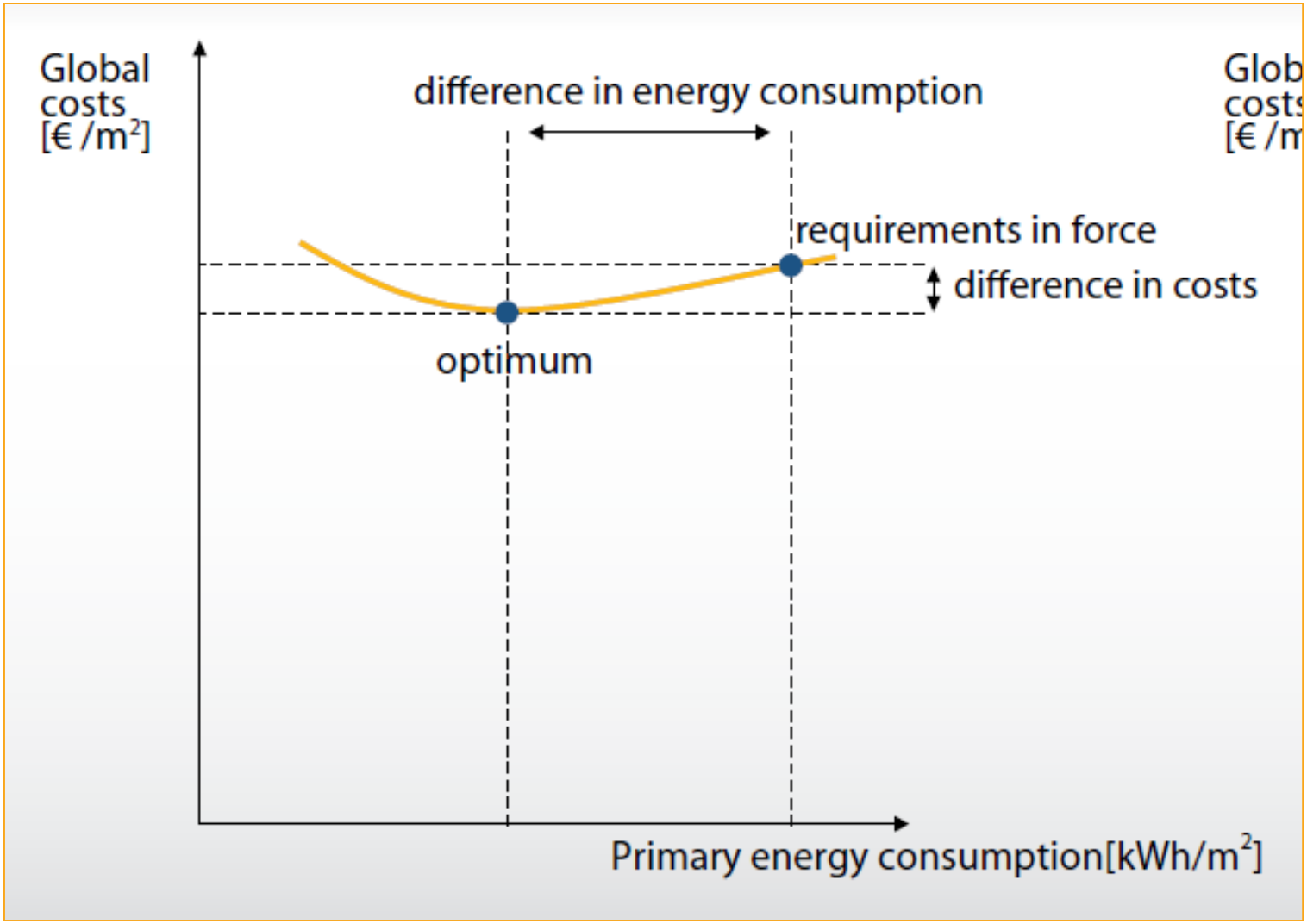
The cost-optimal level is defined as "**the energy performance level which leads to the lowest cost during the estimated economic lifecycle**"

- **Comparison** report between energy performance requirements and calculated cost-optimal levels
- EC provides a comparative **methodology framework**
- **Discrepancy** between cost-optimal level and minimum energy performance requirements should **not exceed 15%**
- If national requirements less ambitious than cost-optimal ➔ **justify the gap**
- If gap cannot be justified ➔ **plan on how to reduce the gap**

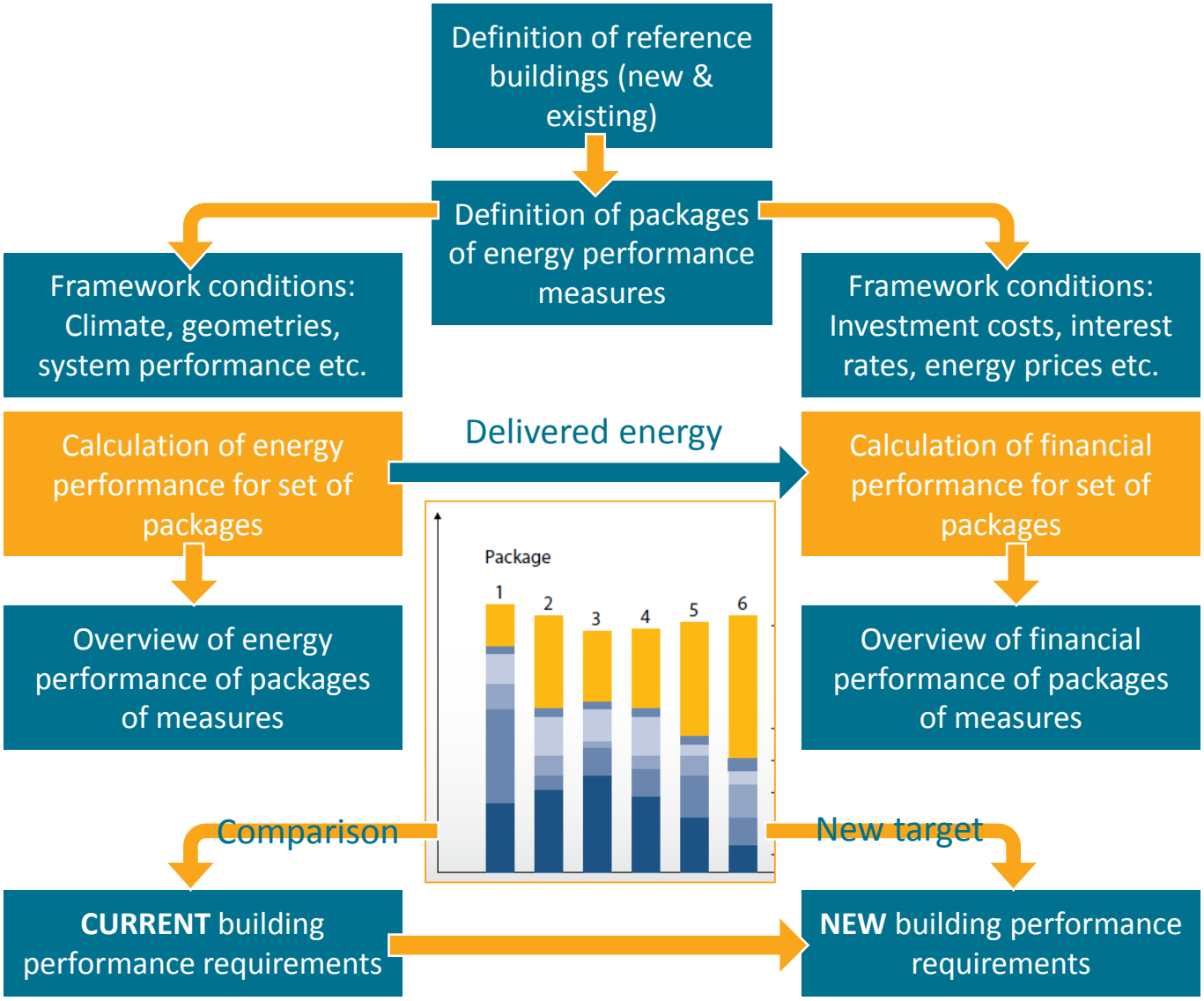
Different packages cost calculations



Concept of cost-optimal building performance requirements



Implementation steps

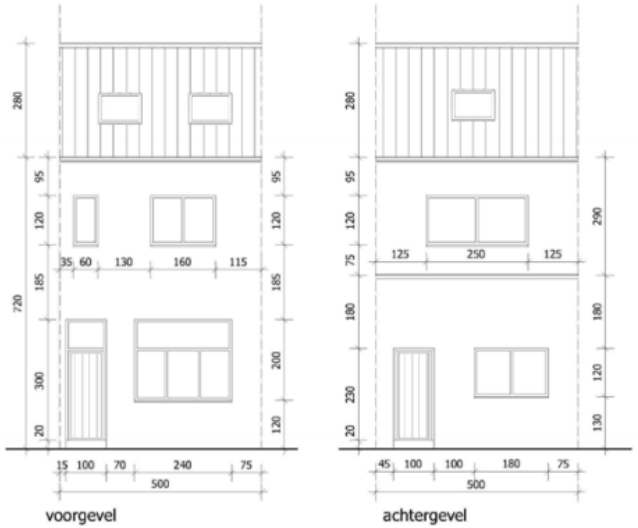


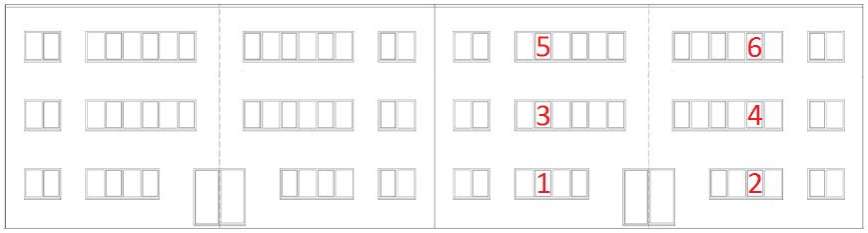
Reference buildings – e.g. Germany

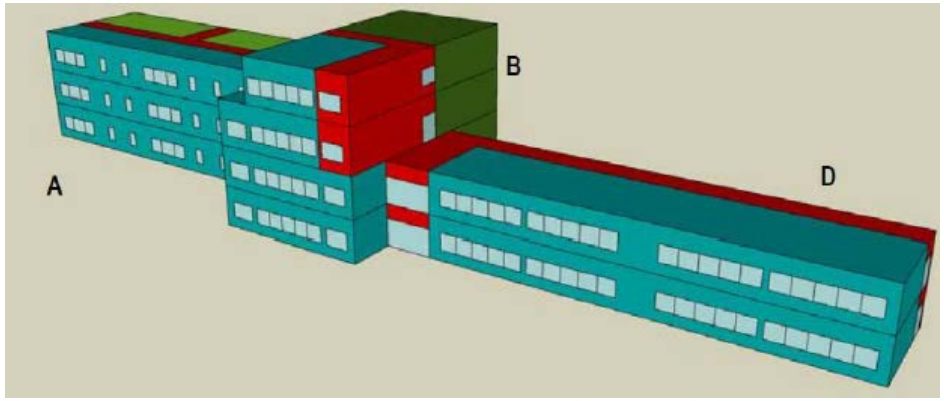
- Identify at least one reference building for new buildings and at least two for existing buildings for the following categories
  - Single-family buildings
  - Apartment blocks/multi-family buildings
  - Office buildings
  - Other non-residential
- Simple geometries and reproducible in practice

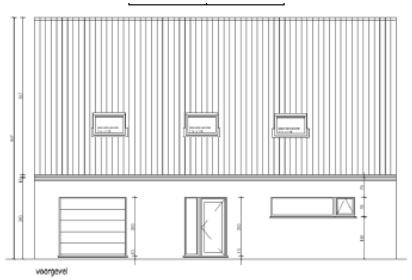
Building's characteristics	Single-family building (SFH)	Multi-family building (MFH)
Building sketch		
Heated volume (Ve)	586 m^3	1848 m^3
Heated living space	139 m^2	473.0 m^2
Useful floor area (AN) acc. to EnEV standard	187.5 m^2	591.4 m^2
Surface area (S)	344.5 m^2	776.0 m^2
Surface-area over volume ratio (S/V_e)	0.59 m-1	0.42 m-1

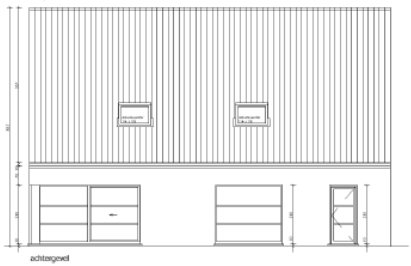
Example of references for existing buildings - Belgium

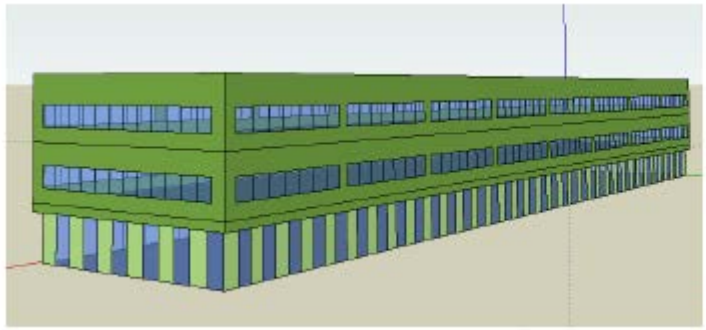












Selection of packages of measures

Reference case which reflects actual regulations

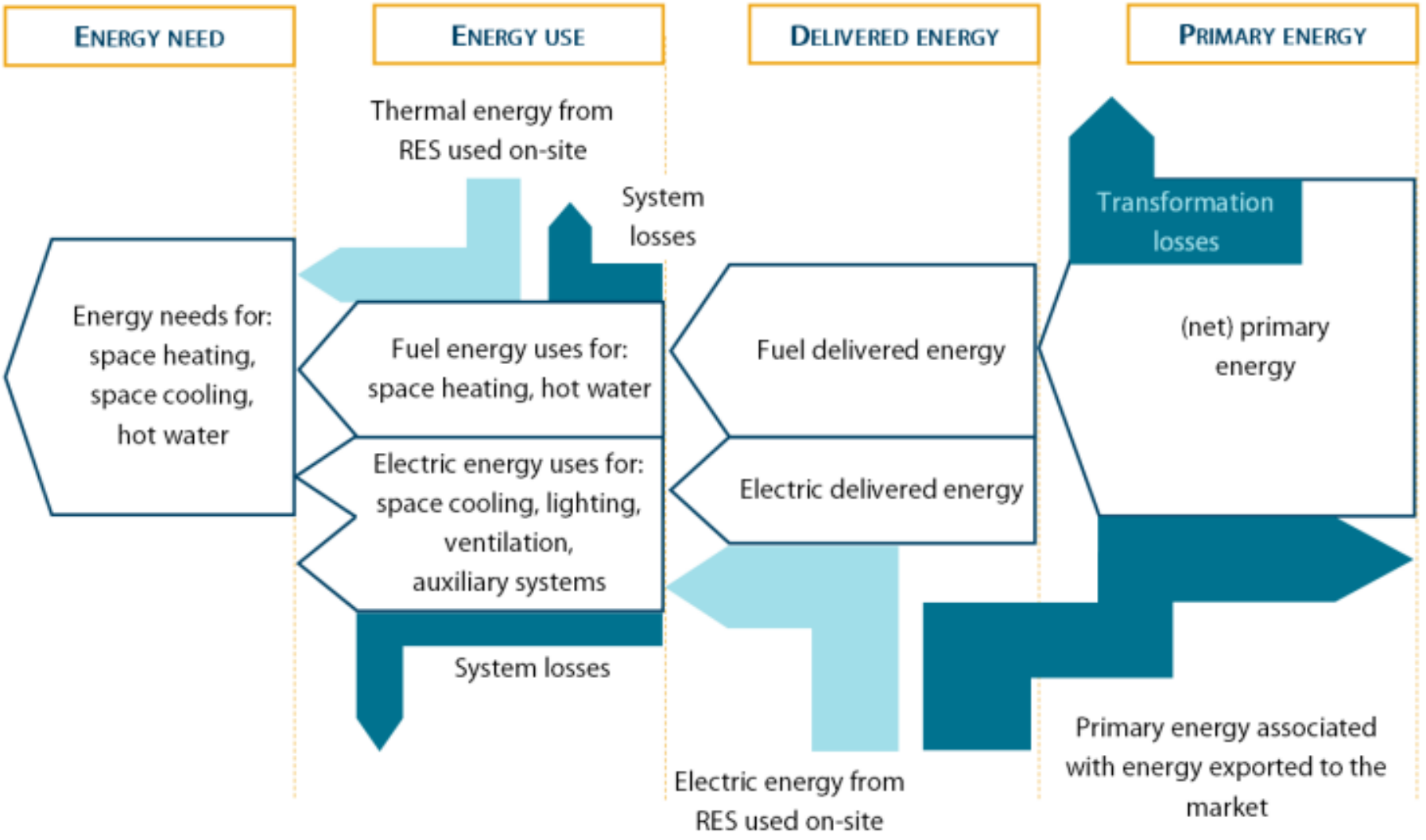
At least 10 calculated packages in addition to the reference case

Based on existing or planned national standards or/and on widely accepted ones

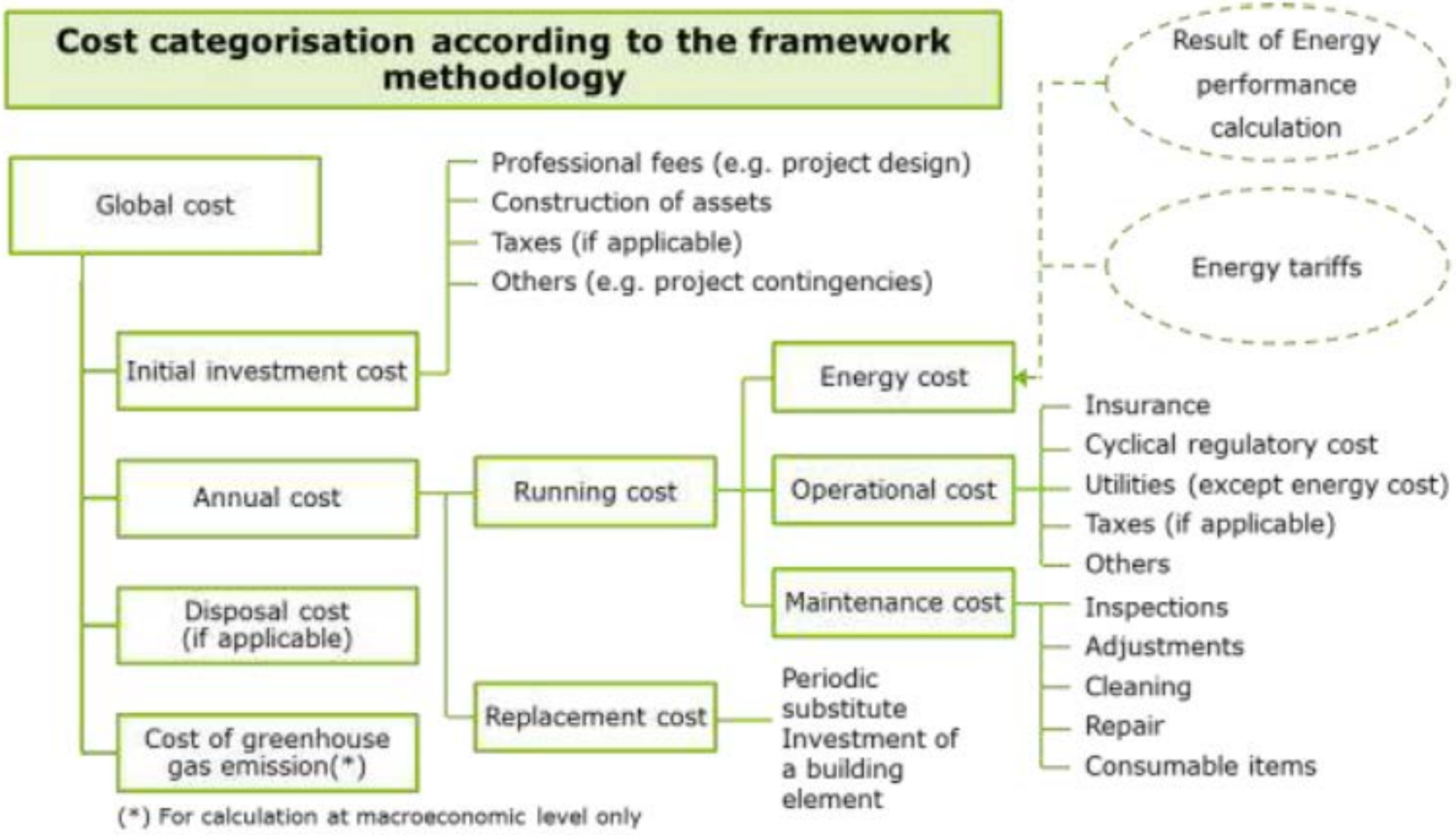
Very ambitious packages of measures should be included

- To estimate the financial and environmental implications of nZEB requirements

Energy performance calculation scheme



Cost categorisation according to the framework methodology



Source: Ecofys (from European Commission)

Costs of materials, work and equipment

- Costs assessed on country, regional or climate zone level
- Average price for building owner
- Including (private perspective) or excluding (societal perspective) all applicable taxes
- Including (private cost calculation) or excluding subsidies (societal cost calculation)
- Including installation costs
- Accurate information is missing ➔ stakeholder involvement

Estimated economic lifetime

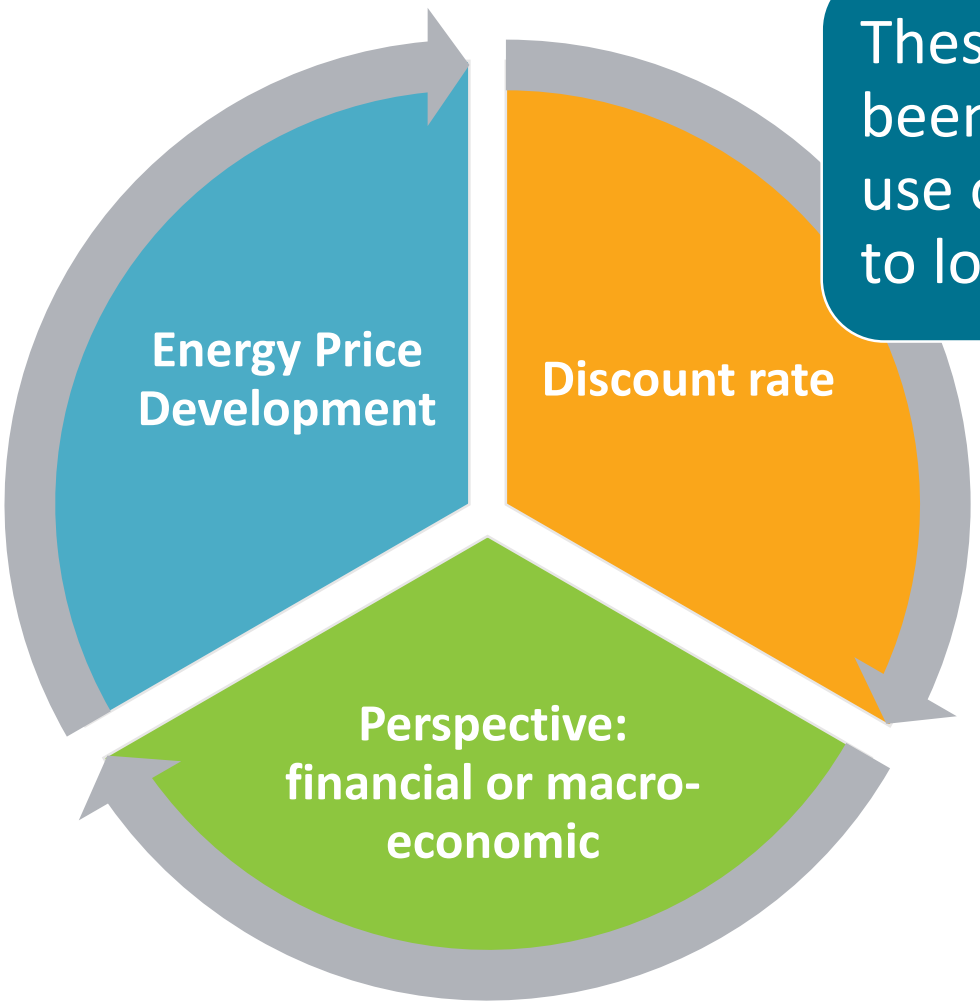
Countries estimate economic lifetime of building elements and entire building

Option: guidance in standard EN 15459 and other standards

Example economic lifetime Belgium

Schools and residential buildings: 30 years	Offices: 20 years

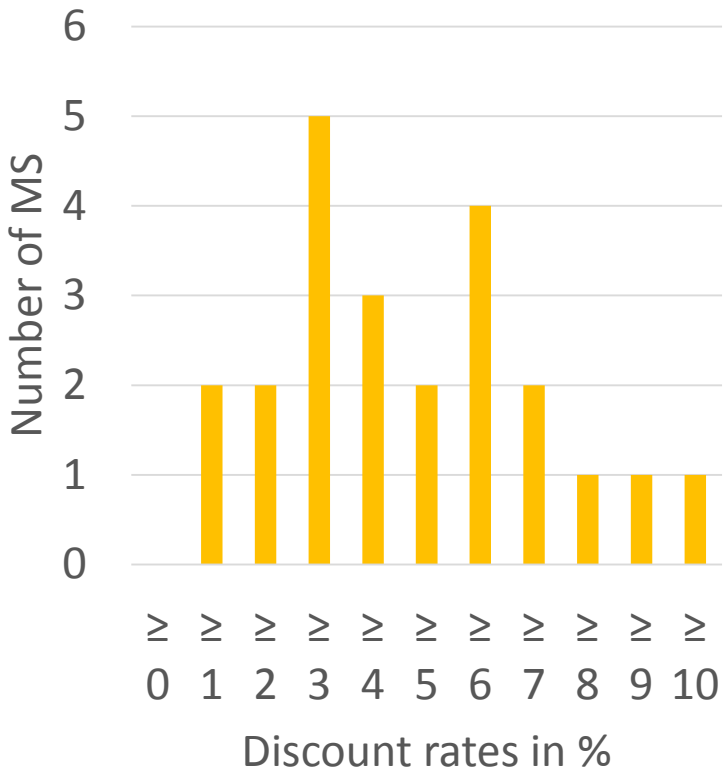
Parameters impacting the outcomes



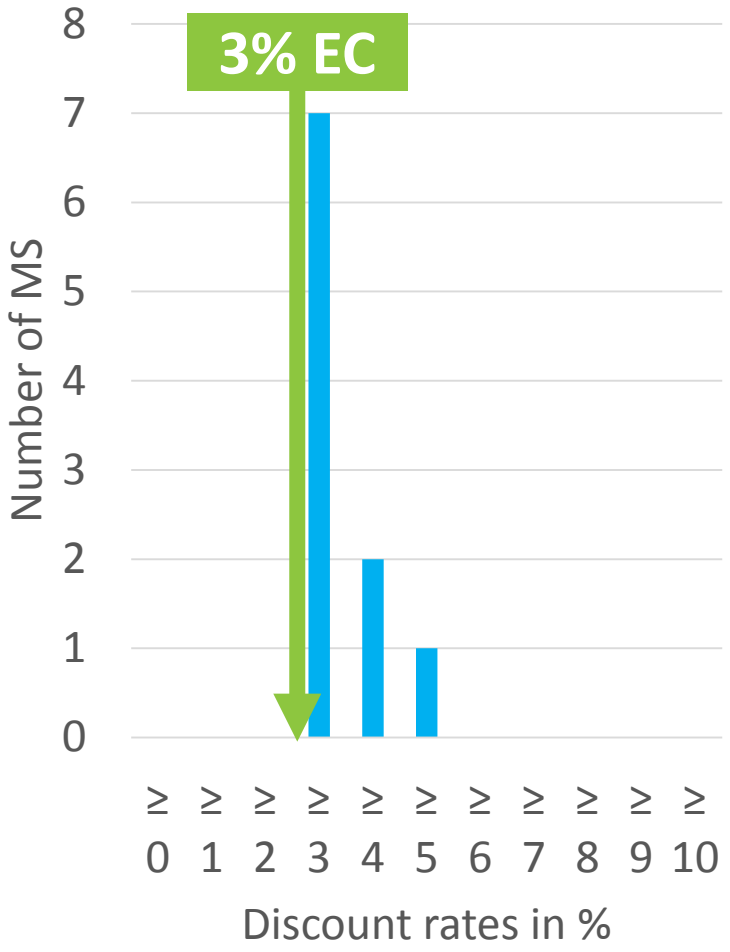
These parameters have not been pre-set and MSs made use of the possibility to adapt to local circumstances

Discount rates have to reflect the actual costs of capital for long-term mortgages or the expected minimum return on investment in case of self-financing

Discount rate Financial Perspective

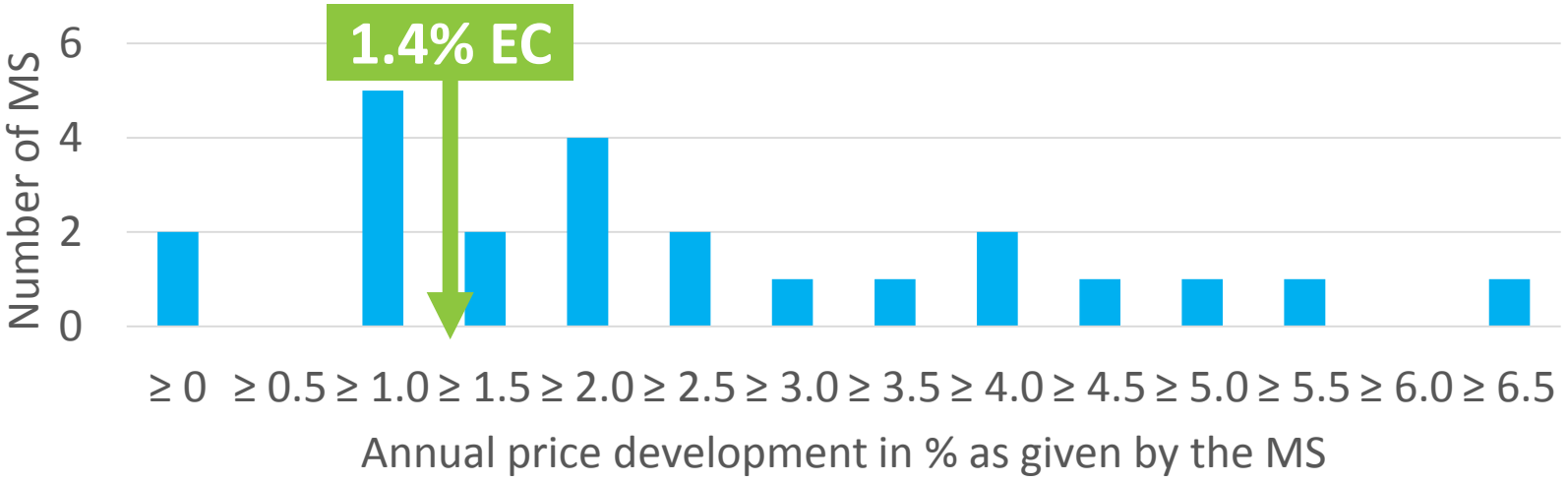


Discount rate Macroeconomic Perspective

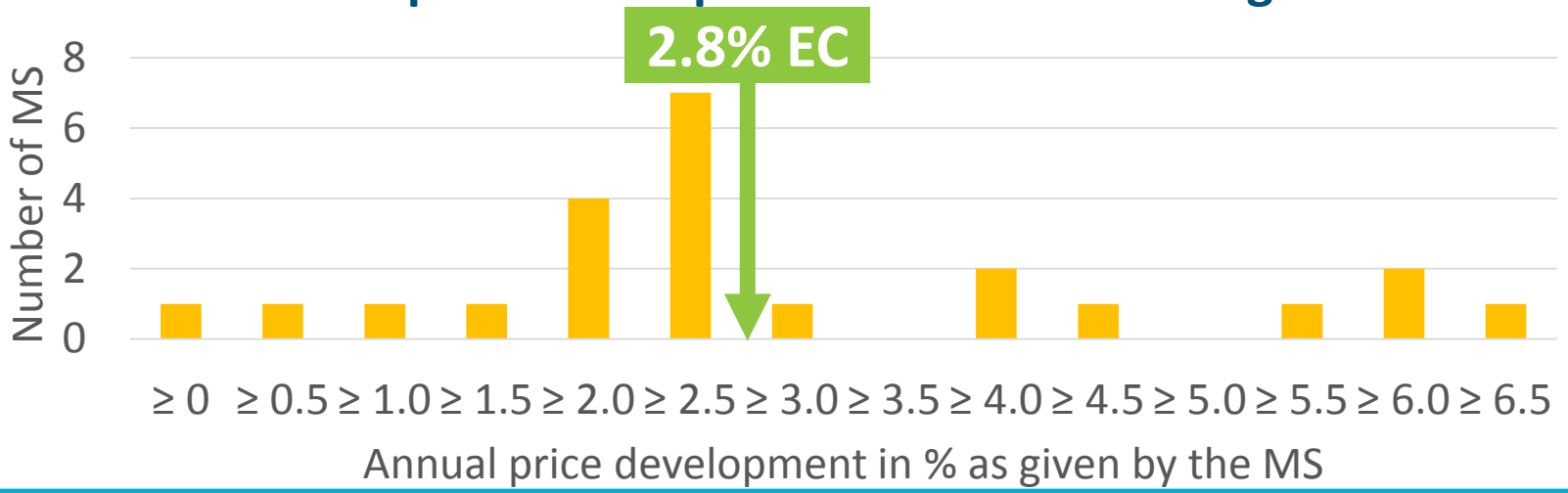


Source: Ecofys

Annual price development in % until 2030 - electricity



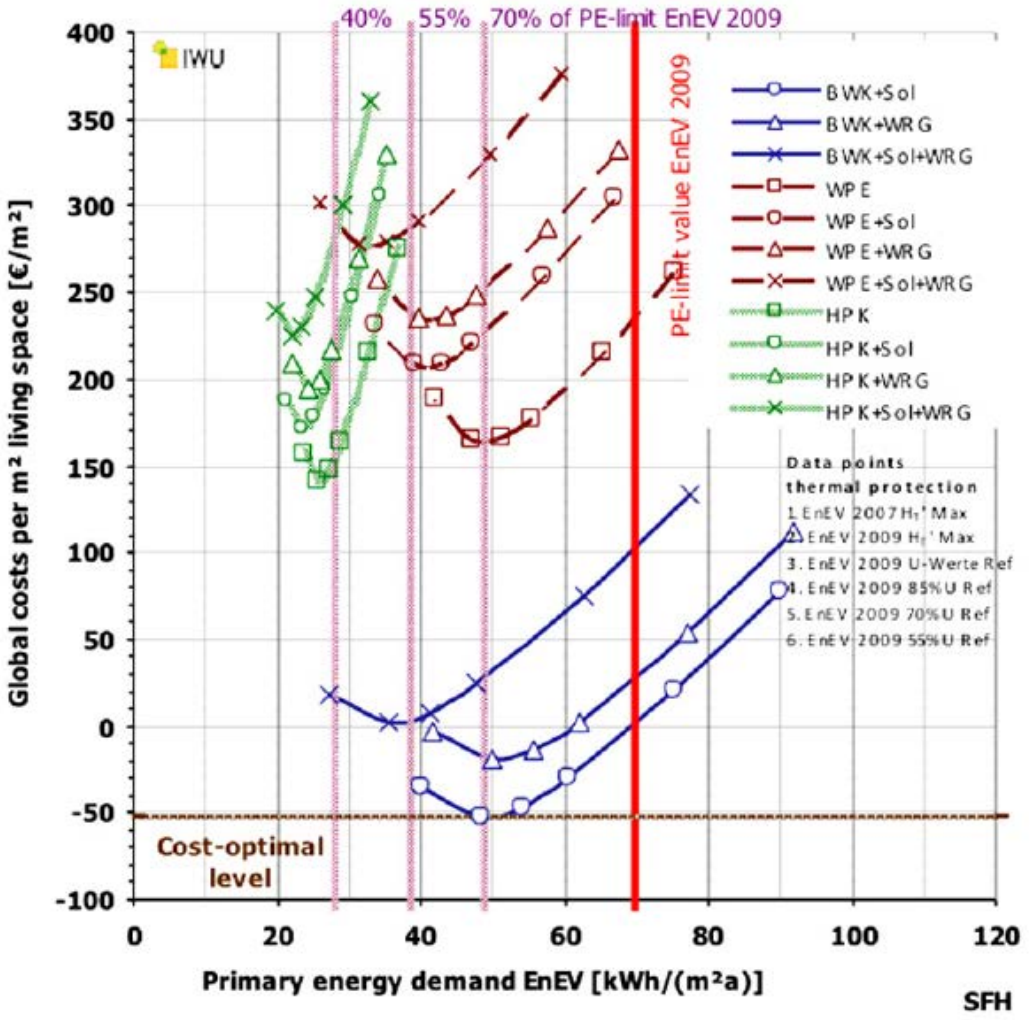
Annual price development in % until 2030 - gas



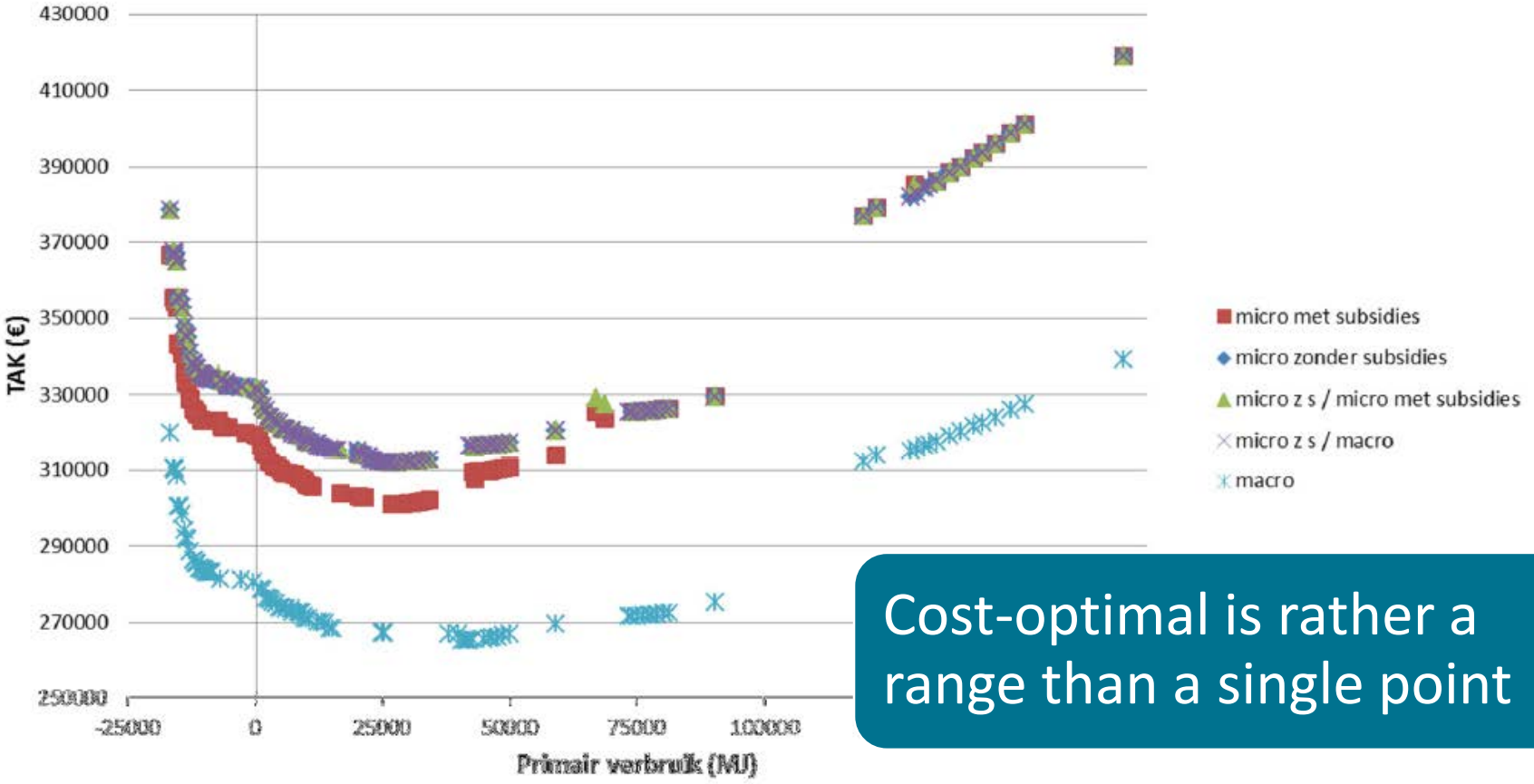
Source: Ecofys

Example Germany - Single Family Home

- Global costs for SFH
- All heat supply systems
- High energy price development
- Discount rate 1 %



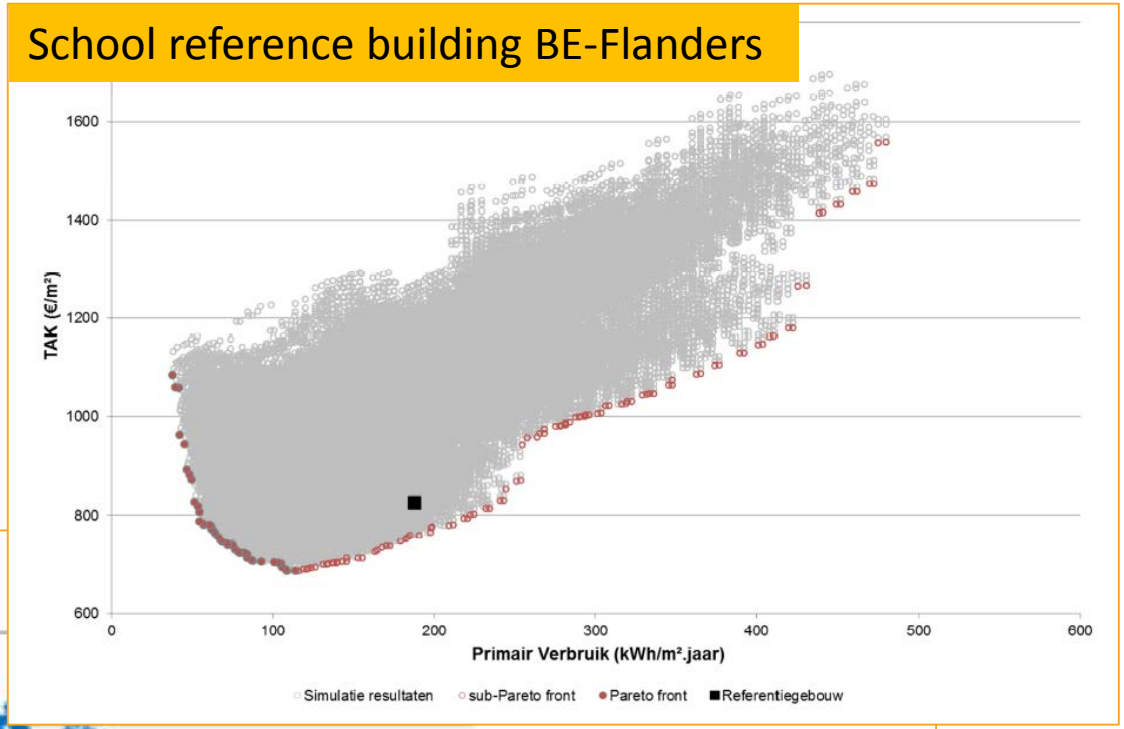
Example Belgium



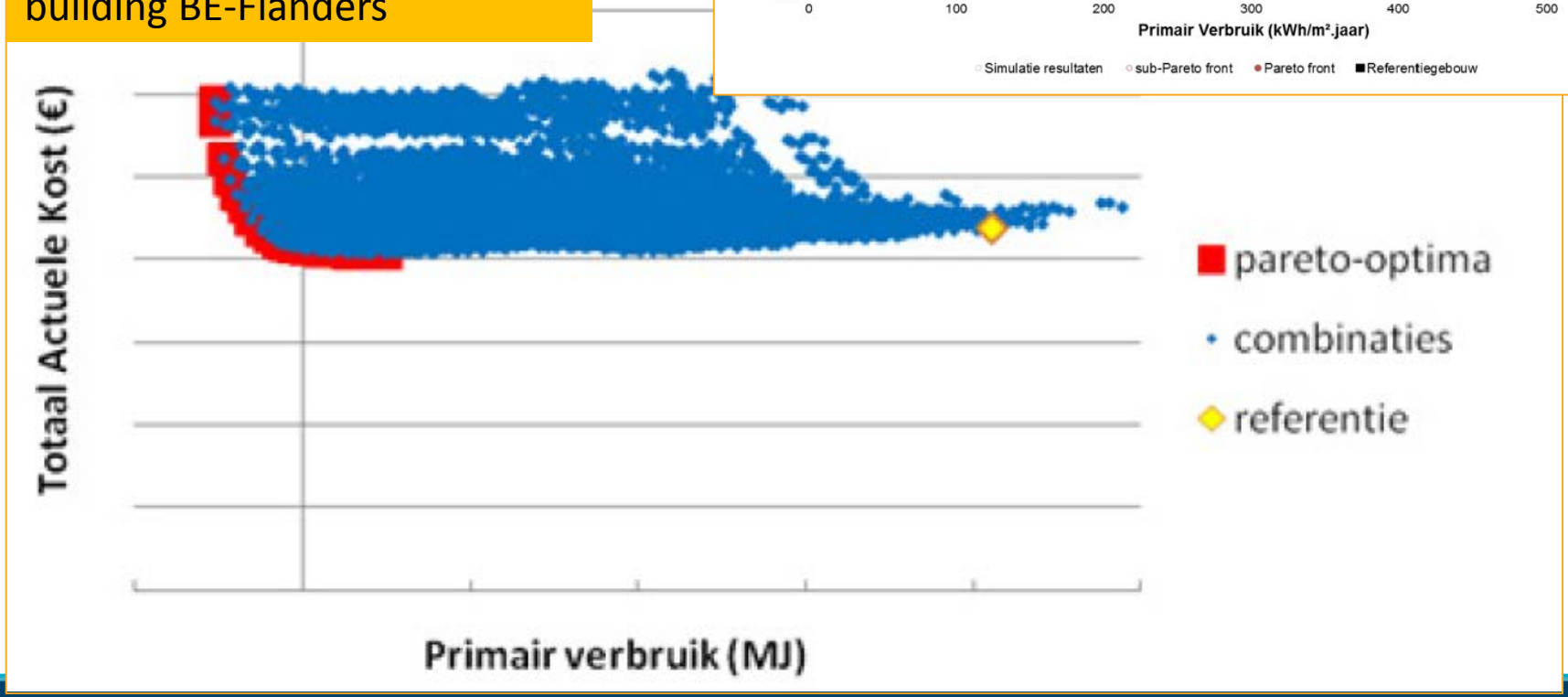
Cost-optimal is rather a range than a single point

- Optimisation calculation for a residential unit – different combinations micro and macro, with and without subsidies
- Calculations from private and macroeconomic perspectives lead to the same cost-optimal point, yet to lower global costs

School reference building BE-Flanders



Single Family House reference building BE-Flanders



Assessment of cost optimal calculations in the context of the EPBD (2015)

Overview of the conformity of the country reports per category after the final assessment

Source: Ecofys

Overview of main issues

Scope	• Renovation – calculation for building elements **AND** building level
Reference buildings	• Renovated building
Measures	• < 10 packages • nZEB
Global cost	• Investment and maintenance costs • Lifetimes • 2 perspectives (micro & macro)
Derivation of cost optimal	• No calculation of gaps
Plan to reduce the gaps	• No plan available

Thank you…

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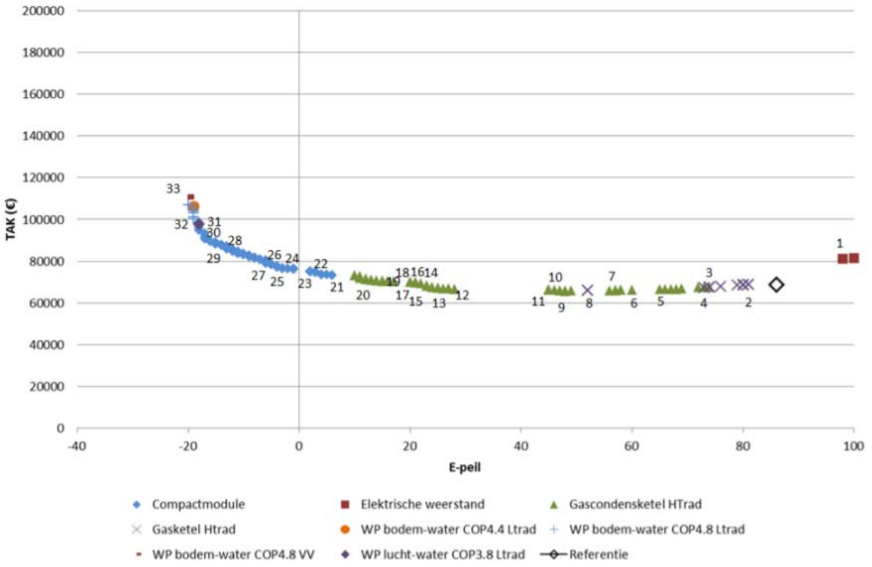


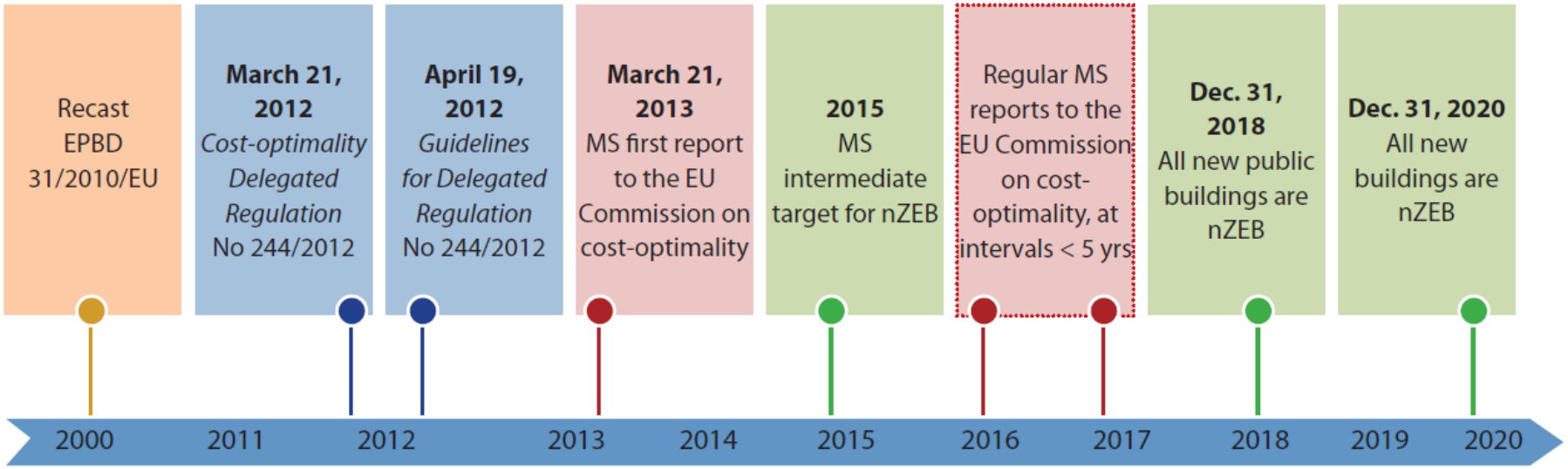
Grafiek 7.1 Macro-economisch paretofront TAK i.f.v. E-peil van de arbeiderswoning

Rijwoning 1: Arbeiderswoning

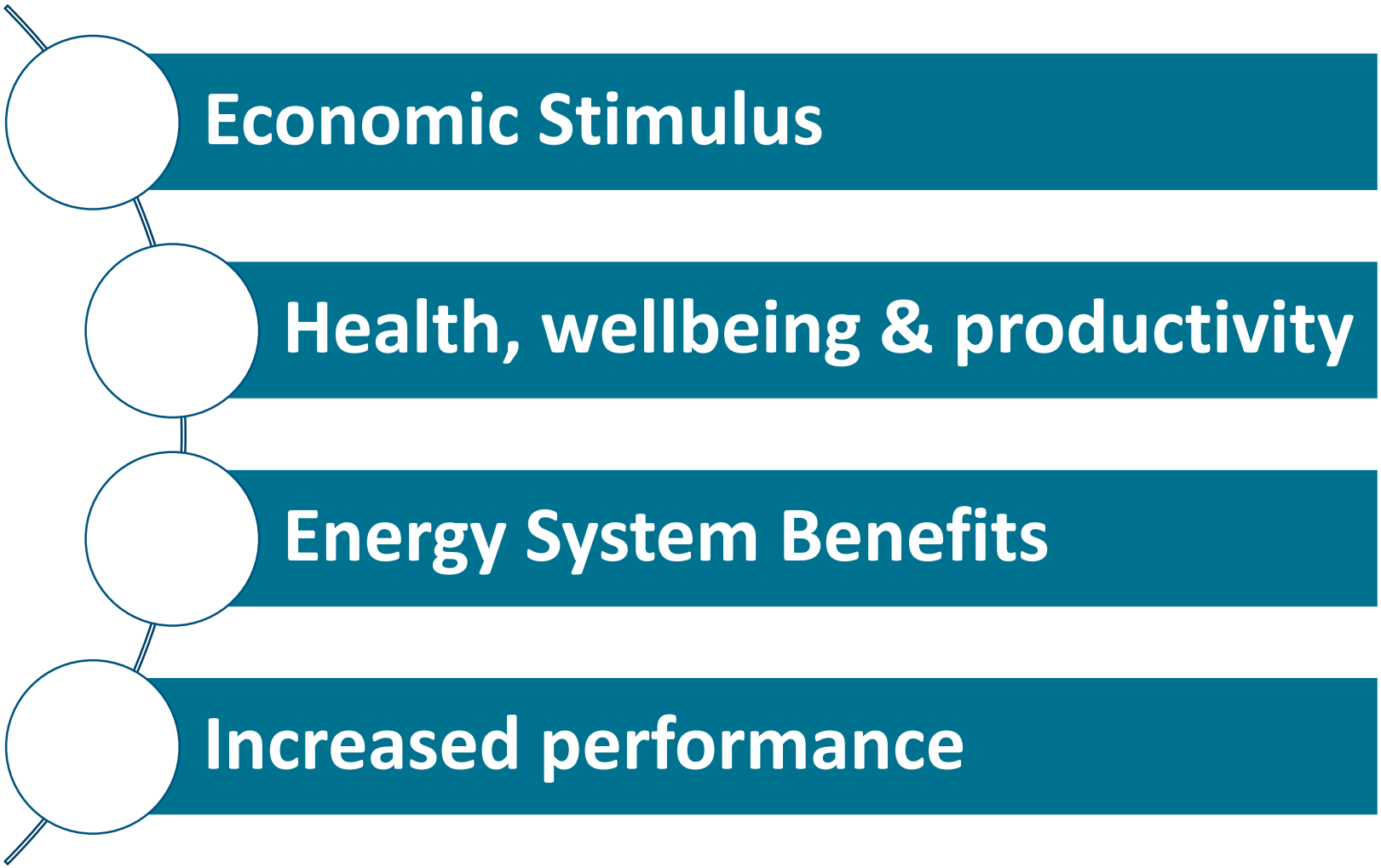
Voorgevel	Noord
Achtergevel	Zuid

Financiële parameters			Energetische parameters				
TAK	Totale Investering	TT	E-peil	K-peil	NEB	PEV	Opmerkingen
€	€	jaar	-	-	kWh/m²j	kWh/m²j	
68897	36543	0	86	55	85	147	referentie : Uvoorgevel = 0.85, Uachtergevel = 0.24, Udaken = 0.24, Vloer grond - kelder = 0.68-0.78, Uprofiel = 2.2, Uglas = 1.1, v50 = 5h^{-1}, ventilatiesysteem C1, gasketel met HT radiatoren en een geiser
80973	35509	/	98	49	55	167	(1) = referentie + Uachtergevel = 0.20 + Uhellend dak = 0.20 + Uvloer kelder = 0.13 + ventilatiesysteem C3 maar elektrische verwarming
68691	37477	6	81	55	78	138	(2) = referentie + ventilatiesysteem C2
67554	38409	7	73	55	78	125	(3) = (2) + gascondensatieketel
67307	38558	8	73	49	68	124	(4) = (1) + gasketel
66435	39490	9	66	49	68	113	(5) = (4) + gascondensatieketel
66346	40735	10	60	52	59	102	(6) = (3) + ventilatiesysteem C3 maar Uprof = 0.26
66087	41271	11	57	49	55	97	(7) = (5) + ventilatiesysteem C3
65925	46123	20	52	39	41	88	(8) = (7) + Uvoorgevel = 0.20 + Uhellend dak = 0.16 + Uvloer kelder = 0.10 + Uglas = 1.0 + v50 = 3.00 maar met een gasketel
65706	47055	20	48	39	41	81	(9) = (8) + gascondensatieketel
66323	48402	21	45	35	37	76	(10) = (9) + Uprof = 1.40 + Uglas = 0.50
66433	48436	21	45	36	37	76	(11) = (9) + Uhellend dak = 0.13 + Uprof = 1.50 + Uglas = 0.60 + ventilatiesysteem C4 maar Uvloerkelder = 0.13
66535	54784	22	28	39	41	47	(12) = (9) + 2.5kWp
67152	56131	23	25	35	37	42	(13) = (10) + 2,5kWp
67472	56577	23	24	35	35	41	(14) = (13) + ventilatiesysteem C4
68279	57195	24	23	35	32	39	(15) = (13) + ventilatiesysteem D5
68328	57335	24	23	34	32	39	(16) = (15) + Uhellend dak = 0.13 maar Uvloerkelder = 0.13
69618	58654	26	21	35	30	36	(17) = (14) + ventilatiesysteem Dwtw3
69979	59268	26	20	34	28	34	(18) = (16) + ventilatiesysteem Dwtw4
70216	59803	25	17	39	41	28	(19) = (12) + 5kWp maar Uglas = 1.10
71121	61617	26	13	35	35	21	(20) = (14) + 5kWp
73194	63639	34	6	39	37	10	(21) = (9) + compactmodule + warmtepompboiler + ventilatiesysteem D5 + 5kWp
73156	63668	28	10	35	30	16	(22) = (15) + 5kWp + ventilatiesysteem Dwtw3
74810	66380	35	2	34	30	3	(23) = (18) + compactmodule + ventilatiesysteem Dwtw3 + 5kWp
76152	70983	38	-1	29	25	0	(24) = (21) + Uhellend dak = 0.13 + Uvloer grond = 0.16
77707	74837	40	-4	23	18	-7	(25) = (24) + Uachtergevel = 0.16 + Uplat dak= 0.13 + Uvloer grond = 0.13 + Uprof = 1.40 + Uglas = 0.50
79536	76690	41	-6	23	14	-10	(26) = (25) + ventilatiesysteem Dwtw4
80943	78992	42	-7	20	14	-12	(27) = (25) + Uvoorgevel = 0.10 + 20% extra opengaande ramen
84376	82560	46	-11	23	16	-19	(28) = (26) + ventilatiesysteem Dwtw3 + zonneboiler
87648	86714	48	-14	20	12	-23	(29) = (27) + ventilatiesysteem Dwtw3 + zonneboiler
91948	92341	52	-17	18	9	-28	(30) = (28) + Uvoorgevel = 0.10 + Uplat dak = 0.10 + Uhellend dak = 0.10 + Uprof = 0.90 + ventilatiesysteem Dwtw4 + zonneboiler-XL + 20% extra opengaande ramen
97463	97615	57	-18	18	8	-30	(31) = (30) + Uvloer grond = 0.10 + 30% extra opengaande ramen + WP lucht-water COP3,8 Ltrad
100133	102142	60	-19	18	9	-31	(32) = (30) + WP bodem-water COP4,8 Ltrad
111179	114369	70	-20	18	6	-33	(33) = (31) + v50 = 1.00 + WP bodem-water COP4,8 met vloerverwarming

Implementation timeline



Considering the multiple benefits?



The Buildings Performance Institute Europe

European not-for-profit think-tank

Promotes policies and support instruments to increase the energy performance of buildings

In operation since 2010

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Knowledge, policy, implementation