Energy reduction potentials in the EU-27
- Analysis by modelling a White Certificate Trading scheme with TIMES PanEU

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Agenda

- Overview and European climate policy targets
- Approach
  i. TIMES PanEU
  ii. White certificates and Scenarios
- Model results
  i. Final Energy Consumption
  ii. Primary Energy Consumption
  iii. Emissions
  iv. Different sector and country contribution
- Key messages
Overview

Introduction

- Reduction of energy consumption as part of European goals
- CO\textsubscript{2} reduction by fossil fuel switch, renewables, nuclear, CCS and energy efficiency
- White certificate measures implemented on country level (UK, France, Italy, Flanders)
- Evaluating strategies for energy efficiency improvements

European climate policy goals

EC in 2007: 20/20/20 goals

- Energy efficiency: Reduction of 20\% compared to reference development [as estimated by Commission in the Green paper on energy efficiency]

November 2008

- Need of European approach for an equitably sharing of reduction targets [Memo-08-699]
- Current measures will lead to energy savings of about 13\% by 2020
The Pan-European model (Times PanEU)

Model description:

- PEM is a 30 region (EU 27 + NO, CH, IS) partial equilibrium energy systems, technology oriented bottom-up model
- Time horizon: 2000-2050
- 12 time slices (4 seasonal, 3 day level)
- GHG: CO$_2$, CH$_4$, N$_2$O, SF$_6$
- Others pollutants: SO$_2$, NO$_x$, CO, NMVOC, PM2.5, PM10

Model description:

- **SUPPLY**: Explicit modeling of reserves, resources, exploration and conversion
- **ELECTRICITY**: Public electricity plants, CHP plants, heating plants, auto-producers
- **DEMAND**:
  1. **Agriculture**
  2. **Industry**: Energy intensive industry (iron and steel, aluminum, copper, ammonia and chlorine, cement, glass, lime, pulp and paper), Other industries
  3. **Residential and Commercial**: Space heating/cooling, water heating, appliances and others
  5. **Country specific characterization of end-use technologies**
Regions in the Pan-EU model and planned electricity interconnection extensions

<table>
<thead>
<tr>
<th>European Priority Projects</th>
<th>P in MW</th>
<th>Year</th>
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<tbody>
<tr>
<td>DE TK 500</td>
<td>2012</td>
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<tr>
<td>AT CZ 900</td>
<td>2009</td>
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<tr>
<td>IT SI 800</td>
<td>2011</td>
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<td>PL LT 1000</td>
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<td>ES FR 1200</td>
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<td>BE FR 400</td>
<td>2015</td>
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<td>NL UK 1320</td>
<td>2010</td>
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Modelling white certificate trade

White Certificates Trading in TimesPanEU

- European-wide trade
- Certificates for reduction of final energy respective primary energy
- Certificates for all energy carriers (including all renewables)
- Certificates for all demand sectors
- No regard of costs

Balancing

- Efficiency method
  
  => valuing commodities in model restriction accordingly
Scenario Definition

**cert_final**
- White certificates for Reduction of Final Energy Consumption
- Base: Reference run
- 13% - 20% reduction (2020-2050)

**cert_primary**
- White certificates for reduction of Primary Energy Consumption
- Base: Reference run
- 13% - 20% reduction (2020-2050)

Final Energy Consumption (EU-27)
Primary Energy Consumption (EU-27)

Reduction of FEC by sectors (compared to REF)

certificates for final energy consumption

- Industry
- Commercial
- Households
- Transport
Reduction potentials by country (2020)
certificates for final energy consumption

Sector view: Electricity Generation
Sector view: Industry

Final energy consumption Industry [PJ]

- Others (Methanol, Hydrogen)
- Waste
- Renewables
- Heat
- Electricity
- Gas
- Petroleum products
- Coal

Sector view: Transport

Final energy consumption Transport [PJ]

- Others (Methanol, Hydrogen, DME)
- Waste
- Renewables
- Heat
- Electricity
- Gas
- Petroleum products
- Coal
**CO₂ Emissions**

- **Transport**
- **Households, commercial, AGR**
- **Industry**
- **Conversion, production**

**Comparison reduction FEC to PEC** (EU-27; compared to REF)

- **Delta PEC (%)**
- **Delta FEC (%)**

- Certificates for final energy consumption
Comparison reduction FEC to PEC (EU-27; compared to REF)

**certificates for primary energy consumption**

<table>
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<tr>
<th>Year</th>
<th>Delta PEC (%)</th>
<th>Delta FEC (%)</th>
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<tbody>
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<td>2030</td>
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<tr>
<td>2050</td>
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**Comparison reduction FEC to PEC**

(EU-27; compared to REF)

certificates for primary energy consumption

Prices of white certificates

<table>
<thead>
<tr>
<th>Year</th>
<th>cert_FEC</th>
<th>cert_PEC</th>
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<tbody>
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<td>2050</td>
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Key model results

**White certificates final energy consumption**
- Higher use of district heat (increased use of public CHP, less autoproducer) and higher share of ELC
- Reduction of FEC stronger than PEC
- Reduction driven by Residential&Commercial, Industry and on a lower level also transport

**White certificates primary energy consumption**
- Higher use of wind and other renewables, less use of nuclear (clear structural change in electricity generation)
- Just small reduction of final energy consumption (reduction stays in conversion/production sector)

Key messages

**Main findings**
- European approach for sharing of reduction goals necessary and cost effective by white certificate trade
  - Different contribution between countries
  - Different potentials in demand sectors
- Reduction initially caused by Households, later on also industry and commercial (less transport)
- Trading of FEC certificates leads to lower emissions (compared to certificates of primary energy)
- 20% reduction of FEC compared to Reference case doesn’t seem to be possible
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