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How to assess investment needs and gaps in relation to the 2030 climate and energy targets

Ingmar Juergens and David Rusnok, Advisors
in co-operation with **Carlotta Piantieri and Malte Hessenius**

Why did we do this review of how the 2030 investment challenge can be assessed?

On the basis of our report it will be possible to develop a better understanding of:

- **how to capture** the 2030 investment challenge and the related investment needs;
- **how to assess** them; and
- **what to pay attention to** when interpreting the results of such assessments.

The review of the "German case" is a concrete **basis for starting the discussions** with decision makers, desk officers, analysts and stakeholders.

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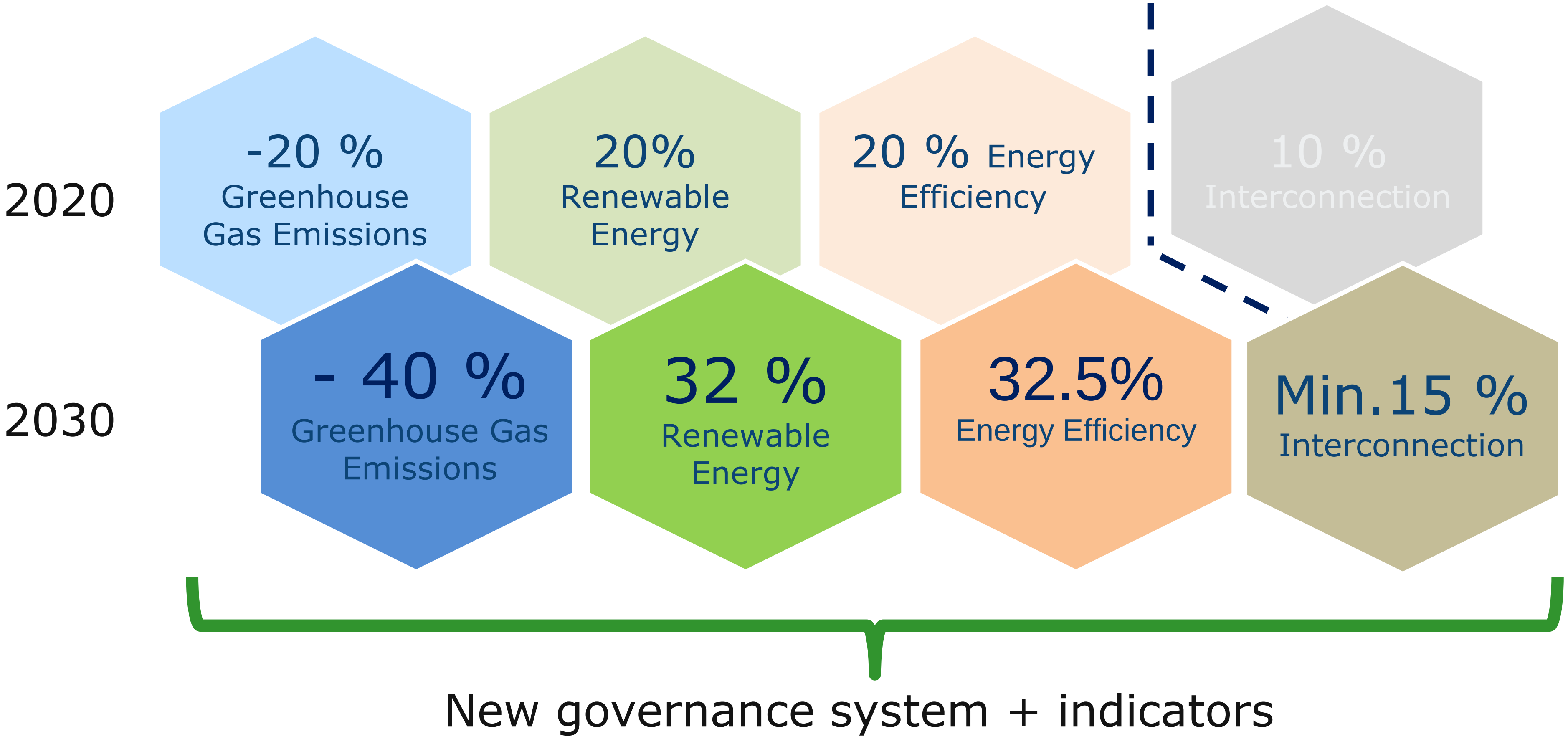
Why do we need to invest?

- Energy Union and the 2030 targets (the EU's "NDC")



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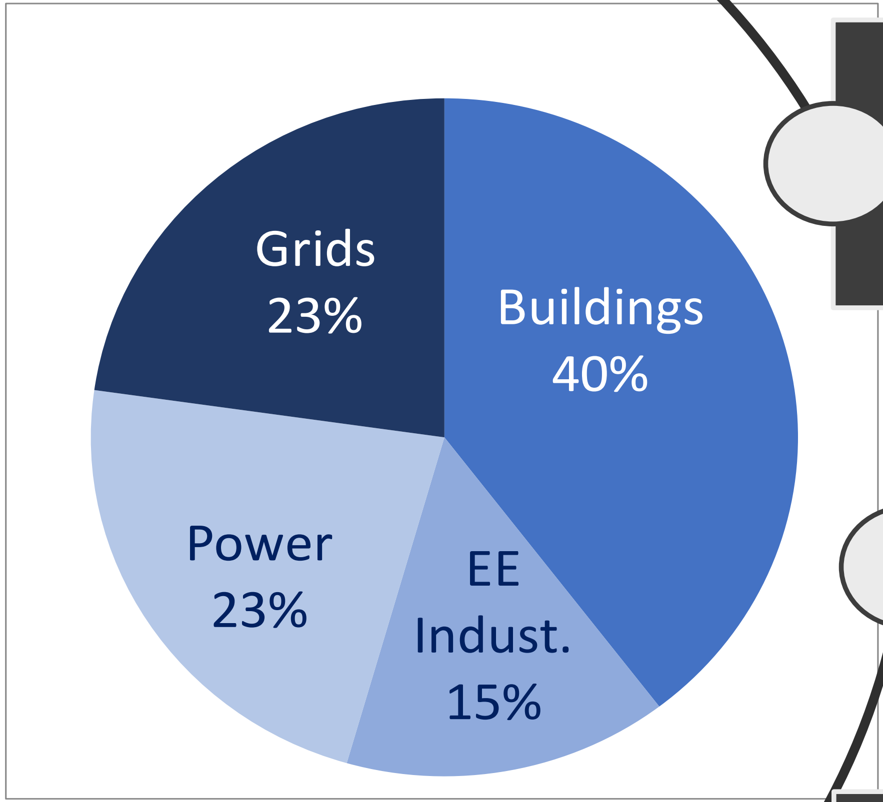
What challenge?
- the investment challenge of reaching the EU's 2030 targets

EUR 209 bn per year 2021-2030 in key sectors



Large investment needs after 2020 in any case due to existing targets. Only about a third related to the new targets of the 2030 framework

Modernisation of the power sector (power generation and grids) remains key. Large impact of 2030 targets on investment needs in the building sector

Need to step-up efforts related to bringing innovative solutions into the market

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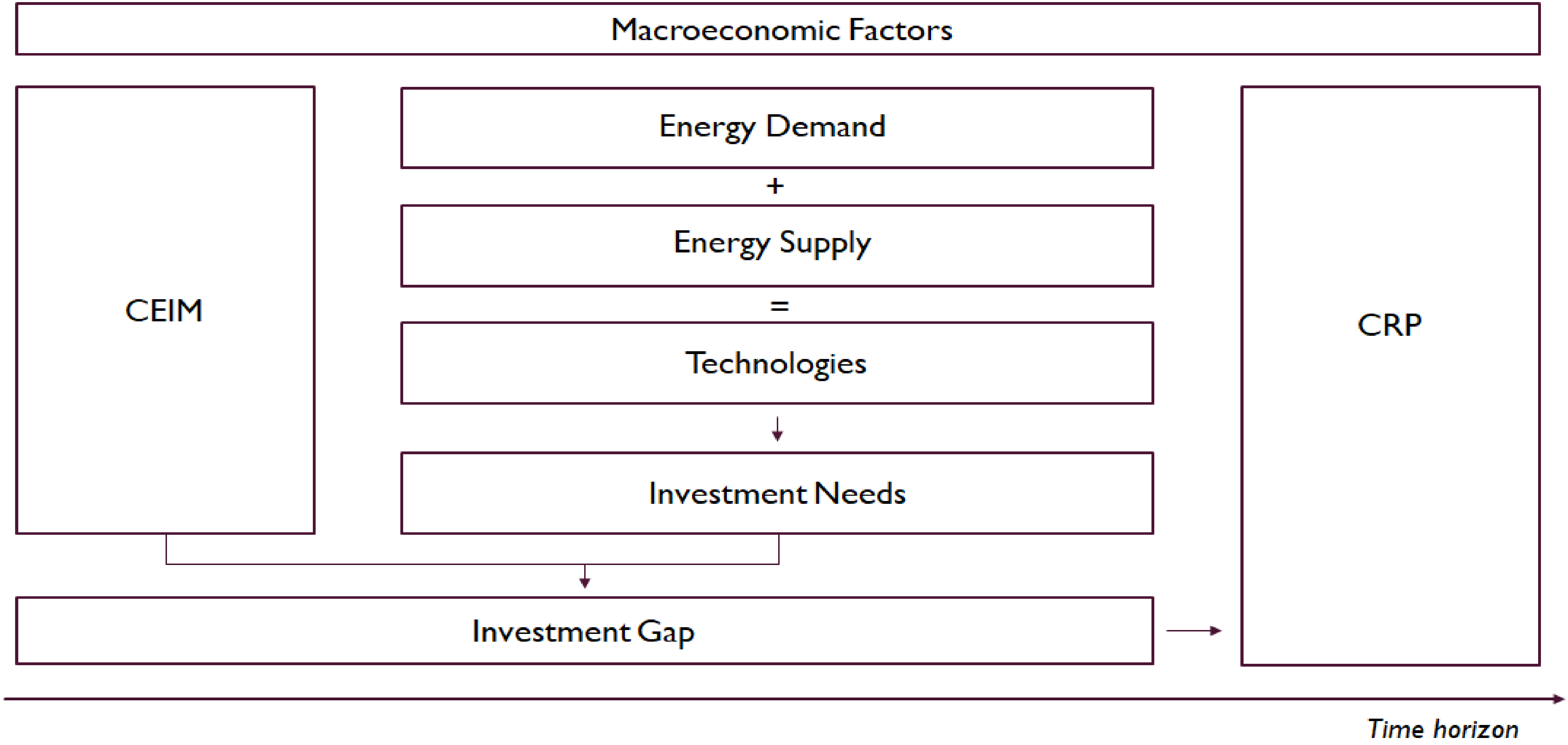
How to assess it? Investment Needs and Gap Analysis (INGA) and the project's analytical framework



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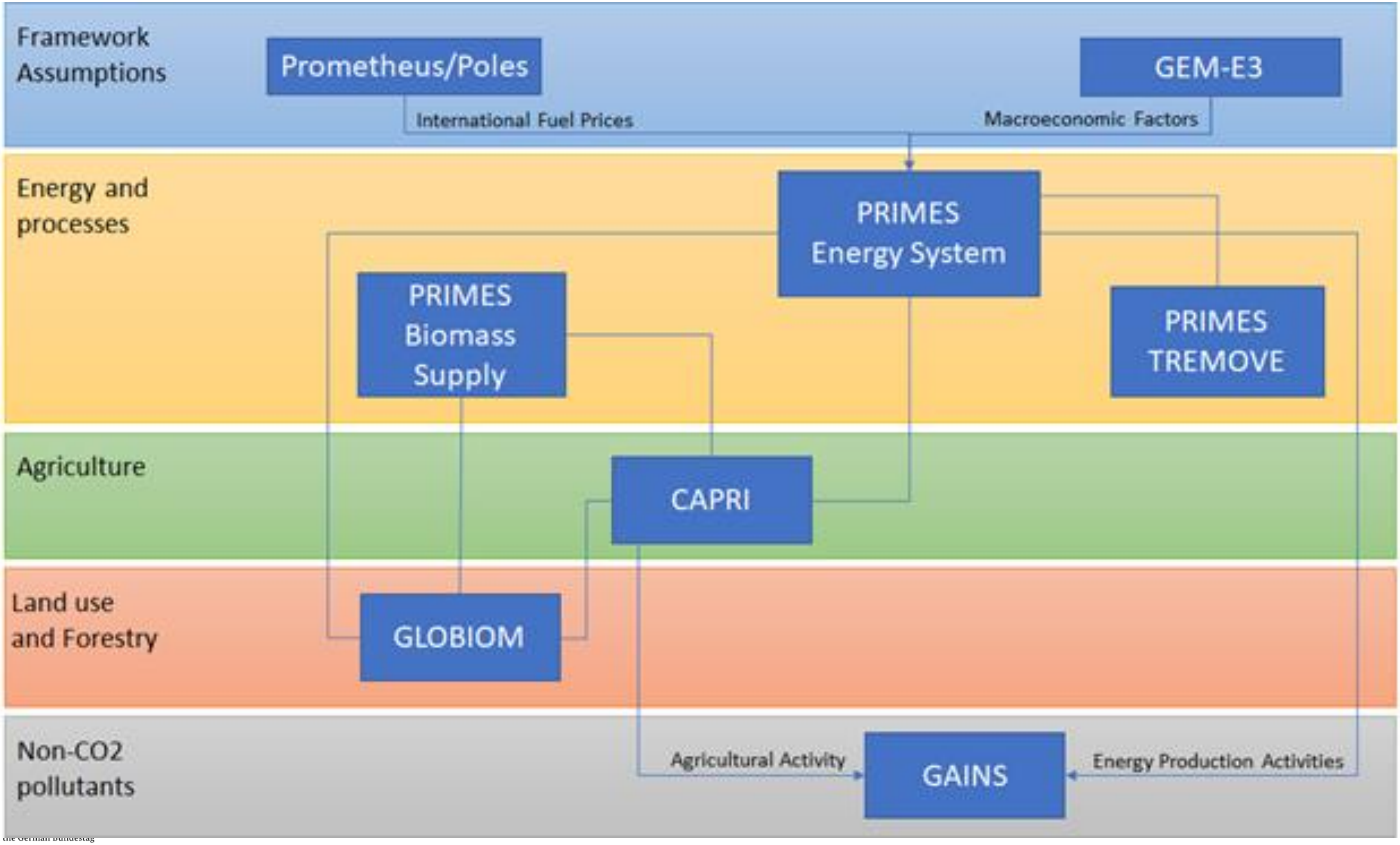
Study	Building bocks			Model-specific output features
	Socioeconomic factors	Energy markets	Technologies / Innovation needs	
OECD (2017)	Yoda model + Oxford GE model	Oxford GE model	Exogenous	SR and LR economic growth, potential output. GEM enables sector-level analysis.
IEA (2017)	Exogenous	WEM	REmap	Energy flows by fuel, investment needs and costs, carbon dioxide (CO2) and other energy-related GHG emissions, and end-user prices.
IRENA (2015)	Exogenous	Exogenous	REmap	Supply substitution cost curve. Current cost of technologies (no LR).
DENA (2018)	Exogenous	DIMENSION +	Exogenous	GHG emissions per sector.
BCG (2018)	VIEW Model by Prognos	Different models by Prognos	Bottom Up Substitution Cost Curve	Sectoral cost-efficient and low carbon technologies related investment needs.
Frauenhofer-ISE (2015)	Exogenous	REMod-D	Exogenous (e.g. expansion capacities of technologies)	System composition including cost analysis.
Prognos et. al. (2018)	ISI_Macro Model	Exogenous	Cost-Benefit Tool (UBA)	Primary effects (direct economic and environmental impacts, investment); Secondary effects (e.g employment)
European Commission (2017)	All the economy is modelled endogenously			Investment needs figures and detailed assessment of relative economic impacts.

(How) are these models linked? The European Commission's modelling framework - Source: EC (2017)



Key model features (Example: World Energy Model)

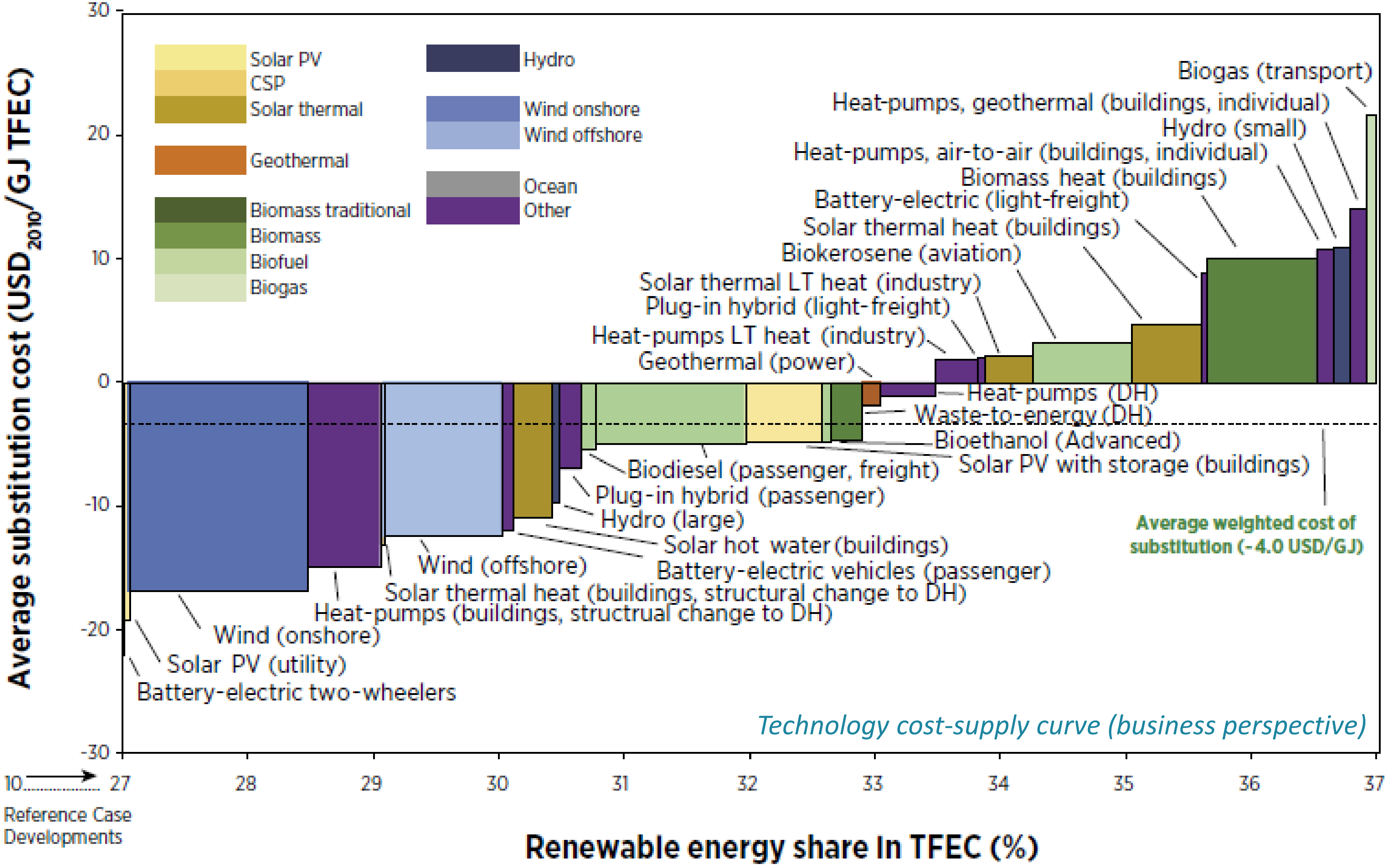
Models	Main sensitivities and assumptions	Inputs	Outputs
WEM	- Economic growth - Population growth - Technological developments - GHG emissions permits cost - Infrastructures development	- Energy markets data - Capacity and cost of energy production technologies - Historical socio-economic data - Capacity and cost of demand-side technologies - Emissions intensity of technologies	- Total final energy demand by sector - Total final energy consumption (TFEC) by sector - Electricity production - Energy flows by fuel - Electricity and fossil fuel equilibrium prices - End-user prices - Energy balances and quantity of GHG emissions

Key model features (Example: REmap)

Models	Main sensitivities and assumptions	Inputs	Outputs
REmap	- Consumption growth (TFEC by sector) - Energy prices - Technological performance and capacity constraints - Capital cost projections - GHG emissions permits cost	- Capacity and cost of demand-side technologies - Emissions intensity of technologies - TFEC by sector - Capital cost projections	- Technology substitution potential - Technology substitution cost - Investment needs to achieve TFEC objectives - Quantity of GHG emissions

Model results: Example Remap (IRENA 2016)

Technology cost difference per unit of final energy consumed if one replaces conventional energy technologies assumed to be in place in 2030 in the Reference Case with renewable energy (RE) technologies.



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RESULTS for Germany - Studies investigating total (additional) investment costs in relation to different GHG emission reduction targets

ID	Study	Time	Investment needs p.a.		GHG reduction target
	Authors	Period	Min. Bn €	Max. Bn €	Reference in square brackets
2050 – 80 per cent targets					
1	DENA (2018)	2018-50	+33.3	+54.6	-80% CO2 [-62%]
2	BCG (2018)	2015-50	+28.6		-80% CO2 [-61%]
3	Fraunhofer-ISE (2015)	2015-50	+24.9	+38.4	-80% CO2 [not stated]
2050 – 90/95 per cent targets					
1	DENA (2018)	2018-50	+34.3	+58.3	-95% CO2 [-62%]
2	BCG (2018)	2015-50	+50.6		-95% CO2 [-61%]
3	Fraunhofer-ISE (2015)	2015-50	+49.6		-90% CO2 [not stated]
2030 – 55 per cent targets					
4	Prognos et. al. (2018)	2018-30	+20.0.	+22.5	-55% CO2 [-35%]

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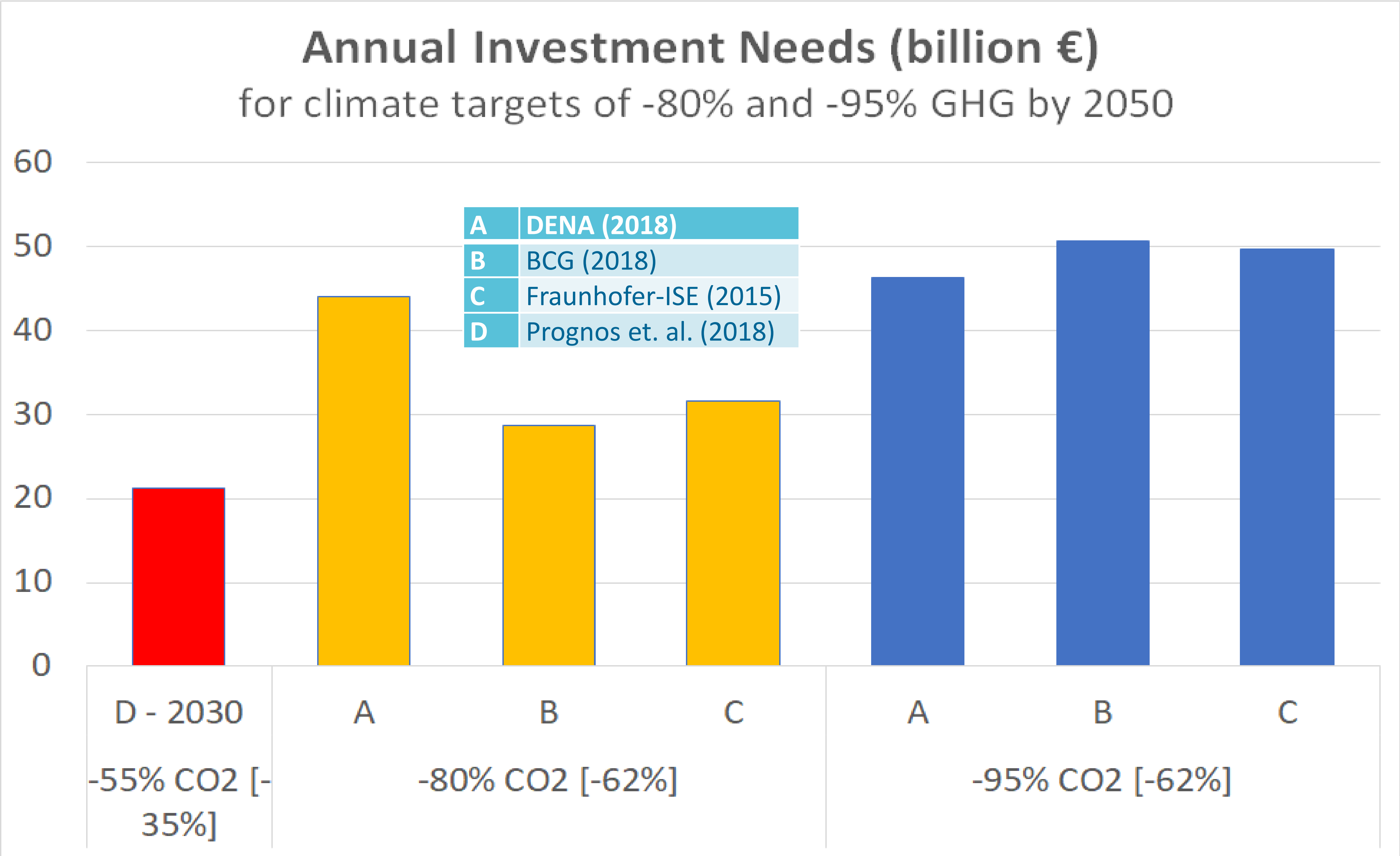

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Exemplifying the approach for a specific sector

1 Energy Efficiency (buildings)

2 *Renewables (power sector)*

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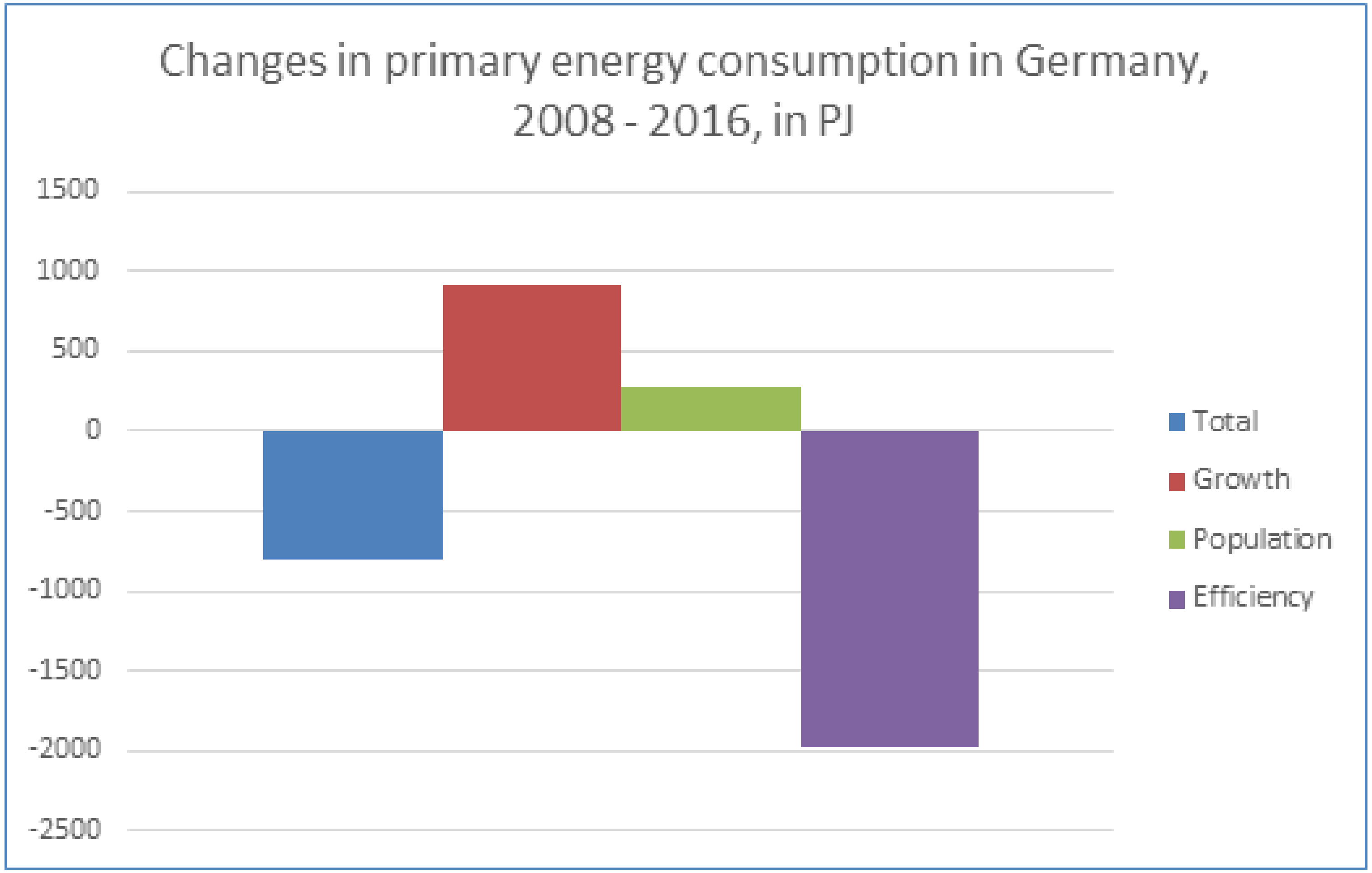

Source: BMWi 2018a

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Expected development of energy efficiency and consumptions figures overtime - Source: BMWi 2018a

	2016	2020	2030	2040	2050
Efficiency and Consumption					
Primary energy consumption (in comparison to 2008)	-6,5%	-20%			-50%
Energyproductivity	1,1% p.a. (2008-2016)	2,1% p.a. (2008 - 2050)			
gross electricity consumption (in comparison to 2008)	-3,6%	-10%			-20%

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Selected studies and their results for investment needs in the building sector

ID	Study	Time	Investment needs p.a.		Reduction target
	Authors	Period	**Min. bn €**	**Max. bn €**	Ref Scenario in square brackets
1	IFEU et al (2018)	2017-50	**+3.4**	**+7.7**	-87.5% CO2 [same]
2	DENA (2017)	2015-50	**+12.6**	**+25.4**	-80.0% CO2 [60%]
2	DENA (2017)	2015-50	**+12.9**	**+29.3**	-95.0% CO2 [60%]
3	IFEU and Beuth (2017)	2011-50	**+12.8**	**+21.9**	No target scenario
4	IFEU et al (2015)	2014-50	**+10[b]**	**+20[b]**	-80% energy demand [-72%][C]
5	BMWi (2017)	2014-50	**<12[a]**		-80% energy demand [-59%][C]
6	BMWi (2015)	2008-50	**+2.1**	**+6.4**	-80% energy demand [-61%][C]

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Conclusions - Understand what lies behind the numbers

1 **Estimates of investment needs depend on assumptions** that are taken at different places in the analytical/modeling framework. Some are more important than others, some are more controversial than others and some may not be obvious

2 **Crucial to understand the scenarios** used for the analysis and in particular what is and what is not included in the baseline. When comparing different modelling results (investment need figures), it is important to understand:

3 **Investment needs to reach climate targets in 2030 for Germany range from EUR 24.9 billion to EUR 58.5 billion.** The wide range represented by the numbers is determined by the scenarios assumed in the different studies and models adopted. This illustrates how important it is for the users of investment needs assessment studies to understand the underlying models, frameworks and limitations.

4 **Sectoral and bottom-up view important to understand specific barriers, drivers and solutions.**

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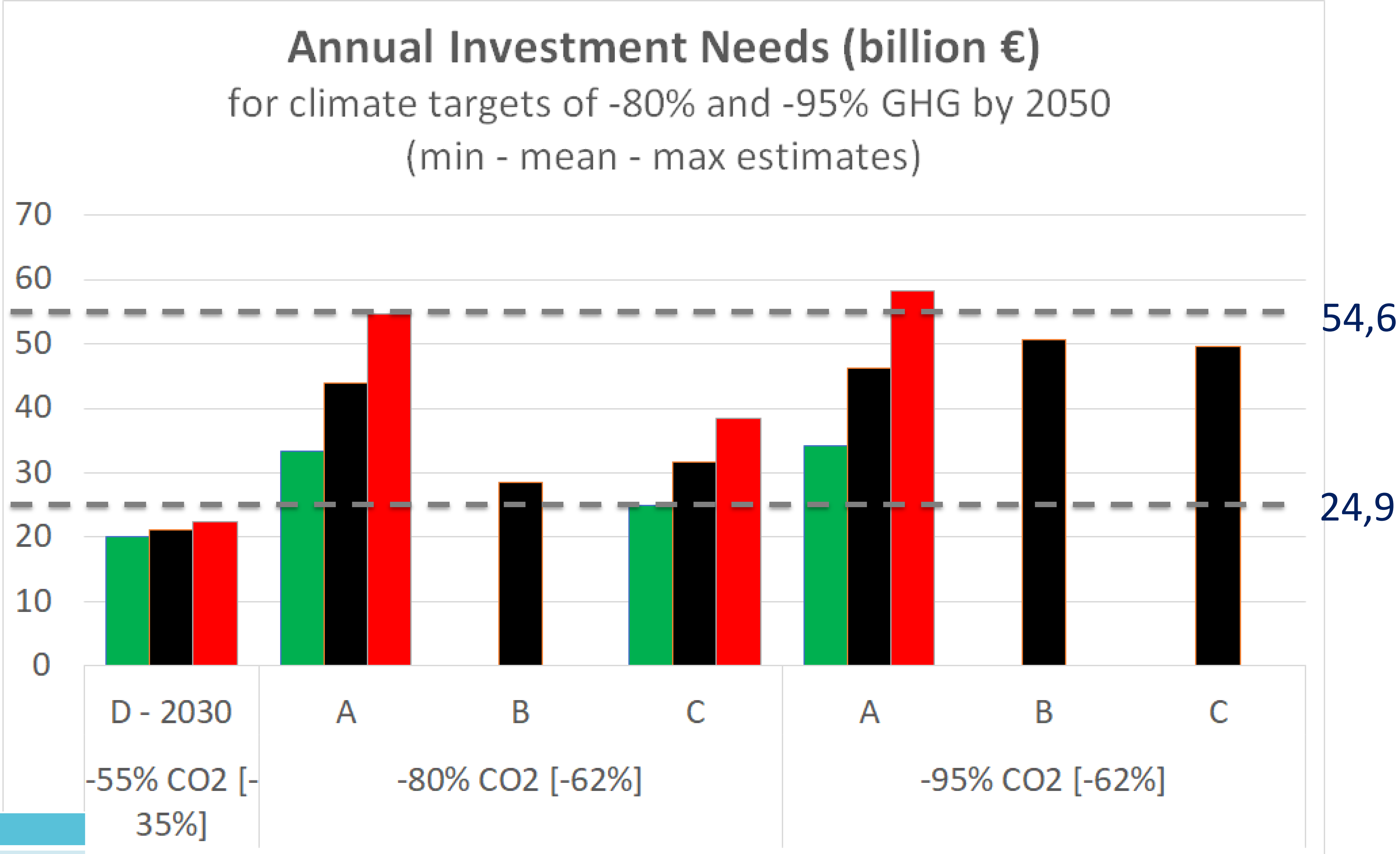

A	**DENA (2018)**
B	BCG (2018)
C	Fraunhofer-ISE (2015)
D	Prognos et. al. (2018)

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Discussion (I)

What can we learn from the different models/ tools/approaches?

- How to use these models' outputs for national analysis?
- National models already available? Sector-specific models?
- Are there analysis and modeling gaps?
- *Do national institutions* ***assess investment needs internally or by contracting*** *studies/assessments?*

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Discussion (ii)

How can we support the work of institutions tasked with tackling and understanding the investment challenge?

1 **Model overview and characterisation (**seems useful in any case)

2 **Workshops, webinars and slide decks** to understand which models (etc.) are available and can be put to which specific use or address which specific knowledge gap or policy question

3 **Direct Support: Review of and inputs** to national institutions' own analysis

4 **Organise/facilitate direct exchange** across countries and institutions

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Next steps

1 The underlying study serves as a learning reference and as the basis for learning materials about “how to do INGAs”.

2 In the coming months: provide support and develop training materials through training sessions, webinars, workshops and/or bilateral discussions and working sessions (prepared and executed together with our partner institutes, Technical University Riga and Prague University) for and with our target groups in CZ and LV.

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Looking forward - toward capital raising strategies:

- Where are the challenges? Public, private (households, corporates), in which sectors?
- What are the key barriers and drivers?
- Which barriers and drivers can be addressed by policy?
- Where to focus public financing?

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Thank you!

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Implementing partners:
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Annex

A short excursion to financing renewable energy and the role of different regulatory frameworks

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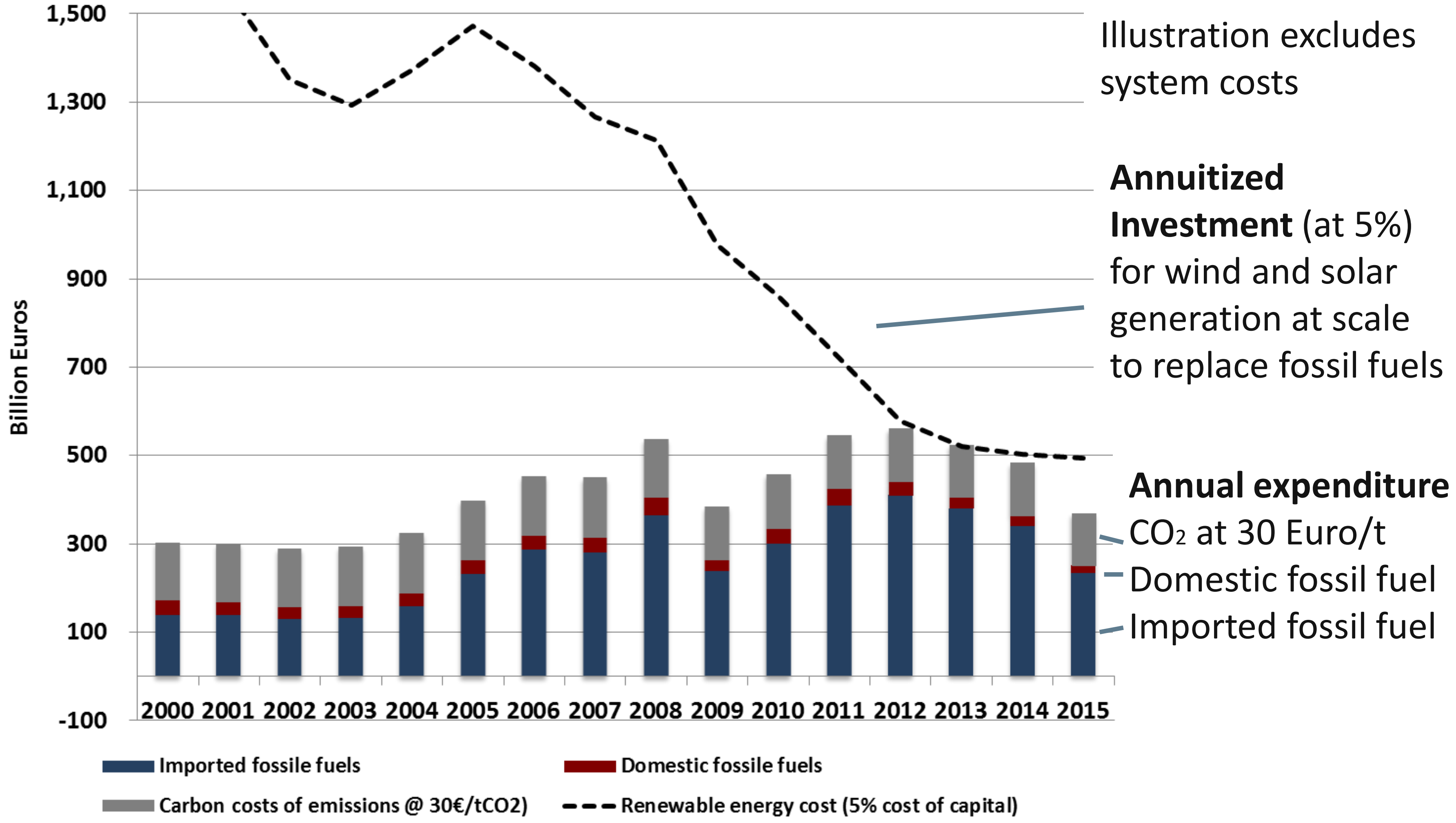
Financing costs determine competitiveness of solar&wind



Similar cost level for serving demand with new wind and solar as with fossil fuel:

- *Cost of learning investment in wind and solar dominates debate but is sunk.*

DIW Berlin Calculations based on BP Statistical Review of World Energy; Energy Statistics for the EU-28; Bundesverband Solarwirtschaft e. V.; IEA; European Wind Energy Association; Bundesamt für Wirtschaft und Ausfuhrkontrolle, first published in Energy Journal (forthcoming)

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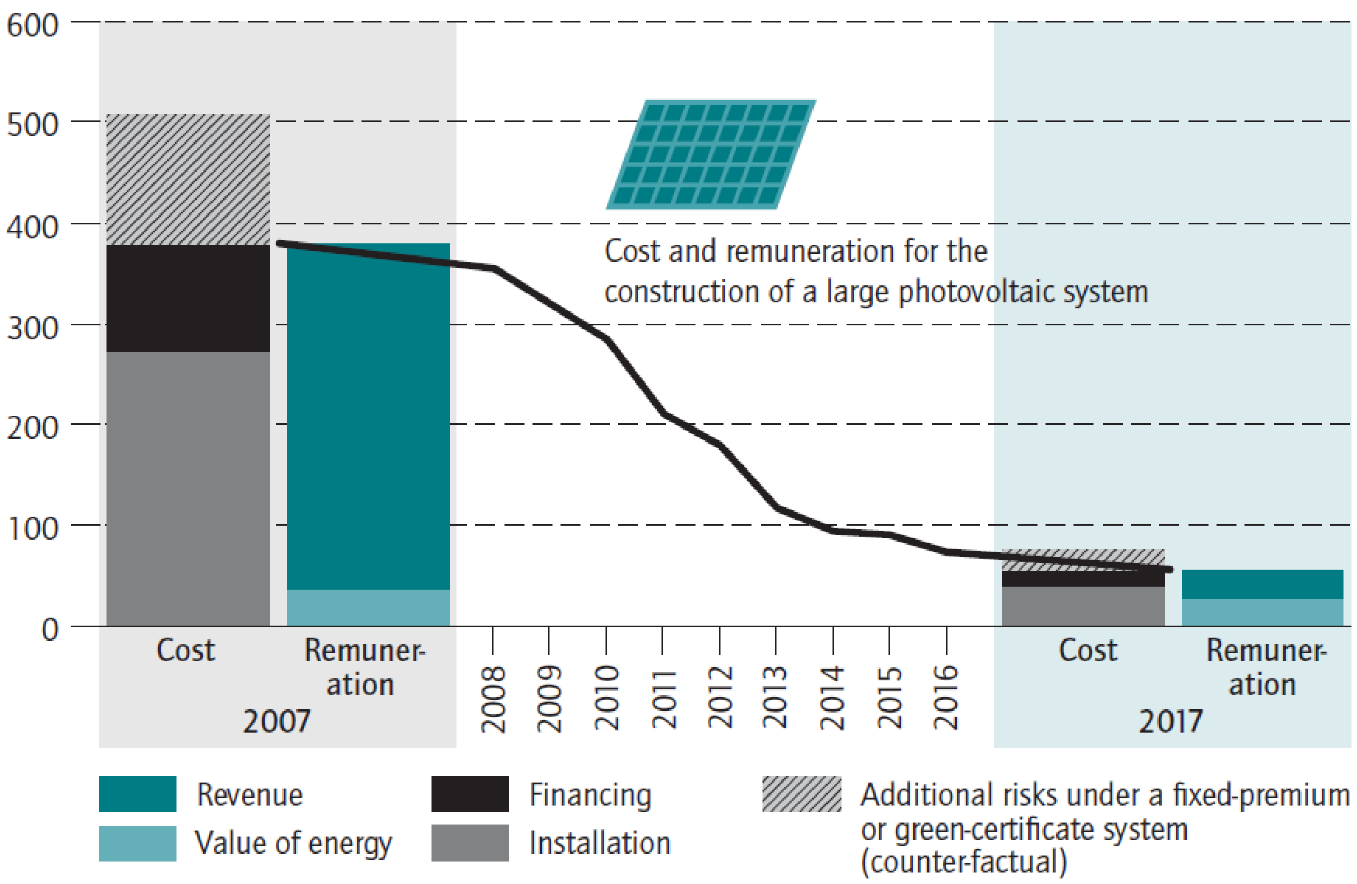
Cost decline of large scale photovoltaics

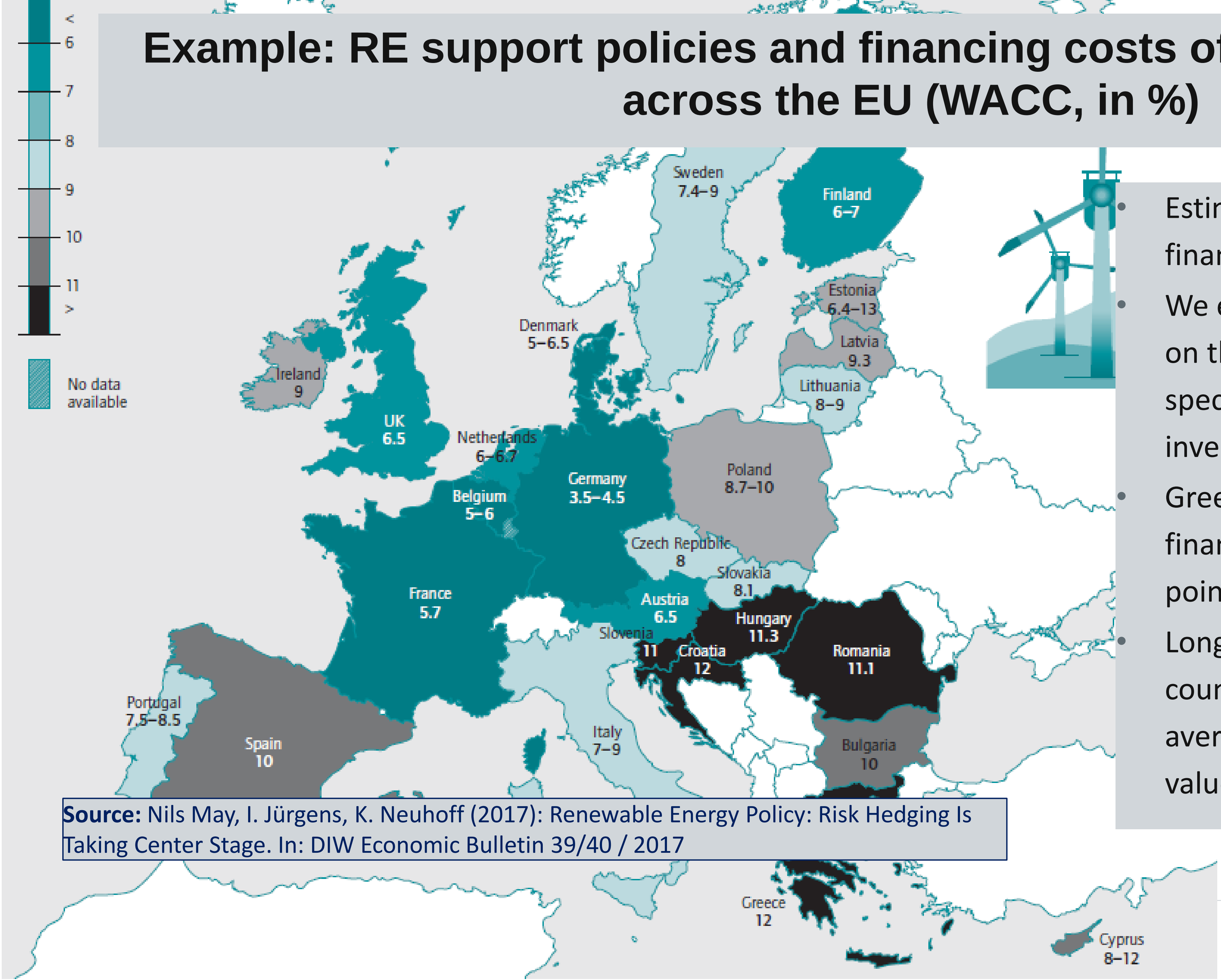
Costs and funding of solar energy over time

In euro per megawatt-hour



- Market risks have gained importance relative to regulatory risks
- Green certificate schemes are associated with an increase in financing costs by 1.2-1.3 percentage points

Example: RE support policies and financing costs of onshore wind energy across the EU (WACC, in %)



- Estimation of policy impacts on investors' financing costs
- We estimate the effect of support policies on the risk premium to control for country-specific effects of generally risky investment environments
- Green certificates increase investors‘ financing costs by about 1.2 percentage points.
- Long-term contracts increase counterparties‘ re-financing costs; for the average of large EU utilities by 20% of the value of the renewable energy investment.

Source: Nils May, I. Jürgens, K. Neuhoff (2017): Renewable Energy Policy: Risk Hedging Is Taking Center Stage. In: DIW Economic Bulletin 39/40 / 2017

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