

# GHG-TransPoRD

## Project and findings on passenger car transport

### GHG-TransPoRD:

reducing greenhouse gas emissions of transport beyond 2020: Linking R&D, transport policies and reduction targets

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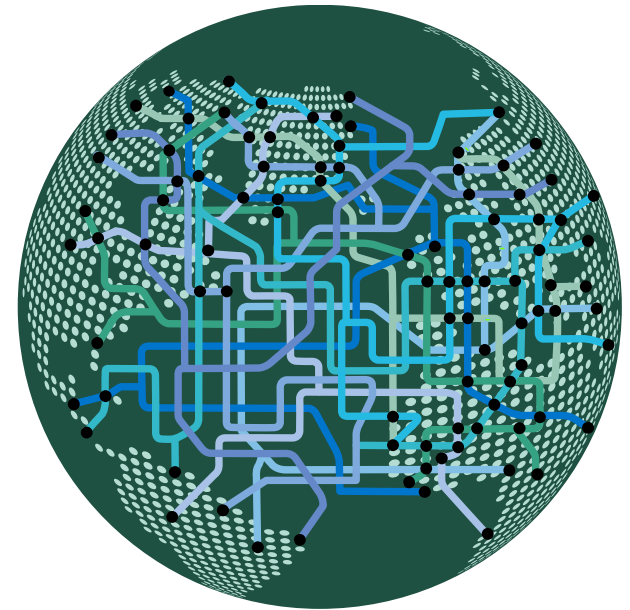
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Project website: [www.ghg-transpord.eu](http://www.ghg-transpord.eu)

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# Agenda

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- Project objectives
- Automotive R&D in EU27
- Long list of GHG reduction measures for cars
- Short list and GHG reduction potential until 2020 und 2050
- Conclusions



# Objective of GHG-TransPoRD

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- Suggestion of an integrated strategy for the EU that links R&D policy for transport with a transport policy strategy such that the European GHG reduction targets for 2020 and 2050 can be met also for transport.
- Expected results:
  - **Reduction targets for transport**
  - **R&D strategy**
  - **Transport policy strategy**
- Project framework
  - Project duration 24 months (Oct. 1<sup>st</sup> 2009 to Sept. 30<sup>th</sup> 2011)
  - Project website: [www.ghg-transpord.eu](http://www.ghg-transpord.eu)
  - Five project partners from five European countries



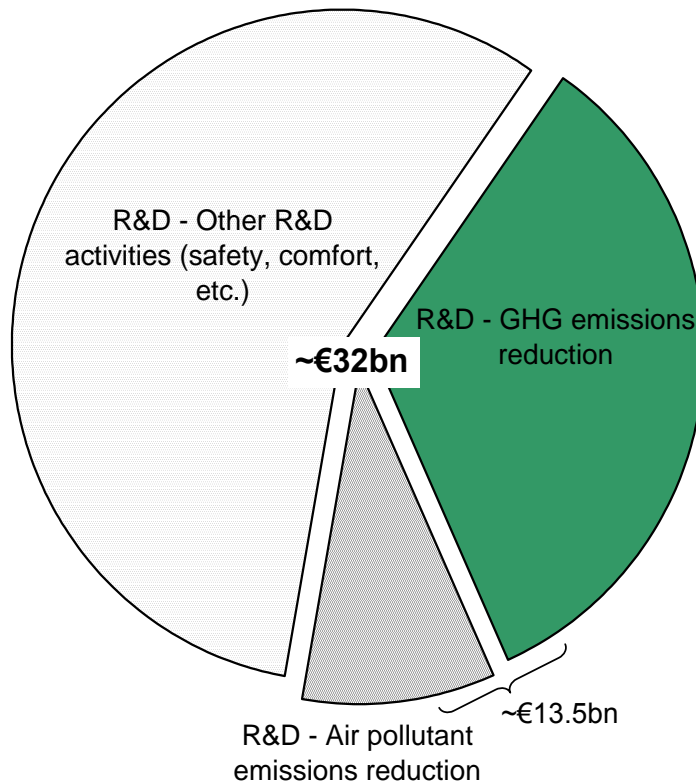
# R&D of European transport sector in the global context (2008)

	R&D investment (€bn)		Sales (€bn)		Number of employees (million)	
	World	EU27	World	EU27	World	EU27
Automotive manufacturers	53	20.9	1,213	423	2.76	1.26
Automotive suppliers	19.6	9.5	437	156	2.33	0.98
Commercial vehicles and trucks	6.9	2.4	233	66	0.62	0.22
Aerospace and defence	15.6	7.5	379	129	1.74	0.55
<b>'Transport' sector</b>	95.1	40.3	2,262	774	7.5	3
<b>All industries</b>	431	130	13,897	5,712	45.1	21

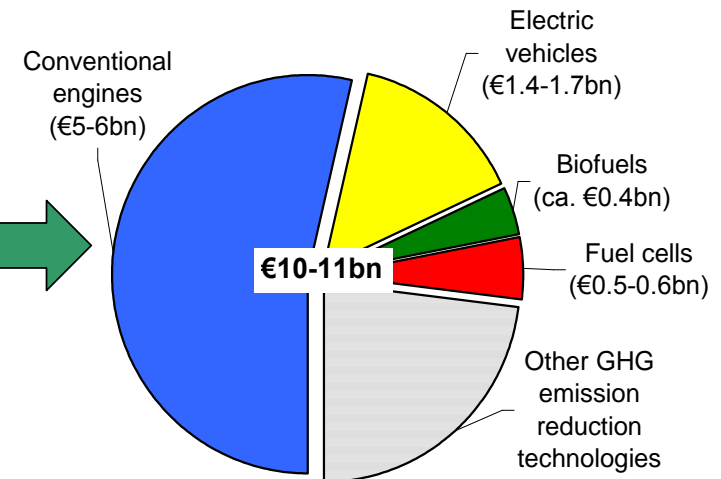
Source: GHG-TransPoRD D1, based on EU Scoreboard 2009 (DG RTD-IPTS, 2009) (rounded numbers)

# Distribution of European automotive R&D effort (2008/2009)

## Total R&D (32 bn€/year)



## R&D for GHG reductions (10-11 bn€/year)



Source: GHG-TransPoRD D1

# GHG reduction potentials of passenger cars



# GHG reduction potentials of cars (long list)

Nr.	Measures / Technologies	CO2 Reduction	
		Min	Max
1	Reduced mechanical friction components	0.4%	5.0%
2	Low viscosity lubricants	0.5%	4.0%
3	Low rolling resistance tires	2.0%	2.0%
4	Improved aerodynamics	1.5%	1.8%
5	Tire-pressure monitoring system	1.0%	1.0%
6	Substitution of fossil fuel by battery electric vehicles	7.8%	7.8%
7	Control mechanism for servo-steering	3.1%	5.0%
8	Electric power steering (EPS)	2.0%	3.0%
9	LED headlights		2.5%
10	Pneumatic brake booster	1.6%	2.5%
11	Intelligent fuel pumps	0.3%	0.3%
12	Solar panels on roofs	17.0%	29.0%
13	High efficiency alternators	0.5%	2.0%
14	Intelligent battery sensor	1.5%	1.5%
15	CNG	16.7%	16.7%
16	LPG		9.0%
17	Electrohydraulic valve gear		10.0%
18	Variable compression ratio	5.0%	10.0%
19	Cylinder deactivation	2.1%	8.0%
20	Variable valve actuation	3.0%	7.0%
21	Start-stop system	3.0%	4.0%
22	Variable valve timing	1.0%	3.0%
23	Fuel quality sensor	1.2%	1.2%

Nr.	Measures / Technologies	CO2 Reduction	
		Min	Max
24	Latent-heat storage	8.1%	8.1%
25	Intercooling	2.5%	2.5%
26	Dual cooling circuits	0.5%	2.0%
27	Exhaust heat recuperation	1.5%	1.5%
28	Cooling fluid shutdown system	1.0%	1.0%
29	Hybridtype: full	18.0%	22.0%
30	Hybridtype: mild	10.0%	11.0%
31	Brake energy recuperation	3.0%	3.0%
32	Hybridtype: plug-in		
33	Homogeneous Charge Compression Ignition	11.0%	25.0%
34	GDI with stratified charge (stoichiometric)	8.0%	14.0%
35	GDI with stratified charge (lean burn)	4.3%	6.4%
36	GDI with homogenous charge (stoichiometric)	0.7%	5.0%
37	Piezo injectors	3.0%	3.0%
38	Further penetration of gasoline direct injection		
39	Utilisation of lightweight design and materials	0.9%	20.0%
40	Weight reduction by minimising convenience features	4.9%	4.9%
41	Smaller capacity fuel tanks	2.0%	3.0%
42	Continuous variable transmission	2.1%	9.0%
43	6-speed manual/automatic gearbox	2.5%	5.0%
44	Dual clutch transmission	4.0%	5.0%
45	Piloted gearbox	4.0%	4.0%
46	Optimisation of gear boxes	1.0%	2.0%

Source: GHG-TransPoRD D2



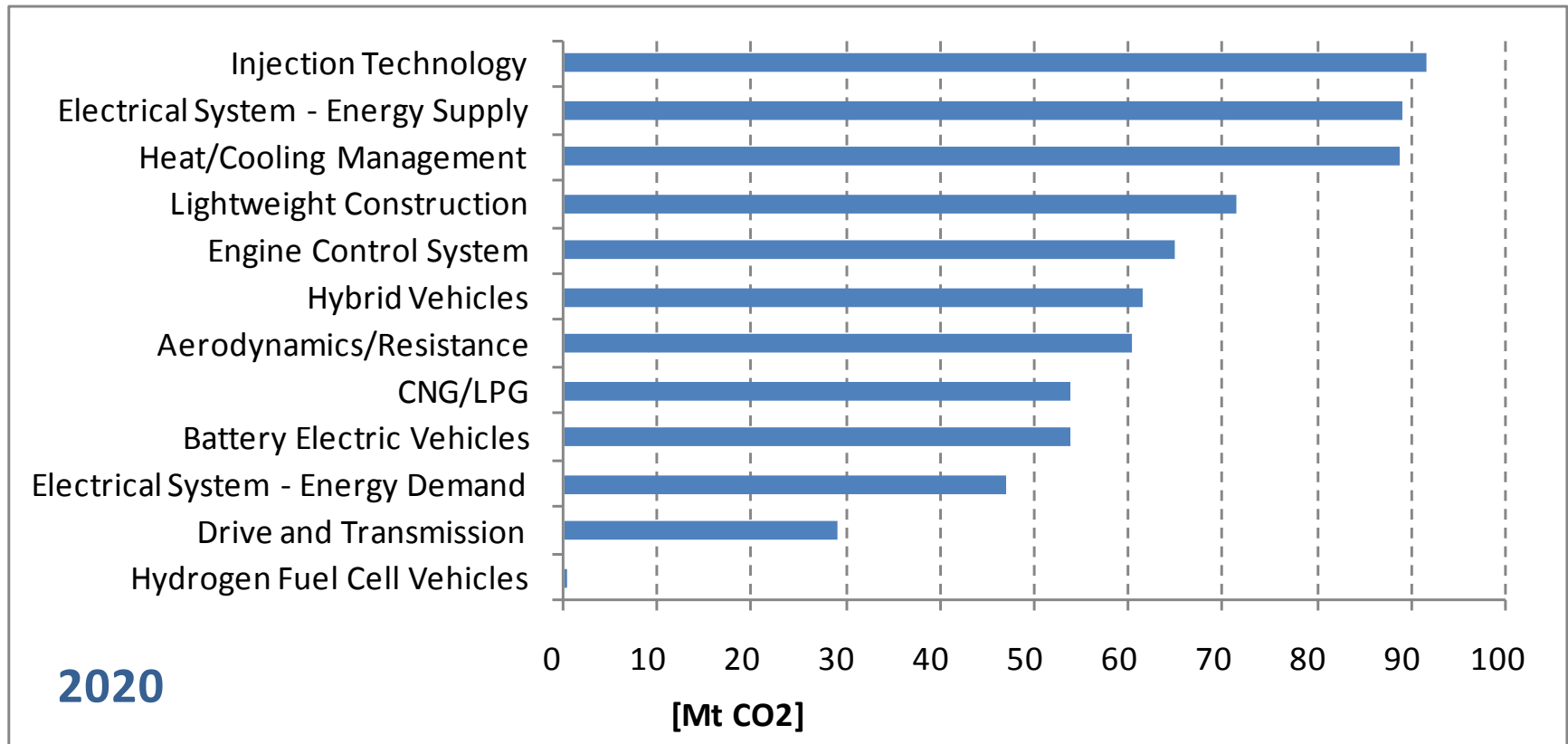
# Example fact sheet explaining GHG reduction measures

<b>“Aerodynamics and resistance” summary</b>			
<b>Description</b>		The group of measures assigned to “aerodynamics and resistance” contains measures that aim at reducing the aerodynamic resistance, the mechanical resistance of tires and the friction within engines in passenger cars.	
<b>Measures included</b>		Aerodynamics and resistance consists of a combination of five measures: <ul style="list-style-type: none"> <li>• improved aerodynamics (e.g. via smooth under flow or lower car bodies),</li> <li>• reduced engine friction losses,</li> <li>• low resistance tires (reducing energy wasted as heat),</li> <li>• tire-pressure monitoring system (controlling if the tire pressure is efficient),</li> <li>• low viscosity lubricants (decreasing the mechanical friction in engines)</li> </ul>	
<b>Field of influence</b>		Energy intensity	
<b>Earliest implementation date</b>		Partially already implemented	
<b>Relative CO<sub>2</sub> reduction</b>	<b>2020</b>	<b>EU27</b>	7% for all passenger cars
	<b>2050</b>	<b>EU27</b>	9% for all passenger cars
<b>Applicability</b>		Measure is applicable on all new passenger cars.	
<b>Absolute CO<sub>2</sub> reduction potential</b>	<b>2020</b>	<b>EU15</b>	50.4 Mt CO <sub>2</sub>
		<b>EU12</b>	10.1 Mt CO <sub>2</sub>
		<b>EU27</b>	60.5 Mt CO <sub>2</sub>
	<b>2050</b>	<b>EU15</b>	66.2 Mt CO <sub>2</sub>
		<b>EU12</b>	16.4 Mt CO <sub>2</sub>
		<b>EU27</b>	82.6 Mt CO <sub>2</sub>
<b>Feasibility</b>		High	
<b>Maturity</b>		In process	
<b>Cost</b>		1,059 €/Ton CO <sub>2</sub> saved	

Source: GHG-TransPoRD D2

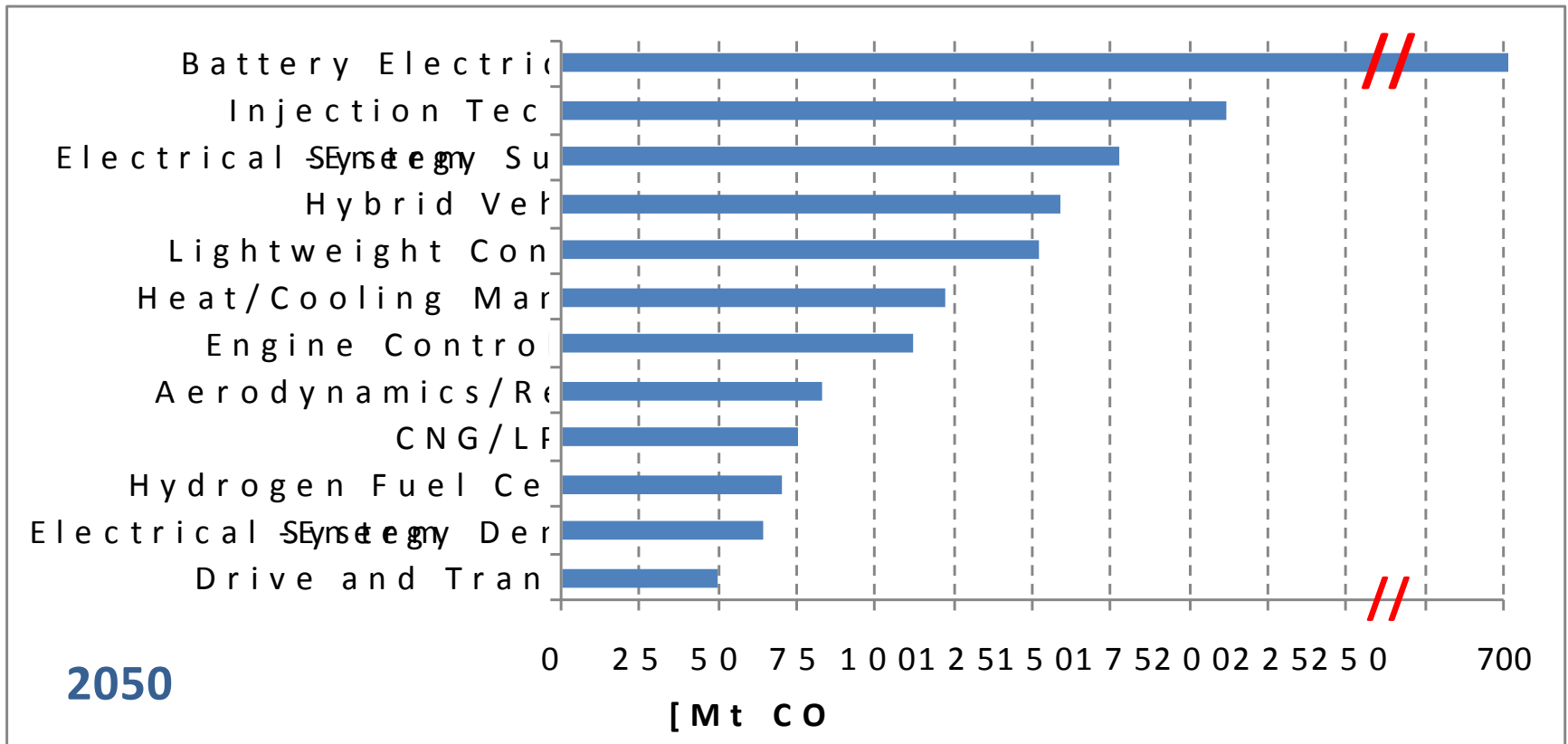


# GHG reduction potentials cars (short list): 2020



Source: GHG-TransPoRD D2, Remark: usage of biofuels was subject to separate analyses

# GHG reduction potentials cars (short list): 2050



Source: GHG-TransPoRD D2, Remark: usage of biofuels was subject to separate analyses

# Theoretical technical reduction potentials

- Excluding cost considerations
- Excluding considerations of other barriers e.g. political barriers, sustainability issues

[%-relative reduction to reference]	2020	2050
Car technology*	-40 to -45%	-60 to -68%
Urban measures**	-43%	-70%
National policies***	-40%	-70%
Biofuel technology****	-16%	n.a.

Source: GHG-TransPoRD D2

\* Potentials are calculated using the reference energy mix for electricity. Potentials can be higher if electricity would be produced carbon free, as then upstream emissions of electric vehicles would become zero.

\*\* Taking into account most relevant and compatible urban measures, about 37% of car transport would be urban transport.

\*\*\* Assuming reasonable combinations of national policies.

\*\*\*\* Not considering the impacts of land use changes. The economically realizable potential for reductions by use of biofuels is significantly smaller than the theoretical technical potential. And it strongly depends on external factors like the price of fossil fuels.

# Conclusions

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- Technical reductions and reductions by policies / urban measures can be overlaid (multiplicative).
- Theoretical technical reduction potentials even until 2020 would reach about -60% reductions of GHG compared to reference.
- Considering cost , timing and barriers of implementation -15% to -30% until 2020 seems feasible for car transport compared with 2005.
- The EU target of reducing -10% GHG reductions in Non-ETS sectors from 2005 to 2020 is easily feasible for car transport.

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