Energy and environmental systems modelling design: Scenario modelling for Latvia

Dr. Janis Rekis

Institute of Physical Energetics

Veiksmīga enerģētikas transformācija: plaisa starp ambīcijām un rīcību
Successful Energy Transition: Gap between Ambition and Action

Content

- RES targets and modelled scenarios
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- Results
  - Energy consumption
  - Trajectories of the RES shares and GHG emissions
  - RES and emission reduction costs

RES targets and modelled scenarios

- WEM – scenario with existing measures
- RES Target scenarios
  - base on Proposal for Directive on the promotion of energy from renewable sources (REDIII) (Brussels, 24 June 2022, 10488/22)

RES share in:		2020	2030	2050	Scenario	
Gross Final Energy Consumption		**41.6%**	**62.0%**	**85.0%**	**target-res**	target-res-res-goals
Heating and Cooling		57.3%	67.0%	71.0%	target-res-goals	
District heating and cooling		55.2%	76.0%	84.7%		
Industry		50.0%	69.0%	69.0%		
Buildings		58.0%	68.0%	72.0%		
Transport	At least Advanced BioFuels and Biogas produced from the feedstock listed in Part A of Annex IX	0.0%	2.2%	2.2%		
	No more BioFuels and Biogas produced from the feedstock listed in Part B of Annex IX than	0.0%	1.7%	1.7%		
	No more 1st gen BioFuels and Biogas than	3.1%	4.1%	4.1%		
	At least Renewable fuels of non-biological origin (RFNBOs)		5.7%	5.7%		
	At least RE within the final consumption of energy in the transport sector	5.8%	26.1%	26.1%		
	Or A GHG intensity reduction of at least 13% by 2030, Index	1	0.87	0.87	target-res-goals-traemisint	target-res-res-goals-traemisint

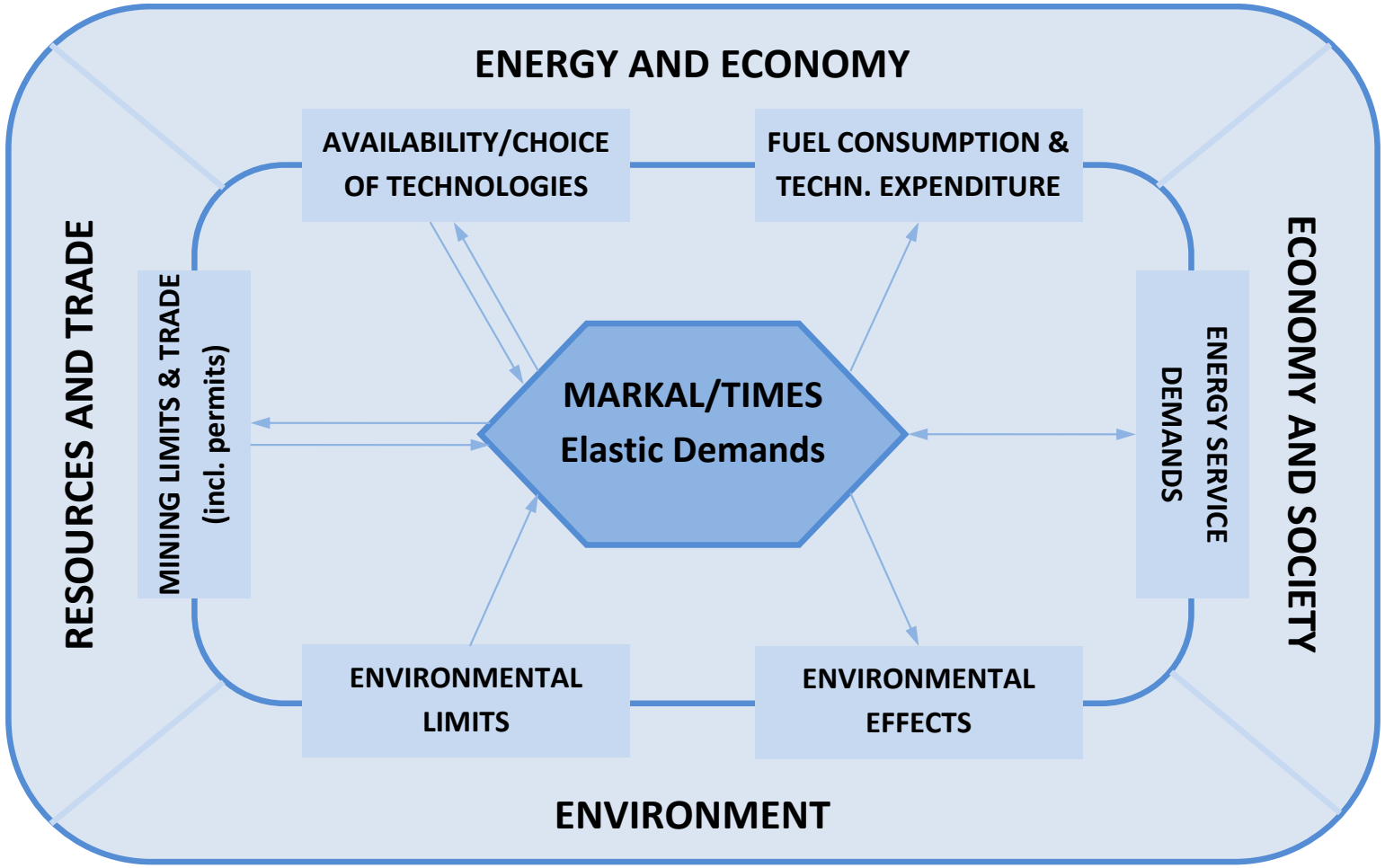
Methodology

- The system (e.g., energy environment system) optimization model TIMES is used
  - The model MARKAL (TIMES predecessor) was started to introduce in 1995
- Technology rich bottom-up integrated energy systems model with detailed description of the processes/commodity options
- Rational decision making with perfect information, competitive markets and perfect foresight (all model periods are optimized simultaneously)
  - The result is a supply-demand equilibrium
- A least cost optimization model
  - Model minimizes the net total cost)
- Elastic demands - partial equilibrium formulation (i.e. demands respond to price changes)
  - Model maximizes the net total surplus (i.e. the sum of producers' and consumers' surpluses)
- Range of scenarios and sensitivity analysis

Methodology

Assessing energy, economy, environment, trade interactions

ETSAP (The Energy Technology Systems Analysis Program) (http://iea-etsap.org/) tools are used

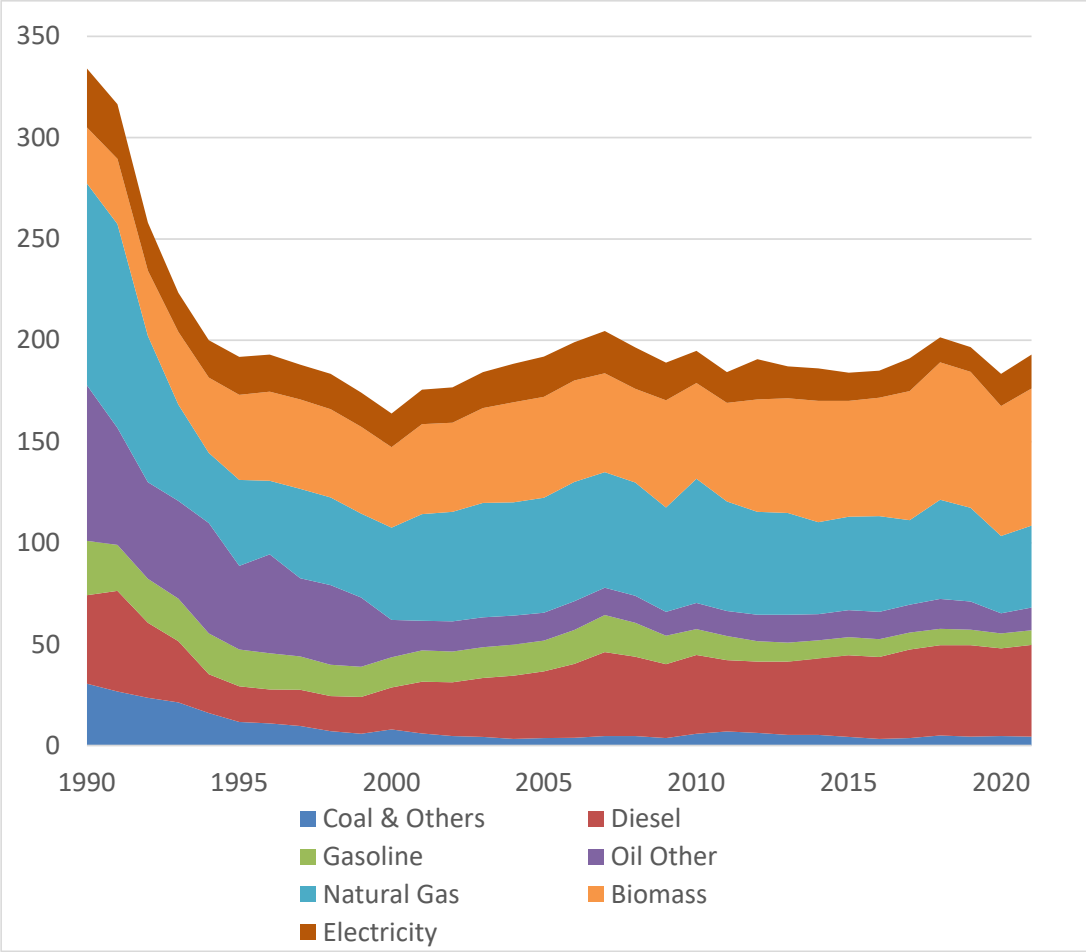


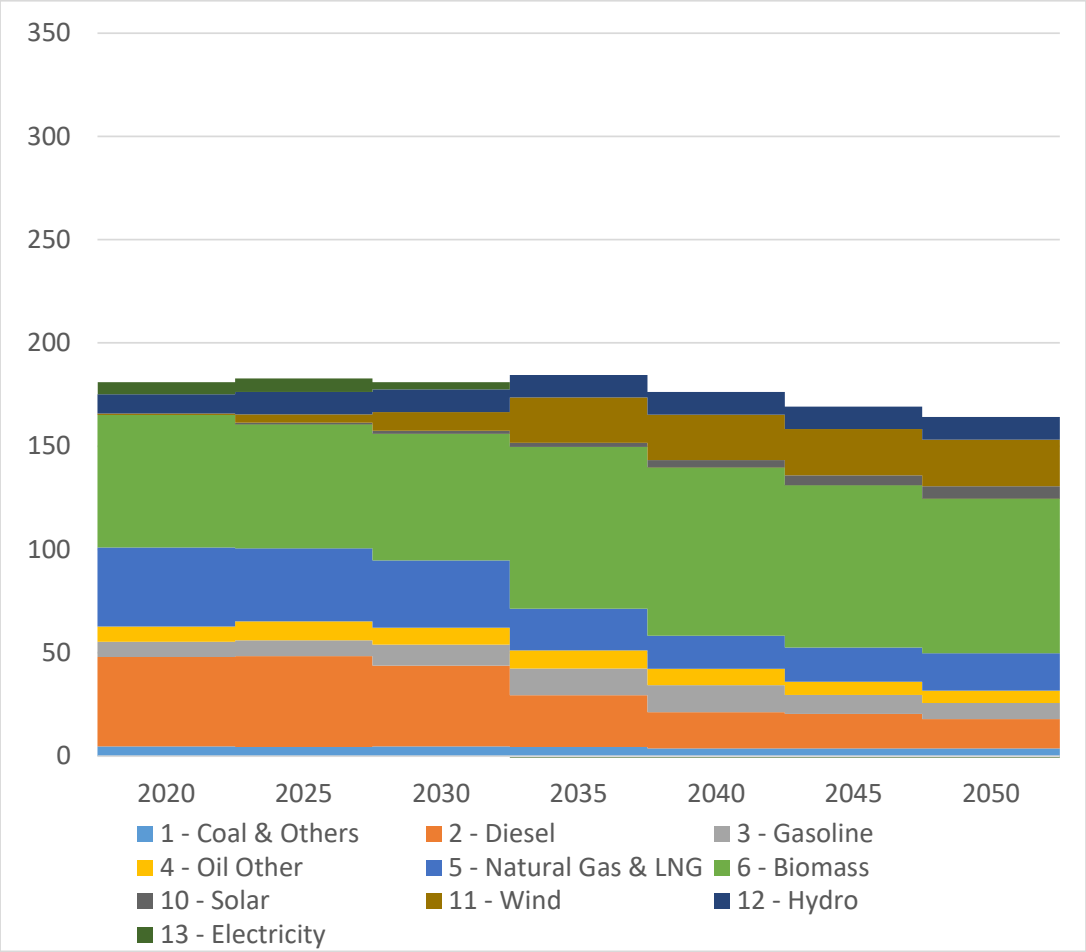
Methodology

What questions model can answer?

- How do particular technologies and policies affect emissions of GHG and other pollutants?
- What are the costs of meeting mitigation targets?
- How do demand-side actions affect the supply-side and vice versa?
- How do technology and fuel mix changes resulting from environmental policies affect energy prices?

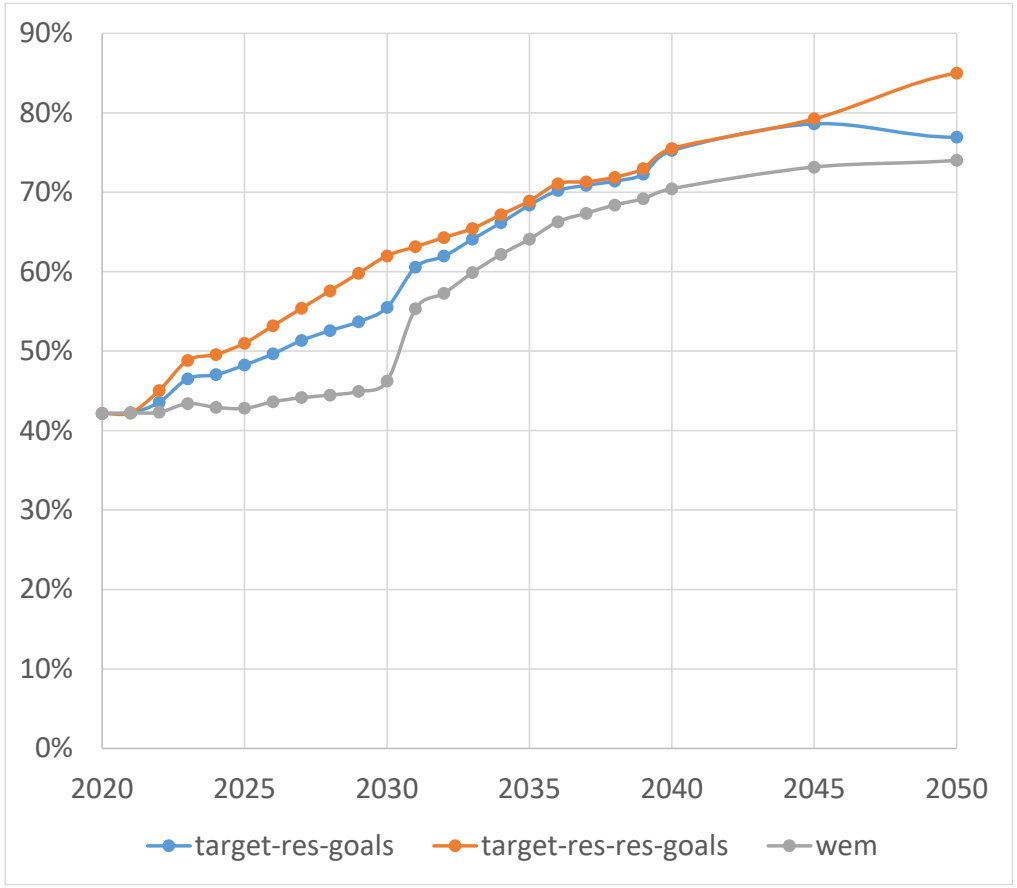
Primary energy consumption in WEM scenario, PJ



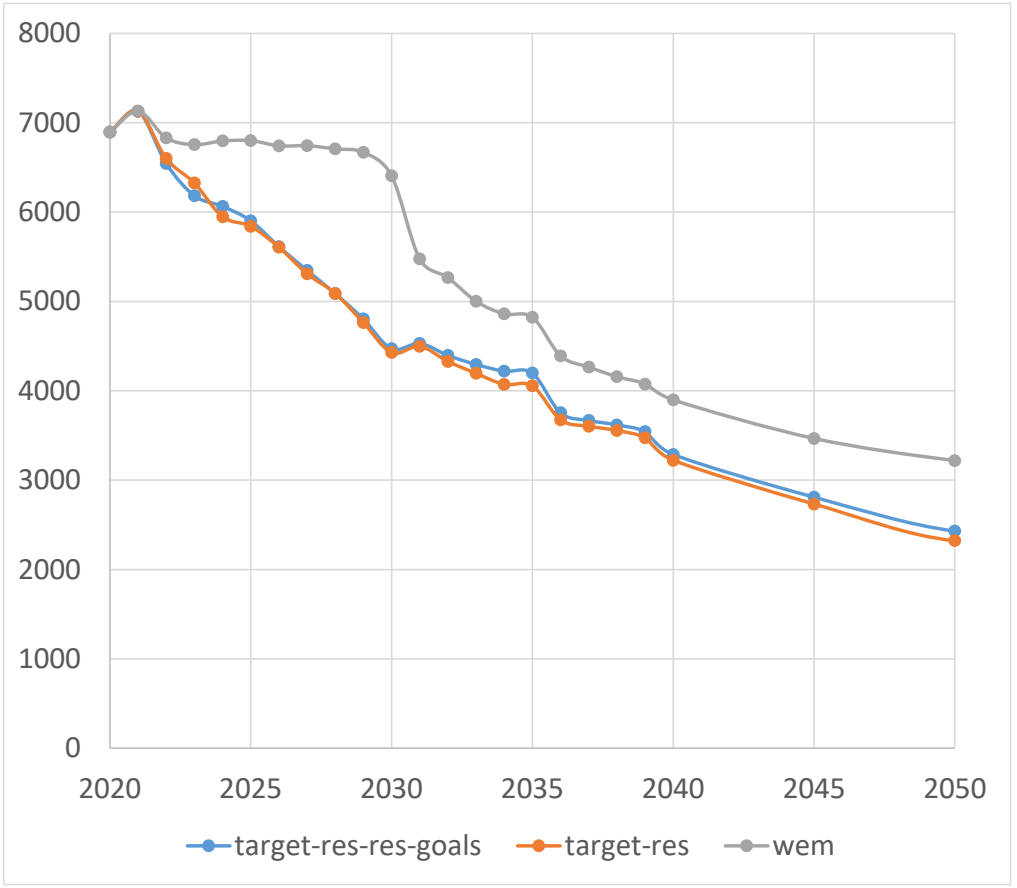


RES share and GHG emissions

RES share in Gross final energy consumption

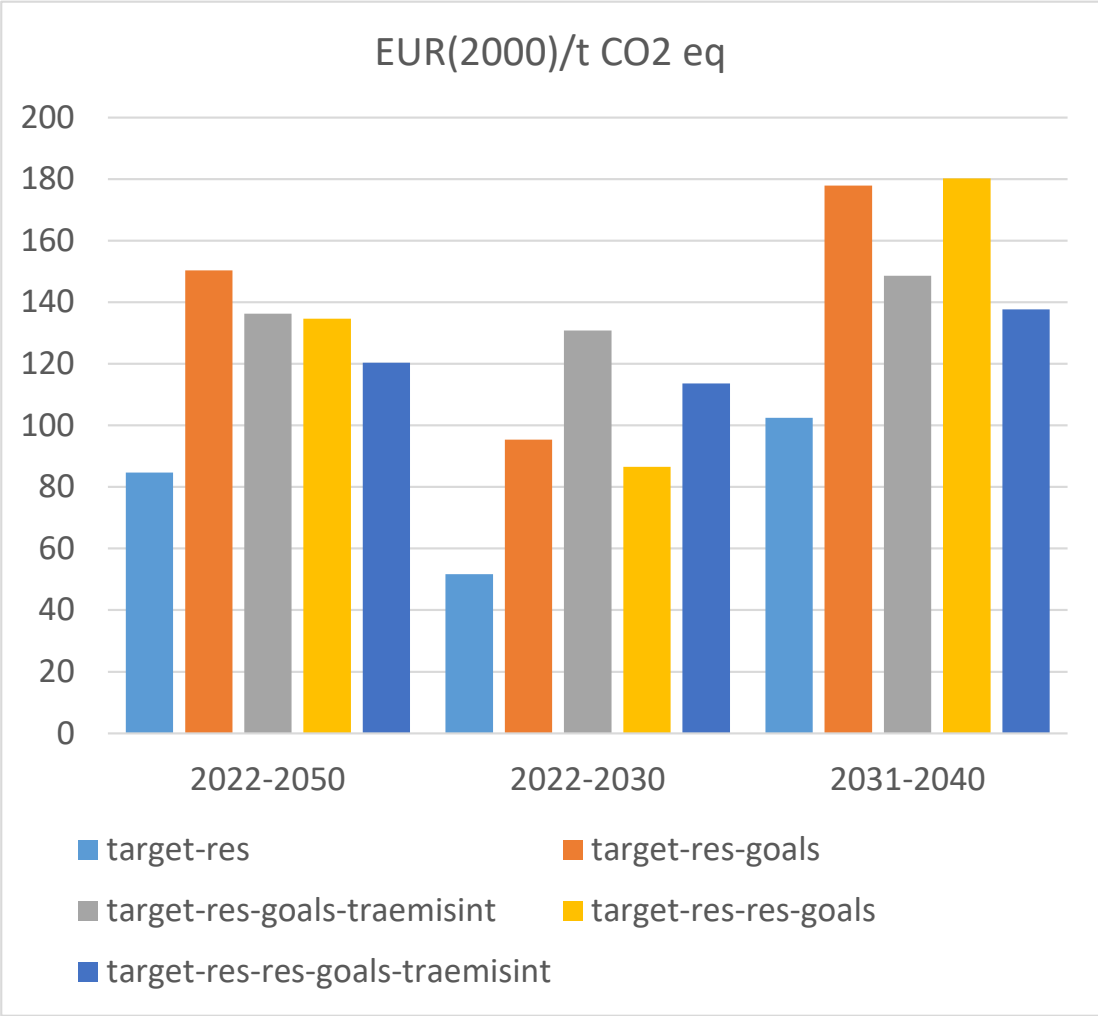


GHG emissions in energy sector, kt CO2 eq



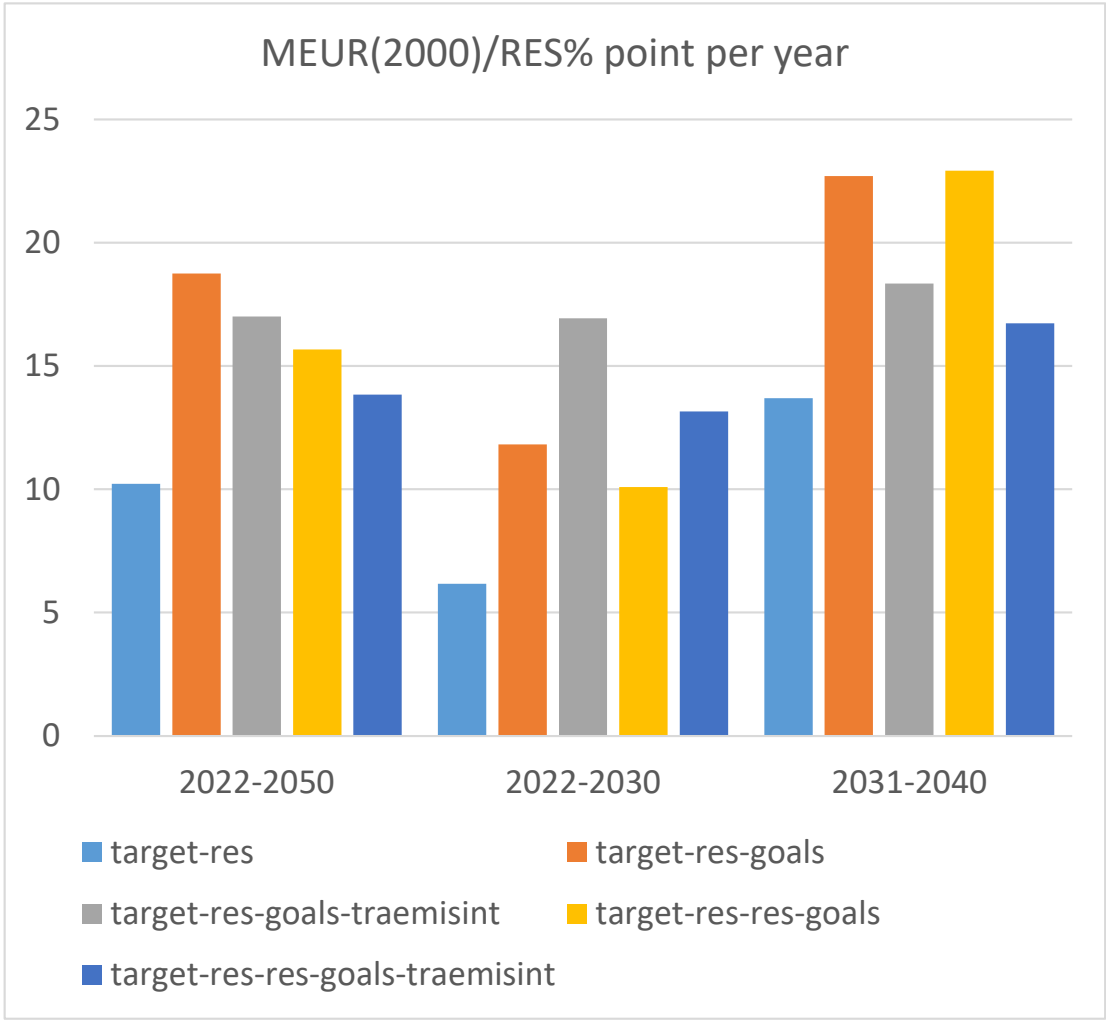
GHG emission reduction average cost

- Due to implementation of RES targets for period 2022-2030 GHG reduction in Target-RES-RES-Goals scenario against WEM scenario is 11.1% or 1132 kt GHG emissions (CO2 eq)
- Reduction costs 98 EUR(2000) per t CO2 eq



RES percent point cost per year to achieve targets

- For period 2022-2030 average RES share in gross final energy consumption
  - In WEM scenario is 43.9%
  - In Target-RES-RES-Goals scenario 53.6%
- Deficit is 9.7% percent points to achieve RES target and goals
- It costs 98 MEUR(2000) per year
- Or 10 MEUR(2000) per RES percent point per year



Thank you!


This is a Banana.
If you see an Apple, you're
a Right Wing Extremist.

Data Requirements and outputs

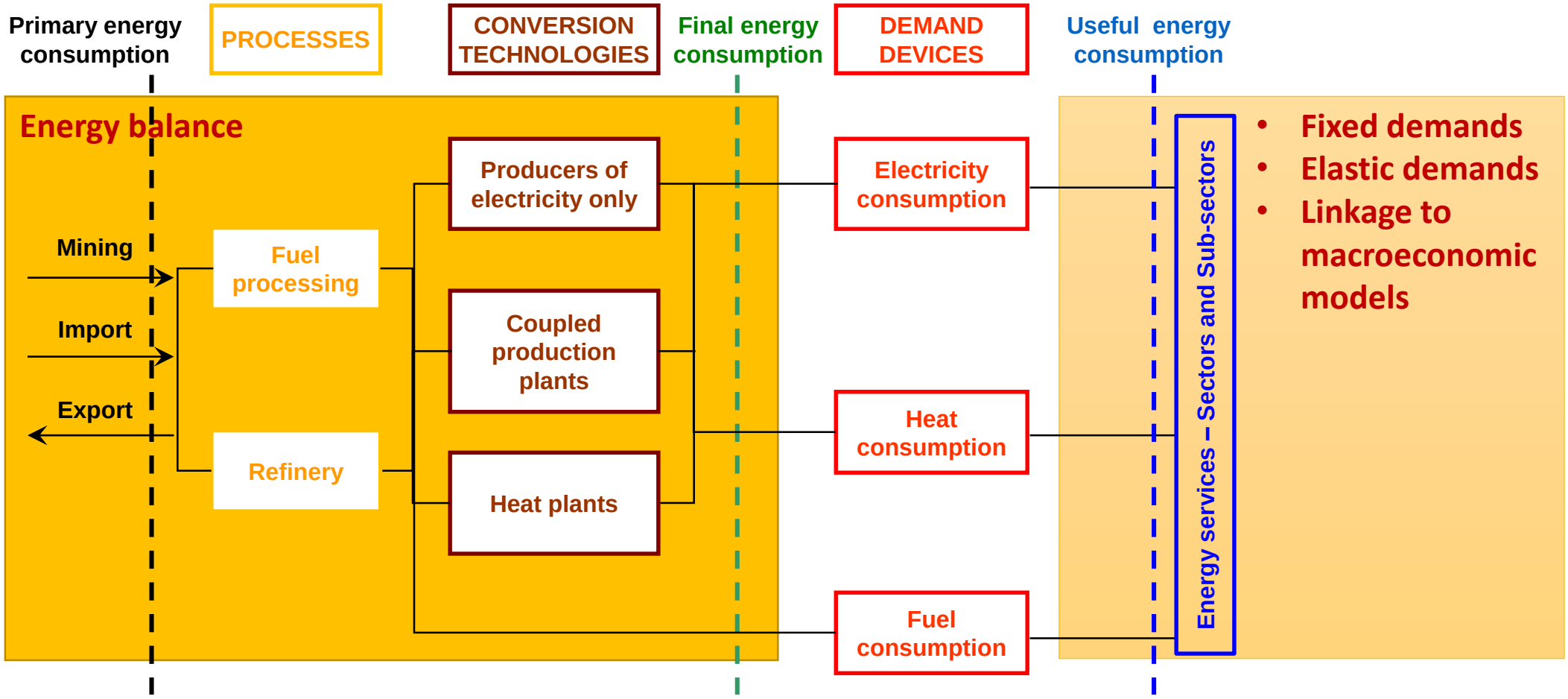
Key input parameters

- Useful Energy Demands / Energy Services (and Elasticities) - to a detailed sub-sectoral level
- Detailed Costs
  - Resources, Investment, fixed, variable, fuel delivery, hurdle rates
- Technology Characteristics
  - Fuels in/out, efficiency, availability, technical life duration
  - Resource supply curves/steps - imports and domestic production, cumulative resources limits, installed capacity of technologies, new investment possibilities
- System configuration - potential energy pathways and interactions
  - Reference Energy System (RES) concept is used to summarize the relationships in energy system among Demands, Energy sources, Technologies, Commodities
- Environmental Impacts
  - Unit emissions per resource, per technology
- System and other parameters
  - Discount rate, seasonal/day-night fractions, electric reserve margin
- Constraints – physical and policy driven

Key output parameters

- Primary energy, final energy - by sector and by fuel
  - Imports, exports & domestic production of fossil & renewable fuels
  - Electricity generation mix– by fuel and by technology
  - Transport fuels, transport technology by mode
- GHG emissions/air pollutants - by fuel, sector; marginal emissions prices
- Total and annual energy system costs
- Use of energy efficiency

Energy system simple building blocks



An energy technology is any device that produces, transforms, transmit, distribute or uses energy