Workshop on methodologies for socio-economic evaluation of climate change related policies and measures (PAMs)

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The PLANET Model for Forecasting Transport Demand

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Outline of the Presentation

The PLANET model – general setup

The Reference Projection – Greenhouse Gas Emissions

Application – Excise Reform 2016-2018

Discussion

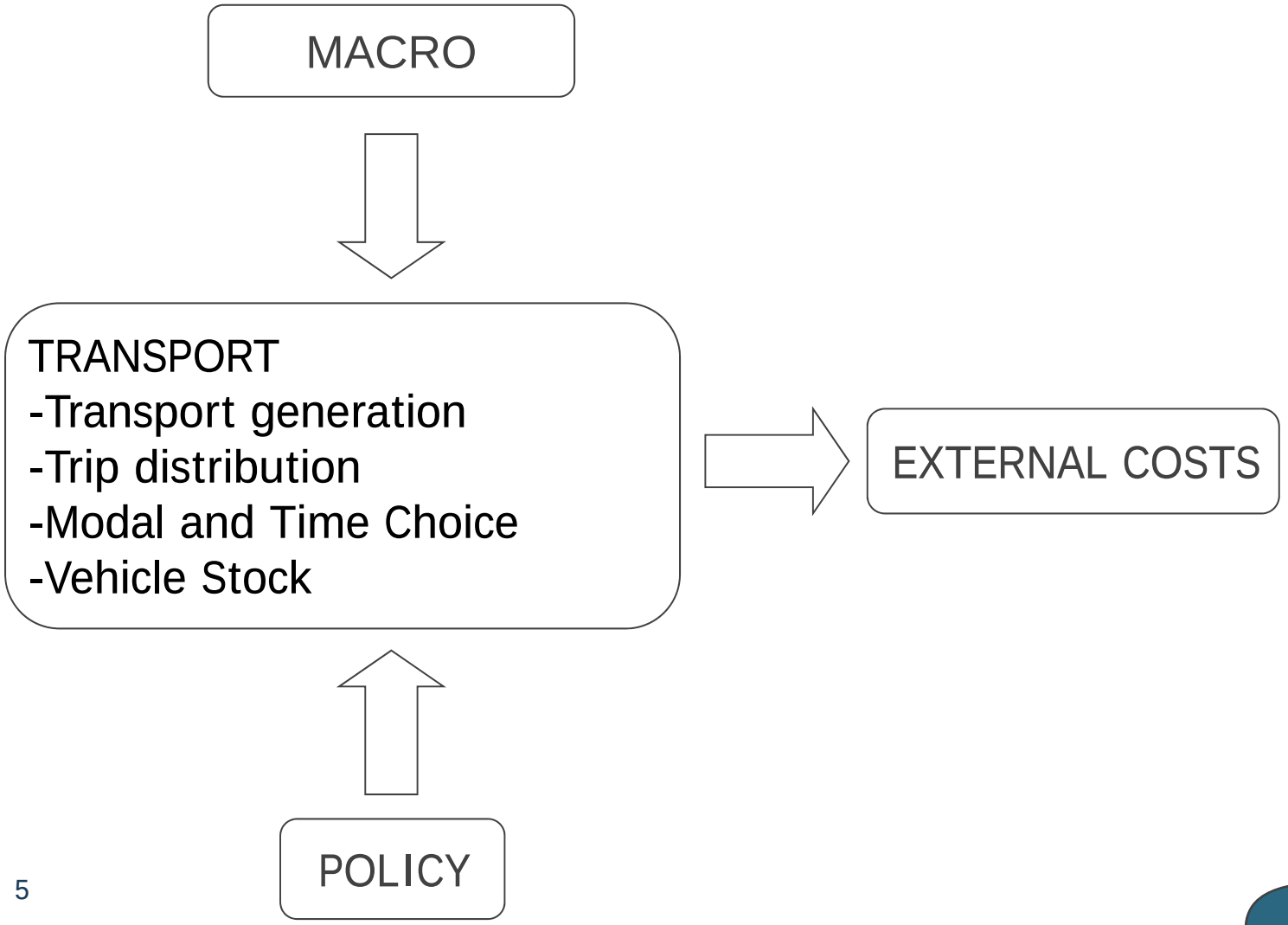
PART I

The PLANET Model: Setup

Model Setup: General Features

- Goal: long term projections of transport demand (horizon 2030) – freight and passengers by goods type and motive
- Top – down modelling: transport demand follows exogenously from demographics and macro-economics – no feedback mechanisms
- Endogenous choices: mode, location and time period according to generalized costs, car type according to monetary costs
- Congestion on the road network as a main driver, captured by an ad-hoc national speed-flow function
- Policy analyses: impacts on traffic levels, emissions, congestion + monetary evaluation and cost-benefit analysis

Model Setup: Schematic Overview



Model Setup: Focus on External Costs

- Transport generates a multitude of external cost: climate change, local air pollution, congestion, noise, accidents, …
- PLANET: focus on the first three
- Why important: evidence that policy focus on one cost generates unwanted outcomes
- Also: need to compare external costs with existing configuration of taxes
- E.g. Subsidy fuel efficient cars contributed to dieselization of car park
- E.g. Dutch scheme for electric and hybrid vehicles: substantial loss of tax revenue for few environmental gains

Model Setup: Environmental Costs

- Modes: Road, Rail, BTM, Internal Waterways
- Type of emissions
  - Direct emissions

    Produced during use of vehicle ('Tank-tot-Wheel')
  - Indirect emissions

    Emissions produced ('Well-to-Tank')
  - Non-exhaust emissions

    Emissions from vehicle wear-and-tear
- Pollutants
  - Greenhouse Gas Emissions (GHG): CO_2, CH_4, N_2O
  - Local Pollutants (NGHG): NMVOC, SO_2 ,NO_X and $PM_{2,5}$

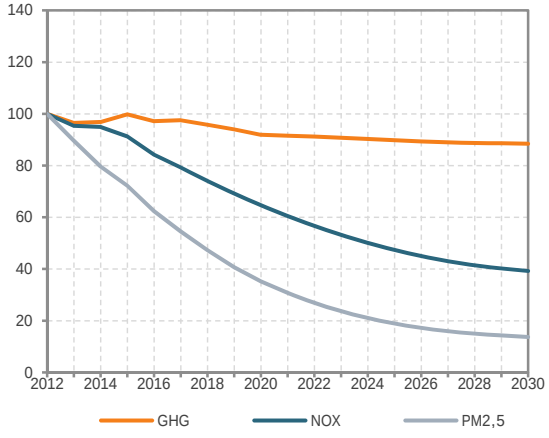
PART II

Reference scenario: results

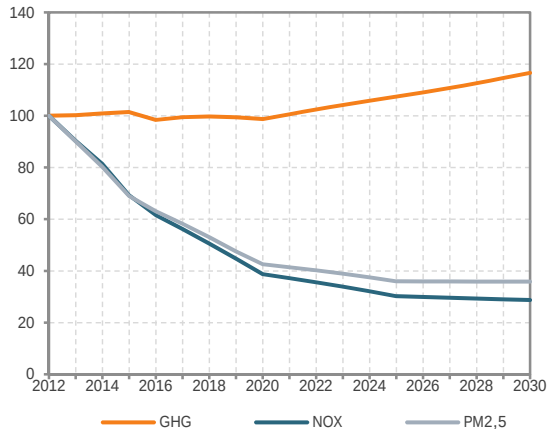
Reference scenario: impact on the environment

- Direct Emissions

Passengers (2012 = 100)



Freight(2012 = 100)



Passengers & freight	Change 2012-2030
GHG	+0,1%
NOx	-66%
PM2,5	-76%

Source: Transport Perspectives (FPB en FOD M&V, 2015)

→ Greenhouse gasses are stabilising

Energy-efficiency, introduction of new engine technologies versus transport demand

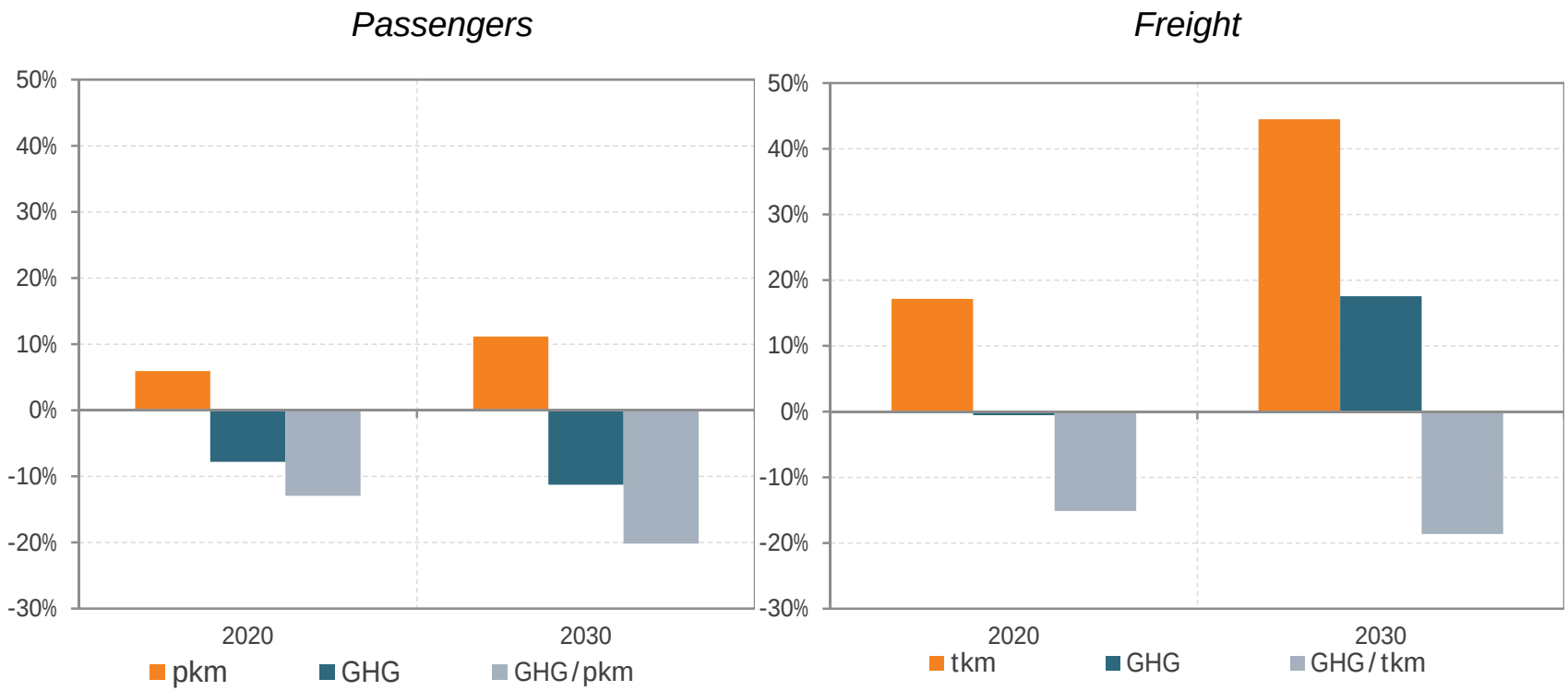
→ Less local pollutants

Euronorms, introduction of new engine technologies

Uncertainty on NOx emission factors

Reference scenario: decomposition of direct GHG emissions

% Change wrt. 2012



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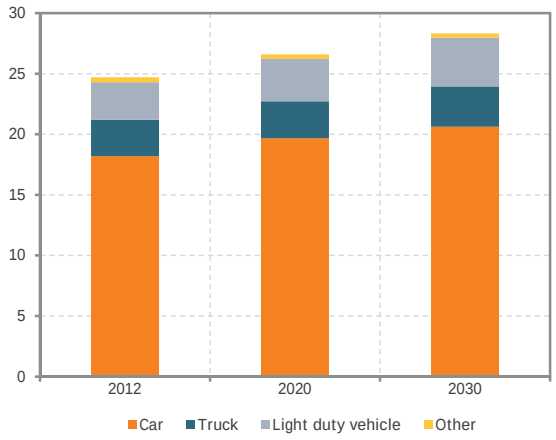
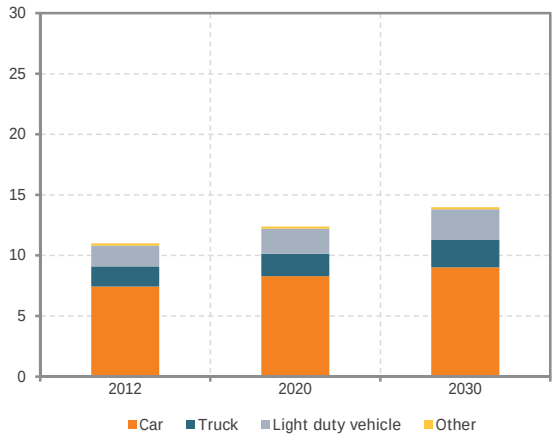
Reference scenario: impact on congestion

Million car-equivalent per hour

Peak period (+15%)



Off peak period (+27%)



- Average speed on the road

	Change 2012-2030
Peak	-24%
Off-Peak	-10%

Source: Transport Perspectives (FPB en FOD M&V, 2015)

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PART III

External Costs and Fuel Excise Reform

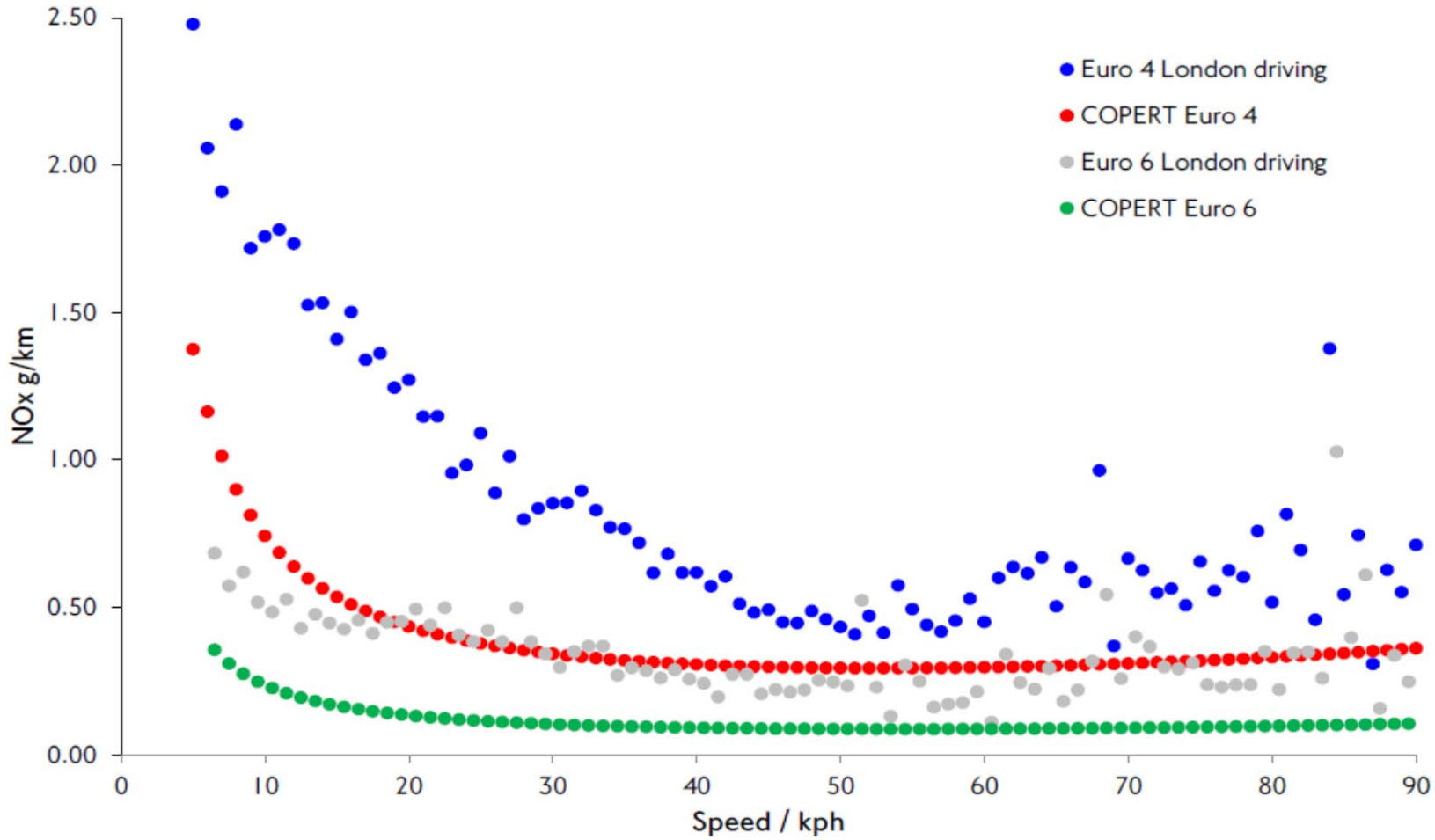
2016-2018 excise reform: context

- A fiscal system that was stacked in favour of diesel cars
  - Historically inherited excise rate differential
  - No more excise compensating fixed taxes
  - New CO_2 related incentives (e.g. tax credit fuel efficient cars, eco-malus/bonus Walloon Region, …)
- Incapability of tackling pollution of diesel cars by European regulation
  - Standardized tests (NEDC) fail to capture real driving emissions NOx → well known before Dieselgate
  - Even though real progress is made for $PM_{2.5}$
- Congestion is high and rising

Vehicle stock module

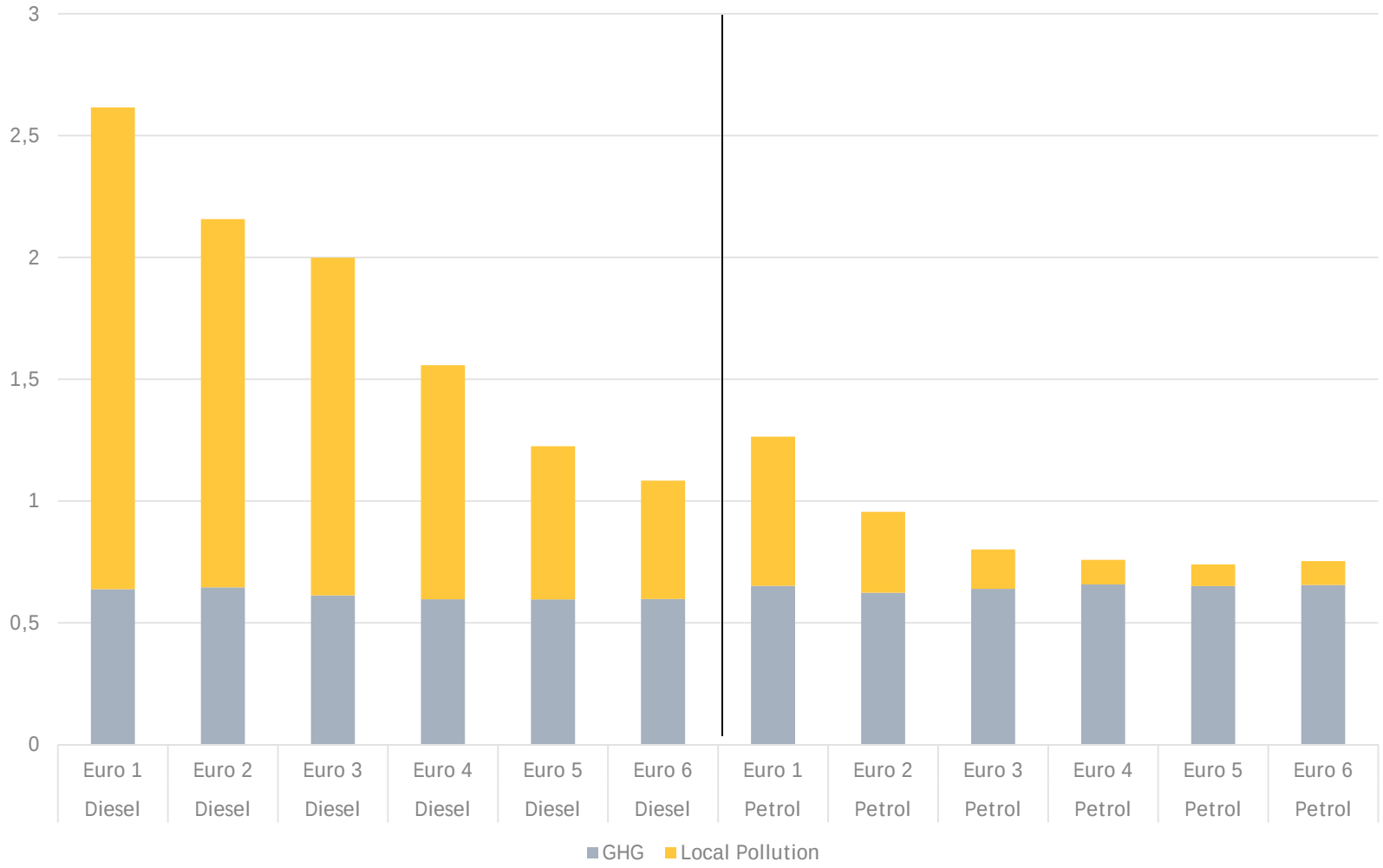
- Tracks the car fleet over time -> introduction of new standards
- Endogenous choice of size and fuel type
  - Three size classes
  - Two fuel types: petrol and diesel
  - Exogenous share of hybrids, CNG, electric vehicles
- Calibration of behavioral reactions
  - External study: Grigolon e.a. (2014)
  - Diesel excise + 20 cent -> drop market share by 4%
- Emission Factors
  - Copert V4.11 for all but NOx
  - NOx – Diesel: ICCT (2014)

London NOx emissions



External environmental cost by fuel type and euro-class

Eurocent/km – 2012



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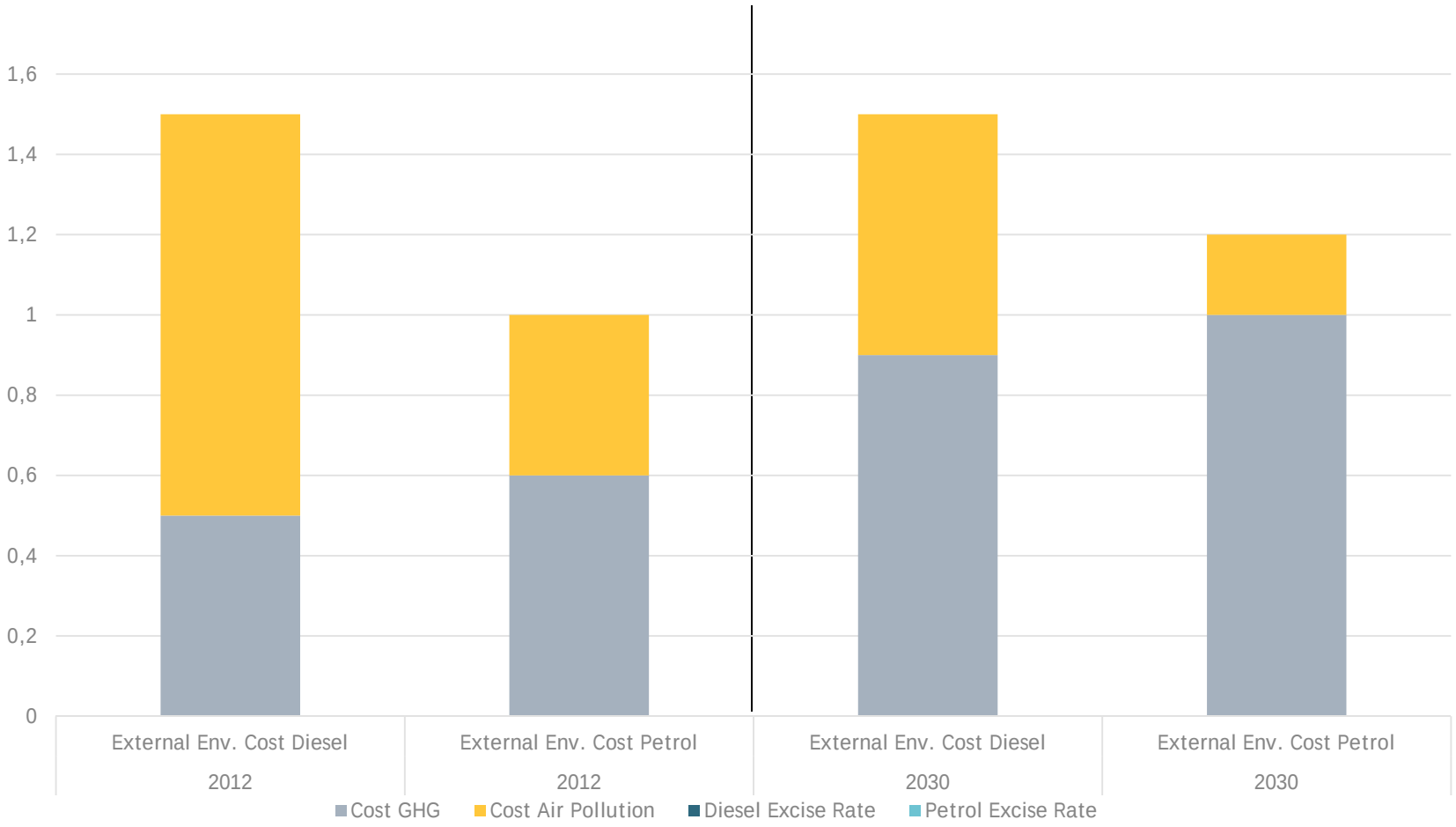
External costs environment per fuel type (medium sized car)

Eurocent/km, 2012 – 2030



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Excise rates and marginal external costs

- Comparison taxes and direct external costs road transport

	2012			2030		
	Excise Rate cent2012/km	External Environmental Costs cent2012/km	External Congestion Costs cent2012/km	Excise Rate cent2012/km	External Environmental Costs cent2012/km	External Congestion Costs cent2012/km
Peak						
Petrol ICE	4.6	1.0	63.6	4.4	1.2	139.8
Petrol Hybrid - CS	3.4	0.4	63.6	3.3	0.9	139.8
Diesel ICE	2.5	1.5	63.6	2.4	1.5	139.8
Diesel Hybrid - CS	2.1	0.9	63.6	1.8	1.3	139.8
Electric	0.0	0.0	63.6	0.0	0.0	139.8

- Marg. Environmental Costs < Excise << Marg. Congestion Costs
- Diesel will remain more polluting in the future than gasoline
- Congestion will become more acute

Two policy scenario's

	2015	2016	2017	2018-2030
Excise reform (actually implemented)				
Diesel excise (euro/l)	0.428	0.461	0.496	0.546
Petrol excise (euro/l)	0.614	0.591	0.568	0.546
Congestion charge (km charge at peak period)				
Diesel excise (euro/l)	0.428	0.428	0.428	0.428
Petrol excise (euro/l)	0.614	0.614	0.614	0.614
Congestion charge Cars (euro/vkm)	0.004	0.009	0.013	0.018
Congestion charge Trucks (euro/vkm)	0.007	0.013	0.018	0.027
Congestion charge LDV (euro/vkm)	0.012	0.018	0.027	0.036

Effects on car park, traffic, emissions,…

Horizon 2030

	Excise Reform	Congestion charge
Market share DIESEL	-3.1%	-0.8%
Vehicle kilometres car	-0.9%	-0.7%
Speed at peak	+0.9%	+3.4%
Direct emissions		
CO_2	-0.5%	-0.4%
NOx	-2.6%	-1.1%
$PM_{2.5}$	-0.6%	-0.5%

Welfare gains environment and congestion

Cent per euro of additional tax revenue (NPV)

	Excise reform	Congestion charge
GHG	1.5 cent	1.2 cent
Local pollution	2.7 cent	1.9 cent
Total environment	4.2 cent	3.1 cent
Time gains	32.1 cent	81.1 cent

Discussion

- Excise reform leads to reduced externalities in transport market
  - By tackling local air pollution
  - By abating congestion, somewhat (the ‘dumb’ kilometre charge)
- The time gains from a ‘smart’ differentiated kilometre charge are a multiple of those the excise reform
- Points towards an ‘optimal’ system: relatively less weight on excise rates (but relatively more on diesel cars), more on smart congestion charges
- Corollary: should we fiscally stimulate the purchase of fuel-efficient cars, hybrids, EV? Costly in terms of gov. revenue, does not tackle what’s really wrong in transport -> See De Borger en Proost (2015), De Borger, Ovaere and Proost (2015)

Discussion: CO2 – related tax schemes in Belgium

- Walloon Ecomalus (formerly: ecomalus/bonus)
- Imputed value company car (personal income tax)
- Employer's social security contribution company car
- Deduction car costs in corporate income tax

-> Are their beneficial effects worth the lost tax revenue?

E.g. The now abolished subsidy fuel efficient diesel car cost about 1000 per euro per tonne CO2, for a Volkswagen Golf – Mayeres & Proost, 2013

Discussion: in transport, most externalities are local

Thanks for your attention