Future of road transport?

Stef Proost

KULeuven (B)

Issues in EU white paper for transport (March 2011)

- Key goals by 2050 include:
  - No more conventionally fuelled cars in cities (and 50% less in 2030)
  - 40 % use of sustainable low carbon fuels in aviation
  - 50% shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport (30% shift by 2030)
  - Triple length of HSR network by 2030
  - Near zero road casualties (and 50% less by 2020)
  - Move towards full application of user pays and polluter pays principles…

Future is

- Electric cars in cities ?
- Mostly rail for passengers ?
- Mostly rail + waterways for freight ?

Outline

- Diagnosis of problems
- What long term trends?
- How to assess Climate Change policies?
- Survey & Assessment of solutions
  - Modal choice
  - What vehicle technologies make sense?
- Land use issues

Diagnosis of road transport problems

	Source	Nature of costs	Orders of magnitude of costs[a] (cents/mile, 2005 prices)	Public abatement and supply-type policies	Policies affecting demand and vehicle characteristics
Congestion	Volume of use approaches or exceeds design capacity per unit of time	Mainly time and schedule delay costs	4.2–35.7	Network capacity	Congestion charges, fuel taxes, access restrictions, land-use regulation, quantity controls
Climate change	Greenhouse gas emissions from fossil fuel use	Wide-ranging and uncertain adverse impacts from climate change	0.3–3.7		Fuel efficiency standards, CO_2 or fuel taxes, cap and trade
Traffic safety	High traffic density and heterogeneity in vehicle weight and speed, increase average accident risk	Mainly health and loss of life; material damage	1.1–10.5	Adaptation of road infrastructure, emergency services, mandatory insurance	Traffic rules and procedures, risk-dependent insurance premiums
Air pollution	Fuel combustion and exhaust	Mainly health, loss of life, and environmental degradation	1.1–14.8		Standards (vehicle equipment, fuel quality), access charges
Noise	Engines and movement	Health, discomfort	0.1–9.5	Sound barriers, silent road surfacing, curfews	Standards, curfews, tradable permits

What long term trends?

	2050	Share OECD
Road use cars	x 2.5	From 50% now to 20% in 2050
Road use trucks	x 5	From 50% now to 20% in 2050
air	x 5	
GHG emissions transport	x 2 or x 3	From 60% now to 35% in 2050

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- Diagnosis of problems
- What long term trends?
- **How to assess Climate Change policies?**
  - **The Economist’s way**
  - **Stock externality and uncertainty**
  - **International problem**
- Survey & Assessment of solutions

The Economist's way

$$\text{MINIMIZE}\quad TC\left(m\_tr\right)+TC\left(mtr\right)+TotalDamage(m\_tr+mtr)$$

m_tr = non transport measure saving 1 ton of $CO2$

mtr = transport measure saving 1 ton of $CO2$

TC= total cost (including resourcess,comfort, time)

TD= total damage

$$\frac{\delta TC\left(m\_tr\right)}{\delta m\_tr}=-\frac{\delta TD\left(m\_tr\right)}{\delta m\_tr}\quad(1)$$

$$\frac{\delta TC\left(mtr\right)}{\delta mtr}=-\frac{\delta TD\left(mtr\right)}{\delta mtr}\quad(2)$$

cost efficiency= distribute efforts over non transport and transport so as to equal Marg costs

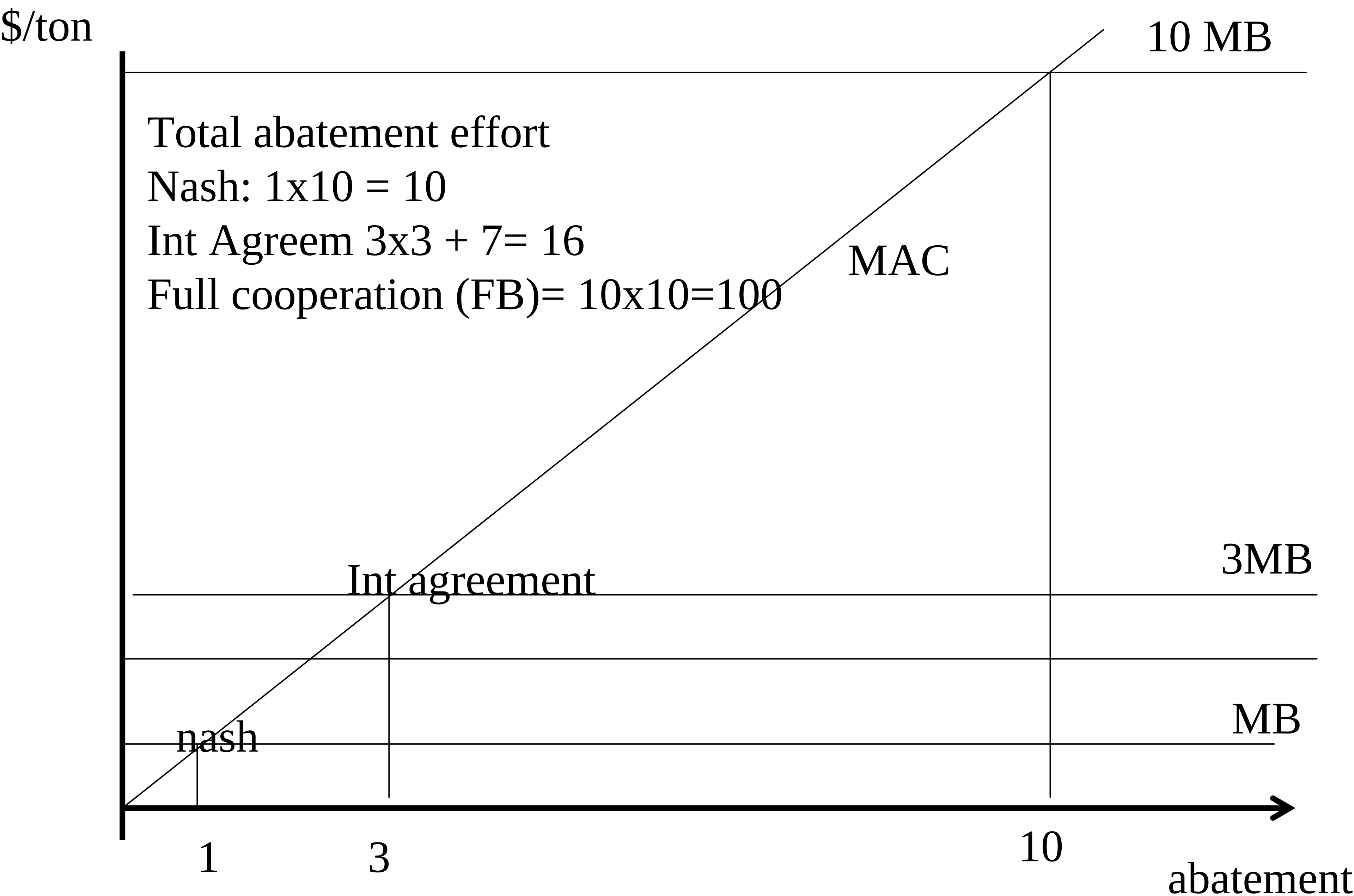
how much to abate: until Marg Cost = Marg Damage

Climate = stock problem+uncertain

- Stock:
  - it is not important to reach a specific target every year
  - one can wait, learn and adapt policies
- Uncertain
  - If Catastrophic: one needs to limit total stock (expected utility breaks down)
  - If not catastrophic: Marginal Damage is best policy guide – acts as maximal cost for a measure

International problem 1

- Every country enjoys the benefits of emission reduction efforts of the others (“common pool” or public good problem)
- International agreements are not enforceable by external party, so they have to be “self-enforcing”: it is in the interest of every country to be member even if the non members can enjoy the same benefits
- Theoretical result: for constant MB,linear MC and N identical countries, the number of signatories of an Int Climate Agreement is 3 whatever N>3…


$/ton
10 MB
Total abatement effort
Nash: 1x10 = 10
Int Agreem 3x3 + 7= 16
Full cooperation (FB)= 10x10=100
MAC
3MB
Int agreement
MB
nash
1
3
10
abatement

International problem 2

- International energy markets: reducing CO2 emissions unilaterally means decreasing total energy demand for fossil fuels
- This will lower prices on world markets of oil, gas and coal and increase consumption by non signatories
- “Leakage”

Transport and Climate policy in EU

- Dominant policy issue: climate change
- 3 major mistakes in policy making:
  - Transport has to do its fair share (not efficient as MCmtr>MCm_tr)
  - EU reduces to 20%, the others will do it too and anyway it does not harm us or it costs us nothing…(naïve)
  - Important to achieve the -30, -50 and -80% targets - no better to count on Marg Damage, as reaching the target can be very costly

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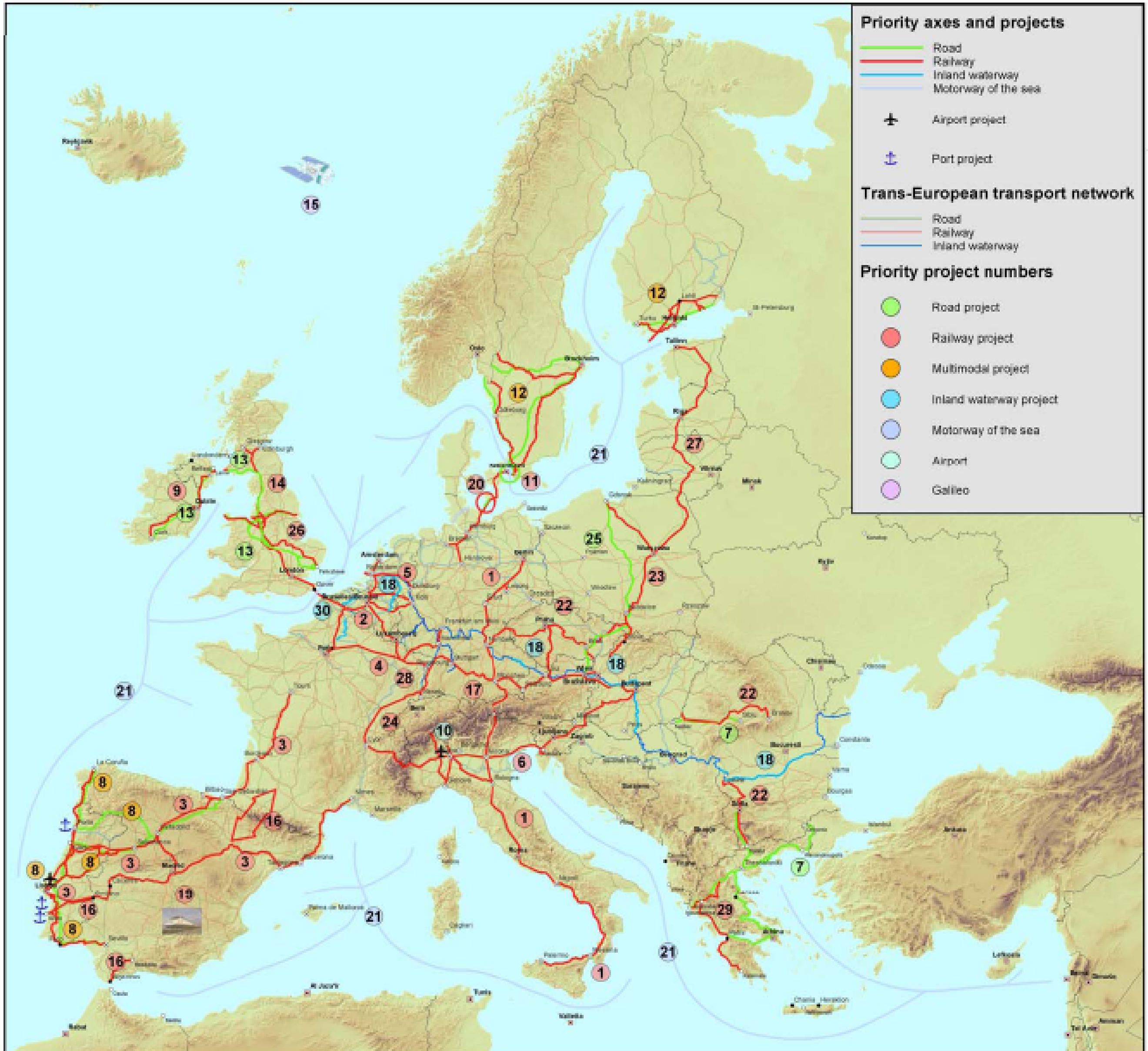
  - **Modal choice policies**
  - Vehicle technology policies
  - Land use policies

Modal shift policies in urban areas (more bus,rail,more bike, walk..)

- Differences between Europe and US:
  - share of car trips in Amsterdam is 30%, in Houston it is 95%
  - In US, most transit systems do not pass Cost Benefit test
- In Europe
  - Heavily subsidized (second best policy- in Leuven there is 15% cost coverage of operation costs – free bus use by students makes that Leuven became bus city rather than biking city)
  - Bias in favour of light rail (usually much more expensive than bus)
  - But bus can only be as efficient as light rail if it gets reserved bus lane, but this is inefficient use of capacity, better is to make car use more expensive via road pricing
  - Road pricing will allow to increase speed, to lower cost of public transport (saving driver costs, bus rather than light rail) and to increase fares for public transport

Modal shift policies in non-urban areas (more rail,waterways..)

- Differences between Europe and US:
  - High Speed rail for passengers in EU, no HSR in US
  - More rail freight in US than in Europe
- In Europe
  - 30 TEN-T priority projects (600 billion €), including Brenner tunnel, Bridge to Sicily, many HSR projects etc.
  - We assessed most of these projects



Trans-European transport network (TEN-T)
Priority axes and projects

1. Railway axis Berlin-Verona/Milano-Bologna-Napoli-Messina-Palermo
2. High-speed railway axis Paris-Bruxelles/Brussel-Köln-Amsterdam-London
3. High-speed railway axis of south-west Europe
4. High-speed railway axis east
5. Betuwe line
6. Railway axis Lyon-Trieste-Divača/Koper-Divača-Ljubljana-Budapest-Ukrainian border
7. Motorway axis Igoumenitsa/Patra-Athina-Sofia-Budapest
8. Multimodal axis Portugal/Spain-rest of Europe
9. Railway axis Cork-Dublin-Belfast-Stranraer (completed 2001)
10. Malpensa (completed 2001)
11. Öresund fixed link (completed 2000)
12. Nordic triangle railway/road axis
13. UK/Ireland/Benelux road axis
14. West coast main line
15. Galileo
16. Freight railway axis Sines/Algeciras-Madrid-Paris
17. Railway axis Paris-Strasbourg-Stuttgart-Wien-Bratislava
18. Rhine/Meuse-Main-Danube inland waterway axis
19. High-speed rail interoperability on the Iberian peninsula
20. Fehmarn Belt railway axis
21. Motorways of the sea
   - Motorway of the Baltic Sea (linking the Baltic Sea Member States with Member States in Central and Western Europe, including the route through the North Sea/Baltic Sea Canal (Kiel Canal);
   - Motorway of the sea of western Europe (leading from Portugal and Spain via the Atlantic Arc to the North Sea and the Irish Sea);
   - Motorway of the sea of south-east Europe (connecting the Adriatic Sea to the Ionian Sea and the Eastern Mediterranean to include Cyprus);
   - Motorway of the sea of south-west Europe (western Mediterranean), connecting Spain, France, Italy and including Malta, and linking with the motorway of the sea of south east Europe.
22. Railway axis Athina-Sofia-Budapest-Wien-Praha-Nürnberg/Dresden
23. Railway axis Gdansk-Warszawa-Brno/Bratislava-Wien
24. Railway axis Lyon/Genova-Basel-Duisburg-Rotterdam/Antwerpen
25. Motorway axis Gdansk-Brno/Bratislava-Wien
26. Railway/road axis Ireland/United Kingdom/continental Europe
27. "Rail Baltica" axis Warszawa-Kaunas-Riga-Tallinn-Helsinki
28. "Eurocaprail" on the Bruxelles/Brussel-Luxembourg-Strasbourg railway axis
29. Railway axis of the Ionian/Adriatic intermodal corridor
30. Inland waterway axis Seine-Scheldt

Important cities

- Capital
- > 500,000 inhabitants
- 100,001 - 500,000 inhabitants
- 50,001 - 100,000 inhabitants
- < 50,000 inhabitants

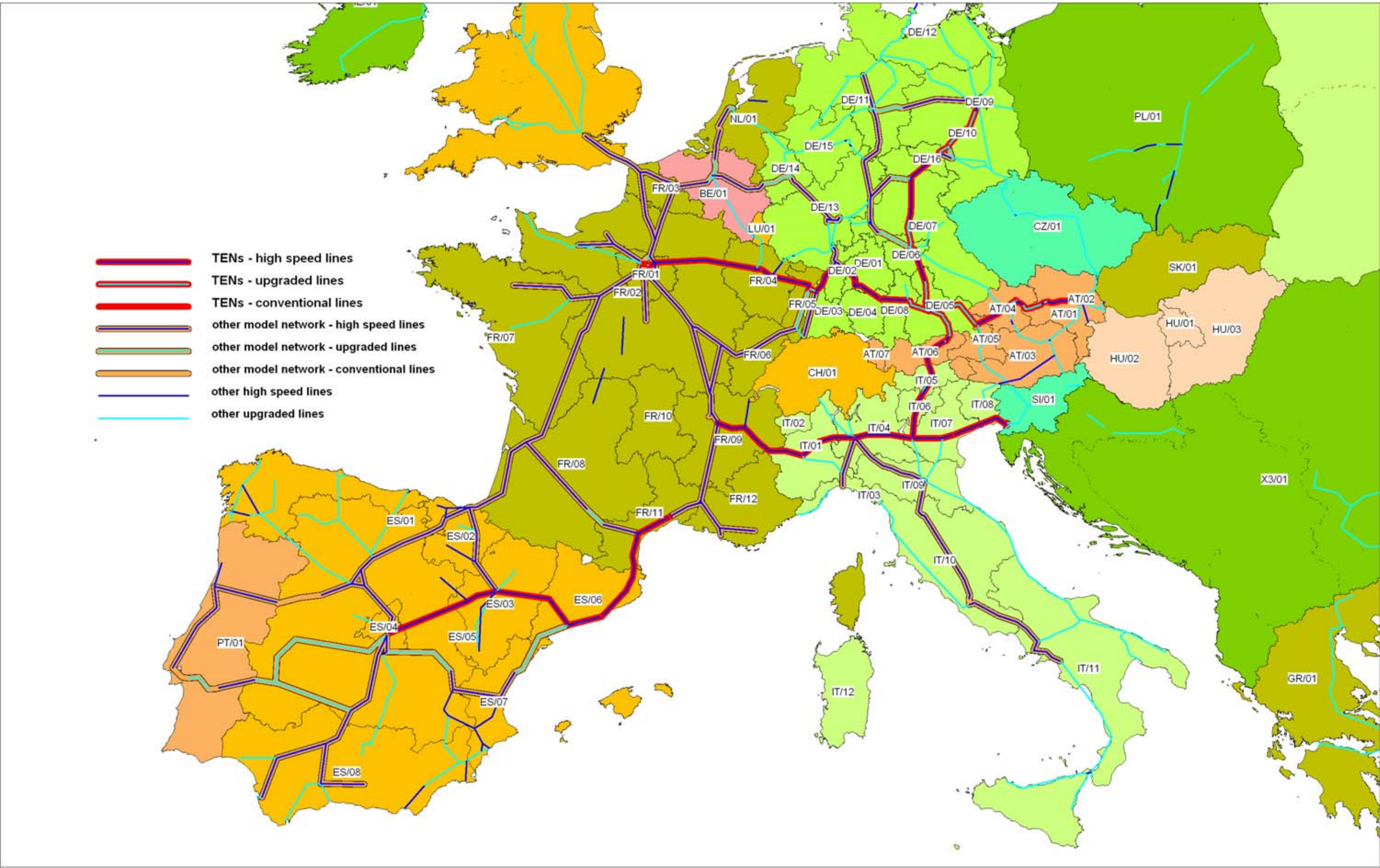
Model 1 :Continent wide Regional GE model (Bröcker)

- « New Economic Geography » Model:
  - EU divided into 260 regions that all produce a separate variant – trade (freight) = consumption of variants by different regions
  - Freight investment: lower trade costs and therefore new consumption opportunities and welfare gain
- Only 10 of the 22 projects studied pass the CBA efficiency test
- 9 out of the 22 projects have less than 10% of their benefits outside their own country
  - So « Transeuropean » character of these projects is very low
- The selected projects do not systematically favour the poorer member countries

Model 2: High Speed Rail and air competition model (Adler)

- EU divided in 71 zones
- Players:
  - 1 EU rail operator (best case to avoid double marginalization)
  - 3 hub and spoke airlines
  - 2 low cost airlines
- Business and leisure travellers
- 6 Compete in prices and frequencies
- Compare equilibria with/without extra HSR lines and with low/high accession charge for use of infra by train operator

High-Speed Rail Network (68 arcs)



Assessing the TEN-T priority projects

- Using 4 different models (New Economic Geography model, network model air-rail, freight corridor model, MOLINO II)
- Difficult to find a reasonable Cost Benefit Analysis in Fr or ENG (4? out of 22)
- Half of the projects have no net economic return
- The proportion of « transit » in many priority projects is small
- The priority projects do not systematically benefit the poorer regions
- Transport pricing matters (rail, road, ..)

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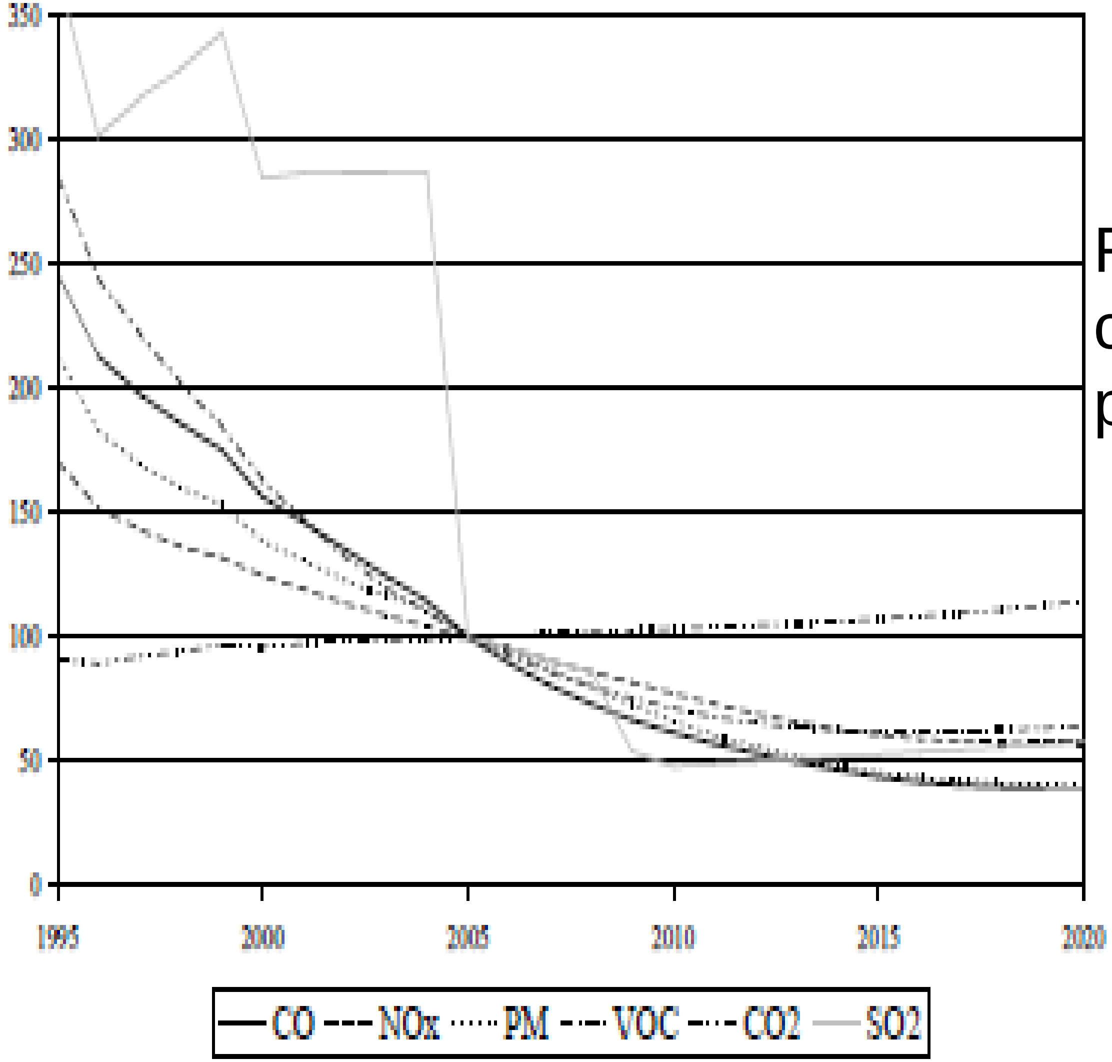
  - **Vehicle technology policies (cars)**
    - **Conventional pollutants (ozone, PM10, …)**
    - **Fuel efficiency of vehicles**
    - **New vehicle technologies and new fuels**
  - Land use policies

Vehicle technology policies 1 (cars)

- Has been very successful for reduction of conventional pollution (NOx, VOC, PM10, ..) using catalytic converter and better fuels
- Emissions per carkilometer have been reduced by factor 10 or more
- One mistake: taxation policies still favor diesel cars in many countries
  - Diesel cars have 60 to 70% market share in B and FR
  - Are more polluting and pay less taxes per carkm because diesel is cheaper and they need less liter/km
  - These days they receive extra subsidies because they emit less CO2 per km

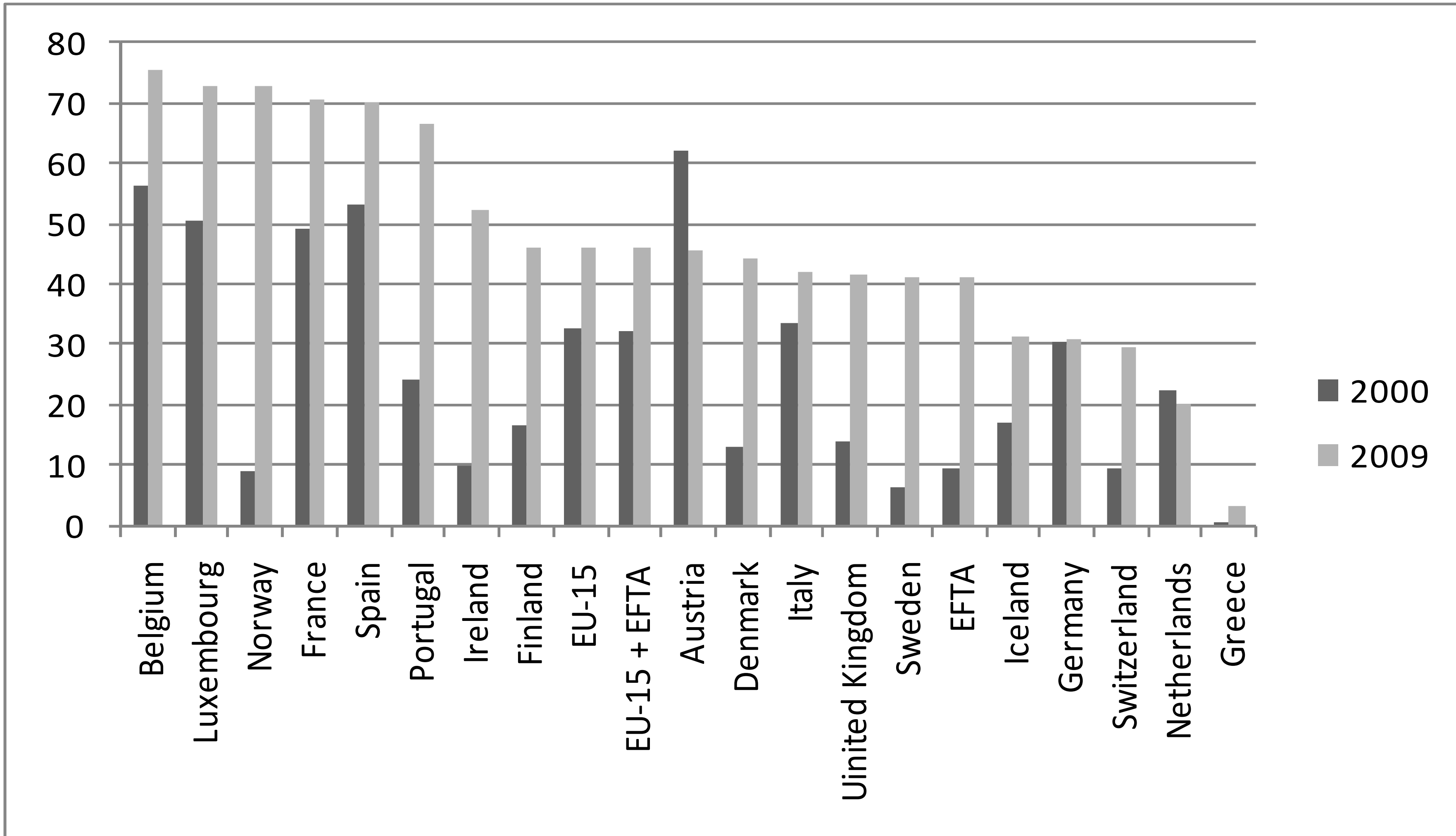


Regulation of conventional pollutants is a success

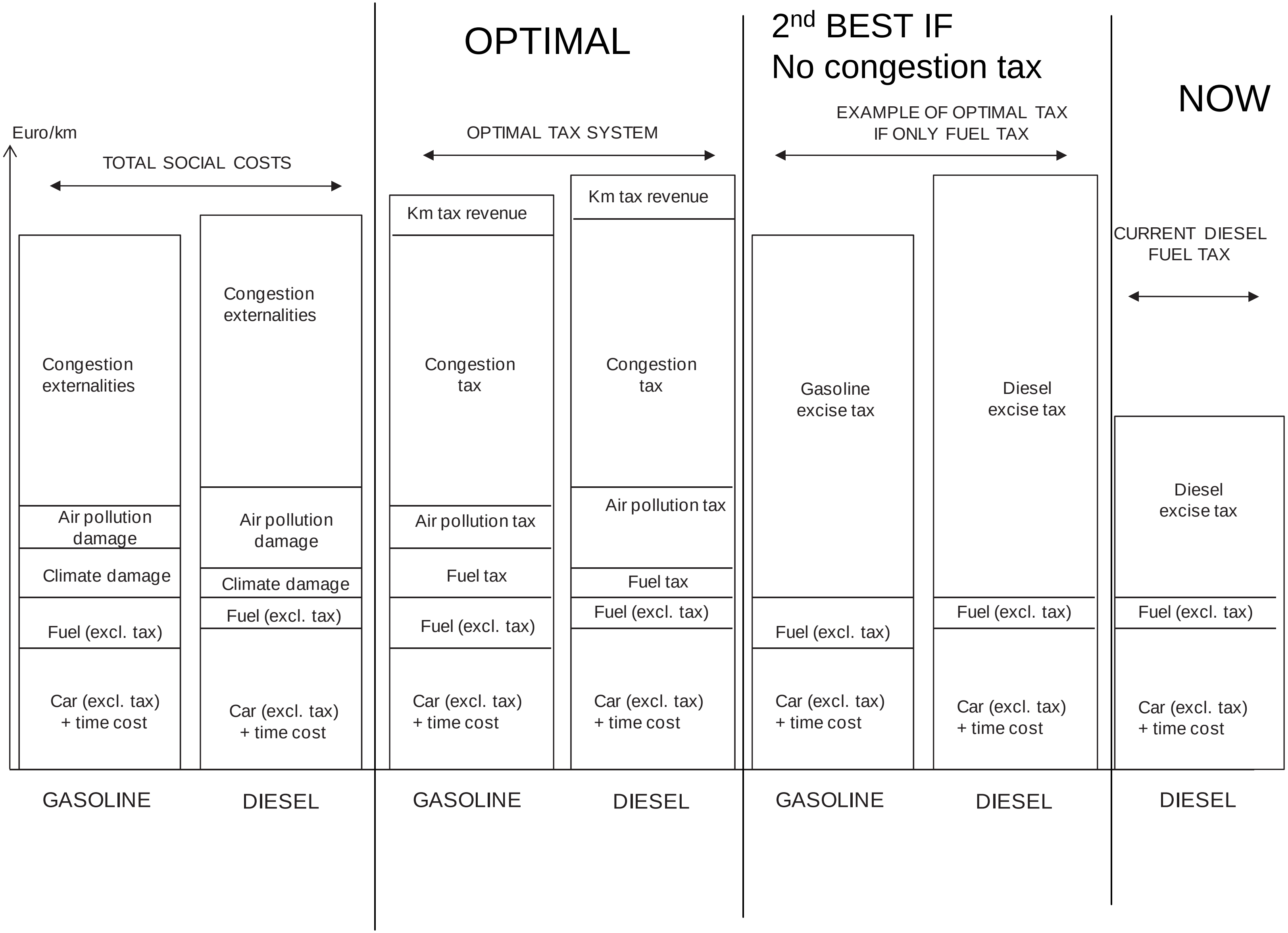
Figure 3.10. Baseline evolution of overall transport emissions (index: 2005 level = 100)

Source: Phd Jasper Knockaert with TREMOVE, 2010

Share of diesel in new passenger car registrations (%)(2000 and 2009)



What is wrong with current car taxes?



Vehicle technology policies 2 (cars)

- Many countries use fuel efficiency standards to decrease fuel consumption per car km
- EU + Japan are the leaders
- Cost efficiency can be questioned because current fuel gasoline and diesel taxes are de facto already a very high carbon tax (200 €/ton of CO2 compared to value of carbon permits in EU of 10 to 20 €/ton of CO2)
- Adding a standard that bites can only increase the marginal cost of achieving the standard above 200 €/ton
  - Other disadvantage: rebound effect = more fuel efficient car has lower variable cost and is used more so increasing congestion etc.
- More fuel efficient cars receive often additional subsidies as one tries to achieve the average fuel efficiency objective by favouring the more fuel efficient cars

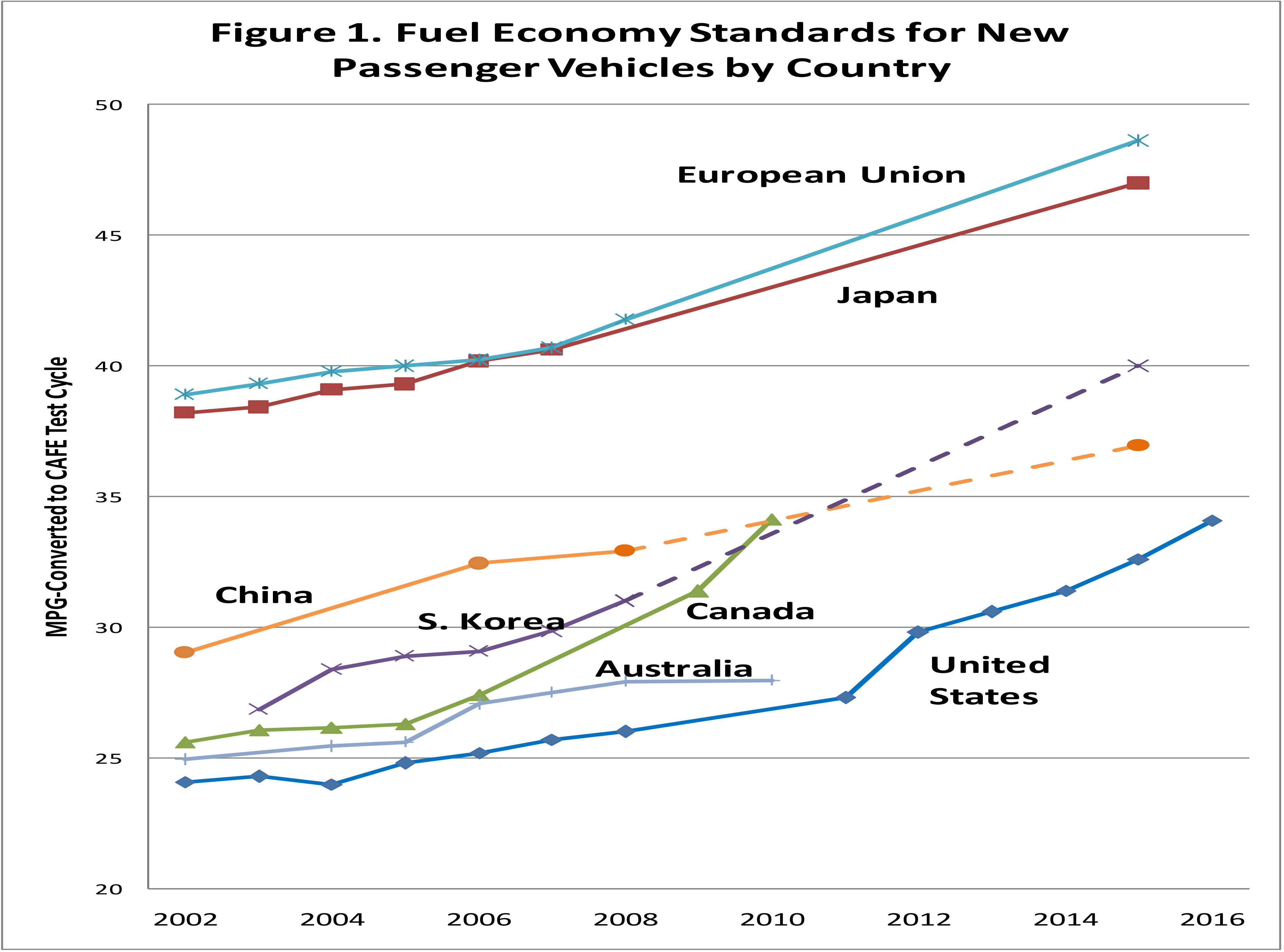


Figure 1. Fuel Economy Standards for New Passenger Vehicles by Country
MPG-Converted to CAFE Test Cycle
50
45
40
35
30
25
20
2002
2004
2006
2008
2010
2012
2014
2016
European Union
Japan
China
S. Korea
Canada
Australia
United States

Example of tax and subsidy favours (B)

	units	VW Golf (77 kW) Diesel	VW Golf (77 kW) Fuel efficient diesel	BMW 320 (120 kW) Diesel	BMW 320 (120 kW) Fuel efficient diesel
Difference w.r.t. gasoline version					
Resource costs (excl. taxes and subsidies)	euro/year	65	140	168	94
External air pollution costs	euro/year	24	9	19	14
External costs due to mileage	euro/year	0	0	0	0
Social costs of raising public funds[a]	euro/year	139	376	336	443
Net social cost	euro/year	228	526	523	551
CO_2 emissions	ton/year	0.225	0.525	0.575	0.975
Cost per ton of CO_2 savings	euro/ton	1012	1002	910	565

Vehicle technology policies 3 (cars) new fuels and new technologies

Table 2 Characteristics of new car technologies in OECD countries

Technology	GHG emissions index (well to wheel) per unit distance, OECD 2010 = 100	Major consumer disadvantages and costs	Other externalities
OECD 2010			
OECD	100		
Gasoline (United States)	115		
Gasoline (EU)	90		
Diesel (EU)	80		More conventional air pollutants
OECD 2020–2040			
Gasoline	80–45	Extra cost of 0–$2,000/vehicle	
Diesel	80–45	Extra cost of 0–$2,000/vehicle	More conventional air pollutants
Hybrid gasoline	60–34	Extra cost of $2,000–$4,000/vehicle	
Hybrid diesel	50–34	Extra cost of $2,000–$4,000/vehicle	More conventional air pollutants
Plug-in hybrid	30–19 Lower bound requires CCS or renewables	Extra cost of $7,500/vehicle	Less conventional emissions in urban areas
Electric car	45–14 Lower bound requires CCS or renewables	Smaller range, slower and more frequent refueling + extra cost of $10,000–$20,000/ vehicle and requires adaptation of electricity distribution	Less conventional emissions in urban areas
Compressed natural gas, hydrogen, biofuels	With current technologies not certain that there is a decrease in GHG emissions	Requires new distribution network extra vehicle adaptation costs and smaller trunk space	

Source: adapted from IEA (2009).

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