Session 2:
Research framework and methodology to analyse the long-term role of « Efficiency First » for Europe's building sector

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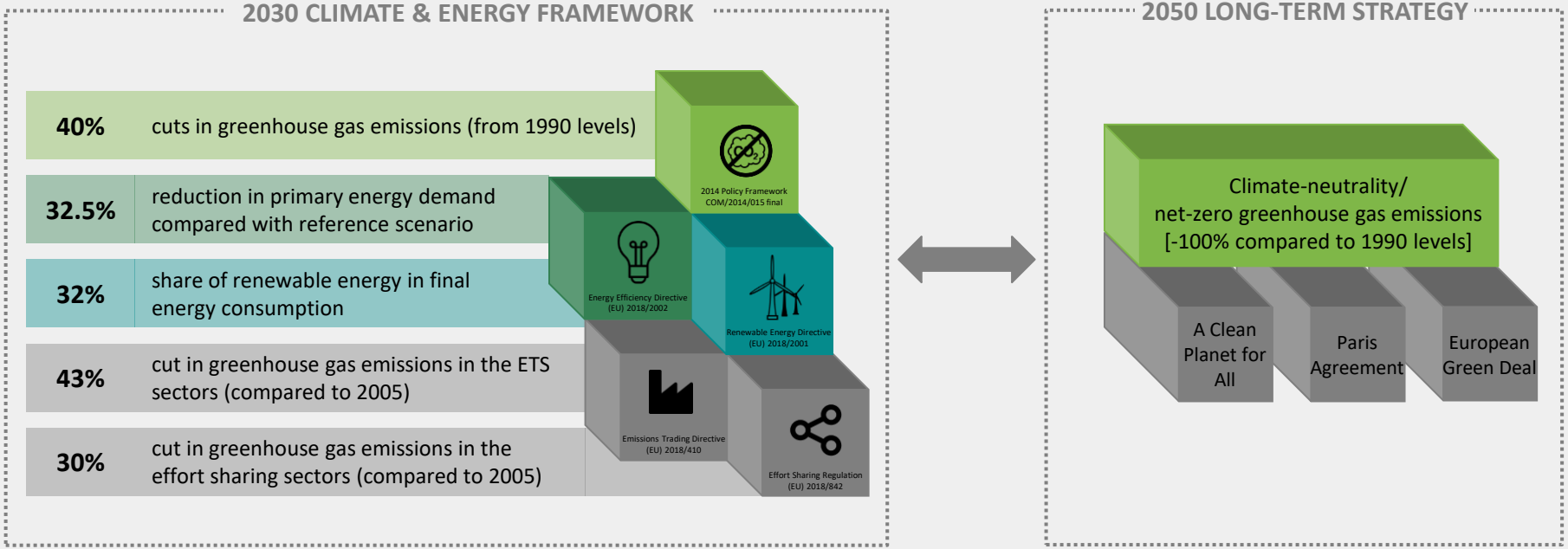
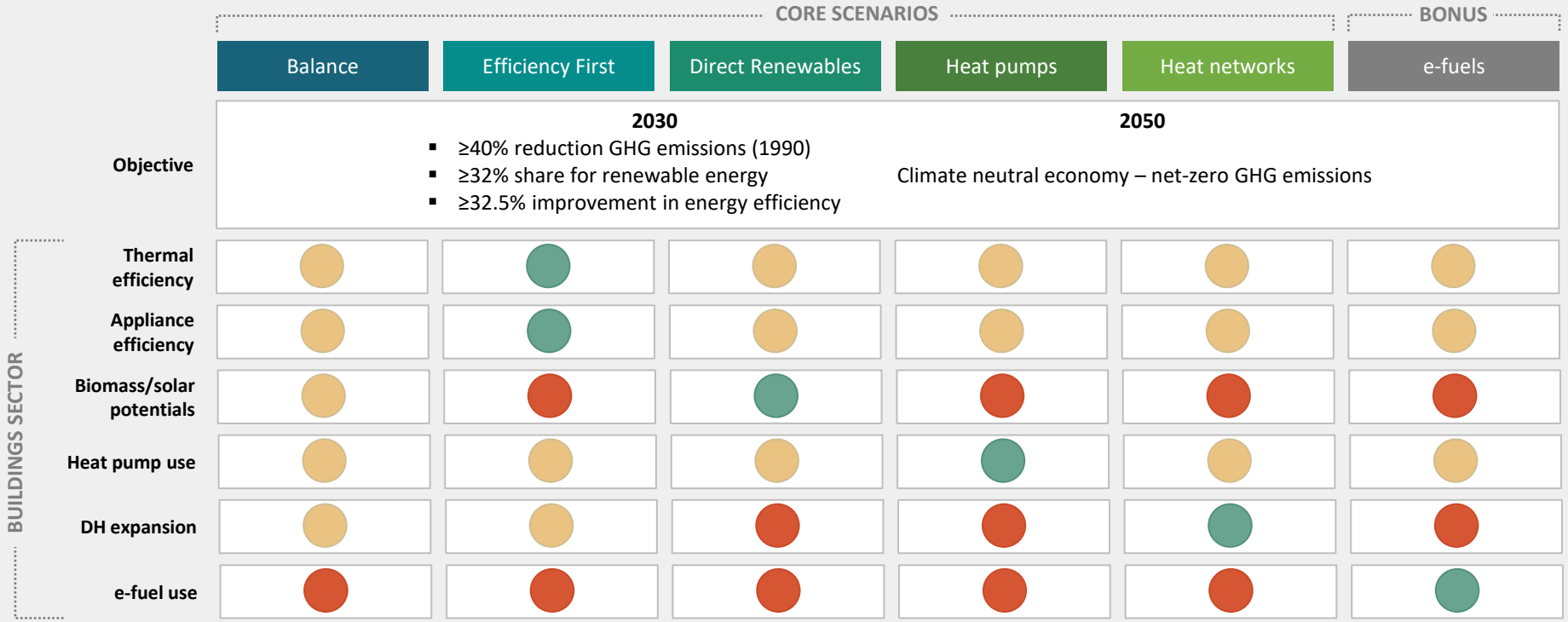
(1) Define objective

Research question: What is the role of building efficiency in pathways towards EU's 2030 and 2050 climate targets?



(2) Define scenarios

Five core scenarios plus one bonus scenario are under consideration



(2) Define scenarios

While the focus is on the buildings sector, we still need a cross-sectoral perspective

	CORE SCENARIOS					BONUS
	Balance	Efficiency First	Direct Renewables	Heat pumps	District heating	e-fuels
Objective	**2030** ▪ ≥40% reduction GHG emissions (1990) ▪ ≥32% share for renewable energy ▪ ≥32.5% improvement in energy efficiency			**2050** Climate neutral economy – net-zero GHG emissions		
Energy demand in other sectors	Ambitious GHG emission reductions in accordance with long-term climate neutrality (transport, industry, land-use, agriculture)					
Electricity supply	Optimized capacity expansion (generation, transmission, distribution, storage) according to GHG emission reduction gap					
District heat supply	Optimized deployment/dispatch of district heating technologies Limited network expansion				Higher network expansion	*see scenarios left*
e-fuel supply	Generation according to demand and potentials; imports not allowed					Imports allowed

CROSS-SECTORAL PERSPECTIVE

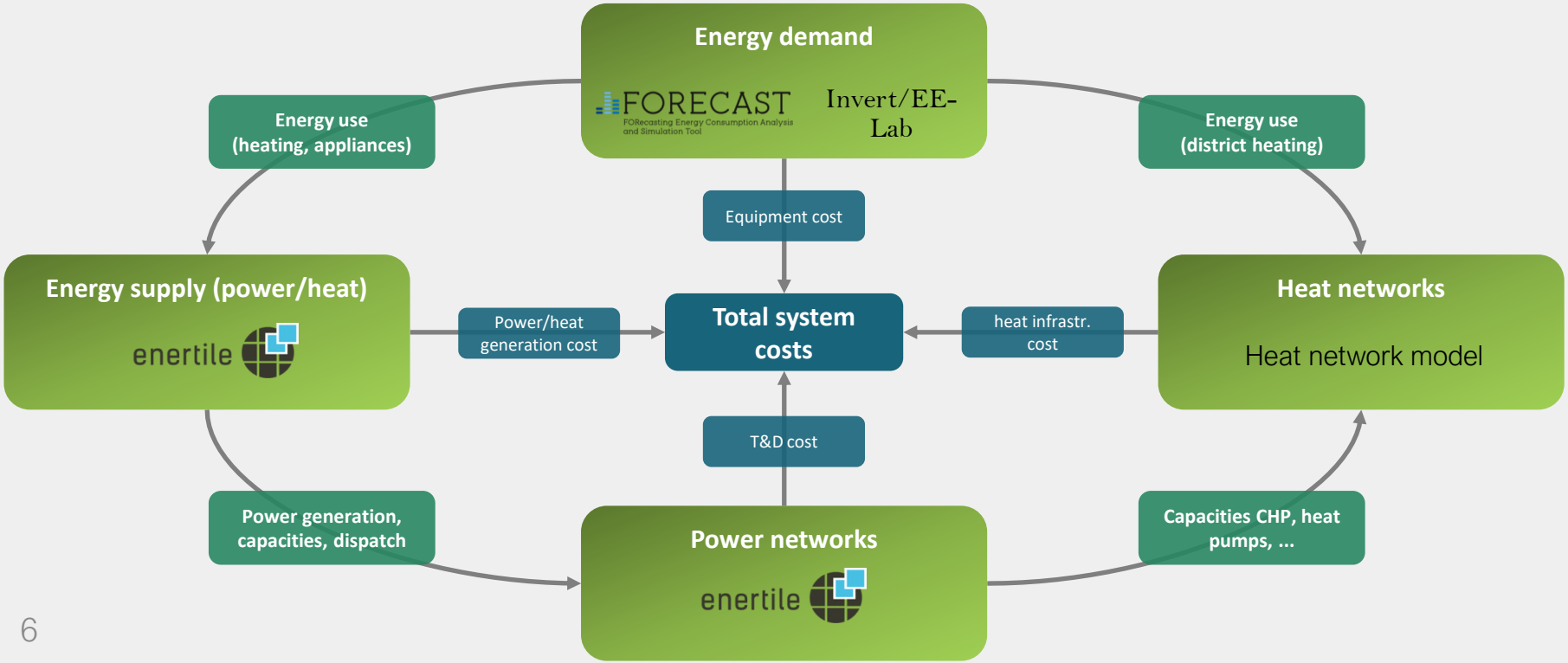
(3) Define model setup

Four models will be employed in the system analysis

model	FORECAST FORecasting Energy Consumption Analysis and Simulation Tool	Invert/EE-Lab	enertile	Heat network model
Partner	Fraunhofer ISI	TU Vienna	Fraunhofer ISI	IREES
Model type	Bottom-up energy demand simulation	Bottom-up energy demand simulation / optimization	Bottom-up energy supply optimization	GIS-based bottom-up network optimization
Sectors [end-uses]	▪ Residential [Electrical appliances, lighting, cooling, cooking, other] ▪ Non-residential [...]	▪ Residential [Space heating, hot water] ▪ Non-residential [...]	▪ Power/heat capacity expansion / system operation ▪ T&D capacity expansion	▪ Heat network expansion
Resolution	▪ temporal: yearly ▪ spatial: country (EU-27)	▪ temporal: yearly ▪ spatial: country (EU-27)	▪ temporal: 8760 h/a ▪ spatial: 100x100 m grid	▪ temporal: yearly ▪ spatial: 100x100 m grid

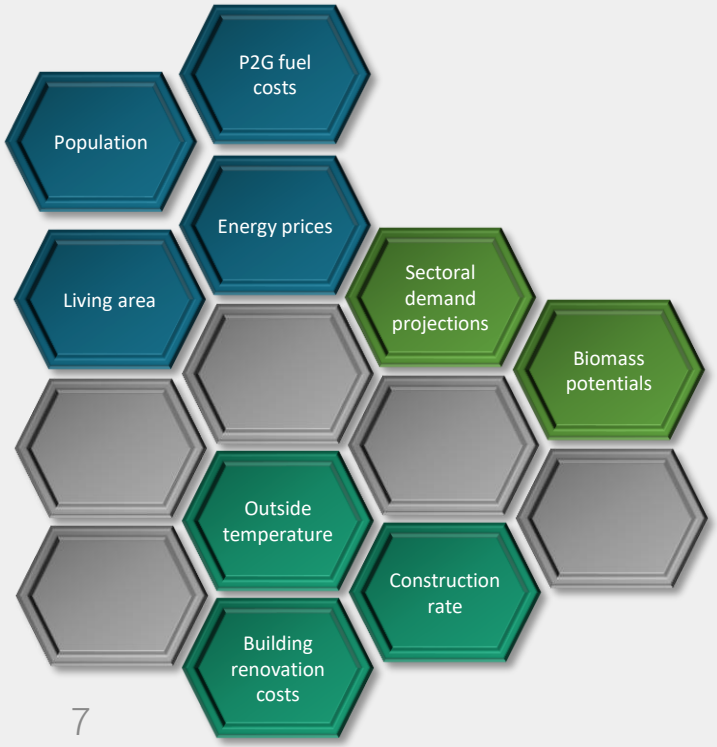
(3) Define model setup | (5) Calculate total system costs

By coupling all four models, total system costs can be calculated



(4) Define framework conditions

Framework conditions and sectoral projections will be assembled from established studies



Possible reference data:

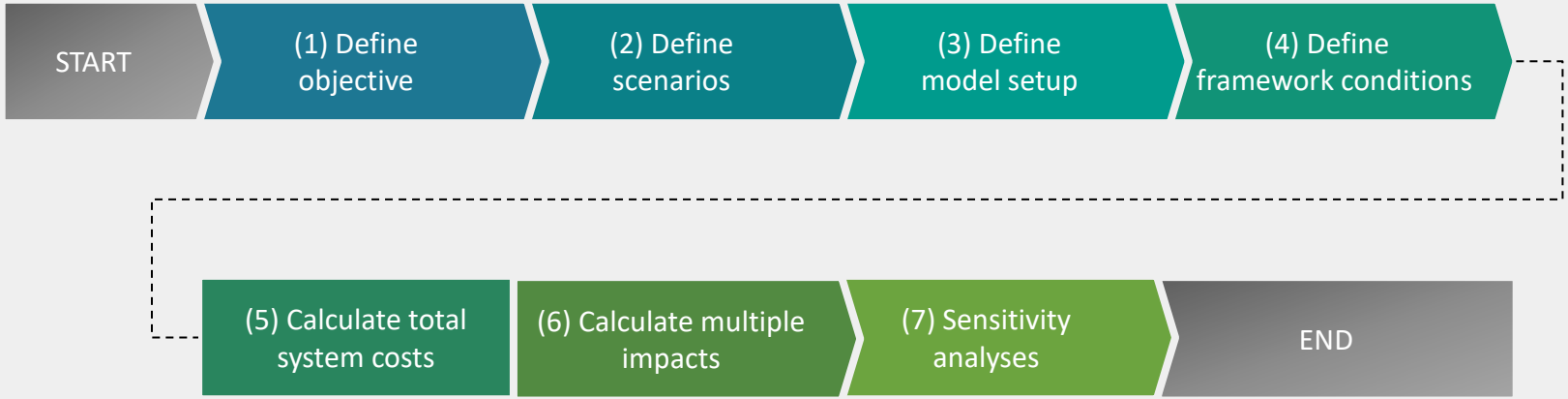
- EU Reference Scenario 2016
- In-depth analysis on *Clean Planet for all* Communication
- ...

(6) Calculate multiple impacts

Our calculation will be guided by – *inter alia* – the COMBI approach

	Air pollution	Macro-economy	Energy poverty	Resource	Energy security
Impact indicators	○ Human health ○ Ecosystem acidification ○ Ecosystem eutrophication ○ Emissions	○ GDP increase ○ Employment ○ Public budget ○ Fossil fuel prices ○ Abatement costs ○ Trade effects ○ Sectoral shifts	○ Thermal comfort/winter mortality ○ Asthma burden ○ Active days ○ Workforce performance	○ Material footprint ○ Fossil fuels ○ Minerals ○ Metal ores ○ Biotic raw materials ○ Unused extraction ○ Direct carbon emissions ○ Carbon footprint	○ Energy intensity ○ Import dependency ○ Aggregated energy security ○ Avoided power investment costs ○ Reserve capacity rate
Quantification methodology	GAINS model	General equilibrium modelling	COMBI model	Material flow accounting (MFA)	Energy balance model

Conclusion


START
(1) Define objective
(2) Define scenarios
(3) Define model setup
(4) Define framework conditions
(5) Calculate total system costs
(6) Calculate multiple impacts
(7) Sensitivity analyses
END