

# Development of the EU Energy System – Low-Carbon Scenarios

Paul Drummond

UCL Institute for Sustainable  
Resources

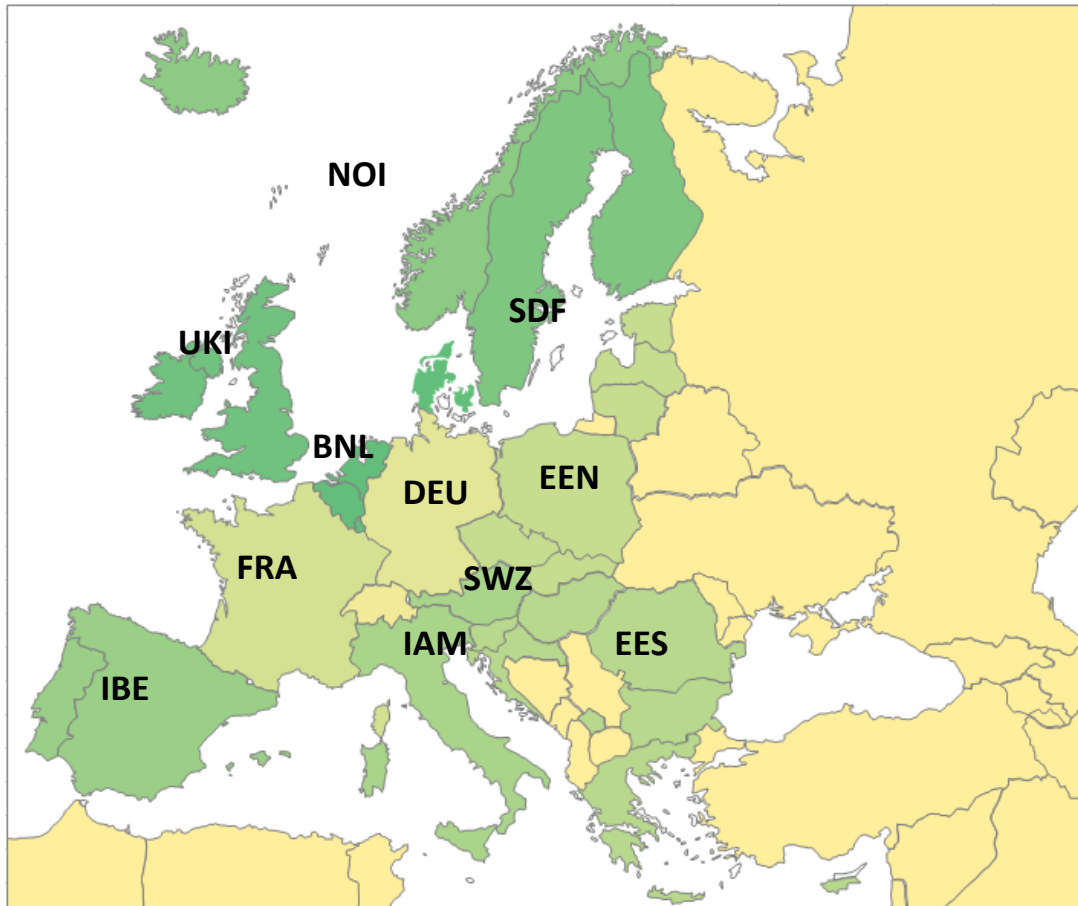


## European TIMES Model (ETM-UCL)

- Energy systems model built on the TIMES model generator
- Dynamic partial equilibrium model approach with inter-temporal objective function minimising total discounted system costs
- Technology-rich bottom-up model
- Covers energy flows from the useful energy demand over end-use sectors and conversion sector to the primary supply
- 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 and electricity



# European TIMES Model (ETM-UCL)



## European TIMES Model (ETM-UCL)

- 11 regions (EU28, plus NOI & SWZ)
- ‘Rest of World’ region – functions as a ‘basket of resources’

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

# 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 specific restrictions elsewhere.
- GDP, population & households projections match IEA 2012 Energy Technology Perspectives data for EU

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

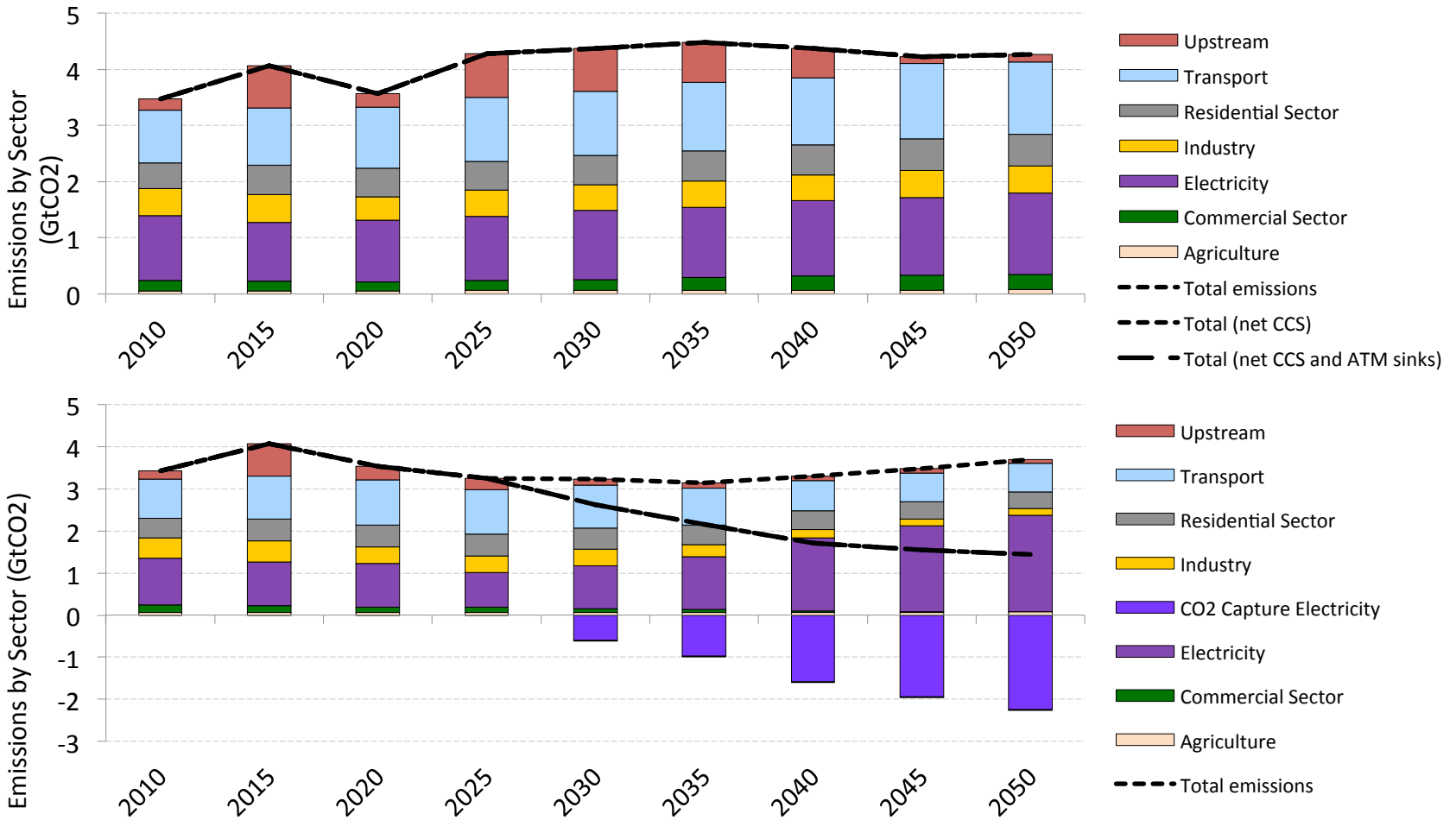
# Scenarios

- **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

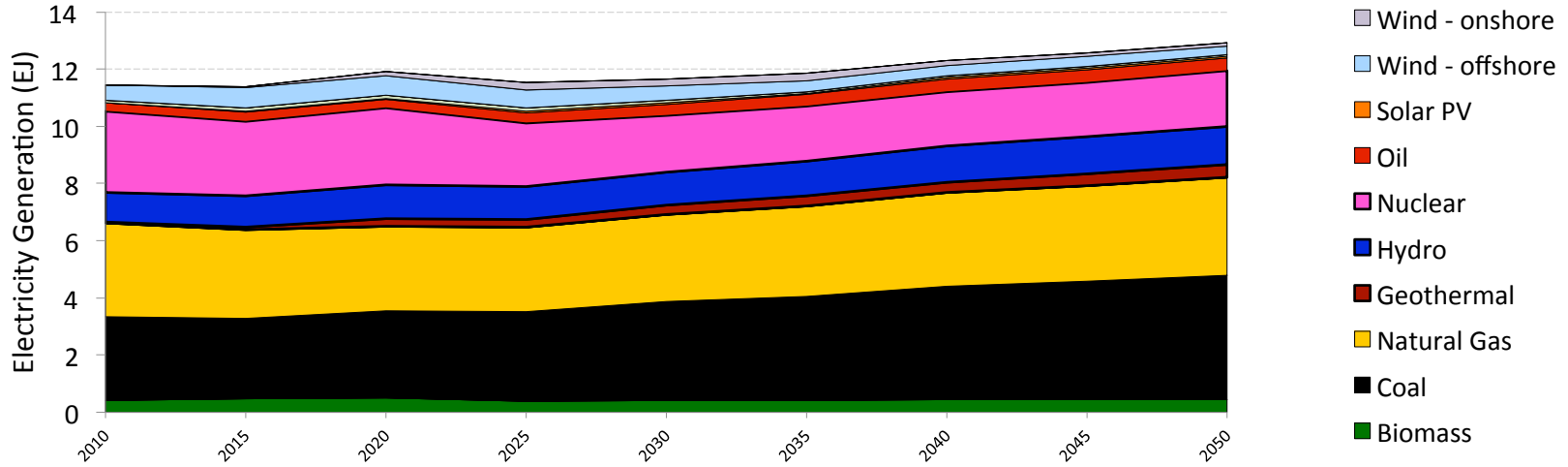


# Sectoral CO<sub>2</sub> trends

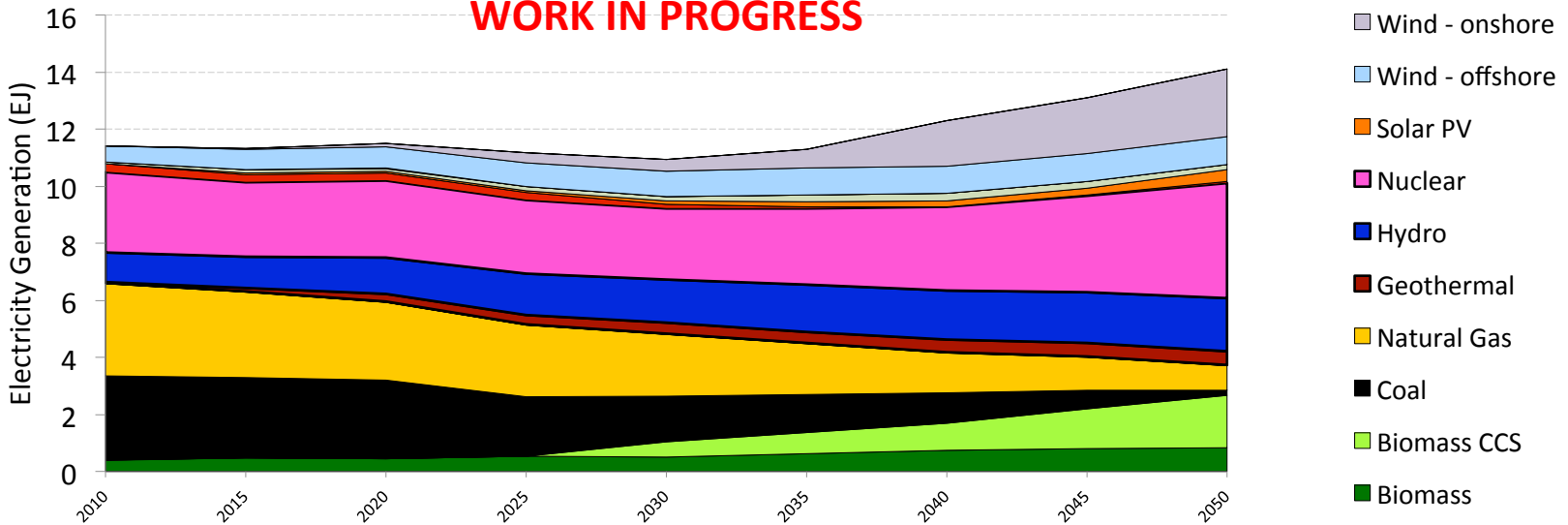
**WORK IN PROGRESS**



# Electricity Generation Trends



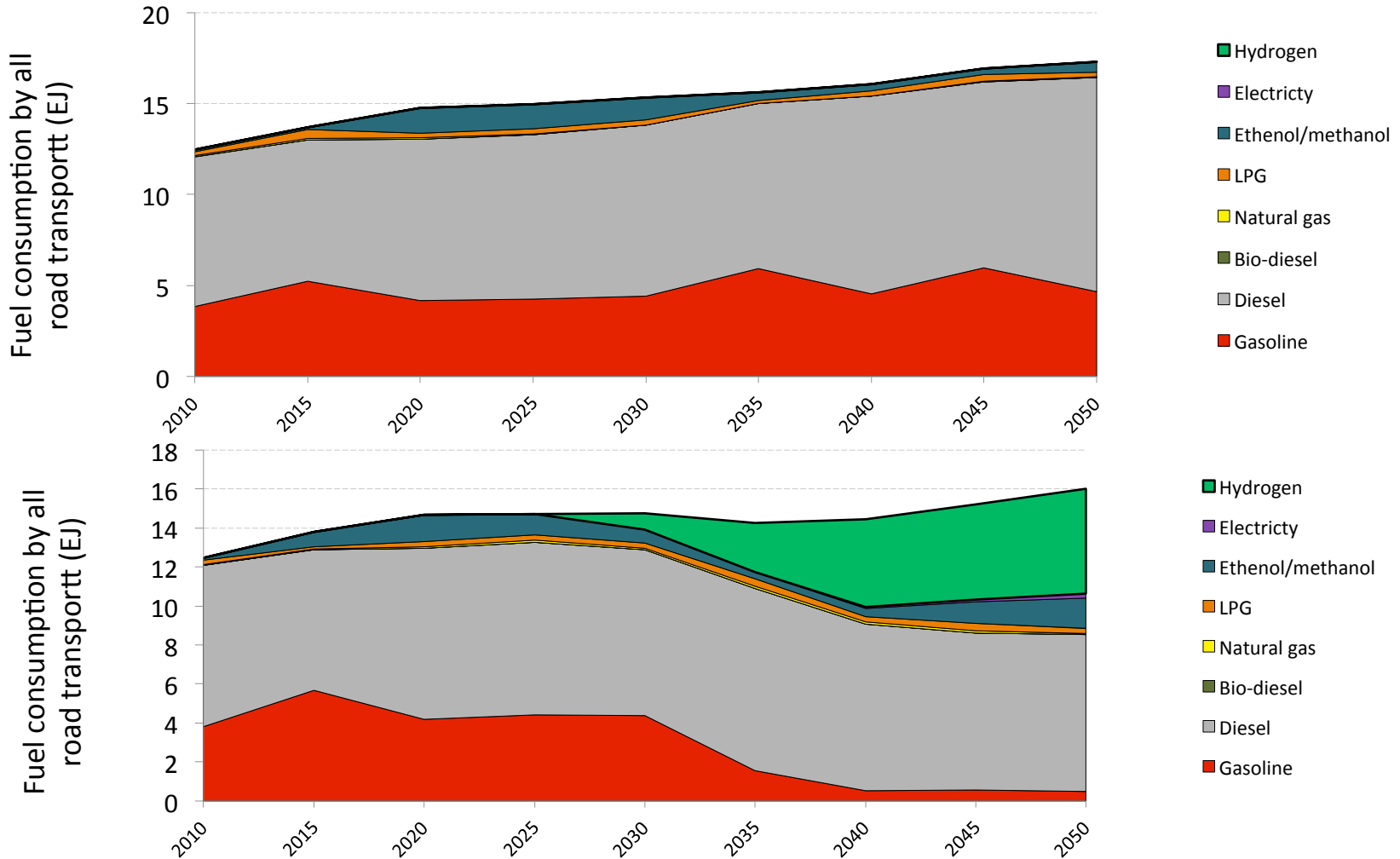
**WORK IN PROGRESS**



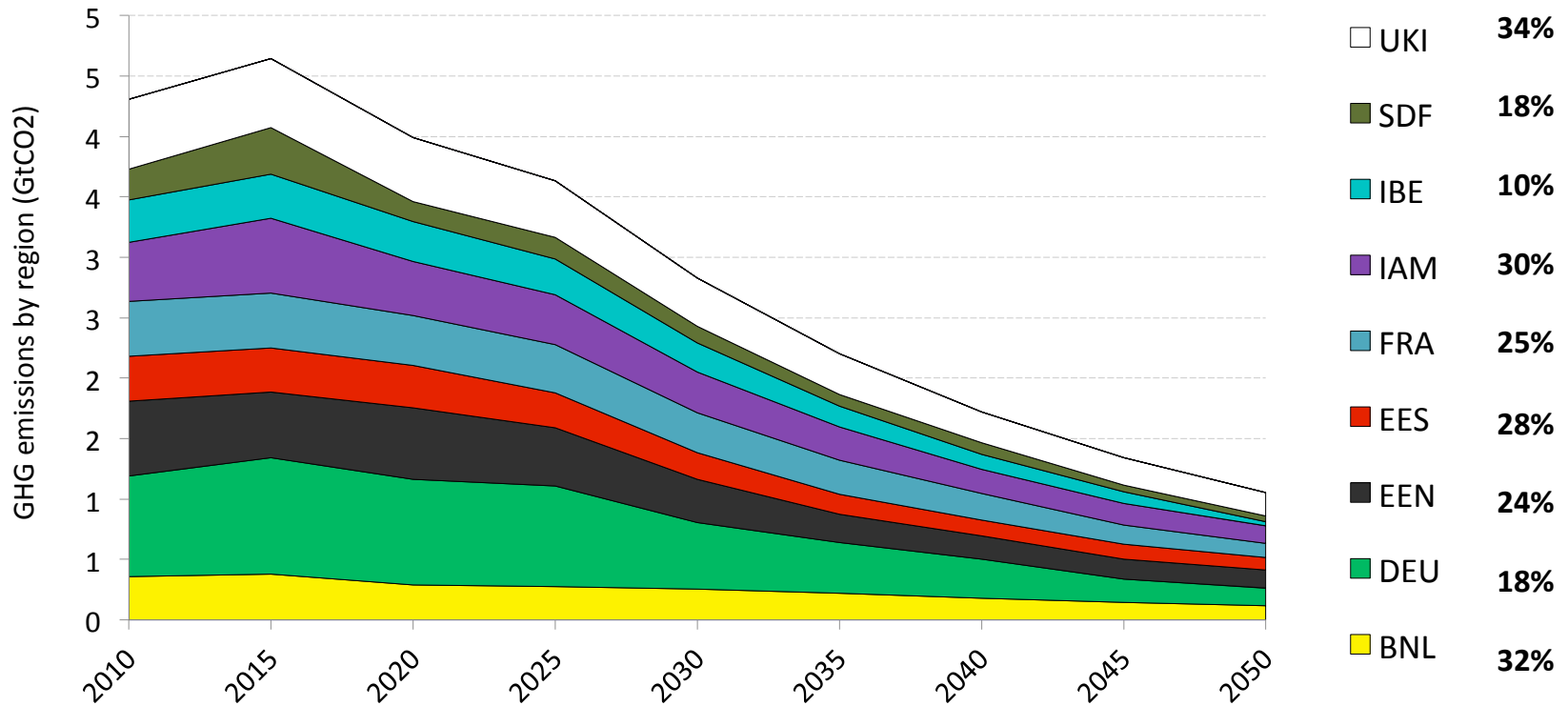


# Road Transport Trends

**WORK IN PROGRESS**



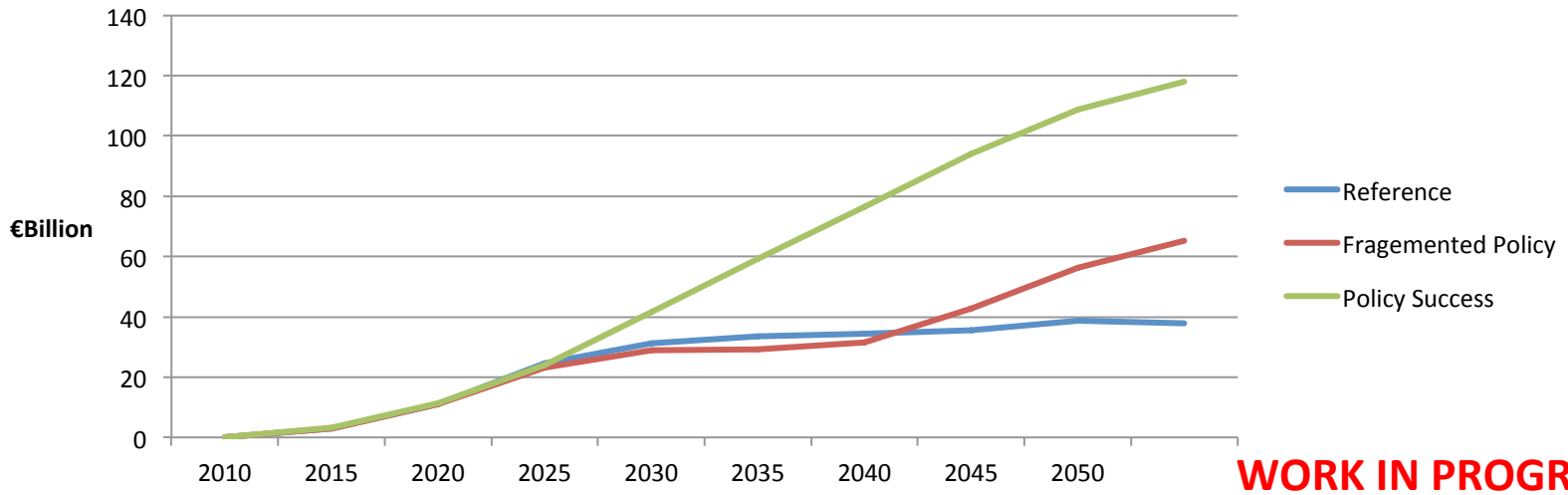
# Regional GHG Trends



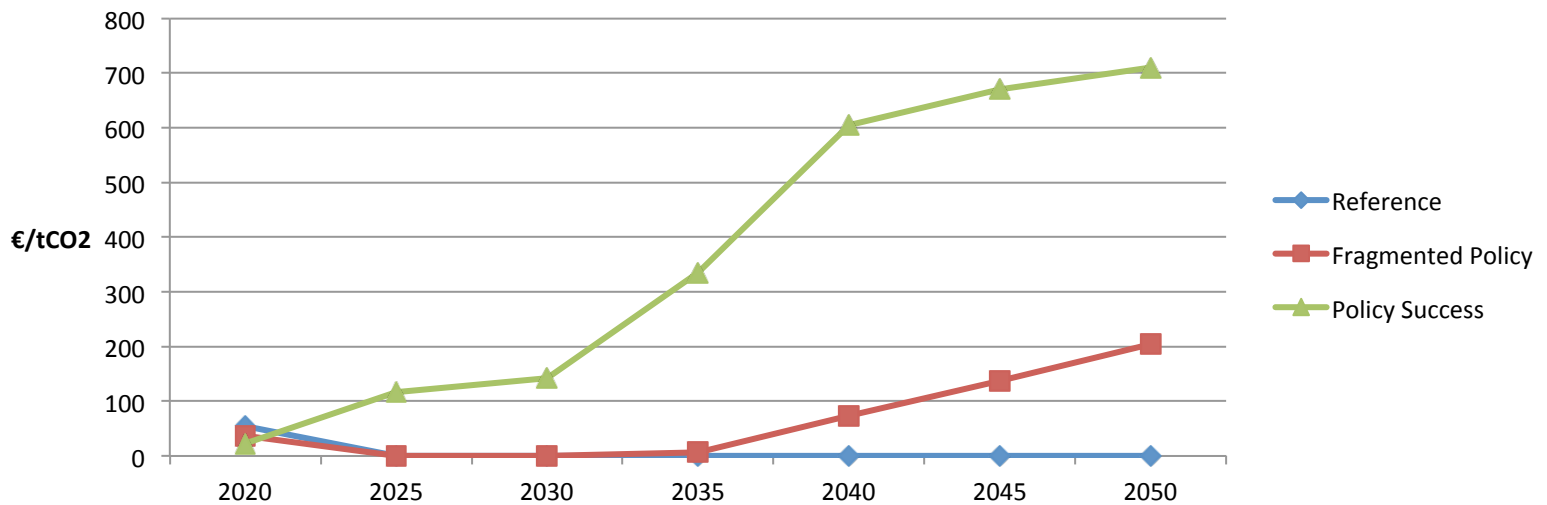
**WORK IN PROGRESS**



# Electricity Inv. Costs & Marginal CO<sub>2</sub> Price



**WORK IN PROGRESS**



# Next Steps...

- Analyse results in detail (by sector, by key technology, etc.), and refine where required
- Run alternative ‘policy success’ scenarios
- Draw policy conclusions

