Wissenschaftszentrum Nordrhein-Westfalen
Institut Arbeit und Technik
Kulturwissenschaftliches Institut
Wuppertal Institut für Klima, Umwelt, Energie GmbH

Security of Energy Supply

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Potentials and Reserves of Various Energy Sources; Technologies Furthering Self-reliance, and the Impact of Policy Choices

Project on behalf of the European Parliament - ITRE Committee

Stefan Lechtenböhmer

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Overview:

Five Scenarios of the EU25 by 2030

- Background, task and methodology of the study
- Baseline scenario and variants N+/N-
- Energy Efficiency and Renewable Energy scenarios
- Comparison with recent DG-TREN scenarios
- Conclusion:
  - Two alternative strategies
  - Robust choices

Background and task of the study

Background:

- The end of cheap fossil energy is approaching
  - EU25 is increasingly relying on energy imports
  - Intensified international competition about dwindling resources
- Climate change is becoming increasingly significant
  - Significant reductions of GHG emissions are needed
- Window of opportunity in EU electricity sector

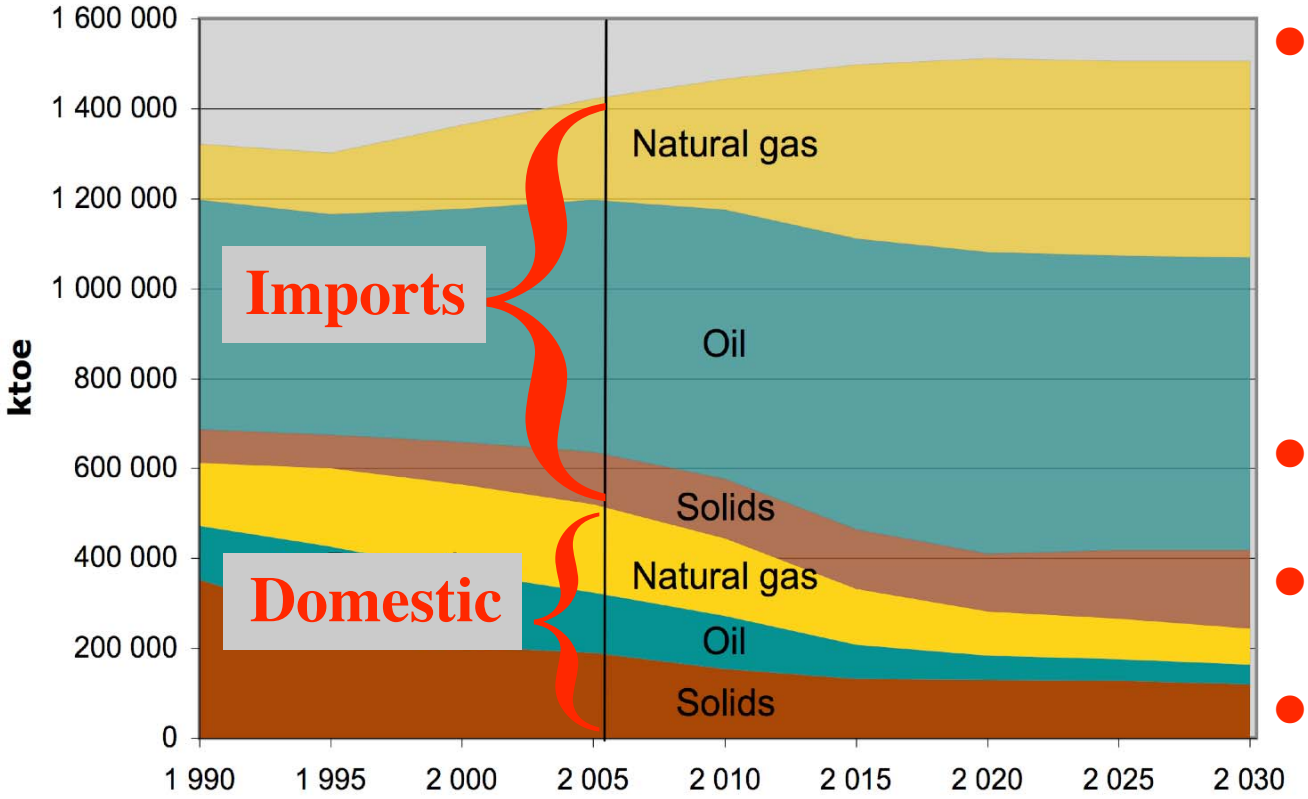
Task of the study:

- Analysis of resource and technology trends
- Development of 5 Scenarios of the EU25 by 2030
- Discussion of existing policy and policy choices

Methodology

- Accounting model of the EU25 energy system
  - Technology specific description of power sector and CHP production (including costs)
  - Modelling of energy demand side by sector and energy carrier
- Baseline compatible with recent DG TREN scenario
- Scenarios on energy demand based on other research
  - Own scenarios for the EU and Germany
  - Own detailed bottom up analysis of efficiency technologies
  - Synopsis of recent studies and political targets
- Policy analysis
  - 3 framework policy areas (climate, Lisbon, external)
  - 5 energy policy fields (energy market, energy efficiency, transport, renewable energy, RTD)

The problem: Imports of fossil fuels to the EU25



- Imports increase by 40 % due to:
  - reduced production (-53%)
  - increasing demand (+6%)
- Natural gas: doubling
- International competition is increasing
- How can the increasing EU demand be secured?

5 Energy Scenarios for the EU 25

BAU: **Baseline scenario (BAU)**
(compatible with the new DG-TREN baseline scenario)

N+: **+25% nuclear capacity** in 2030 vs. new baseline (+ CCS)

N-: **-25% nuclear capacity** in 2030 vs. new baseline
(76 GW nuclear capacity in 2030)

EE: 50% increase in **energy efficiency** on a primary energy level vs. BAU by 2030

RE: >30% **RES** by 2030 (includes + 75% energy efficiency)

BAU scenario and variants

Compatible with 2006 DG TREN baseline

- PE efficiency increase: +1.5% per year
- Primary consumption: +15% vs. 1990
- Import dependency: +38% vs. 2000 (65% in 2030)
- RES share in 2030: 12.2%
- CO_2 emissions in 2030: +4.7% vs. 1990

Variants:

- +25% nuclear capacity in 2030 (stable vs. 2000) (plus CCS)
- CO_2 emissions in 2030: + 1.3% vs. 1990
- Import dependency: + 32% vs. 2000 (63% in 2030)
- *-25% nuclear capacity*

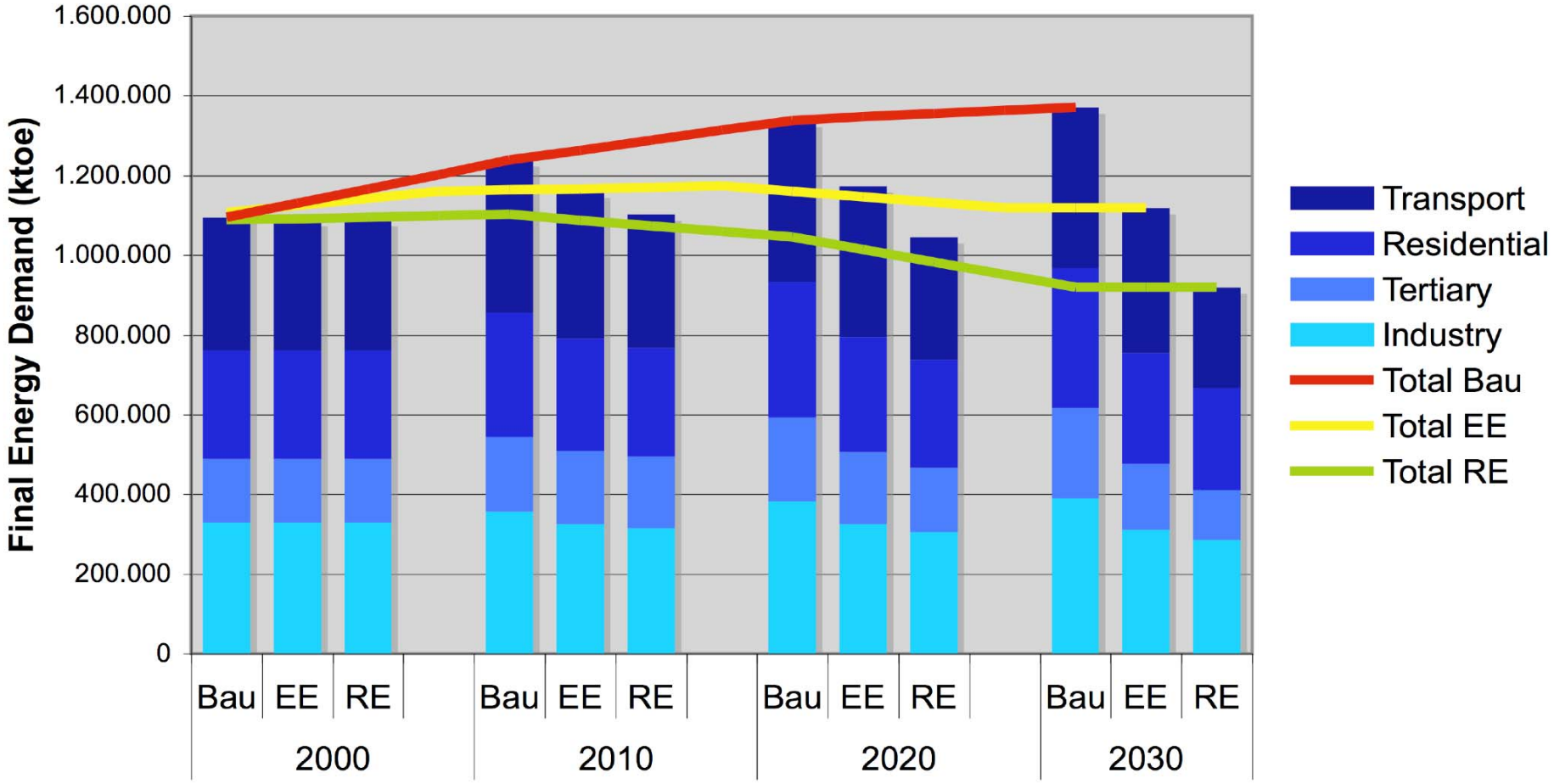
Energy Efficiency (EE) and Renewable Energy Scenarios

- Energy efficiency scenario:
  - +50% primary energy efficiency increase vs. BAU
  - -25% nuclear capacity vs. BAU
- Renewable energy scenario:
  - >30% renewable energies in 2030
  - +75% primary energy increase vs. BAU

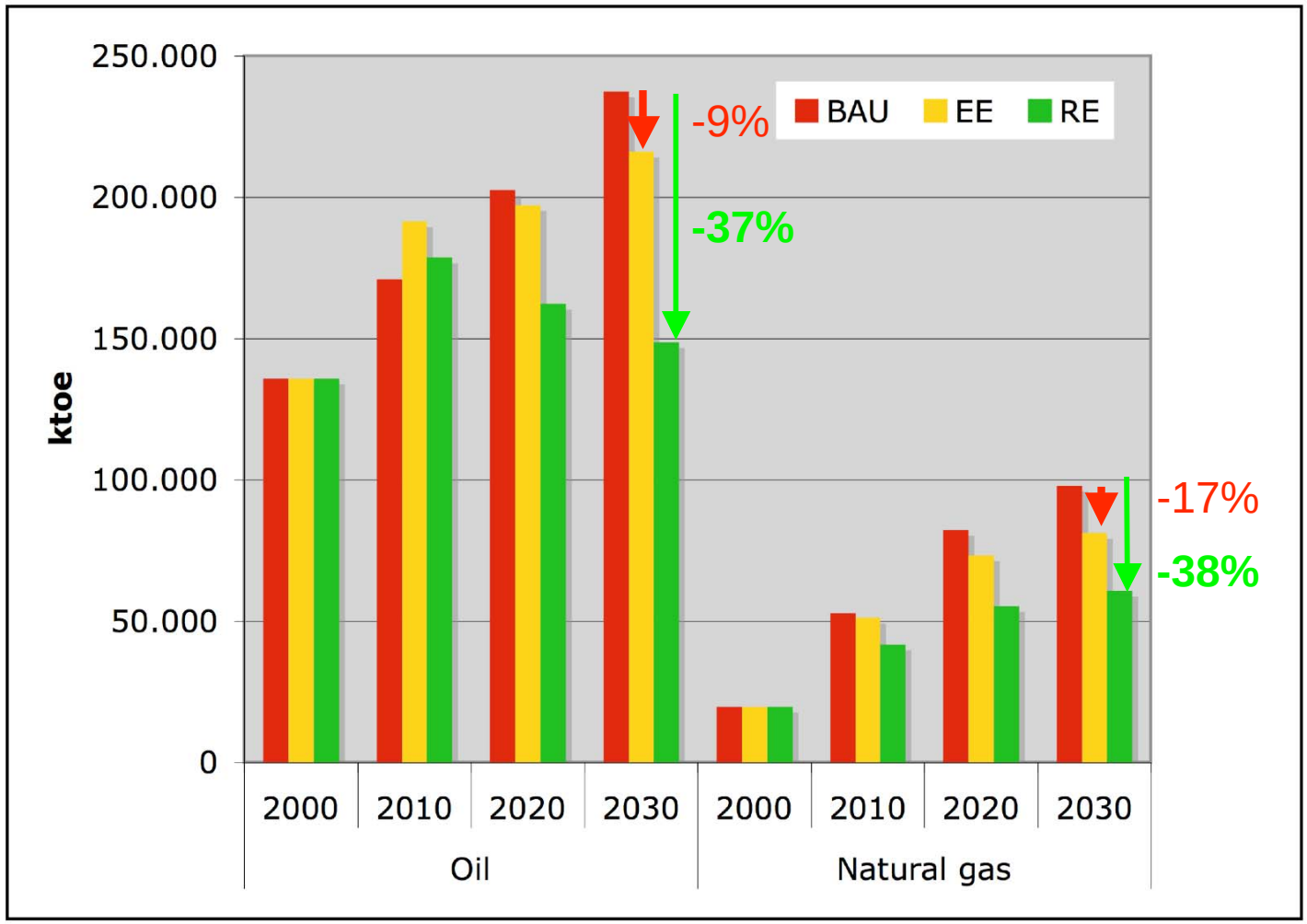
	EE	RE
PE efficiency increase:	+2.2%/y	+2.7%/y
Primary energy (vs. BAU):	-19%	-29%
Import dependency (2030):	60%	49%
RES share in 2030:	15%	31%
CO_2 (2030 vs. 1990):	-19%	-45%

Comparison of scenarios:

Final energy demand

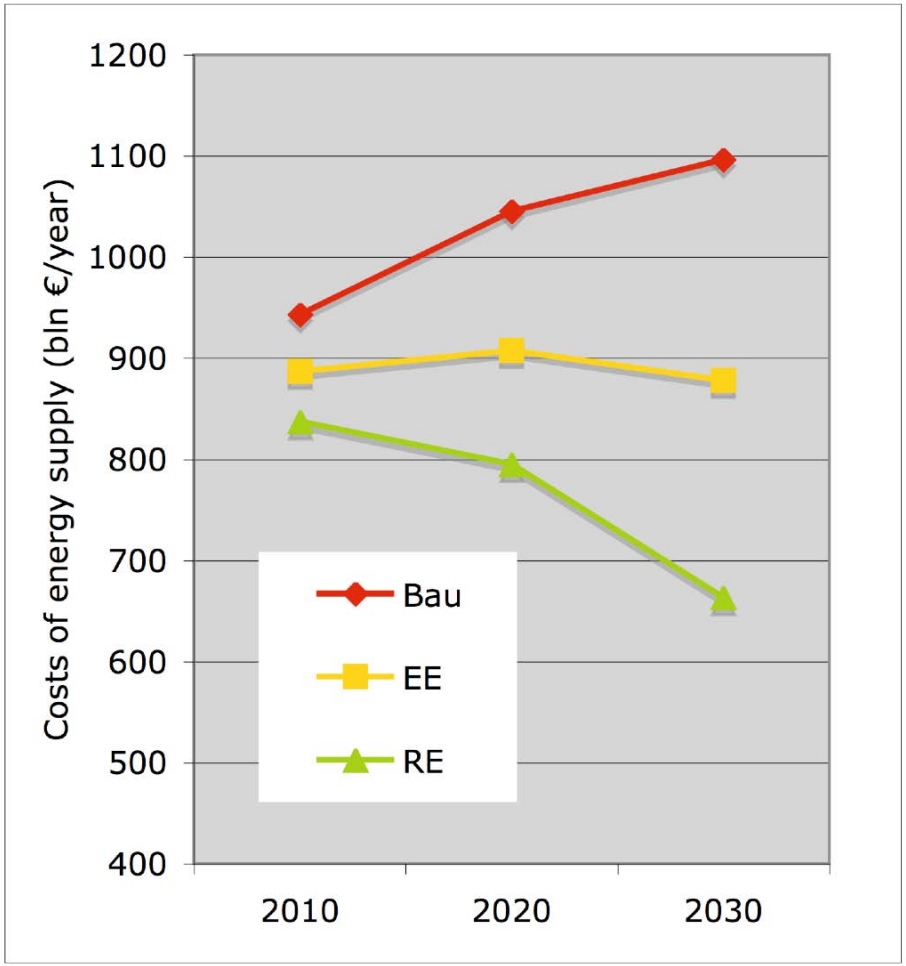


Absolute import dependency by scenario



- **BAU:** increasing import dependency
- **RE:** stabilizing imports at or below current level
- Shares increase in all scenarios

Annual costs of energy supply



- Costs of supply increase in BAU by 0.8% per year
  - Moderate oil price scenario (2010: 38 €/bbl; 2030: 50 €/bbl)
  - High investment in power plants (and grids)
- Costs of supply are lower
  - in EE (by 6 to 20%) and
  - in RE (by 11 to 40%)
- Available for investment in efficiency & dec. renew.:
  - EE: 0.5 to 1.3 % of GDP
  - RE: 0.9 to 1.7% of GDP

Comparison with DG TREN Combined high efficiency & renewable scenario

- **Efficiency** (Primary energy vs. BAU) :
  - DG TREN: 2020: -13%; 2030: -20%
  - EE scenario: -12% -19%
  - RE scenario: -16% -29%
- **Renewable Energies**
  - DG TREN: 2020 325 Mtoe (20%) 2030: 394 (26%)
  - RE scenario: 315 Mtoe (20%) 418 (31%)
- Differences:
  - Less nuclear power in DG TREN scenario
  - Higher import dependency

Conclusion: Two strategies available

- Advanced conventional
  - Business as usual in energy system development plus increased use of nuclear + CCS
  - Needs strong external policy
  - Not so much developed as the Domestic action strategy due to scenario formulation
- Domestic action (RE)
  - Strongly Increased efficiency (20% vs. BAU)
  - Increase of renewable energies by a factor of 2.8
  - CO_2 emissions decrease by 45% (by 2030, domestically)
  - Needs for an active domestic change management
  - Relaxed international policy (imports reduced by 24% vs. 2005)

Advanced conventional

- Business as usual plus increased use of nuclear + CCS
  - Conventional reinvestment of power plants (coal, increased share of natural gas, limited renaissance of nuclear)
- Imports are reduced by about 3% vs. BAU
  - But still increase by about 38% vs. 2005 (to 62% in 2030)
- CO_2 emissions can be stabilized at current levels
- Need for a much more active foreign policy
  - To secure increasing energy supply of oil and natural gas
  - This needs strategic partnerships with Russia, North Africa and Caspian Sea region
  - To acquire carbon emission rights
- Economic consequences:
  - Increasing costs of energy supply (0.8% per year)
    -> 1/3 due to increasing import costs
  - Added costs for CCS and acquisition of CO_2 rights (0.1 to 0.16% of GDP at 25€/t)

Domestic action

- By 75% increased energy efficiency (29% Savings vs. BAU)
  - Strong action to promote demand side efficiency
- Increase of renewable energies by a factor of 2.8
- CO_2 emissions decrease by 45% (by 2030, domestically)
- Needs for an active domestic change management
  - Restructuring of energy industry
    -> cutting of investment in conventional plants by 75%
  - High efficient technology in all investments in all sectors
- Relaxed international policy (Imports reduced by 24% vs. 2005)
  - EU can play a frontrunner role in climate and efficiency policy
- Economic impacts:
  - Redirecting investment from energy imports and conventional power plants to high efficient technology and renewable technology
  - Reduced import bills, higher labour intensity of investment

Conclusion: Robust policy choices

Strategies needed in every scenario

- Demand side energy efficiency (incl. CHP)
  - Is important in all scenarios (BAU: 1.5% per year; RE: 2.7%)
  - Existing directives have to be actively implemented
  - Existing and discussed targets should become mandatory
  - Buildings directive, Transport sector targets, Eco design directive, Energy end use efficiency directive
- Renewable energies
  - Are expanded in all scenarios (BAU: + 40%; RE + 180%)
- Energy market policy
  - to support DSM, decentralized generation, and large wind generation
- EU external energy policy
  - to foster CDM and clean technology transfer (CTT)

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Thank you!