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Quantifying impact of policies on energy efficiency improvements in buildings

Application of policy MESC curves in Bulgaria

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Source: Ongoing ESW on Energy Efficiency in EU5 countries; Project partners:

- **Buildings Performance Institute Europe:**
- **Technical University of Vienna, Energy Economics Group**
- **Infraproject Consult Ltd (Bulgaria)**

Policy rationale

- Bulgaria retains strict political control of retail power prices at the level by far the lowest in the EU, depressing not only the ability of the power sector to invest in reliable supply, but also lowering returns to demand side measures. District heat prices are heavily distorted as well.
- EU energy efficiency (among others) targets require gradual deep thermal retrofit of existing building stock
- Bulgaria has received large volumes of EU grants prioritized for energy efficiency but experienced very low disbursement and investment rate.
- Is the solution to keep increasing grant intensity?

Issues relevant to NDCs

- How to define energy efficiency (and emissions) baseline scenario for buildings in a country with distorted policy environment?
- What policies and measures (policy scenarios) could trigger uptake of EE investments and what will be their impact on energy savings (and emissions)?

The scope of the study

- Thermal retrofit of existing old buildings (built before 2000)

- Buildings covered:
  - Health service
  - Education
  - Offices (public and private)
  - Single family homes
  - Multifamily homes

- Tool: TUV Invert/EE-Lab model modified to generate marginal Energy Saving Cost Curves

- Data collected:
  - Building stock, including energy performance
  - Energy consumption
  - HVAC systems (stock and sales)
  - Ownership & Tenure

Renovation packages for modelling purposes

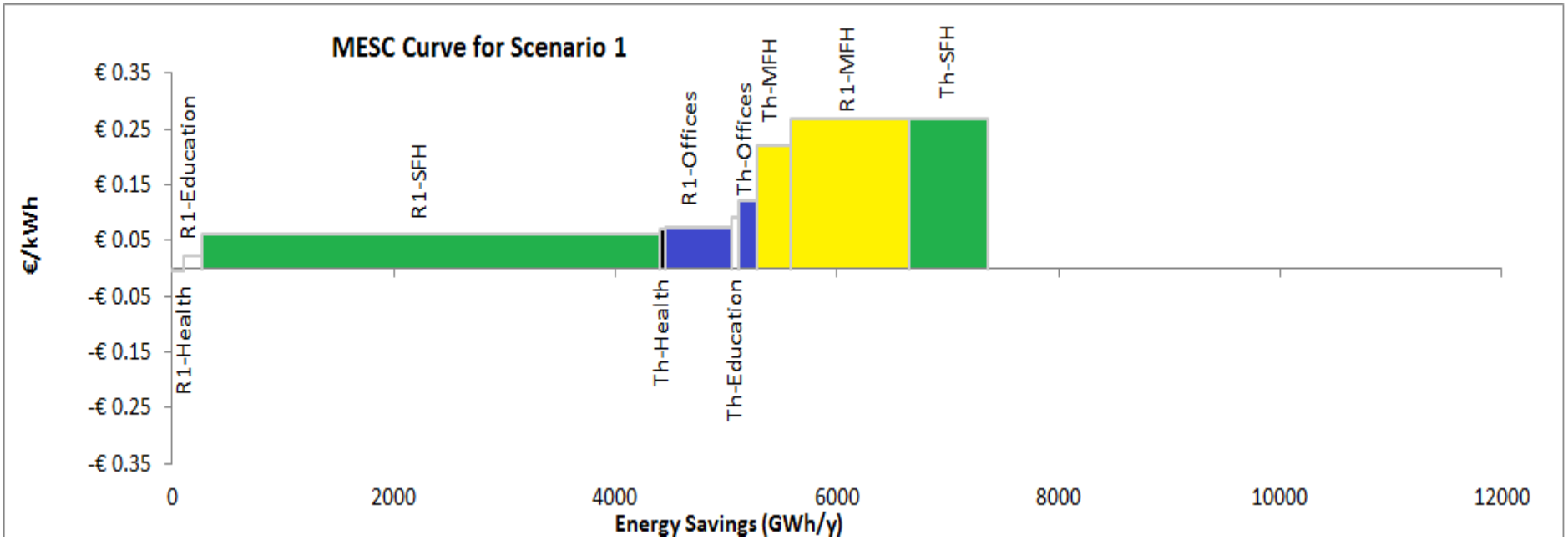
- **Expert judgments for each building category**
  - baseline level of building retrofit
  - menu of incremental energy saving measures
  - incremental energy saving potential and incremental lifetime cost for these energy saving measures
  - Value of comfort and convenience improvement (40% of the value of energy savings)

	Roof	Wall	Floor	Windows	Heat recovery
	Thermal Insulation Thickness				
Residential					
Baseline	-	-	-	Double glazing - GLASS Ug= 1,7 W/m²K; FRAME Uf=1,4 W/m2K	no
R1	5 cm	-	-	Double glazing - GLASS Ug= 1,7 W/m²K; FRAME Uf=1,4 W/m2K	no
R2	15 cm	15 cm	10 cm	Double glazing - GLASS Ug= 1,7 W/m²K; FRAME Uf=1,4 W/m2K	no
R3	30 cm	20 cm	15 cm	Triple glazing - GLASS Ug= 1,0 W/m²K; FRAME Uf=1,0 W/m2K	yes
Non-residential					
Baseline	-	-	-	Double glazing - GLASS Ug= 1,7 W/m²K; FRAME Uf=1,4 W/m2K	no
R1	5 cm	-	-	Double glazing - GLASS Ug= 1,7 W/m²K; FRAME Uf=1,4 W/m2K	no
R2	15 cm	10 cm	10 cm	Double glazing - GLASS Ug= 1,7 W/m²K; FRAME Uf=1,4 W/m2K	no
R3	30 cm	25 cm	15 cm	Triple glazing - GLASS Ug= 1,0 W/m²K; FRAME Uf=1,0 W/m2K	yes

Policy variables

- Energy price subsidies/taxes, for each fuel, heat and electricity prices/tariffs
- Discount rates reflecting different risks profile of retrofitting different building types under different regulatory environment
- Project subsidies: capex grants, opex subsidies
- Innovation (steeper learning curves)
- Revenue enhancing instruments (e.g. feed-in tariffs, carbon prices, white certificates)
- Transaction costs
  - project transaction costs
  - Policy transaction costs activated only with a particular policy intervention

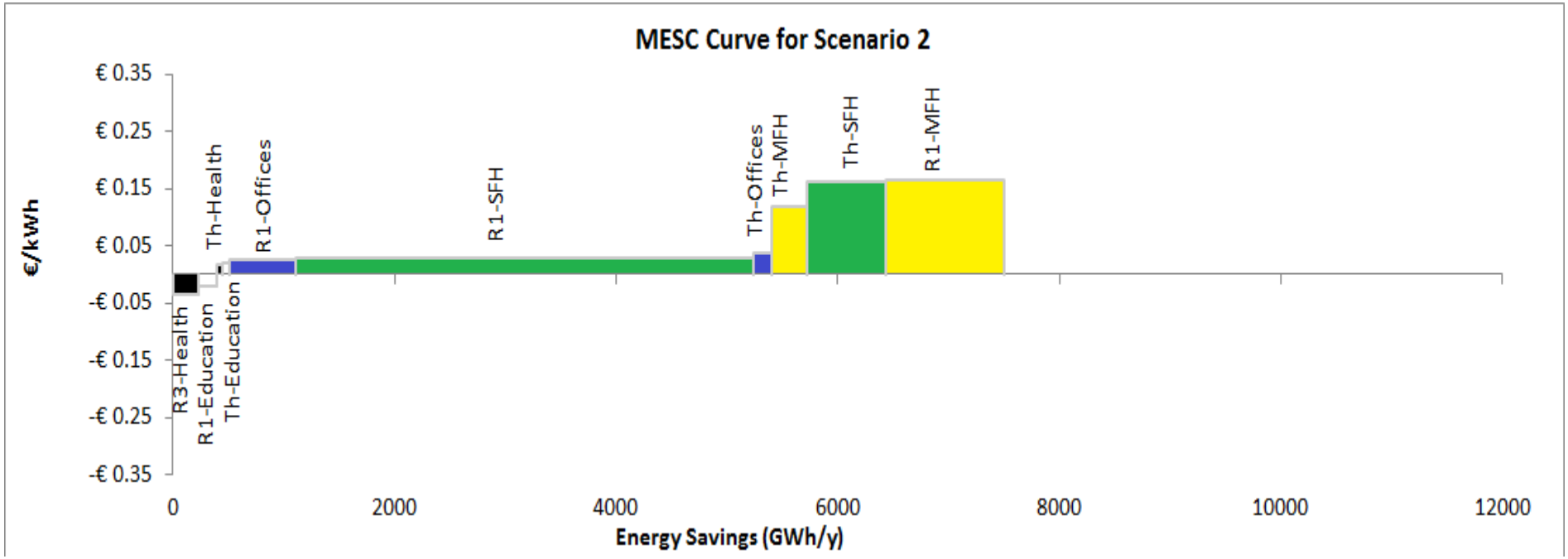
Scenario: Baseline without grants



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)
R1-Health	-0.56		-0.54	96	96
R1-Education	2.23		3.79	170	
R1-SFH	6.13		253.29	4,135	
Th-Health	7.12		3.17	45	
R1-Offices	7.48		44.94	600	
Th-Education	9.08		6.11	67	
Th-Offices	12.15		19.48	160	
Th-MFH	22.07		68.98	313	
R1-MFH	26.96		286.57	1,063	
Th-SFH	26.96		193.47	718	
AVERAGE	**11.94**	**TOTAL**	**€ 879**	**7,367**	**96**

POLICY APPLICATION	
grants (standard)	NO
utility benefit	NO
grants (higher)	NO
reduced discount rate	NO
increased learning curve	NO
reduced transaction costs	NO
energy price reform	NO

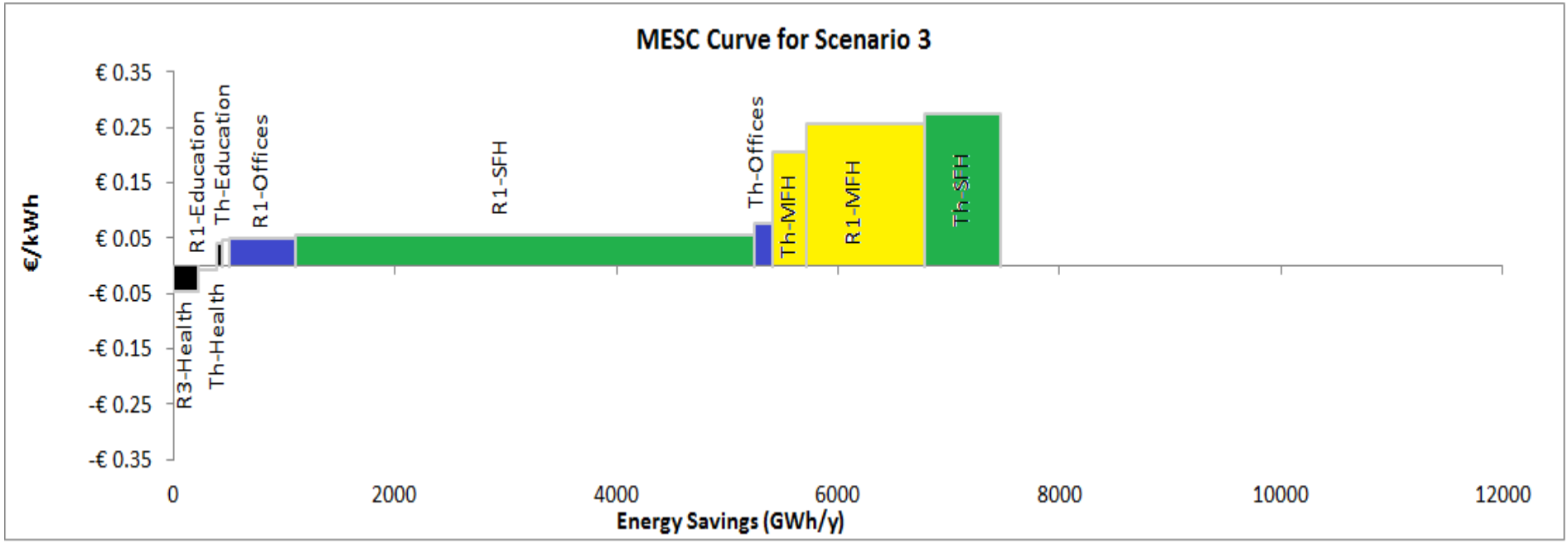
Scenario. Baseline with 25% grants



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)
R3-Health	-3.40		-7.64	224	224
R1-Education	-2.00		-3.41	170	170
Th-Health	1.81		0.81	45	
Th-Education	1.91		1.29	67	
R1-Offices	2.55		15.28	600	
R1-SFH	2.85		117.96	4,135	
Th-Offices	3.70		5.93	160	
Th-MFH	11.79		36.87	313	
Th-SFH	16.19		116.18	718	
R1-MFH	16.45		174.81	1,063	
AVERAGE	**6.11**	**TOTAL**	**€ 458**	**7,495**	**395**

POLICY APPLICATION	
grants (standard)	YES
utility benefit	NO
grants (higher)	NO
reduced discount rate	NO
increased learning curve	NO
reduced transaction costs	NO
energy price reform	NO

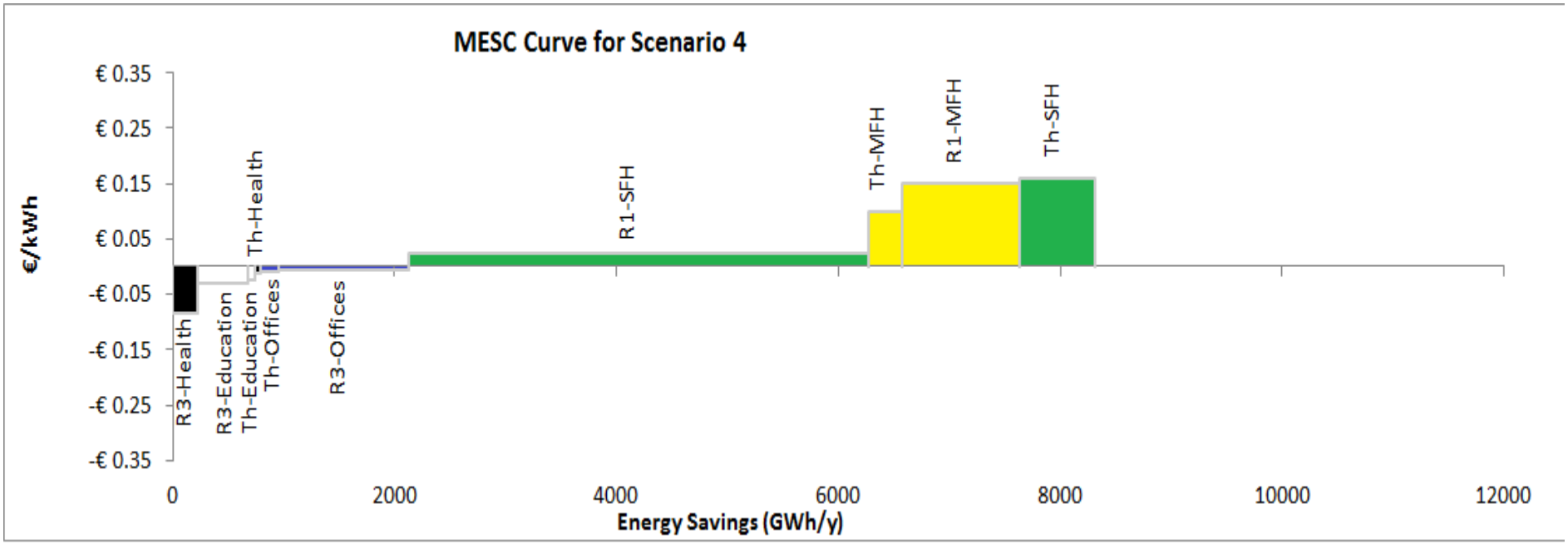
Scenario: Baseline with comfort and convenience valued



Building Category	MESC €c/kWh	Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)
R3-Health	-4.76	-10.68	224	224
R1-Education	-0.74	-1.26	170	170
Th-Health	4.06	1.81	45	
Th-Education	4.74	3.19	67	
R1-Offices	4.96	29.76	600	
R1-SFH	5.69	235.84	4,143	
Th-Offices	7.60	12.19	160	
Th-MFH	20.70	62.56	302	
R1-MFH	25.64	273.03	1,065	
Th-SFH	27.37	187.42	685	
AVERAGE	**10.64**	**TOTAL**	**€ 794**	**7,462**	**395**

POLICY APPLICATION	
grants (standard)	NO
utility benefit	YES
grants (higher)	NO
reduced discount rate	NO
increased learning curve	NO
reduced transaction costs	NO
energy price reform	NO

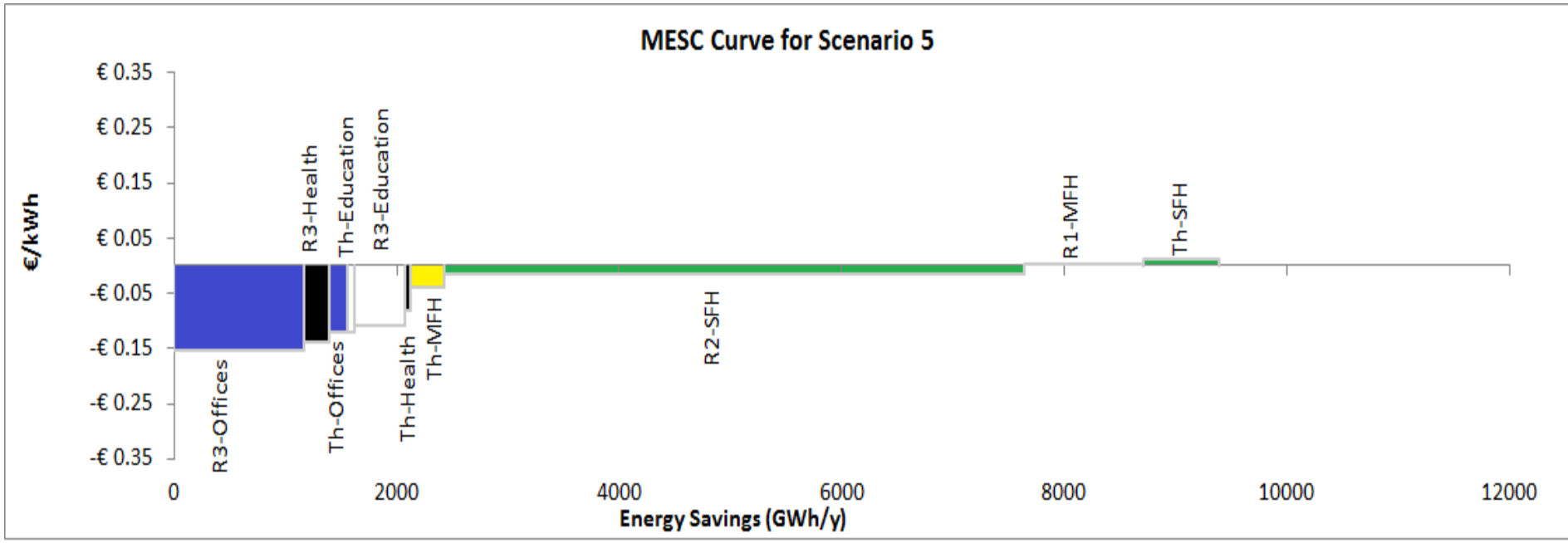
Scenario: Baseline with comfort and 25% grants



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)
R3-Health	-8.56		-19.21	224	224
R3-Education	-3.02		-13.73	455	455
Th-Education	-2.44		-1.64	67	67
Th-Health	-1.25		-0.56	45	45
Th-Offices	-0.85		-1.36	160	160
R3-Offices	-0.50		-5.82	1,172	1172
R1-SFH	2.42		100.46	4,143	
Th-MFH	10.05		30.37	302	
R1-MFH	15.14		161.27	1,065	
Th-SFH	16.06		109.97	685	
AVERAGE	**4.32**	**TOTAL**	**€ 360**	**8,319**	**2,124**

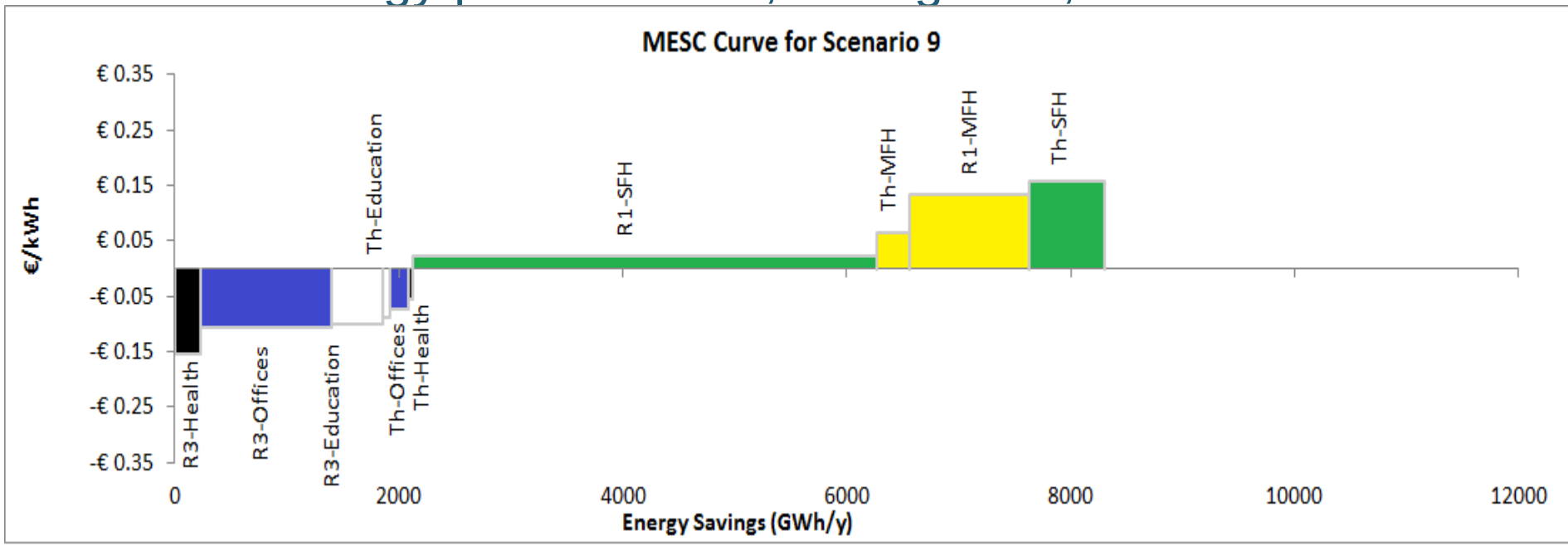
POLICY APPLICATION	
grants (standard)	YES
utility benefit	YES
grants (higher)	NO
reduced discount rate	NO
increased learning curve	NO
reduced transaction costs	NO
energy price reform	NO

Scenario: 50% grants, comfort valued



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)	**POLICY APPLICATION**	
R3-Offices	-15.28		-179.20	1,172	1172	grants (standard)	NO
R3-Health	-13.89		-31.16	224	224	utility benefit	YES
Th-Offices	-12.04		-19.30	160	160	grants (higher)	YES
Th-Education	-11.93		-8.03	67	67	reduced discount rate	NO
R3-Education	-10.75		-48.93	455	455	increased learning curve	NO
Th-Health	-8.28		-3.69	45	45	reduced transaction costs	NO
Th-MFH	-4.05		-12.24	302	302	energy price reform	NO
R2-SFH	-1.55		-80.65	5,213	5213		
R1-MFH	0.45		4.79	1,065			
Th-SFH	1.09		7.48	685			
AVERAGE	**-3.95**	**TOTAL**	**-€ 371**	**9,388**	**7,639**		

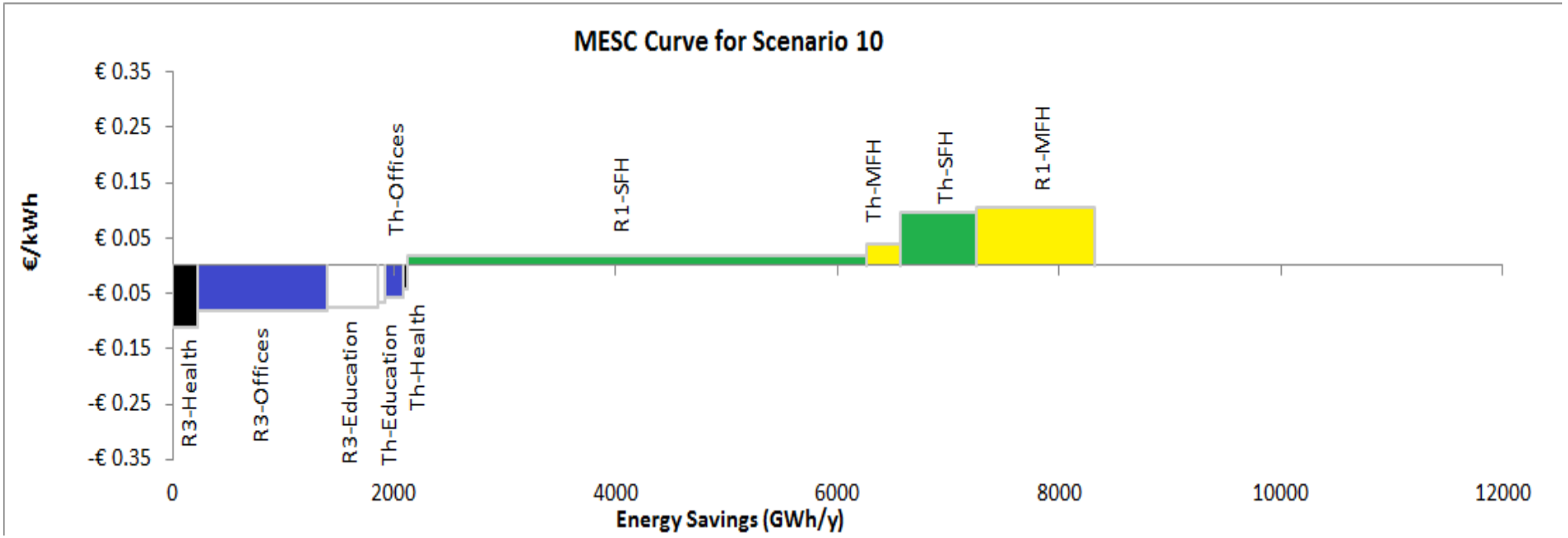
Scenario: Energy price reforms, 25% grants, comfort valued



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)
R3-Health	-15.36		-34.46	224	224
R3-Offices	-10.79		-126.51	1,172	1172
R3-Education	-9.91		-45.09	455	455
Th-Education	-8.71		-5.86	67	67
Th-Offices	-7.44		-11.93	160	160
Th-Health	-5.57		-2.48	45	45
R1-SFH	2.16		89.40	4,146	
Th-MFH	6.52		19.11	293	
R1-MFH	13.26		141.52	1,068	
Th-SFH	15.68		105.75	674	
AVERAGE	**1.56**	**TOTAL**	**€ 129**	**8,305**	**2,124**

POLICY APPLICATION	
grants (standard)	YES
utility benefit	YES
grants (higher)	NO
reduced discount rate	NO
increased learning curve	NO
reduced transaction costs	NO
energy price reform	YES

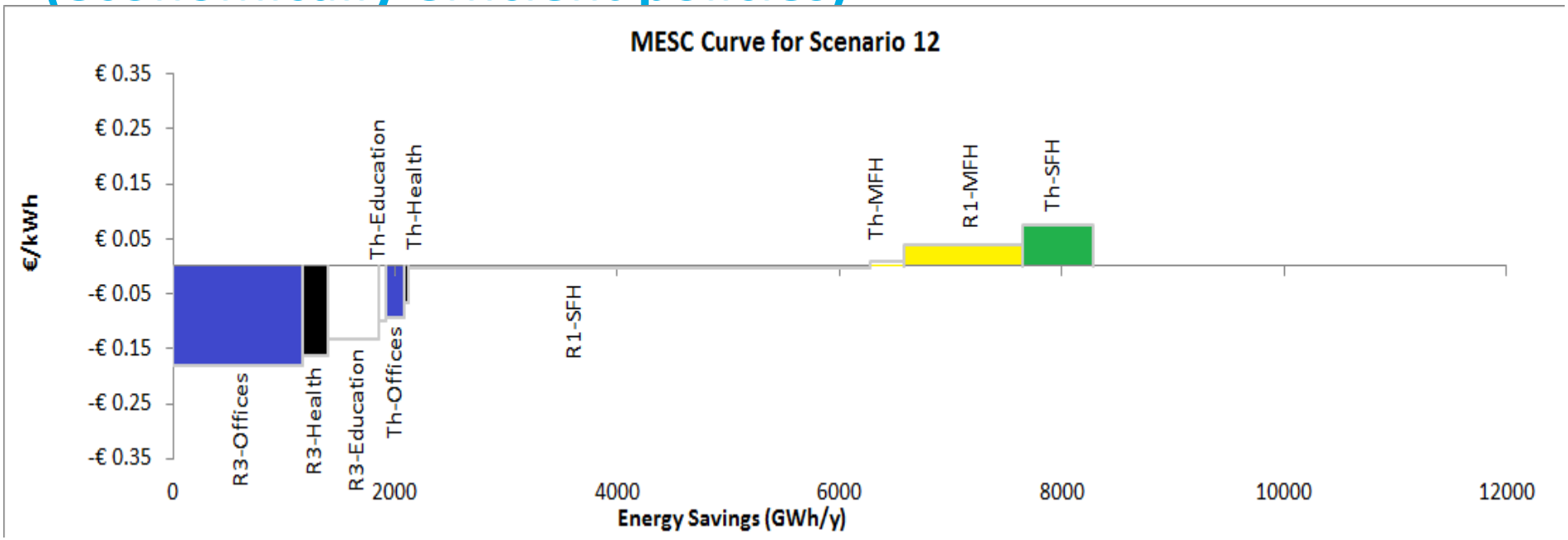
Scenario: Soft policy measures, no price reform



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)
R3-Health	-11.25		-25.25	224	224
R3-Offices	-8.00		-93.77	1,172	1172
R3-Education	-7.51		-34.17	455	455
Th-Education	-6.56		-4.41	67	67
Th-Offices	-5.71		-9.15	160	160
Th-Health	-4.30		-1.92	45	45
R1-SFH	1.93		79.93	4,143	
Th-MFH	3.93		11.87	302	
Th-SFH	9.57		65.49	685	
R1-MFH	10.54		112.22	1,065	
AVERAGE	**1.21**	**TOTAL**	**€ 101**	**8.319**	**2,124**

POLICY APPLICATION	
grants (standard)	NO
utility benefit	YES
grants (higher)	NO
reduced discount rate	YES
increased learning curve	YES
reduced transaction costs	YES
energy price reform	NO

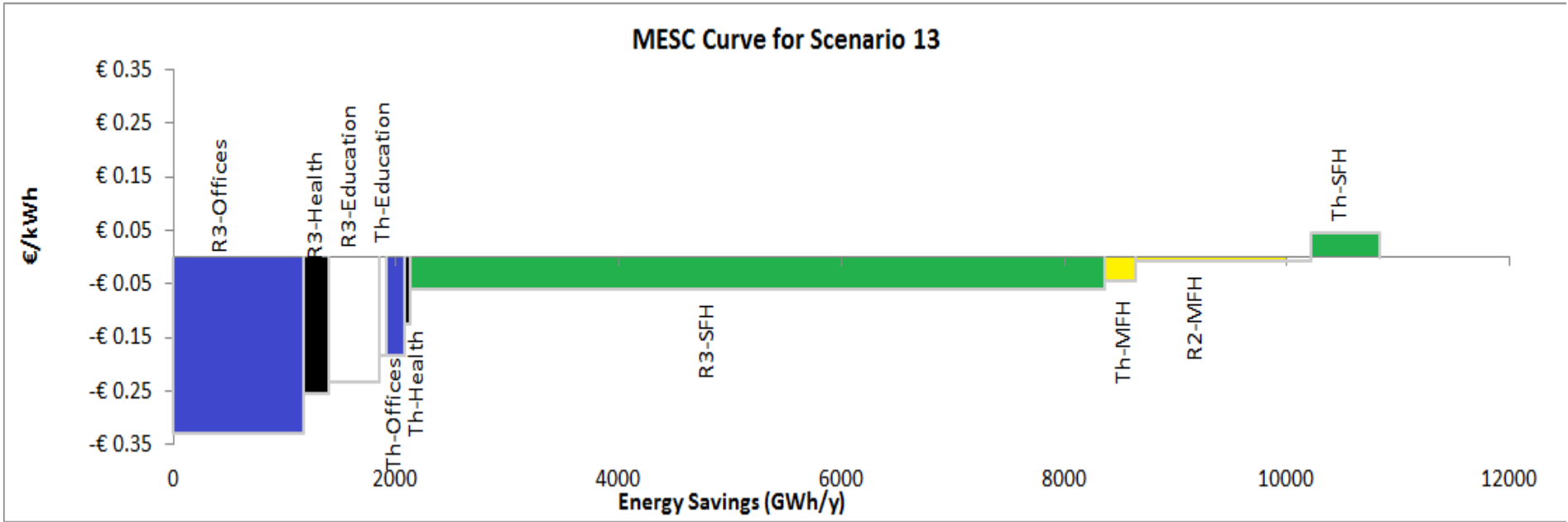
Scenario: Market based combined policy boost (economically efficient policies)



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)
R3-Offices	-17.94		-210.27	1,172	1172
R3-Health	-16.15		-36.25	224	224
R3-Education	-13.35		-60.74	455	455
Th-Education	-9.97		-6.70	67	67
Th-Offices	-9.37		-15.03	160	160
Th-Health	-6.68		-2.98	45	45
R1-SFH	-0.21		-8.56	4,154	4154
Th-MFH	0.96		2.83	296	
R1-MFH	4.05		43.16	1,067	
Th-SFH	7.59		48.82	643	
AVERAGE	**-2.97**	**TOTAL**	**-€ 246**	**8,284**	**6,278**

POLICY APPLICATION	
grants (standard)	NO
utility benefit	YES
grants (higher)	NO
reduced discount rate	YES
increased learning curve	YES
reduced transaction costs	YES
energy price reform	YES

Scenario: Market based combined policy boost +25 grants



Building Category	MESC €c/kWh		Annualised cost €M (area under curve)	Total savings (GWh/y)	Cost effective savings (GWh/y)	**POLICY APPLICATION**	
R3-Offices	-33.09		-388.00	1,172	1172	grants (standard)	YES
R3-Health	-25.57		-57.37	224	224	utility benefit	YES
R3-Education	-23.20		-105.55	455	455	grants (higher)	NO
Th-Education	-18.31		-12.32	67	67	reduced discount rate	YES
Th-Offices	-18.24		-29.24	160	160	increased learning curve	YES
Th-Health	-12.57		-5.61	45	45	reduced transaction costs	NO
R3-SFH	-5.95		-371.27	6,237	6237	energy price reform	YES
Th-MFH	-4.59		-13.13	286	286		
R2-MFH	-0.70		-11.05	1,569	1569		
Th-SFH	4.58		28.11	613			
AVERAGE	**-8.91**	**TOTAL**	**-€ 965**	**10,830**	**10,217**		

Questions for discussion

- **Baseline scenario**
  - With or without current policies (e.g. 25% grants?)
  - With or without co-benefits (e.g. comfort and convenience?)
  - with or without market reforms (in own interest)
- **Policy scenarios**
  - What level of ambition for thermal retrofit (only economically efficient or also beyond)?
  - Grants expected with or without market reforms

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Thank you