

Technology Wedges in the mobility sector

Mobility	Buildings	Industry	Energy supply
M1: Efficient land use	B1: Thermal refurbishment	P1: Energy demand industrial buildings	E1: Wind power
M2: Public transport	B2: Passive House Standard	P2: Process-intensification	E2: Hydro plants
M3: Non-motorised transport	B3a: New heating systems	P3: Energy efficient engines	E3: Biomass CHP plants
M4: Alternative propulsion technologies	B3b: Solar heat	P4: Cogeneration of heat and power	E4: Effects due to reduced final demand
M5: Freight transport	B4: Photovoltaic energy	P5: Substitution of fossil energy sources	
M6: Lightweight vehicles	B5: Energy efficient appliances	P6: Biomass for process heat	
M7: Biofuels		P7: Solar heat	
M8: Relocation of fuel consumption			

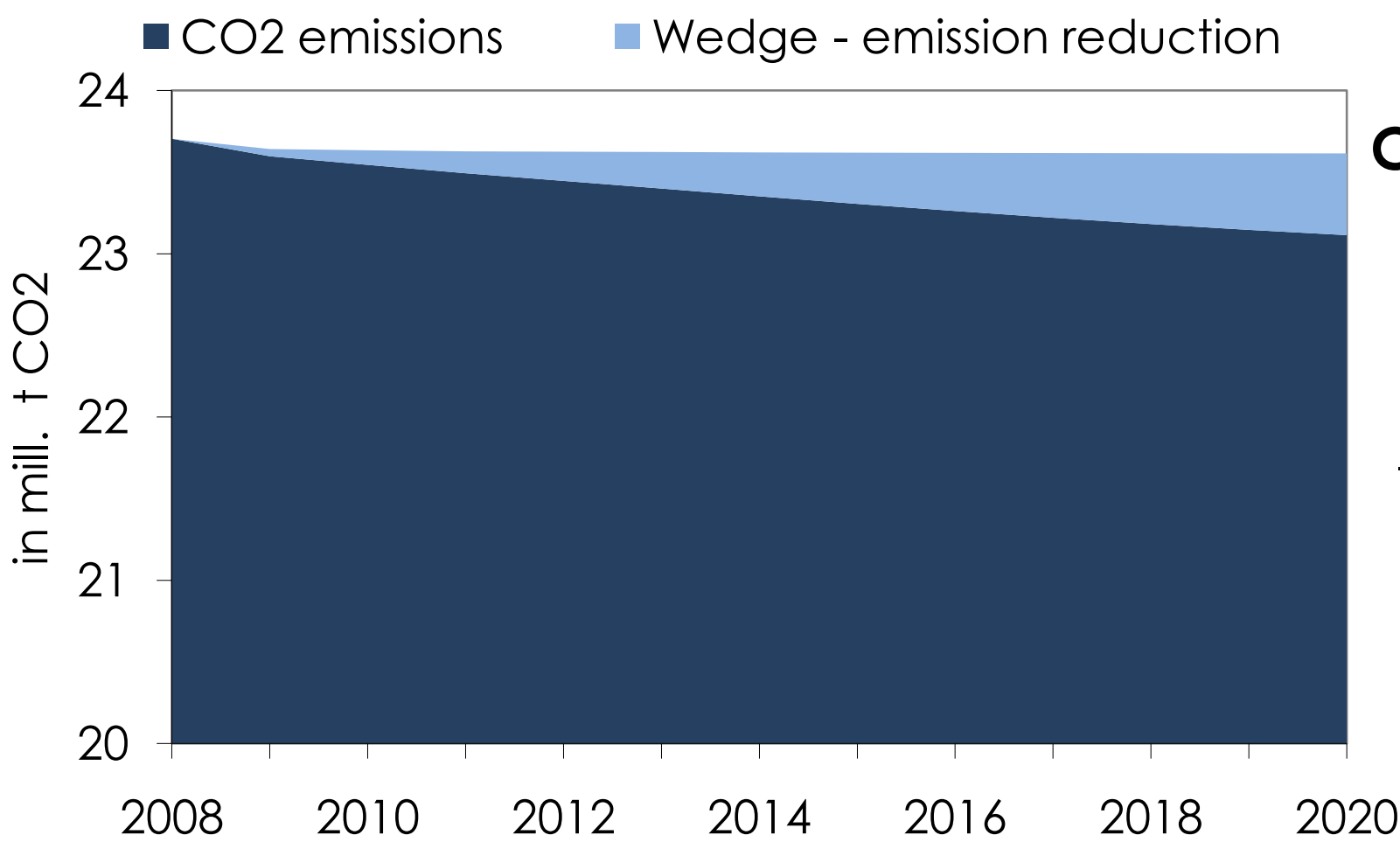
Example: lightweight vehicles

- Increase in weight plus 50-70% from 1975-2005
- Estimated weight reduction potential up to 35%

Technology Wedge Assumptions

- 5% energy efficiency increase (20% weight reduction)
- No change in transport performance (P-km)
- No additional investment
- Expenditure savings in 2020: 260 million € (fuel costs)

Emission effects 2020



CO₂ Emissions:
-0.5 Mt CO₂
Energy demand:
-7.1 PJ

User capital costs

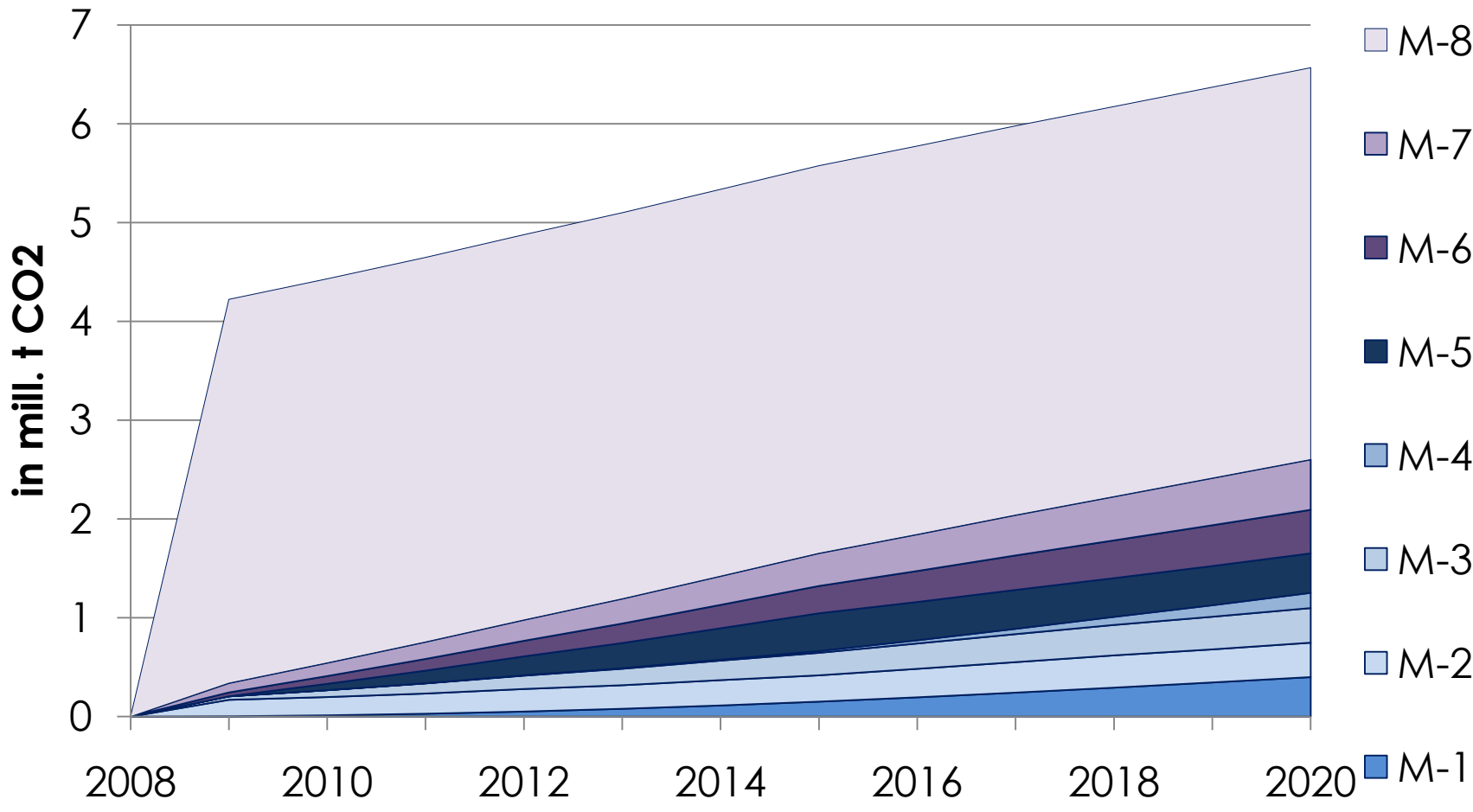
		leight-weight	
		2009	2020
Service Life	years	10.0	10.0
Interest rate	% p.a.	2.5	2.5
User cost of capital additional invest.	€ct/vkm p.a.	-	-
Operating phase			
Energy price (mix) standard	€ct/kWh	13.24	13.30
Energy price (mix) leight weight	€ct/kWh	13.24	13.30
Energy costs standard	€ct/vkm p.a.	8.48	6.94
Energy costs leight weight	€ct/vkm p.a.	8.06	6.59
Energy cost savings	€ct/vkm p.a.	0.42	0.35
Additional cost	€ct/vkm p.a.	-0.424	-0.347

- Energy cost savings: 261 mill. € (2020)
- Net savings through lightweight construction
- CO₂ reduction: 0,5 Mt

Emission effects in the mobility sector

		CO2 reduction in 2020 compared to reference path in Mt	
		Combined technology wedges	Individual tehcnology wedges
M-1	Efficient transport saving land use	-0.40	-0.40
M-2	Public transport	-0.35	-0.46
M-3	Non-motorised transport	-0.35	-0.42
M-4	Alternative propulsion technologies	-0.15	-0.15
M-5	Freight transport	-0.40	-0.40
M-6	Efficiency increase of conventional vehicles by mass reduction	-0.44	-0.50
M-7	Alternative fuels	-0.51	-0.60
M-8	Relocation of fuel consumption	-3.97	-3.97
Total		-6.56	

Emission reduction path from mobility wedges

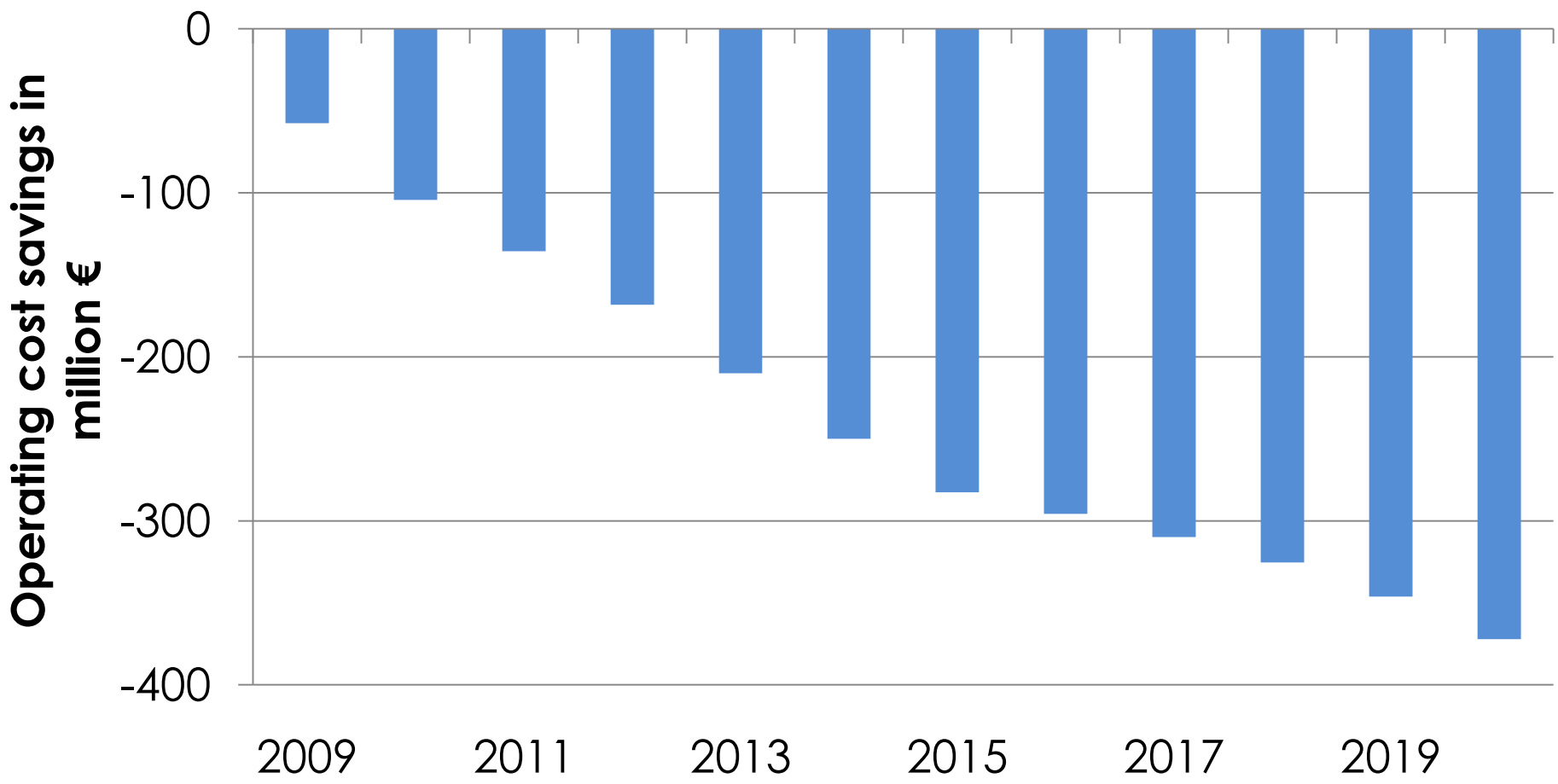


Economic effects of mobility technology wedges
Investment phase

- Additional investment for feasible technology wedge combination: 1.2 bn € p.a.
- Output effect of 1.7 bn € and
- Employment effect of 13,900 FTE

Operating phase

- Energy cost savings in 2020: 400 million €



Conclusions

- Reductions in transport performance top priority (behavioural change – spatial planning)
- Considerable emission reductions through shift towards non-motorised and public transport
- Lower emissions through deployment of more efficient conventional and new propulsion technologies (lightweight, e-mobility)