Addressing the Energy Efficiency First Principle in a National Energy and Climate Strategy – The Case of Cyprus

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March 2022

Background – 1

- Energy Union Governance Regulation (EU) 2018/1999 introduced the "Energy Efficiency First" (EE1) principle.
- Commission Communication of September 2021: EE1 means that *"taking full consideration of security of supply and market integration, only the energy needed is produced and investments in stranded assets are avoided in the pathway to achieve the climate goals"*.
- EE1 is also a key principle in the Renovation Wave strategy and should be part of the national Long Term Renovation Strategies.

Background – 2

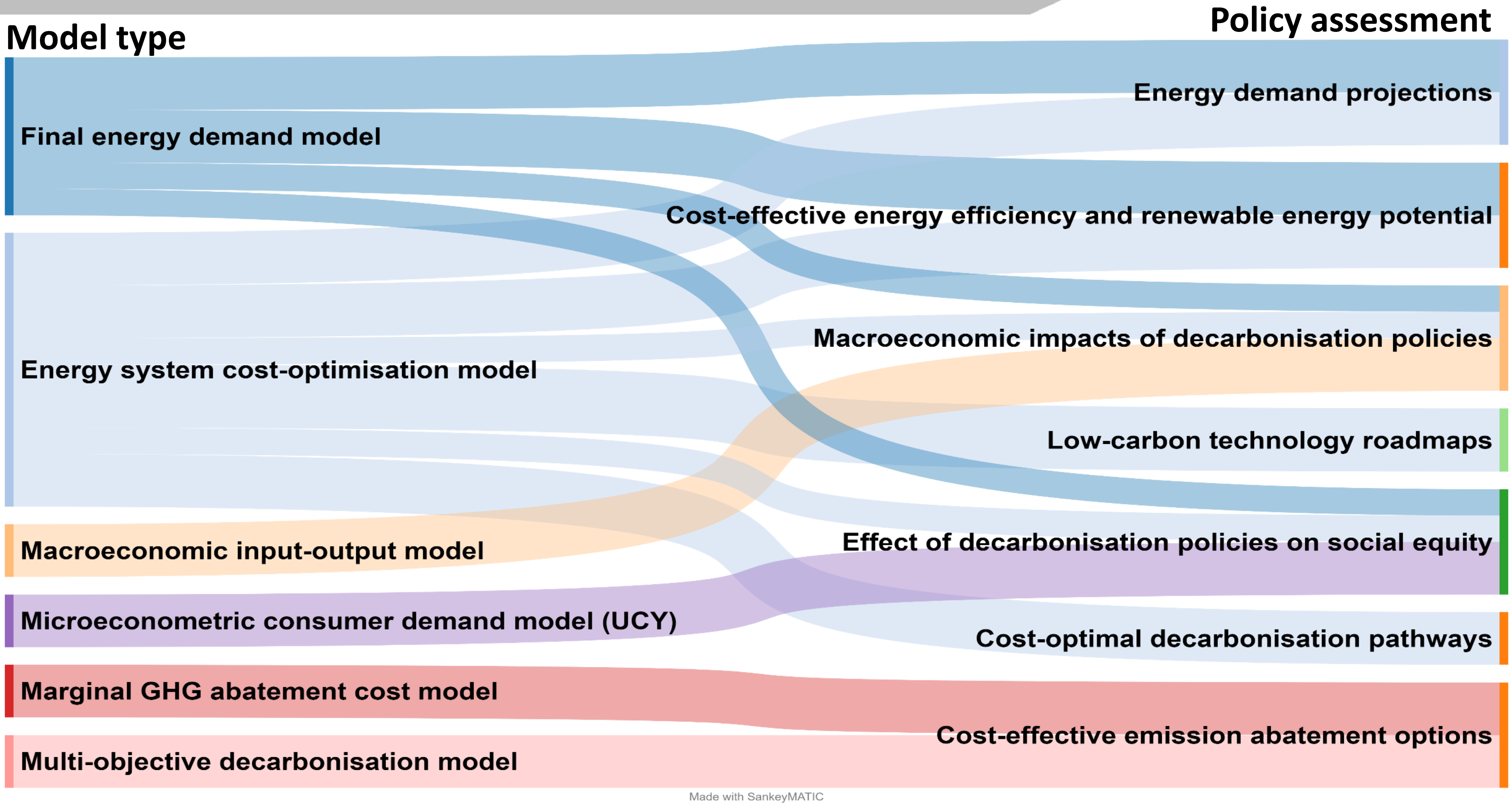
- When designing energy and climate policies, EU Member States have to apply the Energy Efficiency First Principle: priority should be given to cost-effective measures reducing energy demand before other decarbonisation interventions are adopted.
- *"While applying the principle, a societal perspective to assessing the impacts of various alternatives is taken when analysing cost-effectiveness and wider benefits of energy saved. Still, at the operational and sub-national levels the implementation decisions should consider cost-effectiveness of energy-efficiency from the investor and end-user perspectives".*

Background – 3

- ‘Fit-for-55’ package of July 2021: Proposed recast Energy Efficiency Directive reinforces the EE1 Principle:

- *Member States shall assess the application of EE1 annually where policy, planning and major investment decisions are subject to approval & identify the entities responsible for monitoring the application of EE1*
- *Gas and electricity transmission and distribution system operators must apply EE1 in planning, development and major investment decisions*

Our Modelling Framework for Policy Research & Planning



Our Model-Based Support to National Policy

- Contribution to preparation of National Energy Efficiency Action Plans
- Identification of theoretical and economically realistic energy efficiency potential (with GIZ)
- Impact assessment of the 2019 National Energy and Climate Plan of Cyprus
- Today:
  - Scientific support to governmental authorities for the energy, climate and transport aspects of the European Green Deal
  - Support electricity authorities for their ten-year electricity forecast
  - Support for the preparation of the updated NECP up to 2024 (contract by the European Commission with Trinomics BV)

Building the Knowledge Base for the Energy Transition

Development of energy system & economic IO models (2015-19)

Identification of economy-wide energy efficiency potential (2016-17)

Cost-effective GHG emission abatement measures (2017-18)

Impact Assessment of National Energy and Climate Plan, including EE1 assessment

Evaluating cost-effectiveness of emission abatement measures

Calculate:

- Total Discounted Costs up to 2050
- Cumulative GHG Emissions Savings up to 2050
- Cost – Effectiveness Index
- Reduction of Emissions in 2030

Measure	Discounted Costs up to 2050	Cumulative GHG Emissions Savings up to 2050	Cost – Effectiveness Index	Reduction of Emissions in 2030
	kEuro'2015	t $CO_{2\text{-eq}}$	Euro'2015 per t$CO_{2\text{-eq}}$	t $CO_{2\text{-eq}}$
Measure 1				
Measure 2				

Data & Measures Considered

Measures
Deep renovation
Roof insulation
Wall insulation
Insulation of pilotis
Installation of heat pumps
Replacement of windows
Replacement of lightbulbs
Installation of solar thermal water heaters

RESIDENTIAL SECTOR

- Data from a detailed national study, aggregated to arrive at a meaningful number of building variants
  - Two building types: single-family houses and multi-family buildings.
  - Buildings classified according to construction period: buildings completed before 2008 and from 2008 onwards.
- Cost and (useful) energy saving data for each individual measure for the four different classes of buildings.
- Main technologies used for space heating and cooling in residential buildings in Cyprus by construction period, and their corresponding average thermal efficiency.
- Number of interventions foreseen for residential buildings up to 2030.

Example: Costs and energy savings for measures in residential buildings

Multi-family building built before 2008

Intervention	Change in useful energy demand [kWh_{th}]		Investment cost* [€]	Maintenance cost* [€]	Lifetime [y]
	Heating	Cooling			
Deep renovation (to nZEB)	-8278	-19581	46750	3447	20
Roof insulation	-2936	-12943	3350	67	20
Wall insulation	-1481	-1731	15650	313	20
Pilotis insulation	-3090	3426	3350	67	20
Windows replacement	704	-3460	24400	3000	20
Lighting [kWh_{el}]	-3460		1750	53	15
Solar thermal	-6000		3600	300	20
Energy Demand for: [kWh]	15640	45560			

Example: Data for residential buildings

Heating systems for pre-2008 residential buildings

Technology	*Fuel*	*Efficiency*	*Usage*
Central heating	Gas oil	80%	23.6%
Heat pump	Electricity	320%	15.2%
Stove	Electricity	100%	17.1%
Stove	LPG	70%	23.0%
Fireplace	Biomass	30%	7.3%
Storage	Electricity	100%	4.5%

Heating systems for post-2008 residential buildings

Technology	*Fuel*	*Efficiency*	*Usage*
Central heating	Gas oil	80%	9.1%
Heat pump	Electricity	320%	38.6%
Stove	Electricity	100%	18.2%
Stove	LPG	70%	4.5%
Fireplace	Biomass	30%	8.0%
Storage	Electricity	100%	9.1%

Cooling systems for pre-2008 residential buildings

Technology	*Fuel*	*Efficiency*	*Usage*
Heat pump	Electricity	250%	100.0%

Cooling systems for post-2008 residential buildings

Technology	*Fuel*	*Efficiency*	*Usage*
Heat pump	Electricity	320%	100.0%

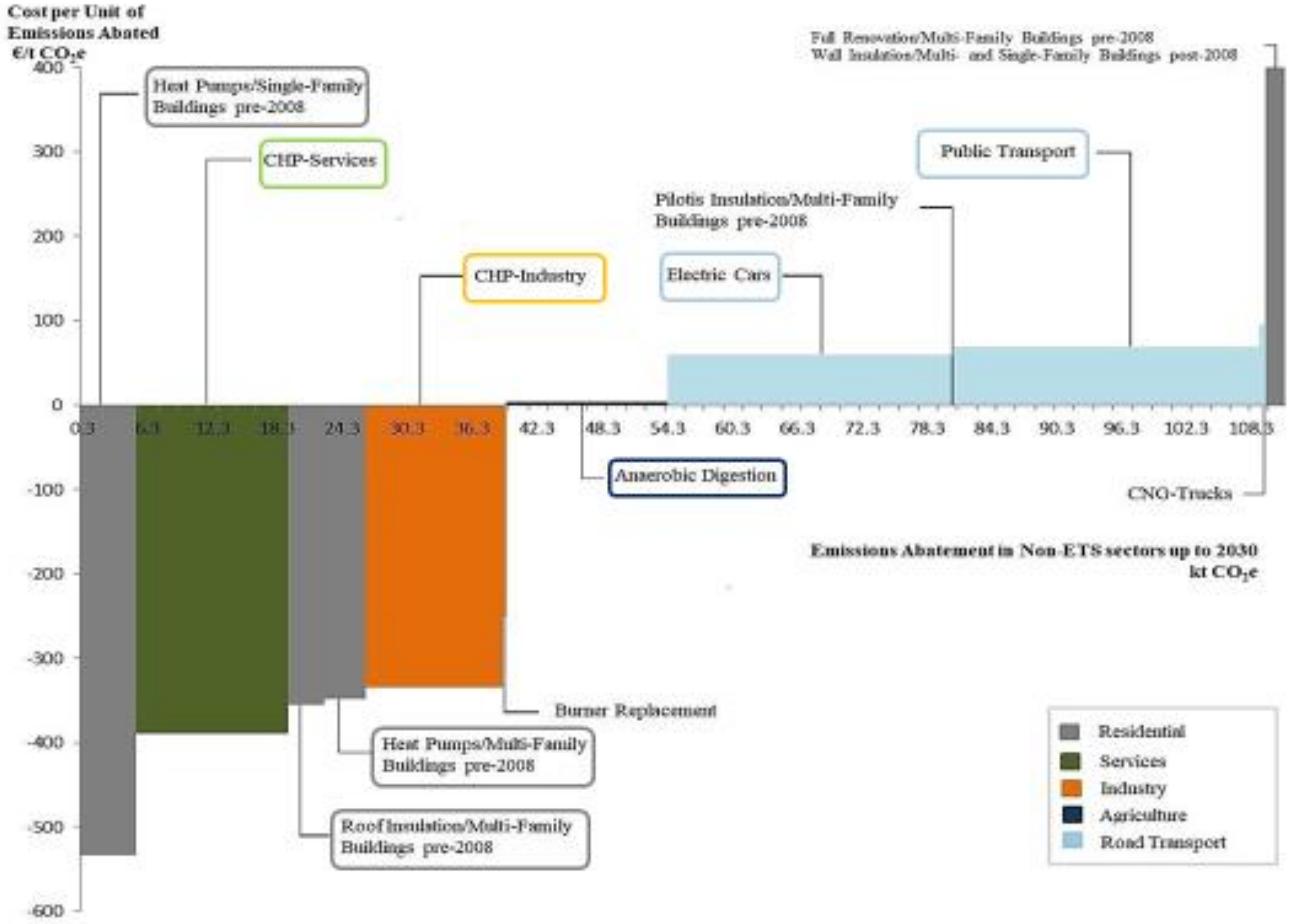
Current (New) heat pump specifications

Type	*SEER*	*SCOP*	*Comment*	*Investment cost* [€]*	*Maintenance cost* [€]*	*Lifespan [y]*
Split, Air-to-Air (AA)	515%	475%	Actual data; applicable to residential single family buildings before 2008	3200	128	15
Split, Air-to-Air (AA)	515%	475%	Actual data; applicable to residential single family buildings after 2008	4000	160	15
Split, Air-to-Air (AA)	515%	475%	Actual data; applicable to residential multi family buildings before 2008	9600	384	15
Split, Air-to-Air (AA)	515%	475%	Actual data; applicable to residential multi family buildings after 2008	14400	576	15
Package, VRV	500%	460%	Actual data; Applicable to commercial buildings	92500	3700	15

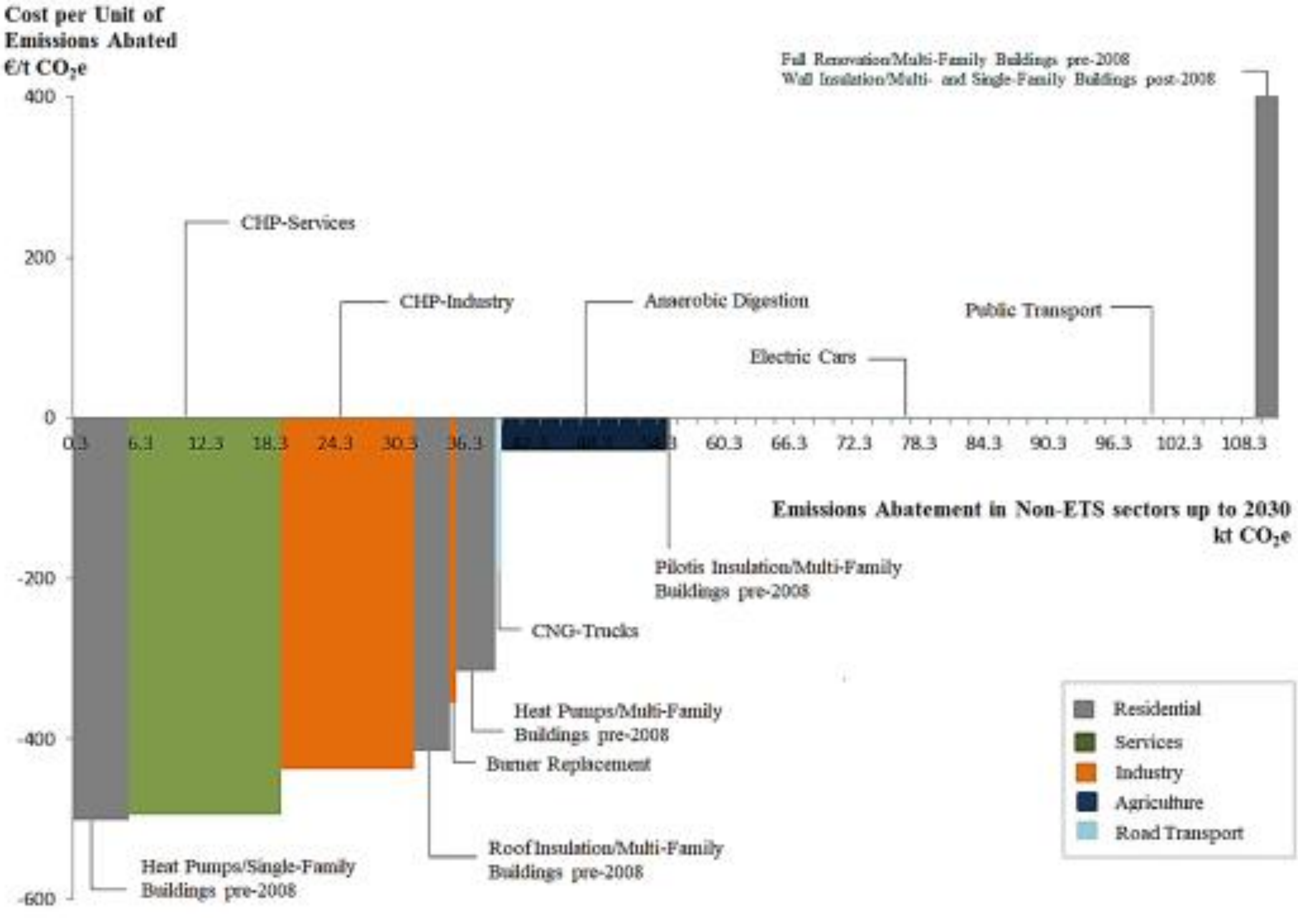
Energy saving potential: Number of energy efficiency measures assumed in residential buildings

Intervention	Renovations up to 2030
1. Single- and two-family houses	
Deep renovation (nZEB)	1,000
Roof insulation	12,000
Wall insulation	2,500
Window frame system upgrade	3,500
Lighting and electronic appliances	21,000
Heat pumps	2,500
Solar thermal system for hot water production	3,500
2. Multi-family buildings	
Deep renovation (nZEB)	500
Roof insulation	3,500
Wall insulation	600
Ground floor/level insulation	300
Window frame system upgrade	2,000
Lighting and electronic appliances	5,500
Heat pumps	1,500
Solar thermal system for hot water production	500

Results: Marginal non-ETS GHG emissions abatement cost curve



Abatement cost curve including external costs of GHG and air pollutants



Using these Results to Address EE1 Requirements

- NECP of Cyprus included those energy efficiency measures calculated as clearly cost-effective (negative discounted costs) in the Planned Policies and Measures Scenario. Special focus on sustainable mobility.
- Cost-effectiveness and cost-benefit calculations were included in NECP Impact assessment (Chapter 5).
- Measures were sufficient to meet national EED obligations (incl. Article 7).
- Stronger energy efficiency measures (with high costs according to our analysis) were not proposed in NECP.
- Carbon pricing was kept as a reserve measure (included in EE1 guidance: *“internalising to fullest possible extent the environmental and climate costs of energy alternatives”*).

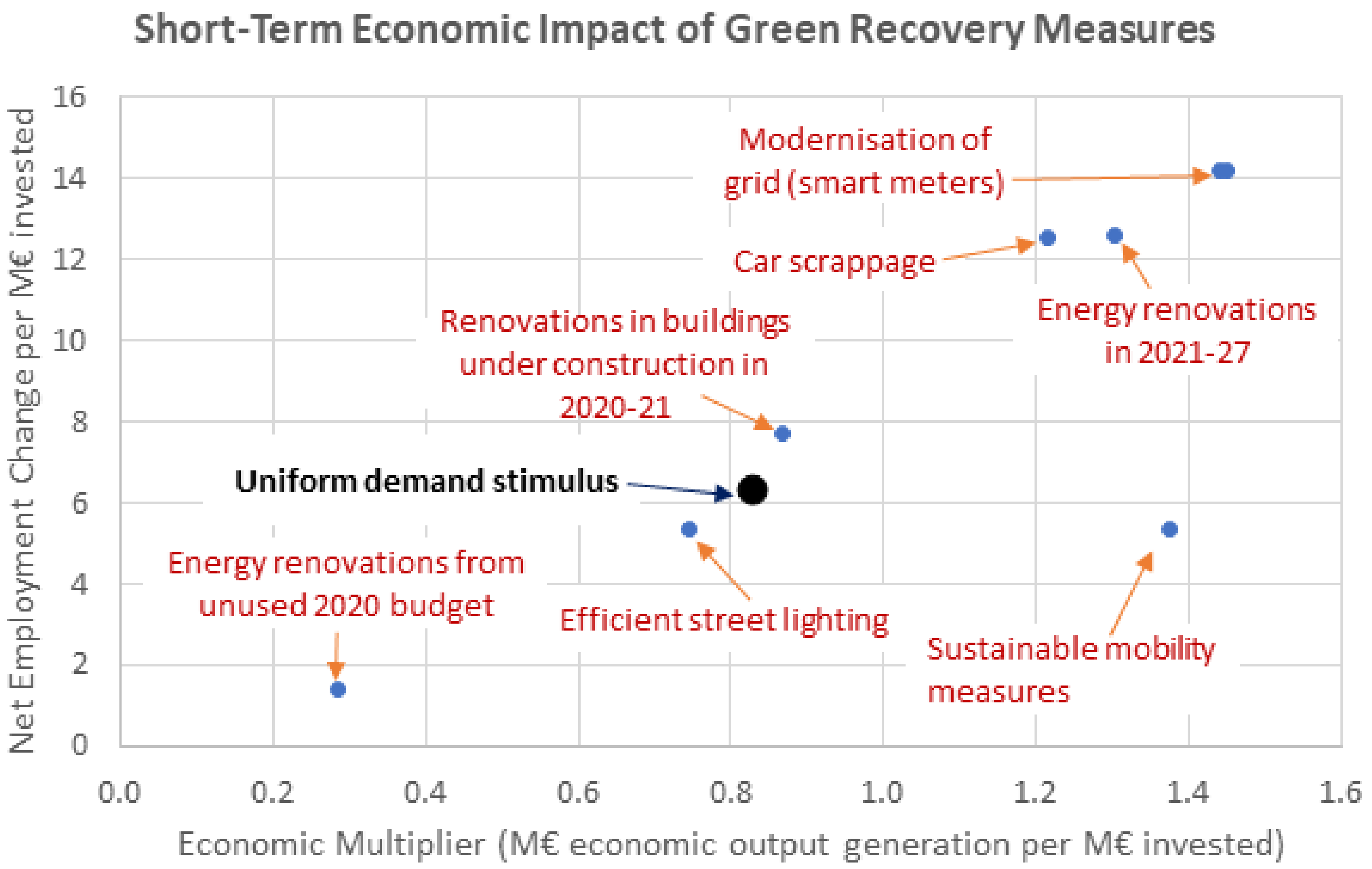
Current Challenges: European Green Deal & European Climate Law

- Since December 2019, the European Green Deal has set the EU on a path to net zero greenhouse gas emissions by 2050
- This target is legally binding for all EU Member States through the European Climate Law adopted in summer 2021
- ‘Fit-for-55’ package to deliver the European Green Deal contains multiple ambitious economy-wide & sectoral targets on energy efficiency, renewables, ETS & non-ETS emissions, new ETS for fuels used in buildings and road transport, sustainable fuels in shipping & aviation, etc.
- EE1 has a more prominent & institutionalised role

Addressing EE1 in the Era of the European Green Deal

1. Assess the energy saving potential of current national budgets & medium-term investment plans – including EU Recovery and Resilience Facility 2021-26 and regular EU budget (MFF 2021-27)
2. Check: are plans sufficient to meet national EE & GHG targets for 2030?
3. Explore cost-effectiveness of additional EE measures to reduce GHG emissions by 2030 – identify environmental & economic co-benefits!

Energy Efficiency Measures are also macro-economically Favourable



Zachariadis et al., World Bank Policy Research Working Paper WPS 9528 , 2021

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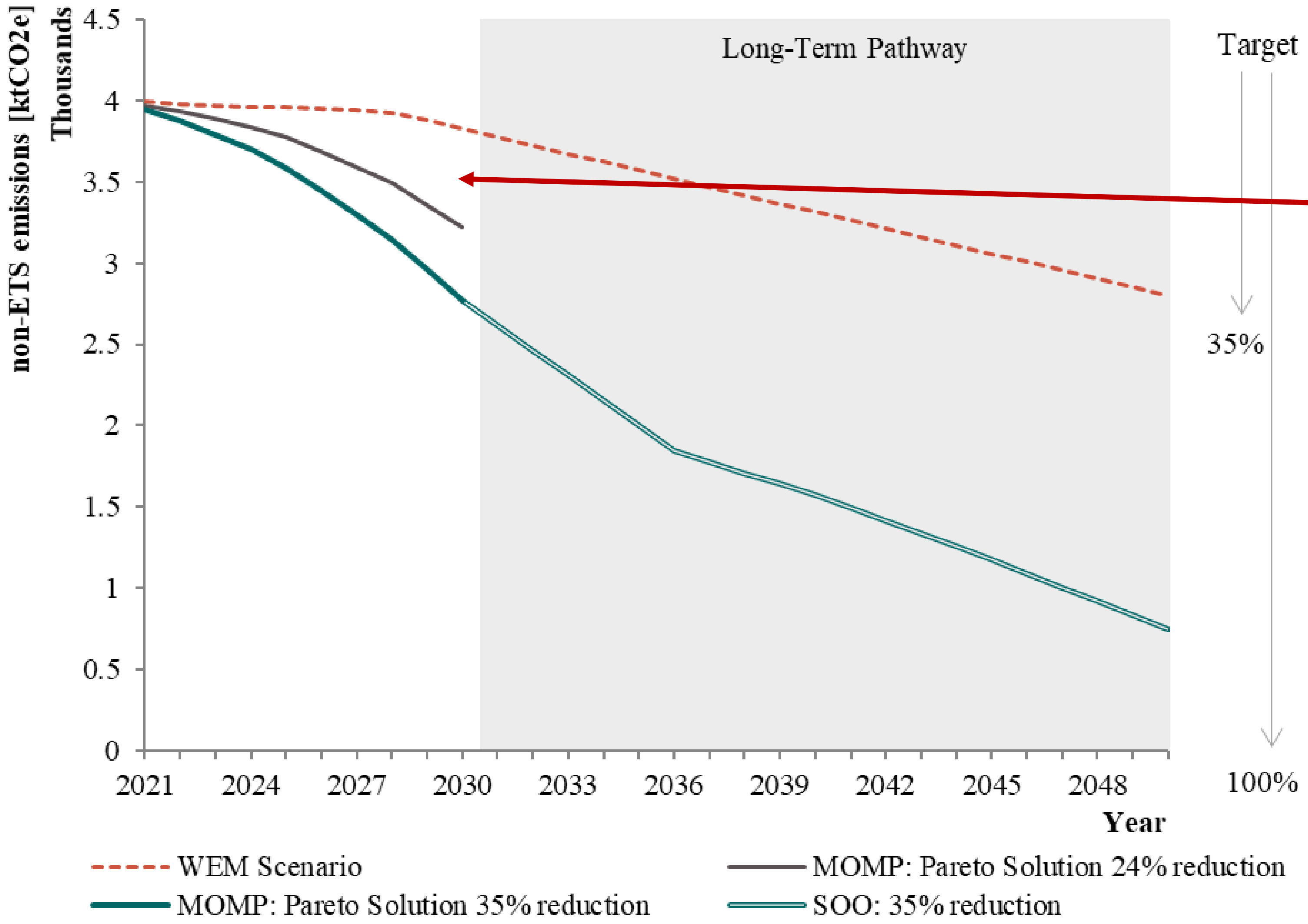
4. Understand the need for early action to avoid carbon lock-in on the way to (legally binding!) carbon neutrality by 2050

Carbon Lock-in Due to Higher Energy Demand



Higher investments in energy supply needed to satisfy higher energy demand in buildings & transport

➔ Stronger effort to achieve net zero emissions by 2050: higher investments + stranded assets

Sotiriou & Zachariadis, *Journal of Cleaner Production* 319 (2021) 128623.

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4. Understand the need for early action to avoid carbon lock-in on the way to (legally binding!) carbon neutrality by 2050
5. Identify challenges in implementation of EE investments – can we realise the Renovation Wave around Europe (shortages of human resources)?

Conclusions

- To address EE1, consider questions such as:
  - Can EE measures substantially reduce energy demand compared to a baseline?
  - Are they sufficient for compliance with EED and other EU & national legislation?
  - Does the national strategy contain all cost-effective EE-related policies and measures? Is there scope for further EE measures? Why not?
  - Have energy/carbon pricing measures been considered?
  - Does the cost-effectiveness calculation contain societal benefits other than lower energy costs (e.g. air quality, security of supply, social equity)?
  - If there are risks/barriers to implementation of EE measures (e.g. financing, human resources), how will these be addressed to avoid falling back on EE1?
- Adequate knowledge base with national data and modelling is key.

Some references

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Acknowledgements (financial assistance since 2015)

- European Commission's Structural Reform Support Service (now DG Reform)
- National government of Cyprus
  (Ministries of Finance; Energy, Commerce and Industry; Agriculture, Rural Development and Environment)
- EU Horizon 2020 programme (Odyssee-Mure project)

➢ Results, interpretations, views etc. presented her do not reflect the official opinion of the European Union or the government of Cyprus

Thank you

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