

Development of the European TIMES Model (ETM-UCL)

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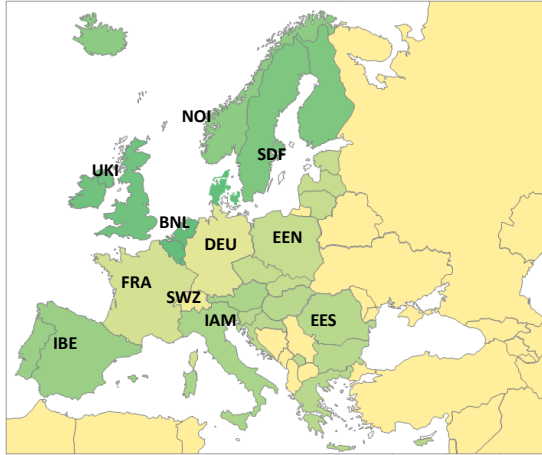


ETM-UCL: Overview

- ETM-UCL : energy systems model built on the TIMES model generator
- Technologically detailed bottom-up model; dynamic partial equilibrium model approach with inter-temporal objective function minimising total discounted system costs
- Based on the 16 region TIAM-UCL
- ETM-UCL is calibrated to 2010 data
- Base-year energy-service demand is exogenous and it is projected for the future using drivers such as GDP, population, output by sector, etc.
- Each region is modelled in its supply, power generation and demand sectors.
- The European regions are linked through the trade in crude oil, hard coal, pipeline gas, LNG, petroleum products, biomass, electricity and emission permits.
- ETM-UCL designed for and currently used in two FP7 EU research projects (<http://cecilia2050.eu/>, <http://www.emininn.eu/>)
- More ETM-UCL info: <http://www.ucl.ac.uk/energy-models>



11 regions, EU28+3



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List of Regions and Countries

Region	Country
BNL	Belgium, Netherlands and Luxembourg
SWZ	Switzerland
DEU	Germany
FRA	France
IAM	Italy, Austria and Malta
IBE	Spain and Portugal
NOI	Norway and Iceland
SDF	Sweden, Denmark and Finland
UKI	UK and Ireland
EEN	Estonia, Lithuania, Latvia, Czech Republic, Slovakia and Poland
EES	Slovenia, Hungary, Romania, Bulgaria, Greece, Cyprus and Croatia



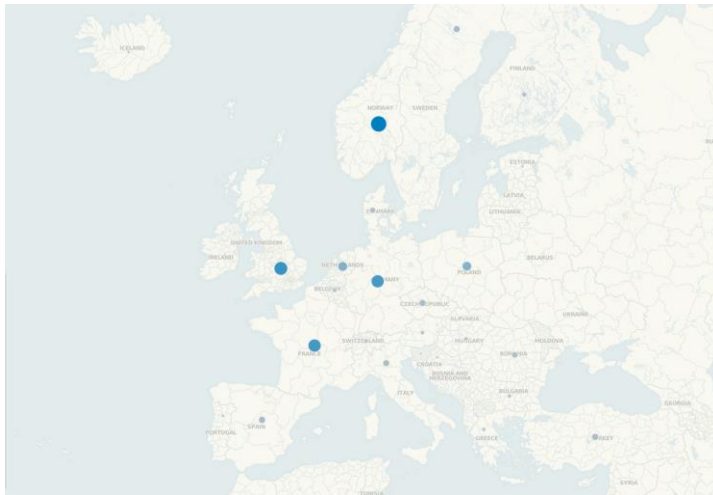
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Energy consumption and production in the EU



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Energy consumption and production in the EU



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Data sources

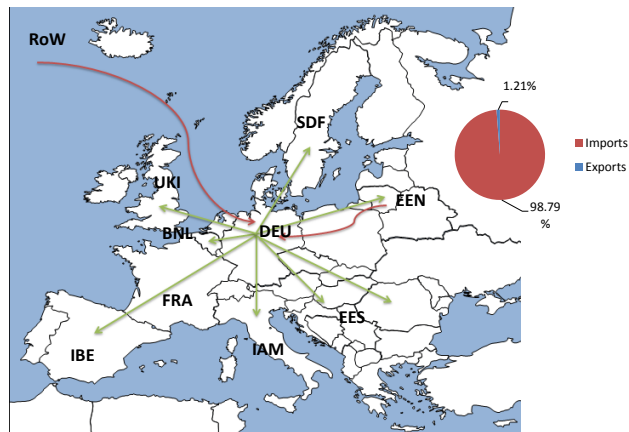
- Base year
 - IEA Energy Balance statistics, 2010
- Demand drivers
 - Cambridge Econometrics, IEA 2DS
- Technologies
 - TIAM-UCL database, IEA ETSAP Technology database
- Other resources
 - Eurostat, European Commission studies
- Oil & Gas supply cost curves and availability
 - BUEGO (Bottom-up economic and geological oil field production model)



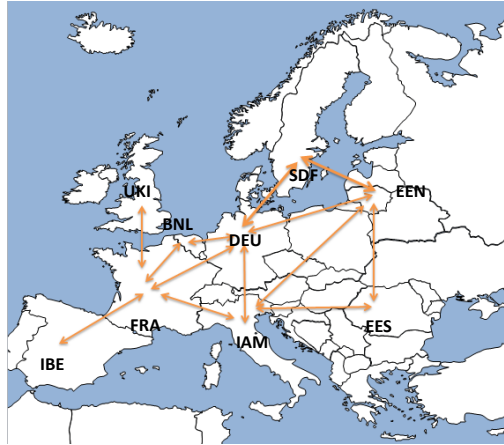
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Trade

Coal, Germany (IEA, 2010)



Electricity



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Scenarios

- **Common Assumptions**

- 2020 GHG emissions & renewables targets reached ('202020' targets – except energy efficiency)
- Closure of existing nuclear follows end of current licences and phase-out plans. No new nuclear in Germany, Italy, Austria and Malta. No restrictions elsewhere.
- GDP, population & households projections match IEA 2012 Energy Technology Perspectives data for EU


Driver	2015	2020	2030	2040	2050
Population	506m	511m	516m	515m	512m
Households	217m	-	238m	-	252m
GDP Growth	2% (2009-20)		1.8% (2020-30)	1.7% (2030-50)	



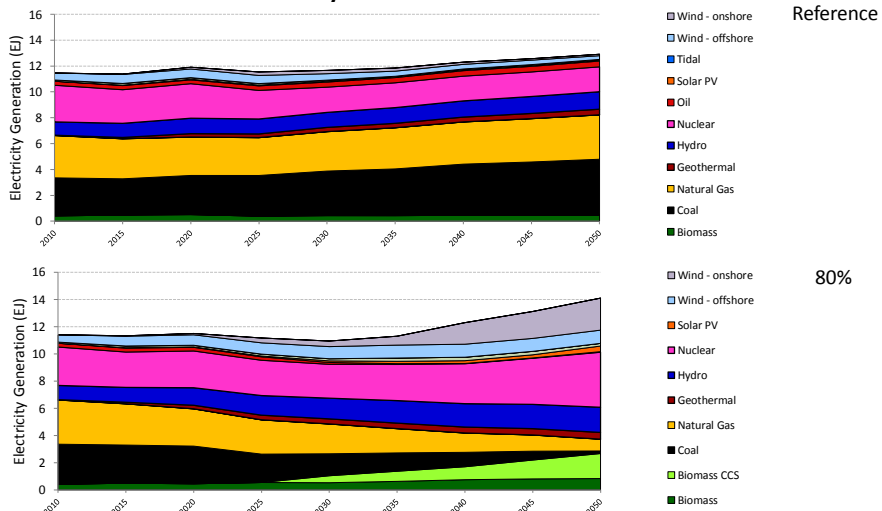
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Scenarios

- **Reference**
 - No targets after 2020
 - IEA ETP 6DS prices for oil, gas and coal imports
- **‘Fragmented Policy’**
 - Binding Target of 60% GHG reduction below 1990, by 2050
 - ‘Firm’ national policies achieved (e.g. UK Climate Change Act)
 - IEA ETP 4DS prices for oil, gas and coal imports
- **‘Policy Success’**
 - Binding Target of 80% GHG reduction below 1990, by 2050
 - ‘Firm’ national policies achieved (e.g. UK Climate Change Act)
 - IEA ETP 2DS prices for oil, gas and coal imports

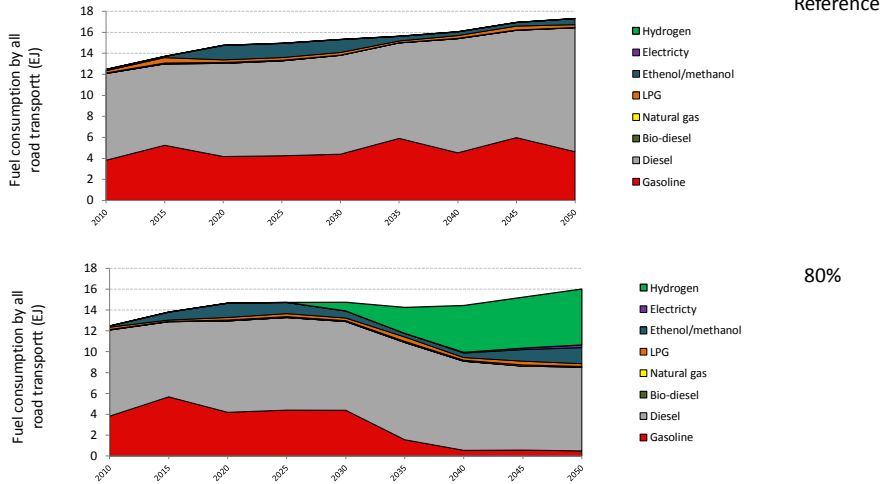
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Electricity Generation Trends



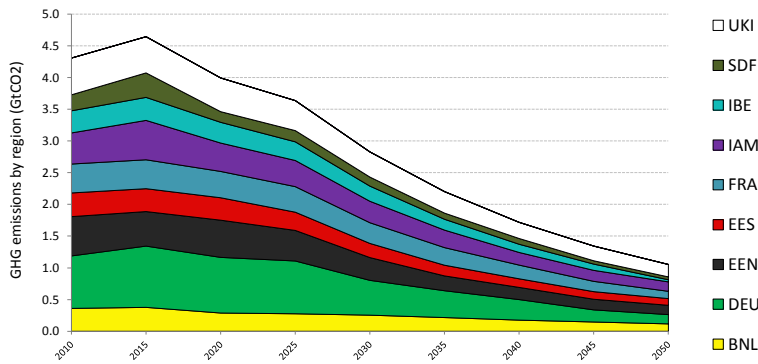
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Road Transport Trends



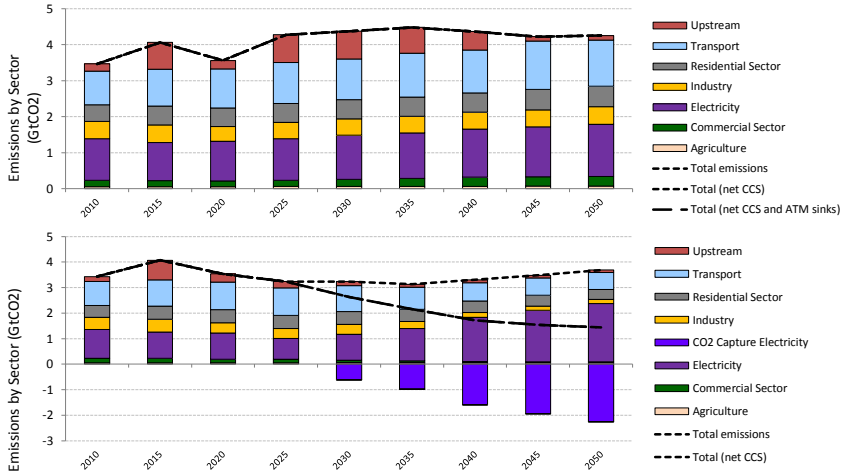
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Regional GHG Trends (80% Scenario)



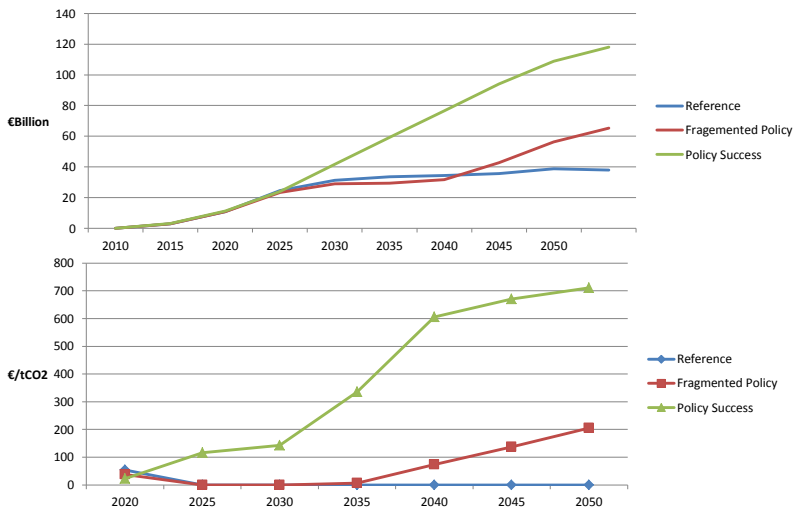
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Sectoral CO₂ trends



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Electricity Inv. Costs & Marginal CO₂ Price



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Future work

- CECILIA2050 and EmInn
- Improve electricity and gas trade modelling
- Update costs of power sector technologies
- Elastic demand functionality
- Soft-link to other UCL models (e.g. TIAM-UCL)



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Thank you

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