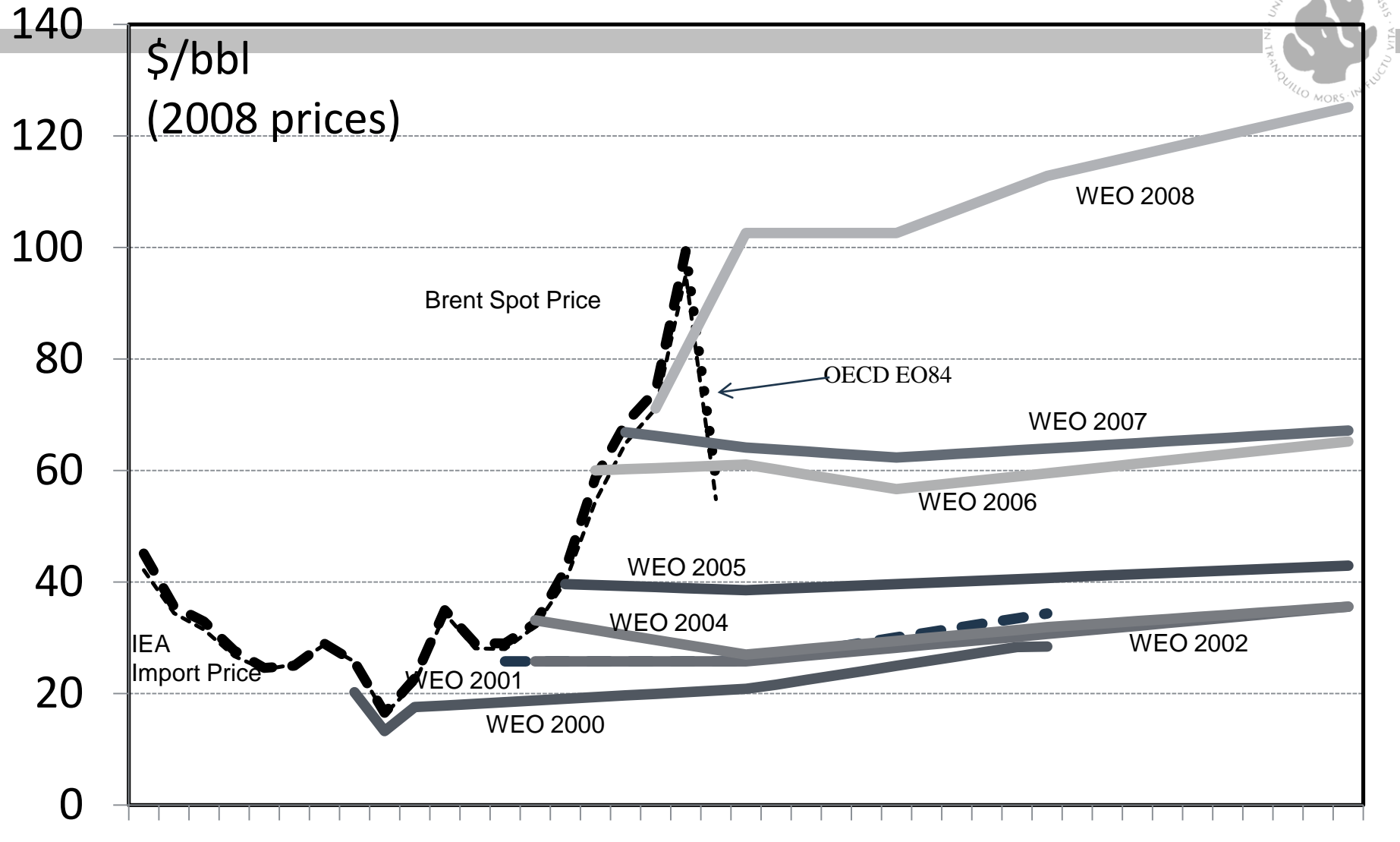




Tax Favours to Zero Emission Vehicle Fuels?

Transition to Zero Emission Vehicles
Competitiveness of Hydrogen
High Tax Rates in EU Favour Energy Efficiency
Tax favours to hydrogen not necessary,
but slightly higher minimum taxes in different design

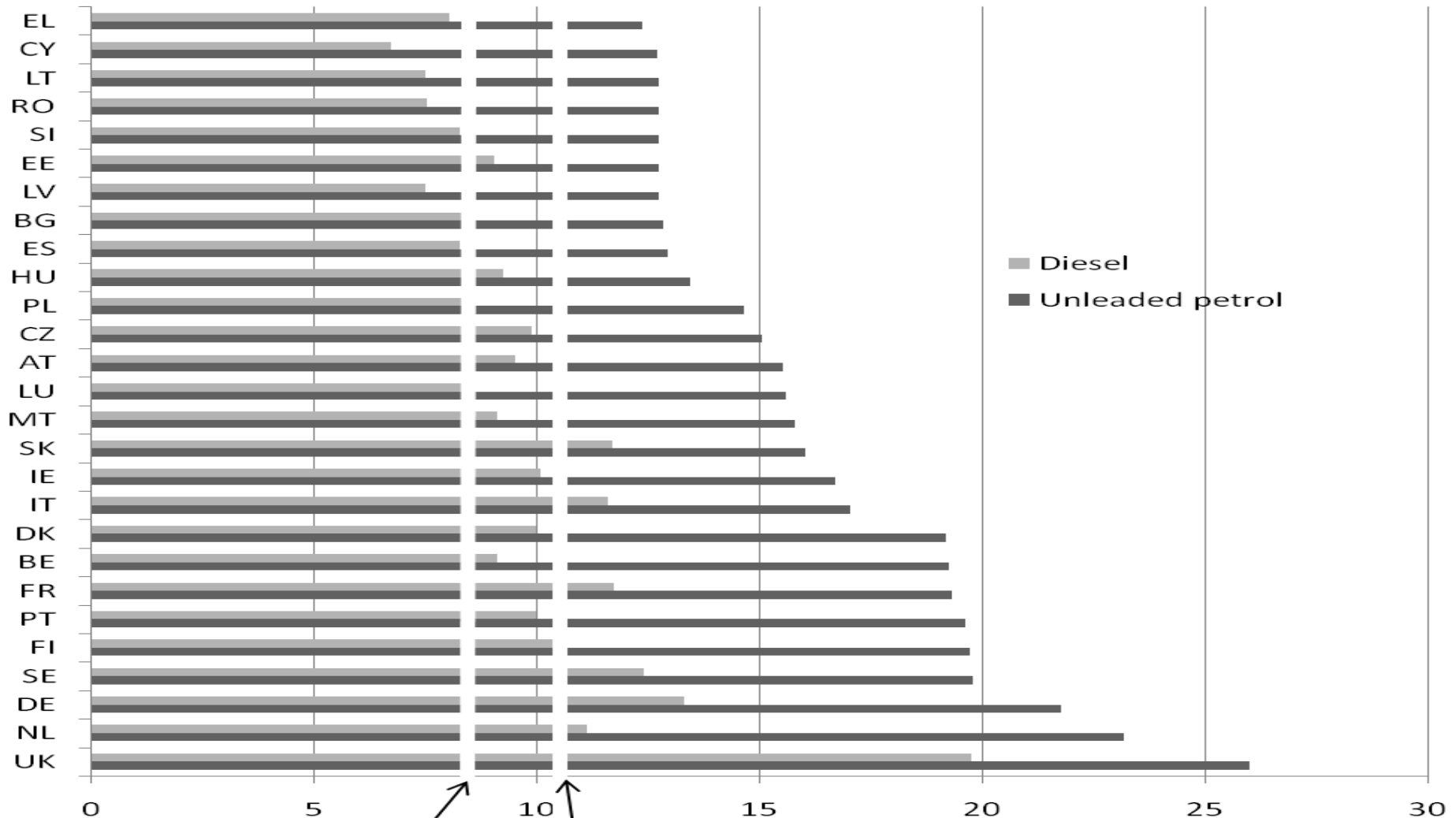
Actual and Projected Oil Prices: Future Prices + \$100/bbl



Fuel and Technology Transitions in Automotive Transport

ICE		Electro-motor	
Petrol & diesel -> biofuels	Advanced ICE	BEV w. replacement stations	Fossil power & hydrogen -> non-fossil
	HEV	PHEV	
	?	FCEV	

European Diesel and Petrol Taxes 2008

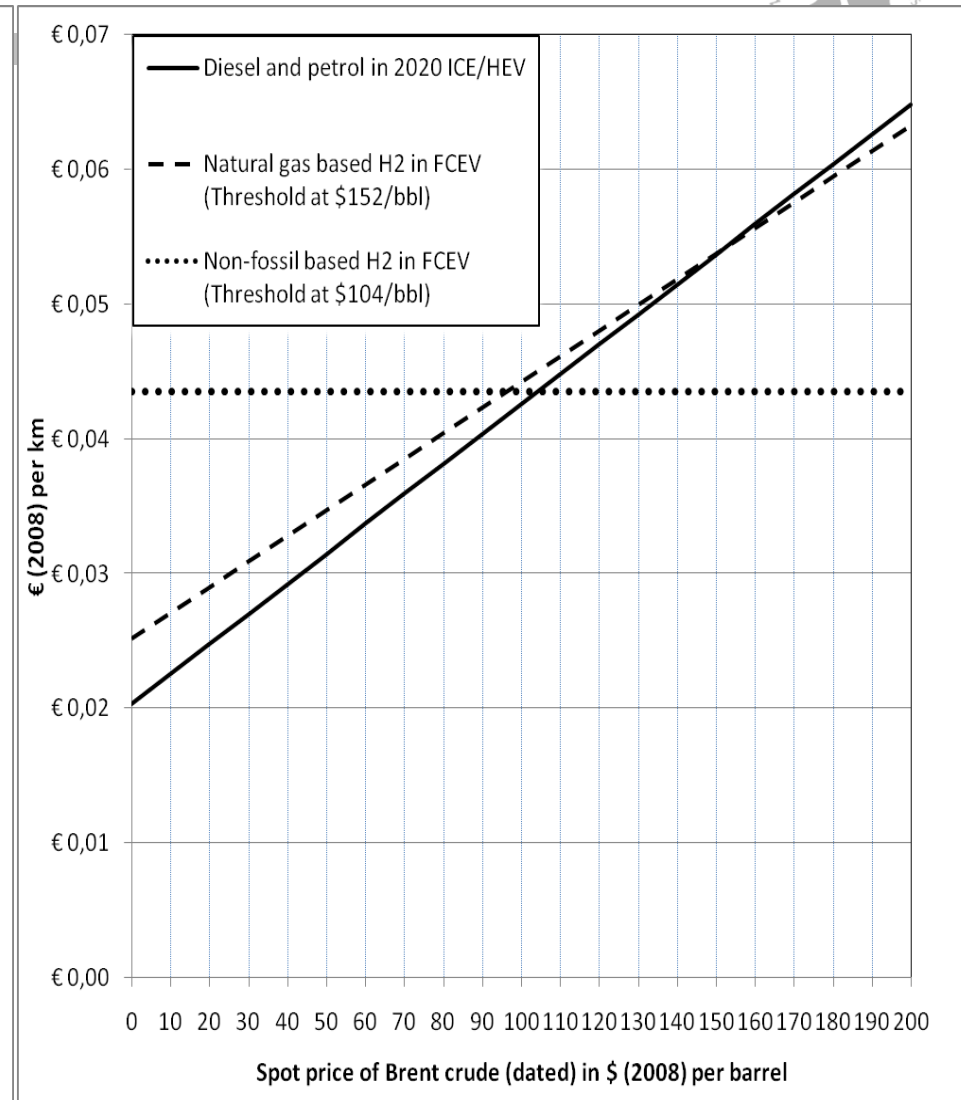
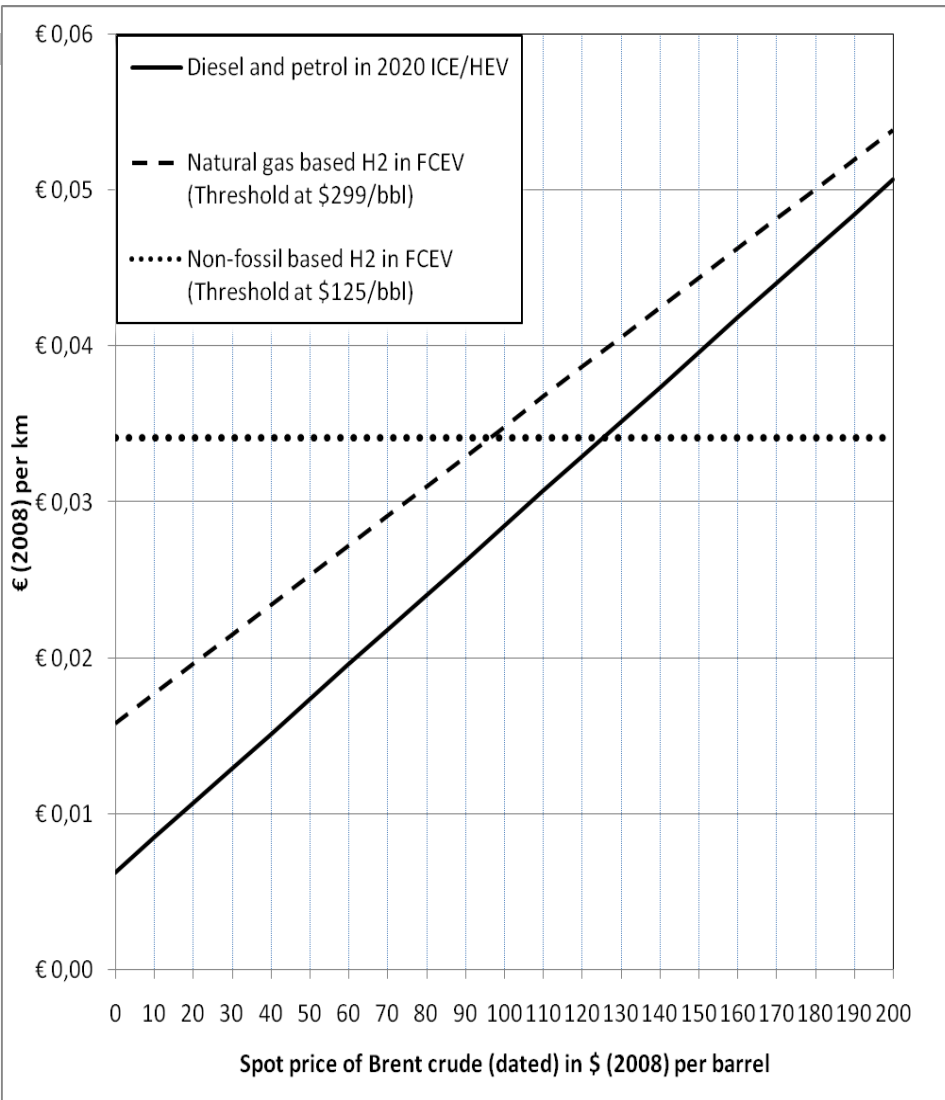


€8.26/GJ *Min diesel* €10.83/GJ *Min petrol* €/GJ (2008 prices)

Source: EU Commission, DG tax and own calculations

No fuel taxes vs uniform fuel tax of €10/GJ

Best case.

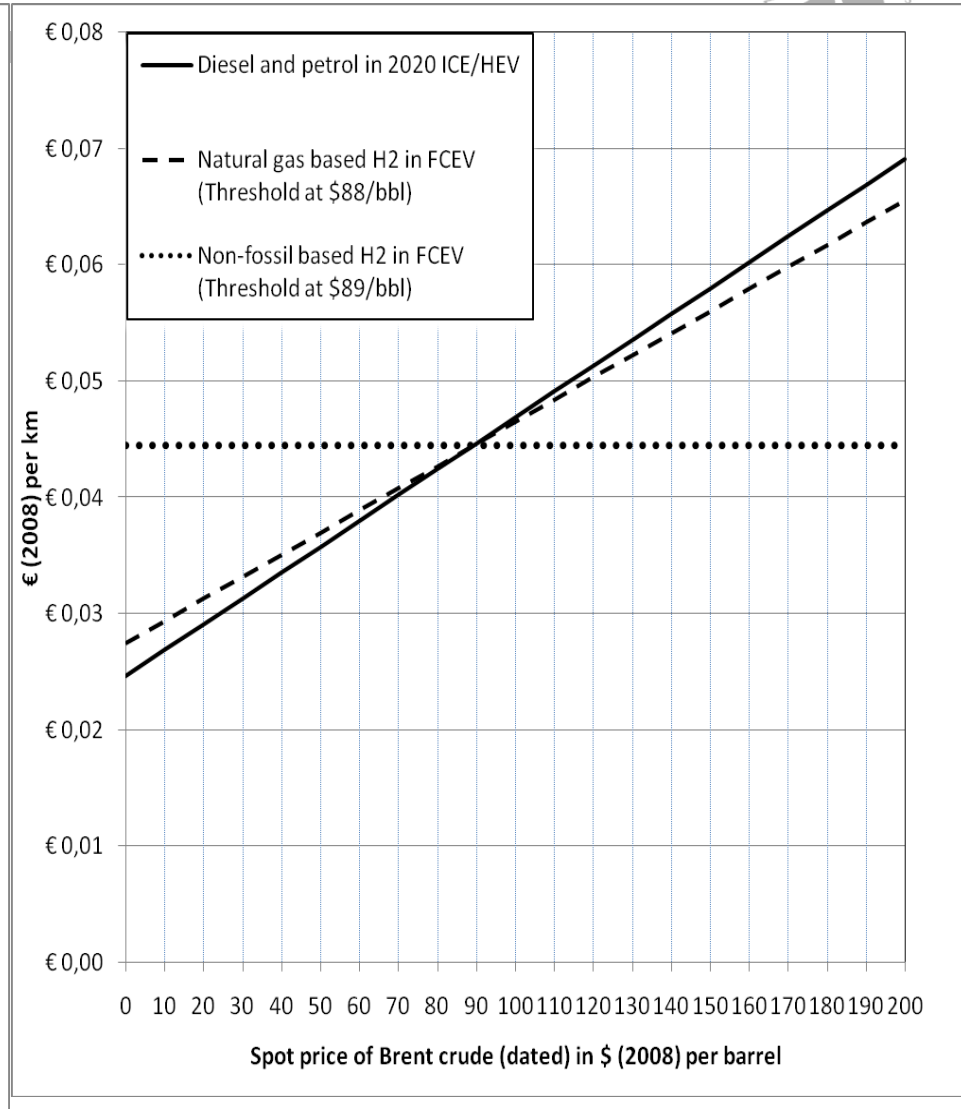
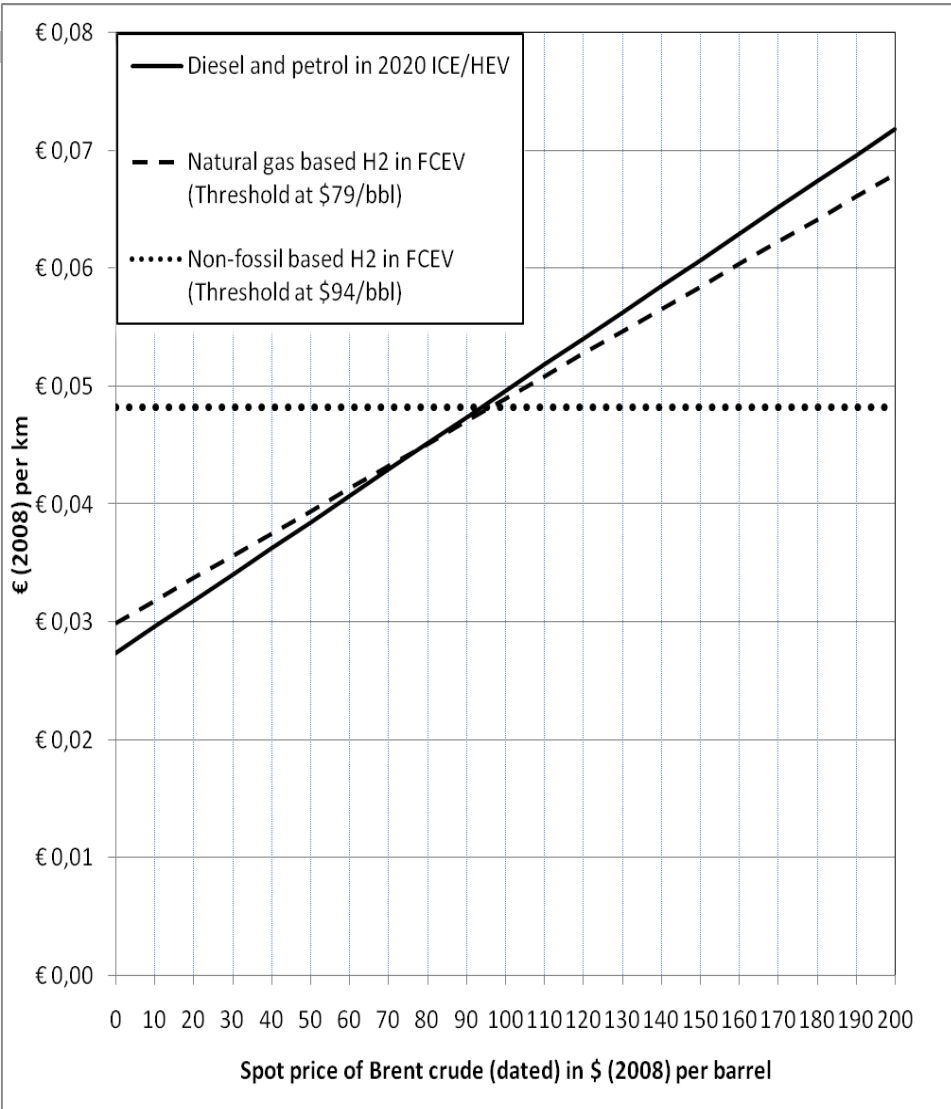


The critical level of oil prices

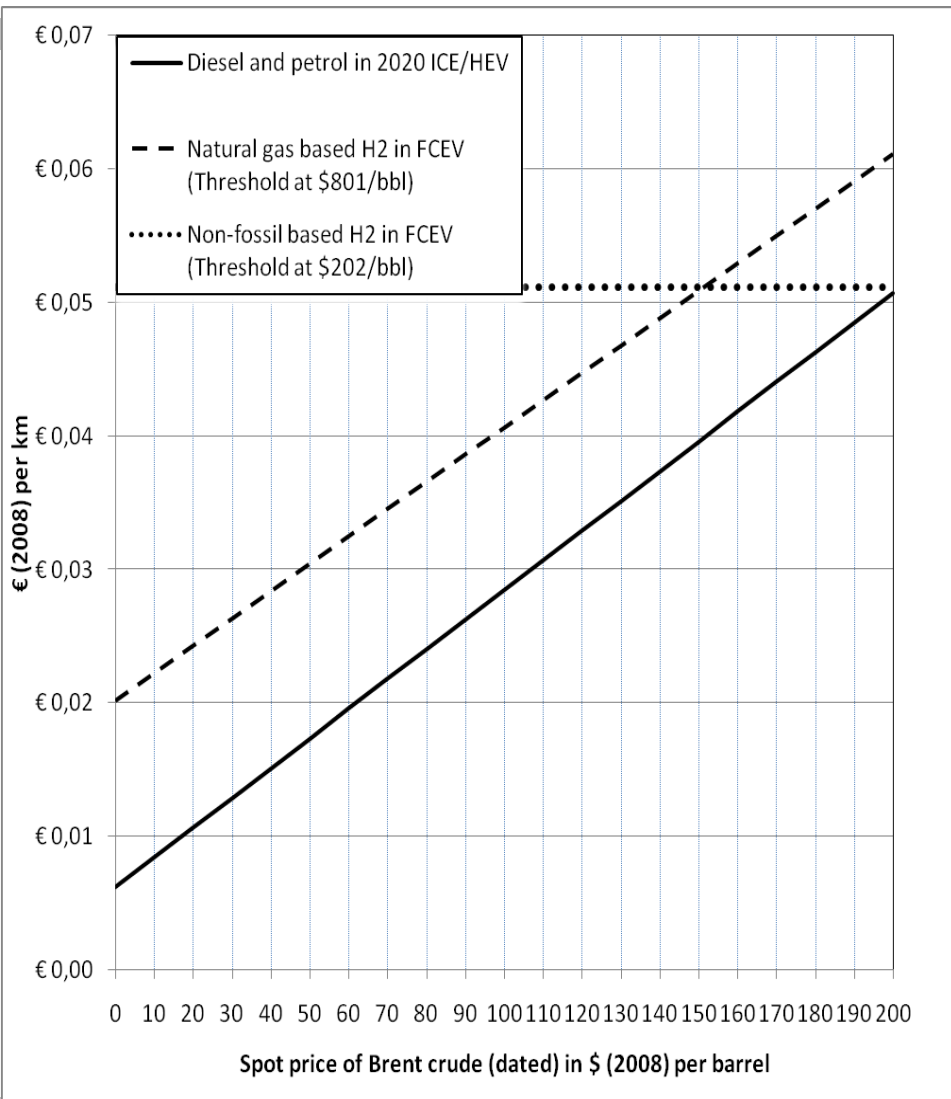


- # Critical oil price level
 - Shift in cost effectiveness ranking
- # That level is now anticipated for the 20s
- # Critical level is shifted downwards by fuel taxes – even without tax favour
- # Critical level will be reached in Europe before in the US (if negligible fuel taxation persists)

Uniform fuel tax of €15/GJ vs. €10/GJ + CO₂ charge on process and end-use.



No fuel taxes vs. fuel tax of €10/GJ. Worst case: Low efficiency, high infrastructure cost.



Source: Hansen (2009): "Will Hydrogen be Competitive in Europe without Tax Favours? "

Adjusting fuel tax design to hydrogen



- # Best approach to minimum taxes is to add CO₂ taxes on transformation loss like emission allowances in refineries
- # For H₂ production, taxation or similar on transformation loss is necessary for overall cost *and* eco efficiency
- # €10/GJ + CO₂-tax along the fuel chain (including transformation) provides same incentive as €15/GJ, but at a smaller tax rate

Are tax favours necessary?



- There is a critical level where renewable (and nuclear) electricity becomes competitive as primary energy basis for transport
- Model: at oil prices not far above \$100/bbl
- This is the price levels expected after 2015 (and already observed in 2008)
- The critical level can be lowered by uniform fuel taxes, i.e. without tax favours
- I.e., taxing energy use and CO₂ evenly across fuels
- Still, fuel taxation should be adapted to reflect the high transformation loss of new fuels

Thank you for your attention!



Anders Chr. Hansen

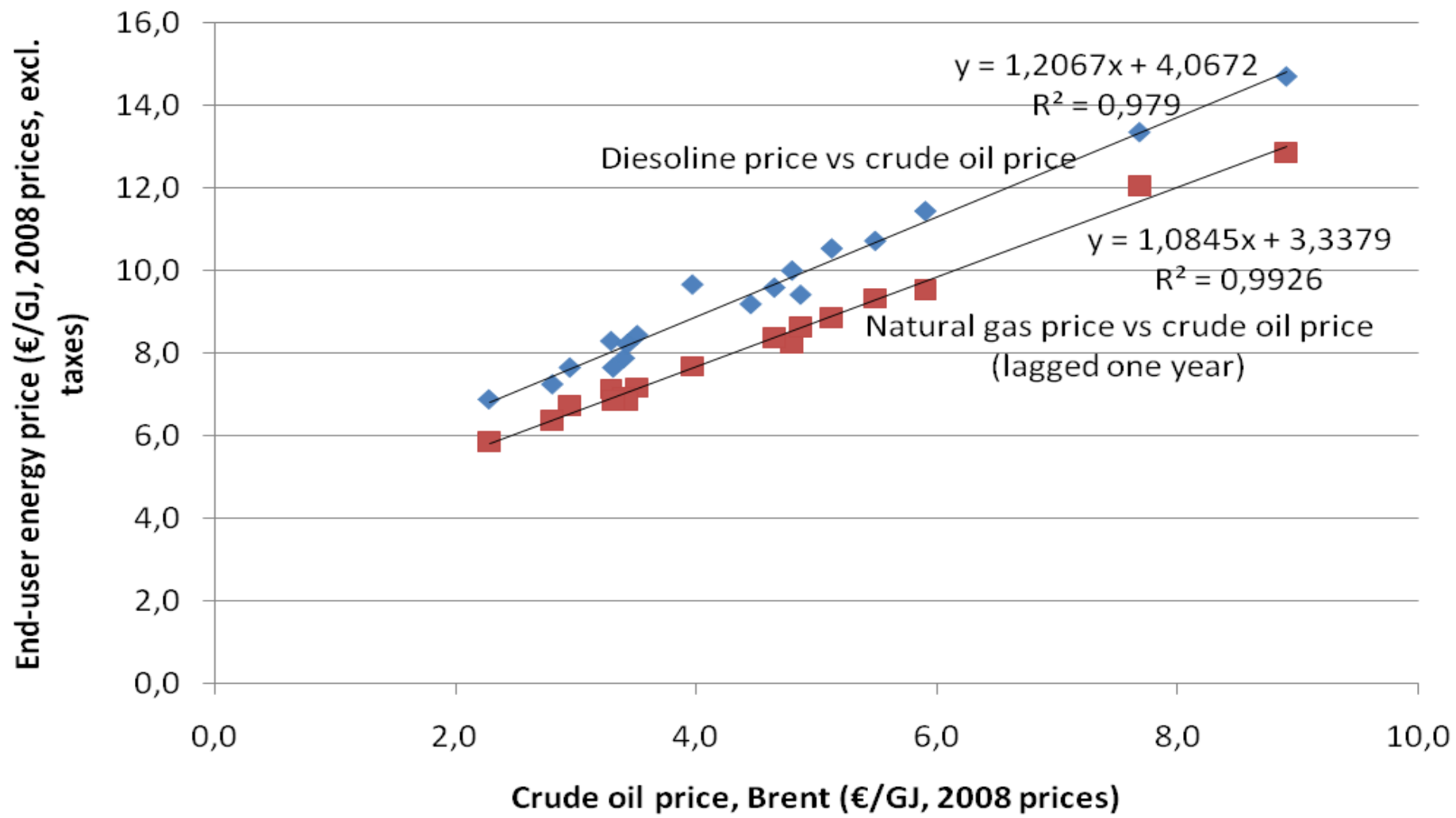
- Roskilde University, Denmark
- Department of Environmental, Social and Spatial Change (ENSPAC)
- E-mail: anders@ruc.dk

Why a Transition away from Conventional Transport Technology?



- # Increasing competition about
 - dwindling oil reserves
 - concentrated in a few countries
- # Climate change and local air pollution
 - Increasing share of CO₂ emissions
 - Exhaust standards eliminate only some of the pollution, still health and death effects

Natural Gas Based Hydrogen No Escape from High Oil Prices



Source: Eurostat and own calculations

Why Electric Vehicle Technology?



- # EV advantages over conventional vehicles
 - Energy efficiency
 - Zero emissions

- # Electricity and hydrogen advantages as fuels
 - Indigenous sources
 - At affordable costs

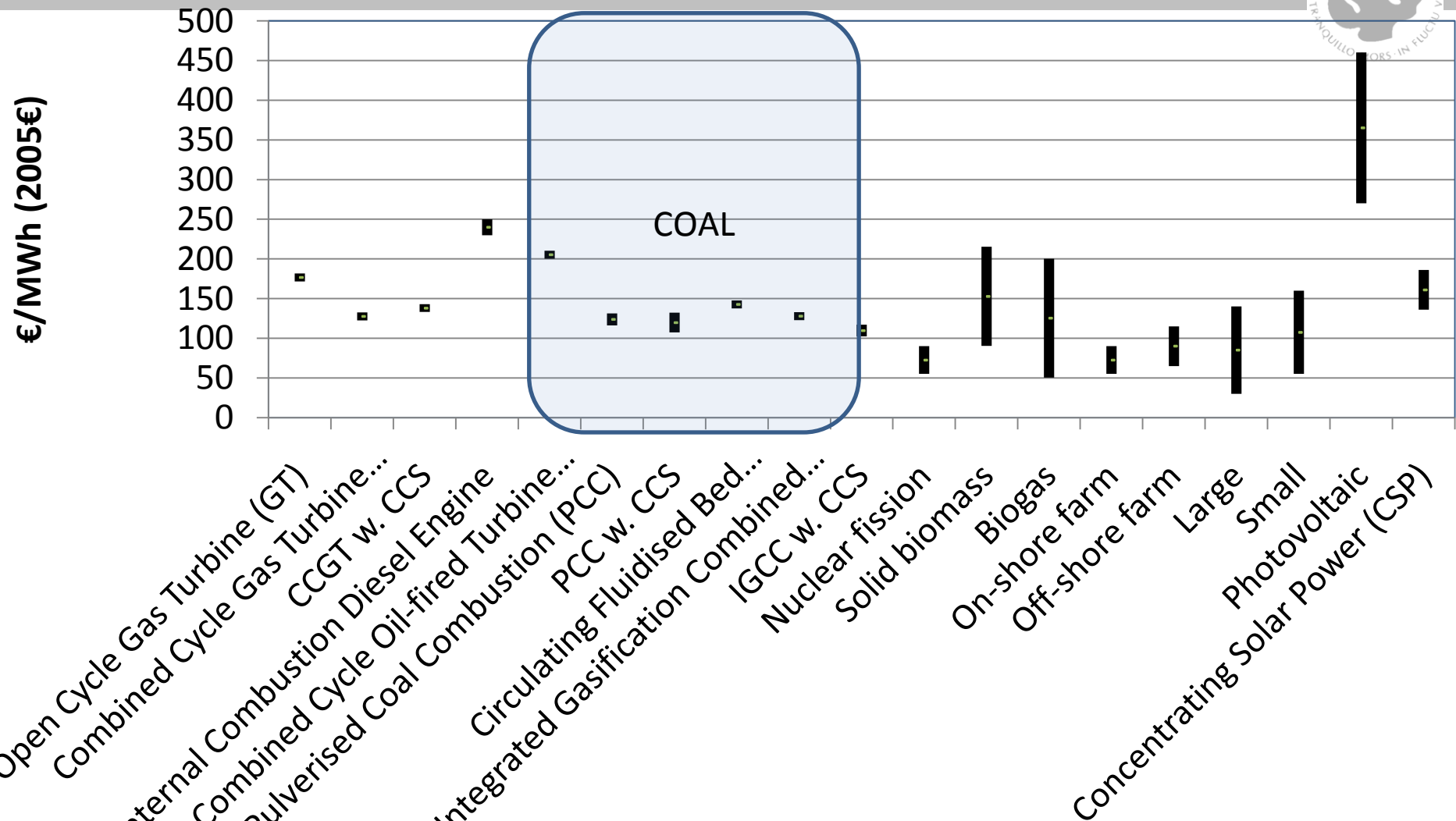
Greenhouse gas effect of transport sector transition?



- # Electricity primarily made from coal
- # Hydrogen primarily made from natural gas
- # Risk of delaying power sector transition?
- # EU energy and climate policy targets for power sector transition:
 - CO2-cap + RE-target
- # Still, research in balance between transitions

Power Cost in Europe 2020

(Oil \$₂₀₀₅/bbl=100) (€₂₀₀₅/tCO₂ =41)



Excess and off-peak power in Europe



- # Higher wind penetration
 - => more excess power
- # Higher nuclear power share
 - => more off-peak power
- # Both:
 - low value – or negative value!
 - Potentially high value transport energy
- # Technology problem: Electrolyzer cost

European Minimum Taxes

