

International Energy Workshop 2009

16 – 18 June 2009, Venice

Analysis of the EU 2020 Package with an Extended Technology Wedges Approach

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Our propositions

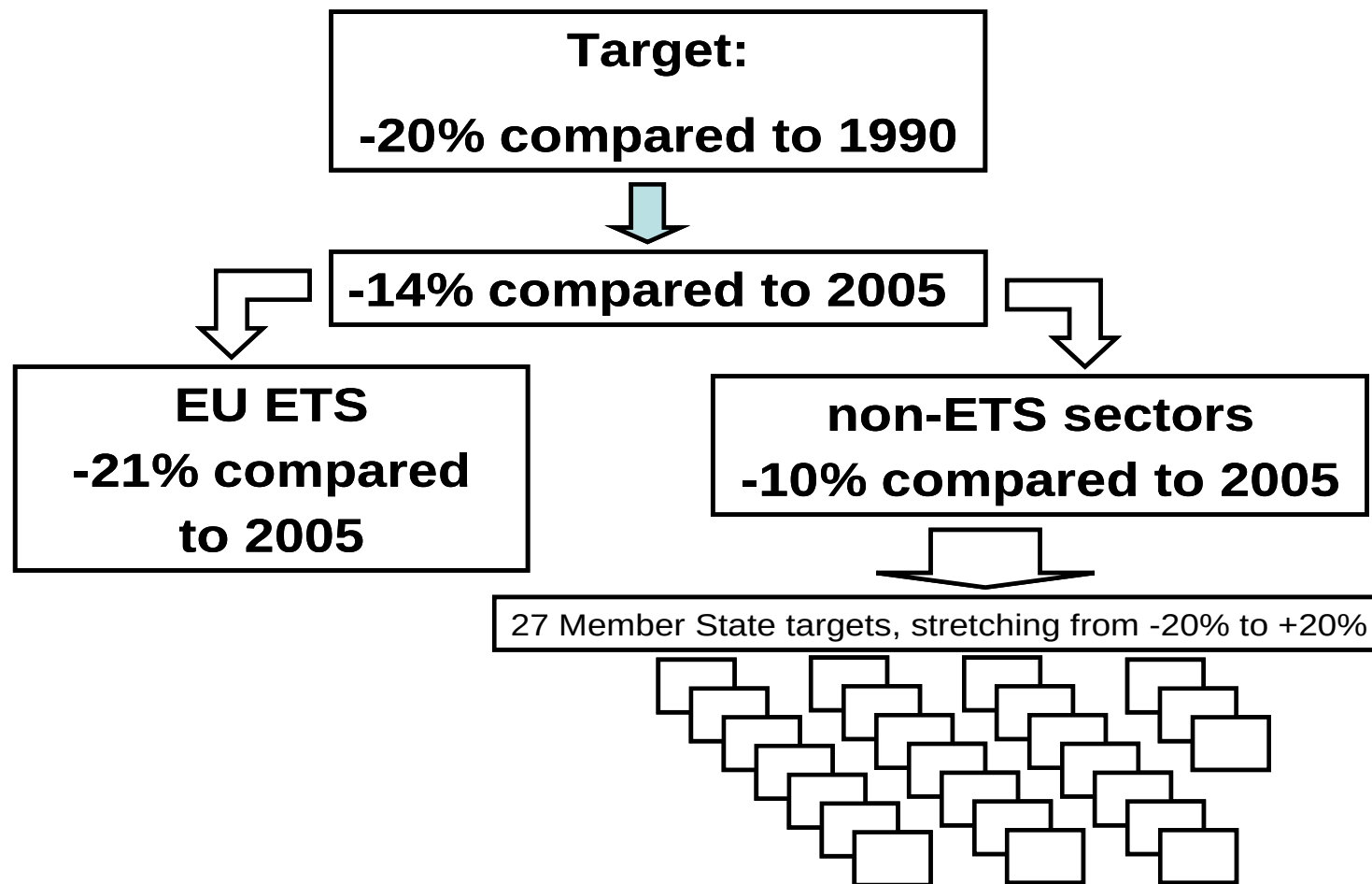
- The implementation of the EU 2020 targets requires a technological quantum leap
- The evaluation of this fundamental change of technologies requires also a change of our modeling paradigms



How ambitious are the EU 2020 targets?

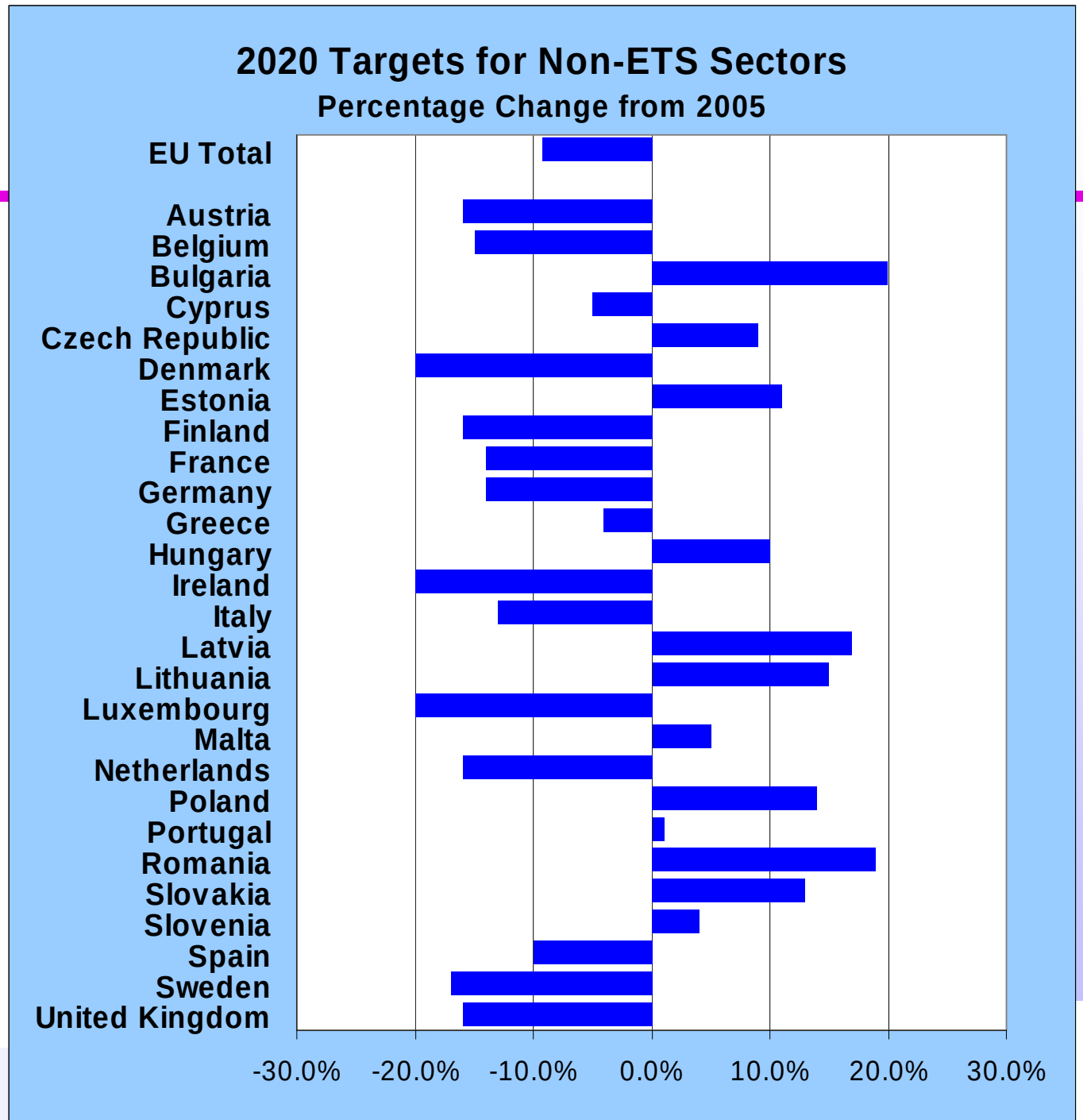
20 + 20 in 2020

The split of the emissions target



20 + 20 in 2020 Non-ETS sector

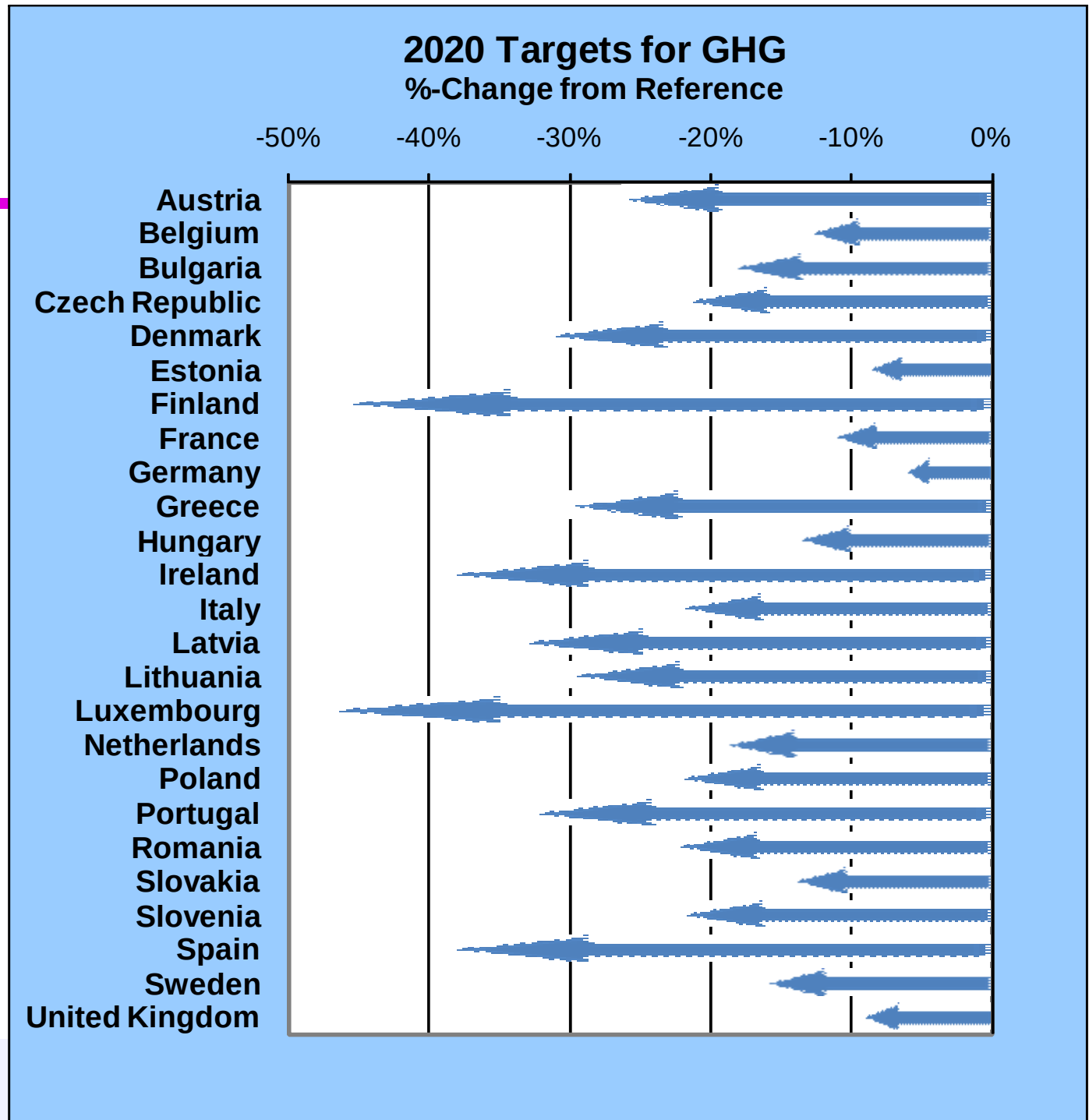
GHG reductions of the
Non-ETS sector
compared to 2005



20 + 20 in 2020 Effective efforts

GHG reductions of the
Member States

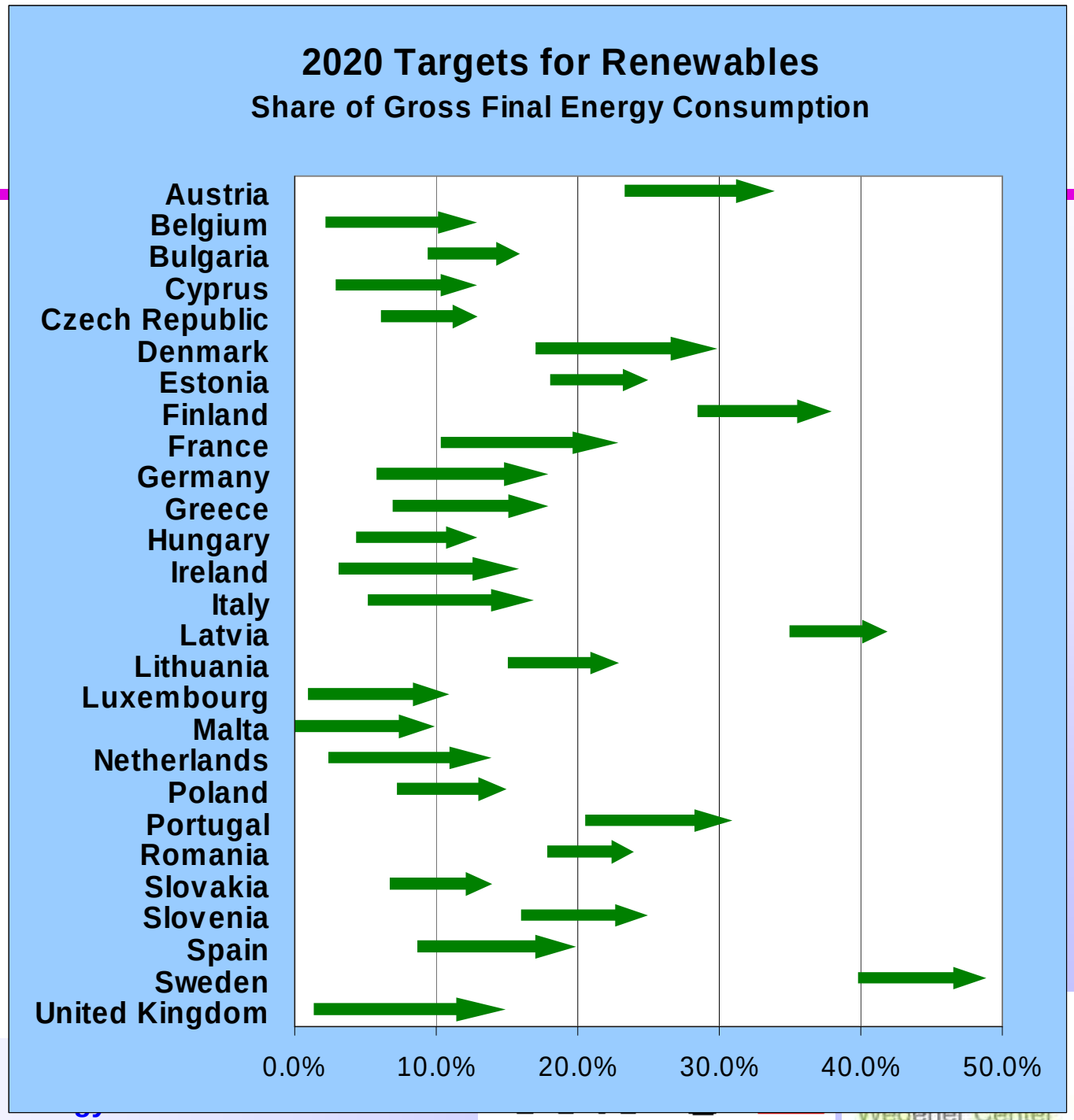
compared to reference
scenario



20 + 20 in 2020 RES target

Change of share of
renewables

in (gross) final energy
consumption



**The implementation of the 2020 Package
requires a technological quantum leap**

Buildings

Zero and plus-energy standards

Gutau 2002



Graz 1999

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Production facilities

Zero GHG emissions



AKS DOMA Solartechnik
Satteins

Solar-Fabrik
Freiburg



Vehicles

Plug-in electric cars

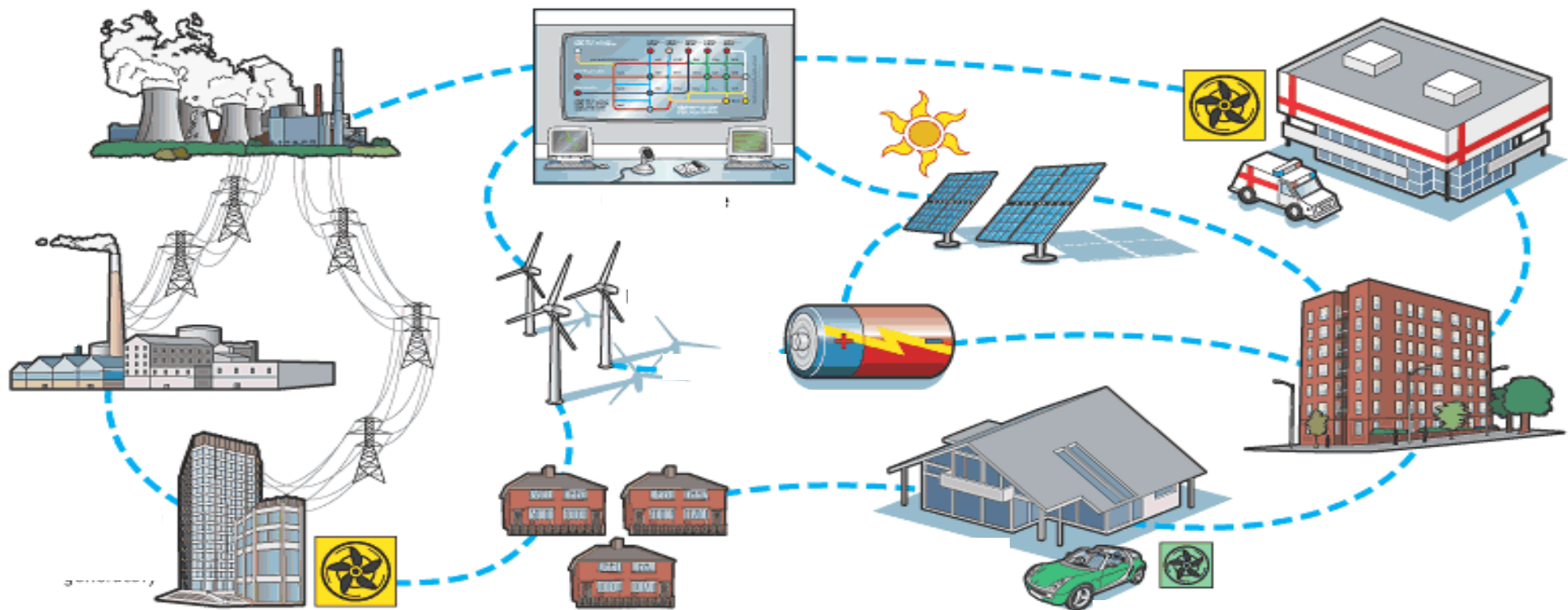
Aptera Typ-1

- 2(+1) persons
 - **386 kg** (90% composites)
 - > 190 km
 - < 0,9 l/100 km
 - ca. \$ 25.000 – \$ 30.000
- www.aptera.com



Internet 2.0 structures for electricity and heat

Smart grids and distributed generation

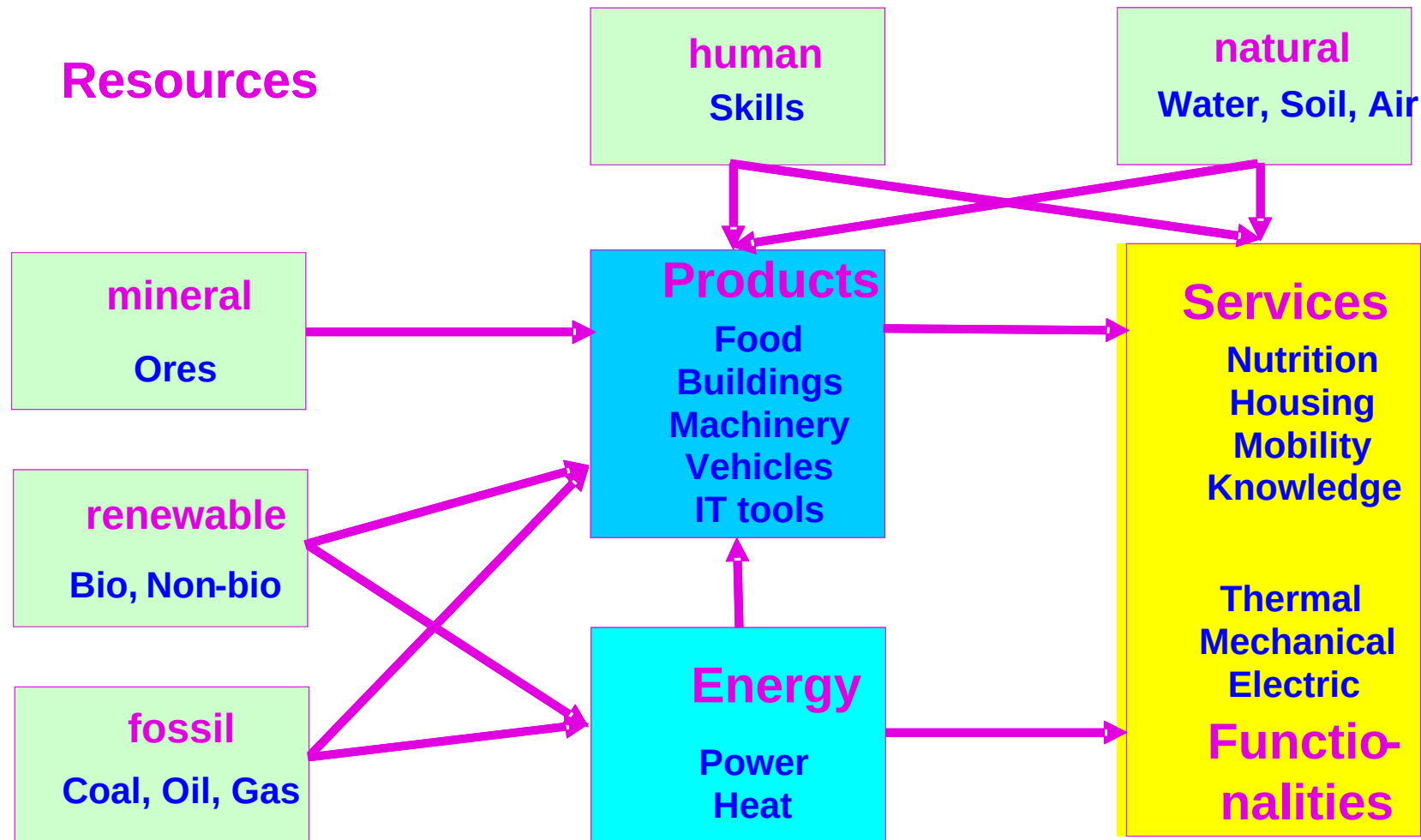


How can we evaluate the implementation
of these technologies?

Joseph Stiglitz

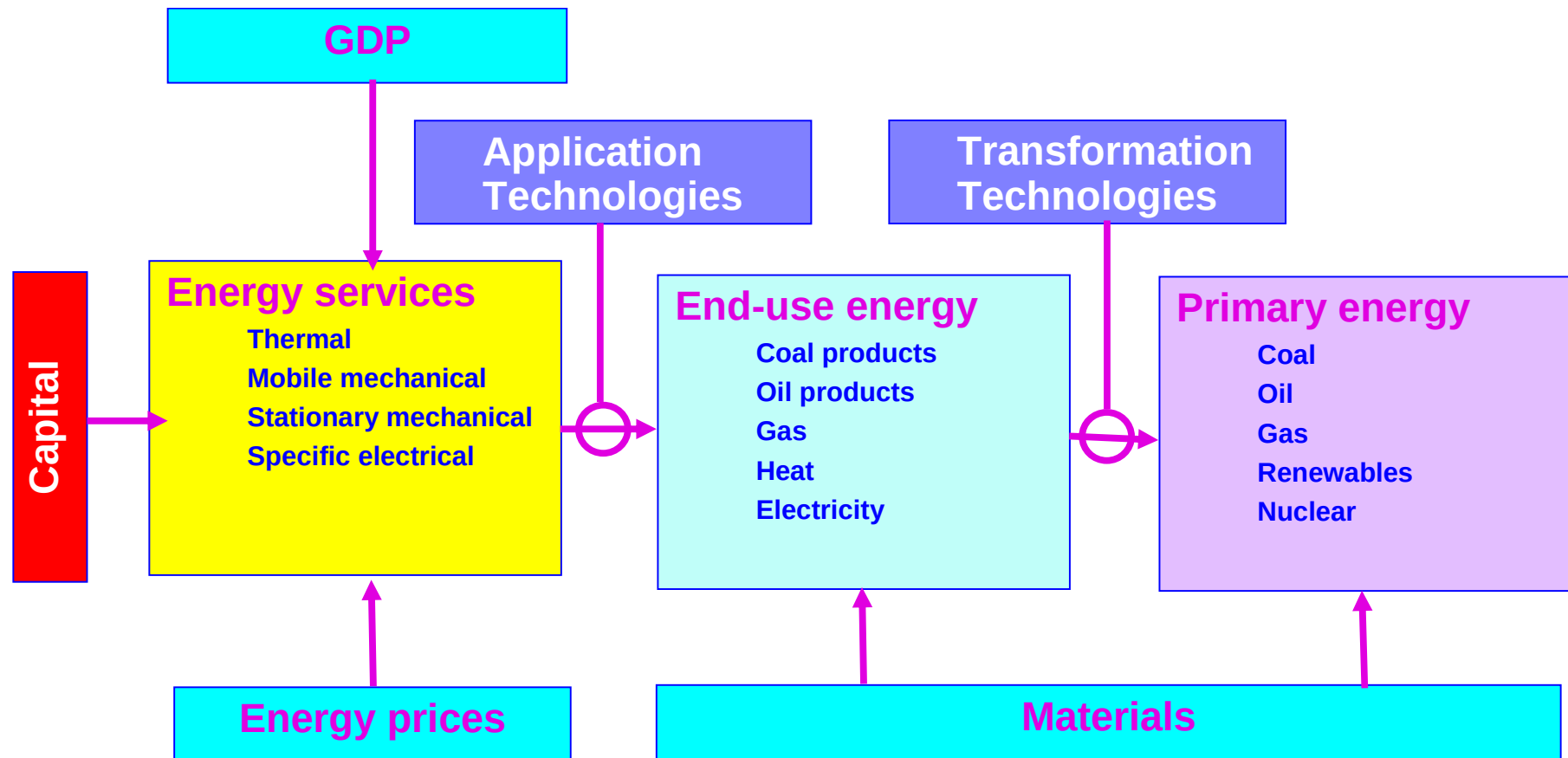
„Our statistical apparatus,
which may have served us well in a not too distant past,
is in need of serious revisions.“ (CMEPSP, 2008).

Beyond GDP: Services and functionalities from products, energy and many resources



The translation into an energy modeling framework

From energy services, to end-use and primary energy



The conceptual approach

The Pacala-Socolow technology wedges

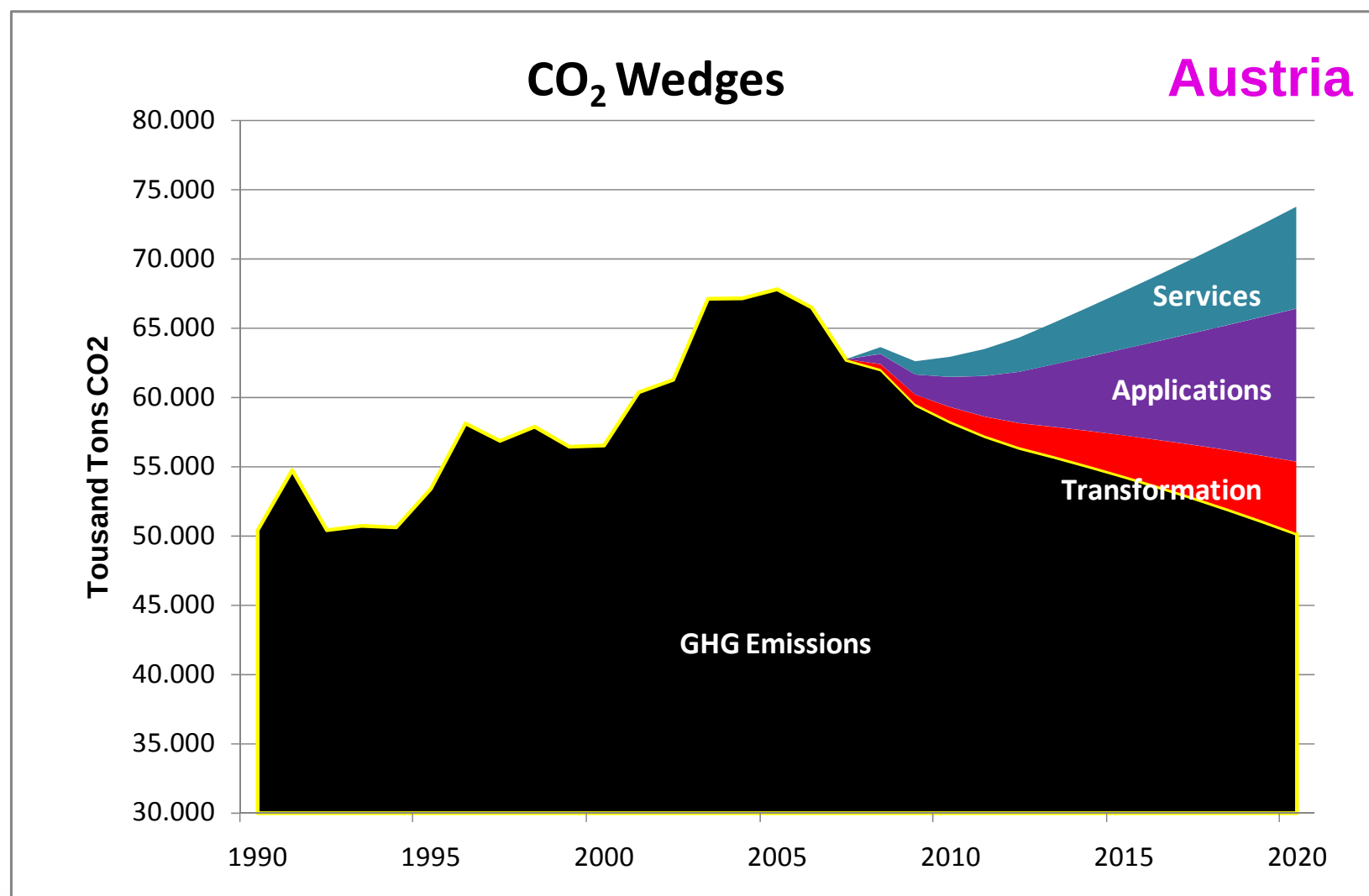
S. Pacala and R. Socolow
Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies
Science, Vol. 305, August 13, 2004.

“Humanity already possesses the fundamental scientific, technical, and industrial know-how to solve the carbon and climate problem for the next half-century.”

Our extended technology wedges approach

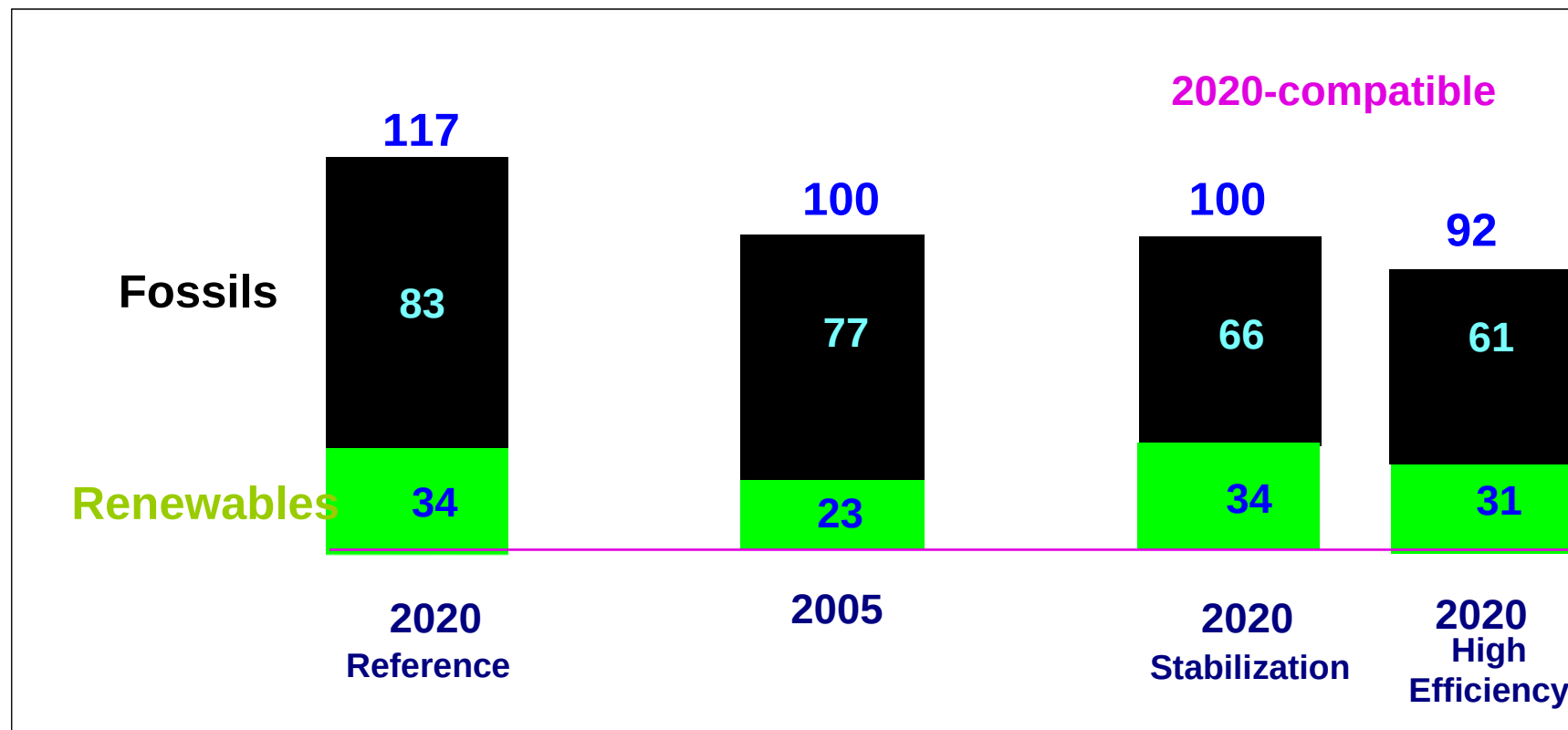
- **Technologies are categorized**
 - Energy services
 - Application technologies
 - Transformation technologies
- **Technologies are scaled**
 - E.g. €1 Bill investments
- **Technologies are evaluated as to their impact**
 - Investment phase
 - Operation phase

GHG Wedges for the 2020 Package



Step 1

Determine 2020-compatible energy flows



Step 2: Find wedges for 2020-compatible structures

■ Energy services

- Reduction of redundant services
- E.g. controls for heating and lighting in buildings reduces energy up to 15%

■ Demand side - application technologies

- E.g. thermal structure of buildings

■ Supply side – transformation technologies

- Reduction of carbon intensity
- Lower transformation and distribution losses

Wedge

Thermal structure of buildings

- € 1 bill investments in improving the thermal structure of buildings
 - 450 GWh energy saved per year
 - Rate of return depends on energy price
 - 3.6 % p.a. for 80 €/MWh energy price

Wedge

Hydro power

- € 1 bill investments in hydro power
 - 800 GWh energy generated per year
 - Generation costs depend on expected rate of return
 - 60 €/MWh for 4 %
 - 108 €/MWh for 8 %

Wedge

Electric cars

- Electric cars will cost approximately twice as much as a conventional car
- The costs of the mobility services, however, could be roughly the same
 - Utilities will invest into the batteries, since they will serve as storage facilities for the electric grid
 - Intensity of use could be increased by innovative marketing concepts

Some conclusions

- More relevant than costs for end-use energy are the costs for energy services.
- Costs for energy services for a given technology are heavily dependent on
 - depreciation rates
 - interest rates
 - scope of the system considered
- Production capacities will limit the dissemination of new technologies
- This highly questions the concept of marginal abatement costs and policy recommendations based upon them.

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Thank you.



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