Moscow City Government
Department for Environmental Management
and Protection

Transport emission reduction in a big city: view from Moscow

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Influence of the Transportation system on Environment

Emissions of pollutants (exhaust emissions, road-tire and break wear)	Around 1 mln. tonns/year exhaust emissions – concentrations near roads exceed daily limit values by 1,1 – NO, 1,7 – NO2, 2,2 – formaldehyde
Noise emissions	Noise levels from 62 to 83 dBA near roads
Waste generation	
Soil exemption and sealing	Total area of roads (without local passages) – around 9% of the city area in June 2012
Contamination of drainage water	Pollution index for near-road soils Zc=7 (<16) – acceptable pollution level (urban background index – 4,3)
Soil contamination	

Automobile transport is the main pollution source in Moscow

Main goals of improvement of the transportation system

- Ability to meet transportation demand
- Minimization of distances (improvement of road network)
- Maximization of mean vehicle speeds (for trips between city centre and periphery as well as between different peripheral regions)
- Minimization of portion of the road network with low mean vehicle speed
- Public transport system improvement:
- minimization of Intermodal change time;
- Minimization of traffic intervals for public transport;
- Tariff scale flexibility and convenience;
- Public transport comfort

Moscow transportation system in 2011

296,8 (345,8*) vehicles/1000 persons

Motorization rate, with population density 100,3 persons/Ga and road density 3,95 km/km^2 (motorization is 2 times lower than in European cities, with road density 2-4 times lower)

350-450 km

Road length shortage → Growth of mean trip distances → Emissions growth for up to 30% **

60%

Portion of overloaded roads in total road length, with mean vehicle speed in the city of 15-20 km/h → "start-stop" traffic → Growth of mileage emissions by up to 2 times

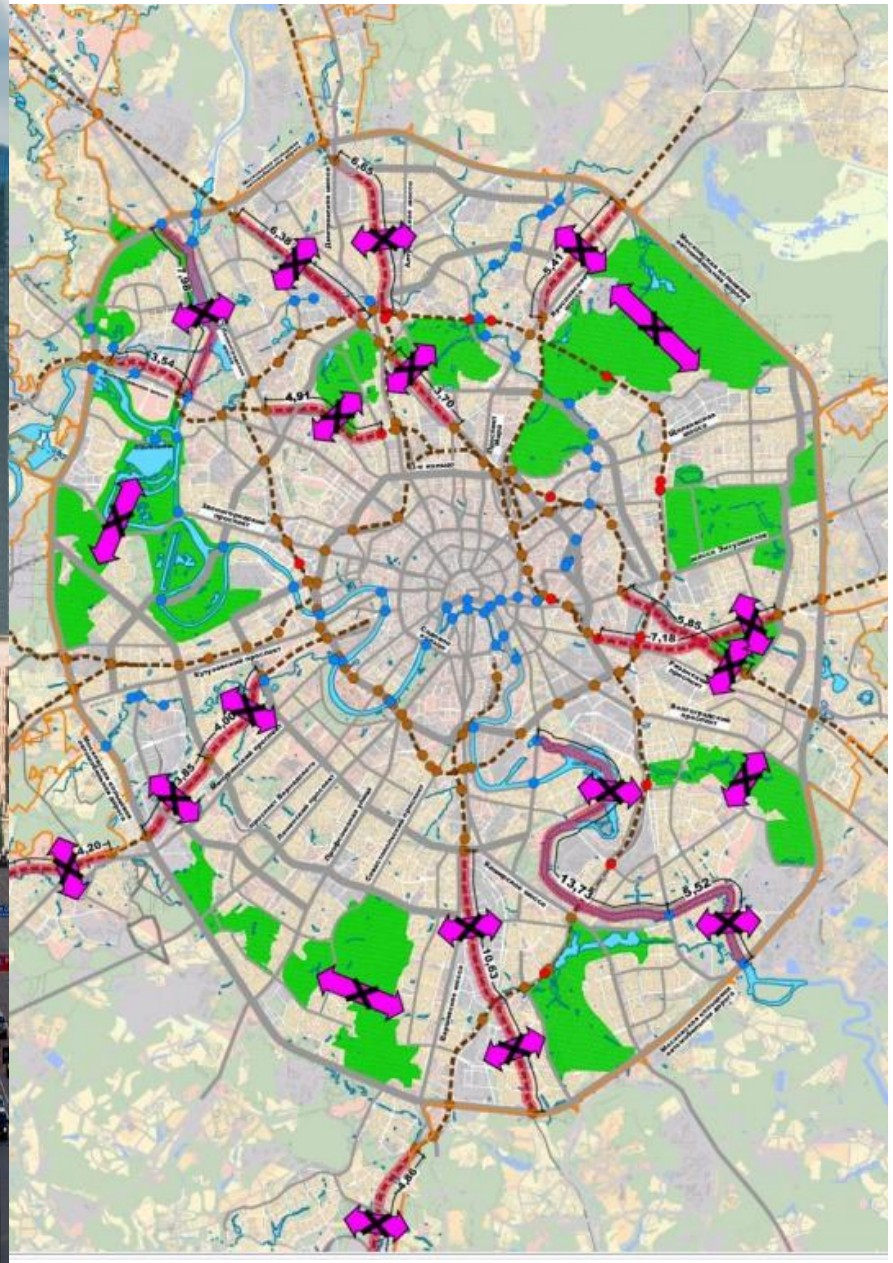
74%

Portion of public transport in total transportation volume → Extensive development of public transport is needed to take on more passengers

Transport system in Moscow in 2011 was limiting further development of the city

* All registered cars including heavy duty and buses. ** Based on trip distance

Bad transport connections in Moscow



- City territory is divided by the railways, rivers and city forests:
- maximum distance between railway underpasses is 10,6 km, minimum – 0,8 km;
- maximum distance between bridges – 13,7 km, minimum - 0,7 km);
- Lack of correspondence between Moscow city and Moscow region transport systems (lack of 23 road lanes)

Existing under and overpasses:

Properly sized

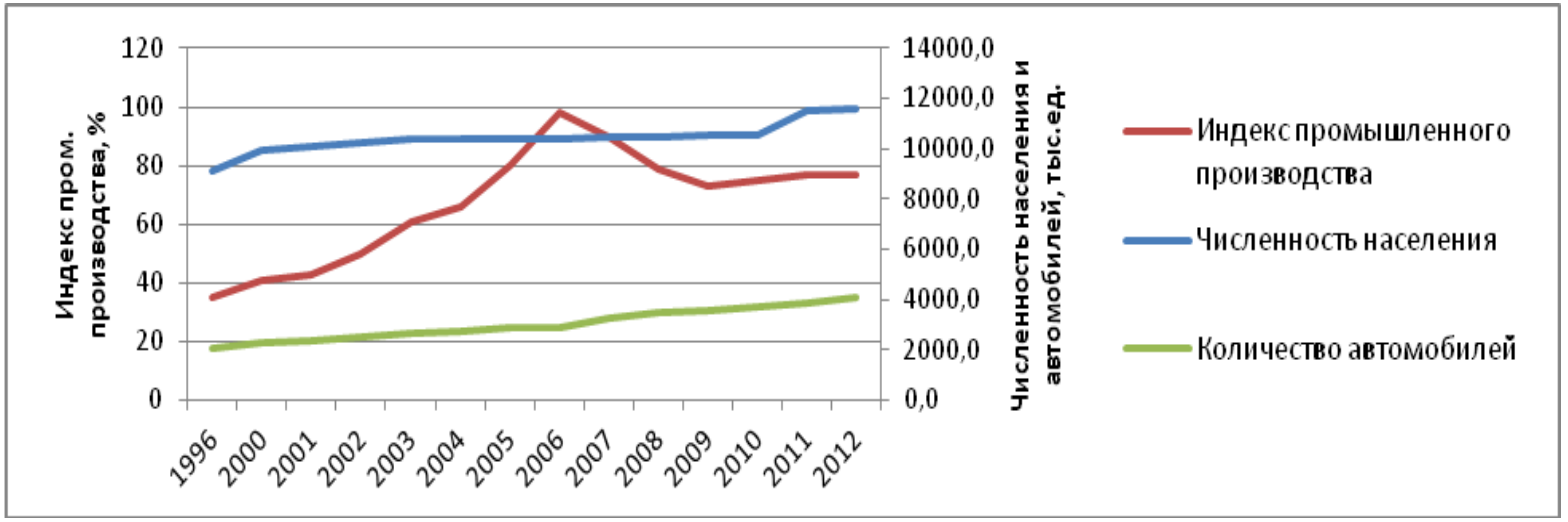
Outsized

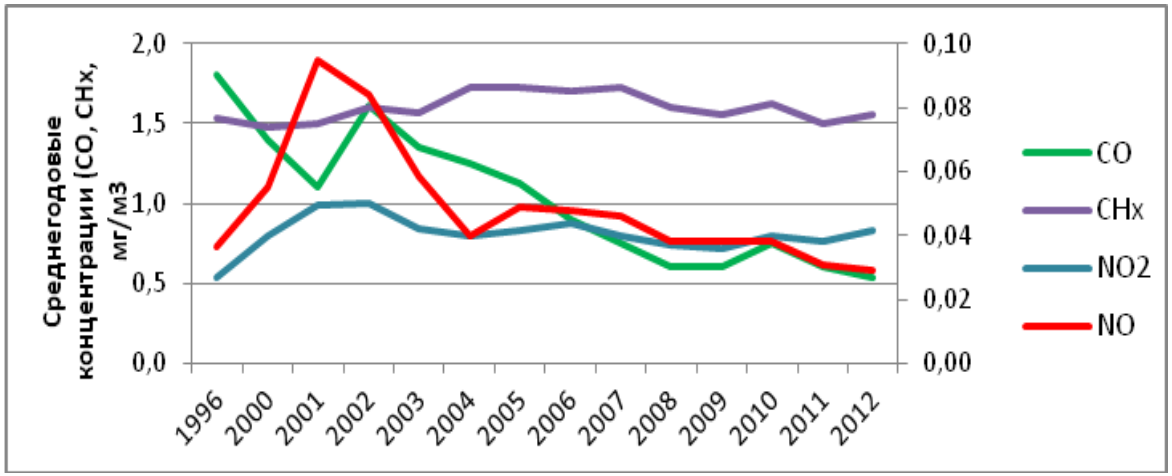
Existing bridges

13,67 Distances between passes

No connection between areas

Ambient air pollution in Moscow





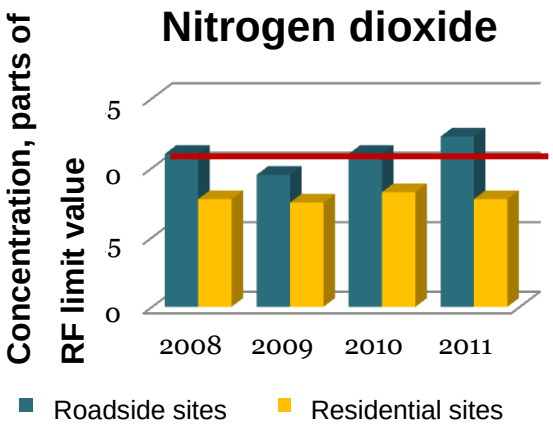
Air pollution near roads is up to 3 times higher than in residential areas far from major roads.

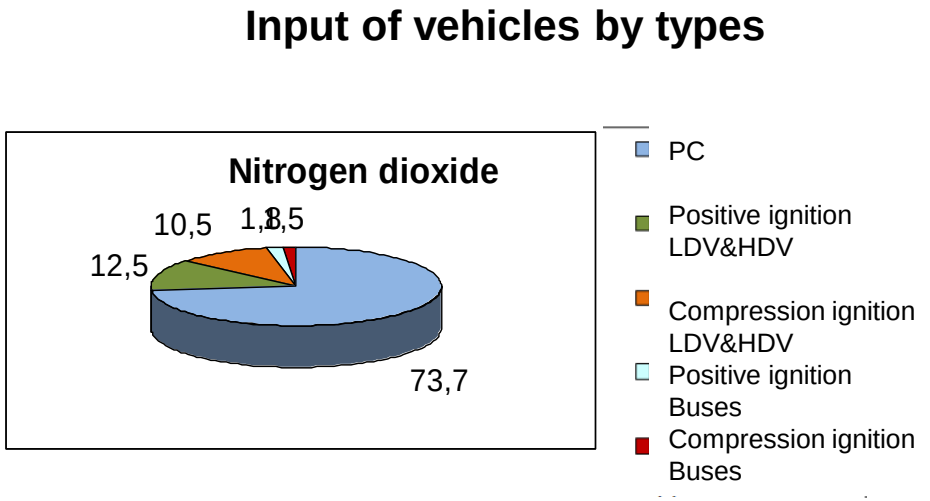
Ambient air pollution in Moscow near roads 2011

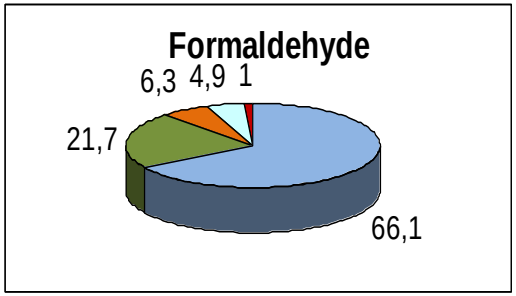
Annual mean concentrations **exceed Russian limit values**: nitrogen oxide by **1.1** times, nitrogen dioxide – by **1.7** times, formaldehyde - by **3.3** times.

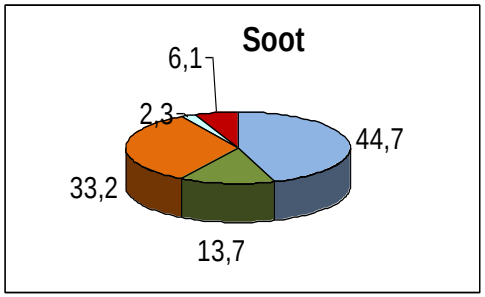
PM10 – annual mean **0,046** mg/m³ near roads (0,038 mg/m³ in residential areas)

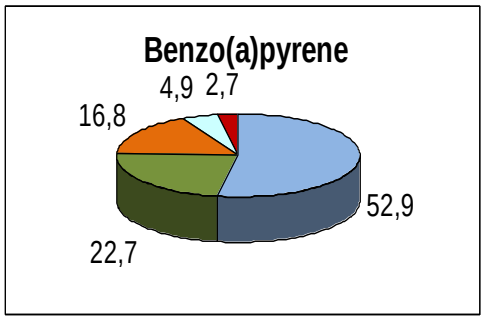
Benzo(a)pyrene - from $0{,}1x10^{-6}$ up to $4{,}2x10^{-6}$ mg/m³ (20-minutes mean)



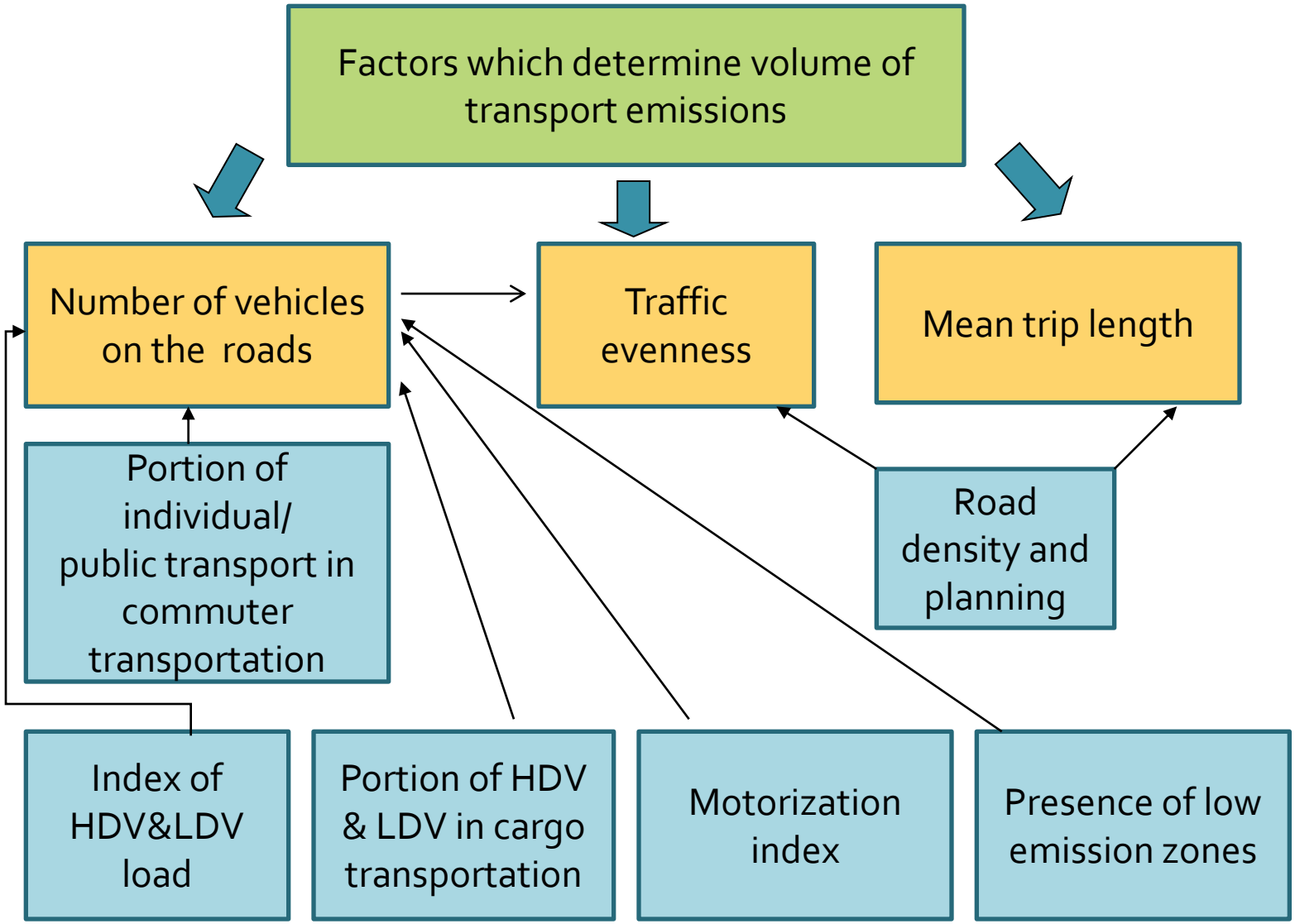








Factors which determine volume of transport emissions



Measures to reduce transport emissions in Moscow

Measure	Emissions reduction
City fuel quality standards (since 2006 – Euro 3; since 2013- Euro 4), fuel quality control	11 % ; 3,5%
Ban on entry to the city centre of LDV&HDV which do not meet Euro 2 (since 2008)	8 000 tons/year
Replacement of HDV used in city communal and building sectors with vehicles meeting Euro 2 and higher requirements – since 2009 (for public transport – Euro 3 and higher)	9000 tons/year 3 000 tons/year
Since 2006 only buses meeting Euro 2 and higher requirements are allowed to operate on newly opened city routes, since 2008 – only those meeting Euro 3 and higher requirements	2,3-3,4 g/km (28-32%)
Public transport using compressed natural gas – 270 in 2013	Euro-4,5 vehicles
Experiment to stimulate use of small-capacity cars (2008 - 2011)	4 000 tons/year
Special lanes for public transport (2010-2011)	Effect in future

Time-tested ways to reduce transport emissions

Experience of other cities tell us than a **complex** of measures is needed
To solve transport problems and effectively reduce transport emissions

1.Technology/city planning:

- development of transport infrastructure (including good connections between all parts of the city), including road, railroad transport and public transport system development;

- incentives for companies to develop environmentally friendly engines and fuel;

- development of Intellectual Transport Systems;

- effective city planning, decentralization.

Time-tested ways to reduce transport emissions

2. Regulation/organizational:

- improvement of traffic organization in order to make use of existing road network more effective;

- traffic monitoring, in order to obtain actual information on traffic load, introduction of speed limits, parking spaces regulation, use of methods to calm traffic, introduction of pedestrian streets;

- Measures to ensure reliability of the transport system;

- Introduction of fuel quality and emissions standards for automobile transport;

- Introduction of low emission zones (restriction by age, emissions and carrying capacity), incentives to promote use of environmentally friendly vehicles and to restrict use of old vehicles.

Time-tested ways to reduce transport emissions

3. Informational:

- Information of commuters, including road signs, indicator boards, information via Internet, radio and GPS;

- Advertising campaigns in order to raise awareness of the impact of road transport on environment and ways to reduce it;

- Incentives to develop telecommunication (in order to lower mobility demand).

4. Economical:

- Measures to discourage individual transport trips: paid parking in city centre, paid entrance to the city centre or overloaded districts, introduction of various taxes, including fuel tax, higher property taxes in overloaded districts etc.

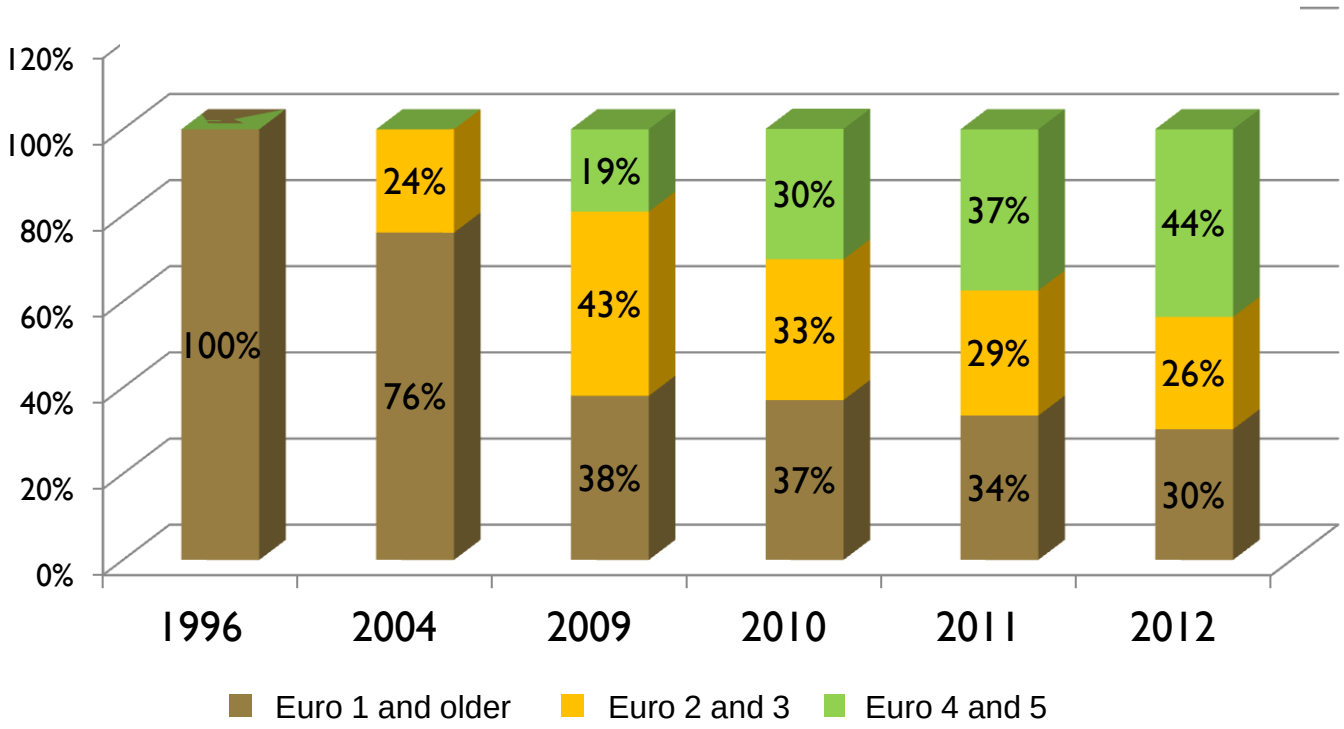
- Reduction of public transportation costs.

Currently implemented measures to reduce transport emissions in Moscow*

Direction	Implemented measures
Measures to decrease number of vehicles on roads	Improvement of public transport, restriction of HDV use during daytime, paid parking in the city centre
Measures to improve fuel quality	Higher fuel quality requirements (since 1 January 2013 – Euro 4); development of infrastructure to use natural gas, public transport on natural gas
Measures to improve environmental characteristics of automobile transport	Emission standards (implemented by Federal government); restriction of HDV use by environmental characteristics; incentives for electric cars (free parking in the city centre, development of electric charging infrastructure)

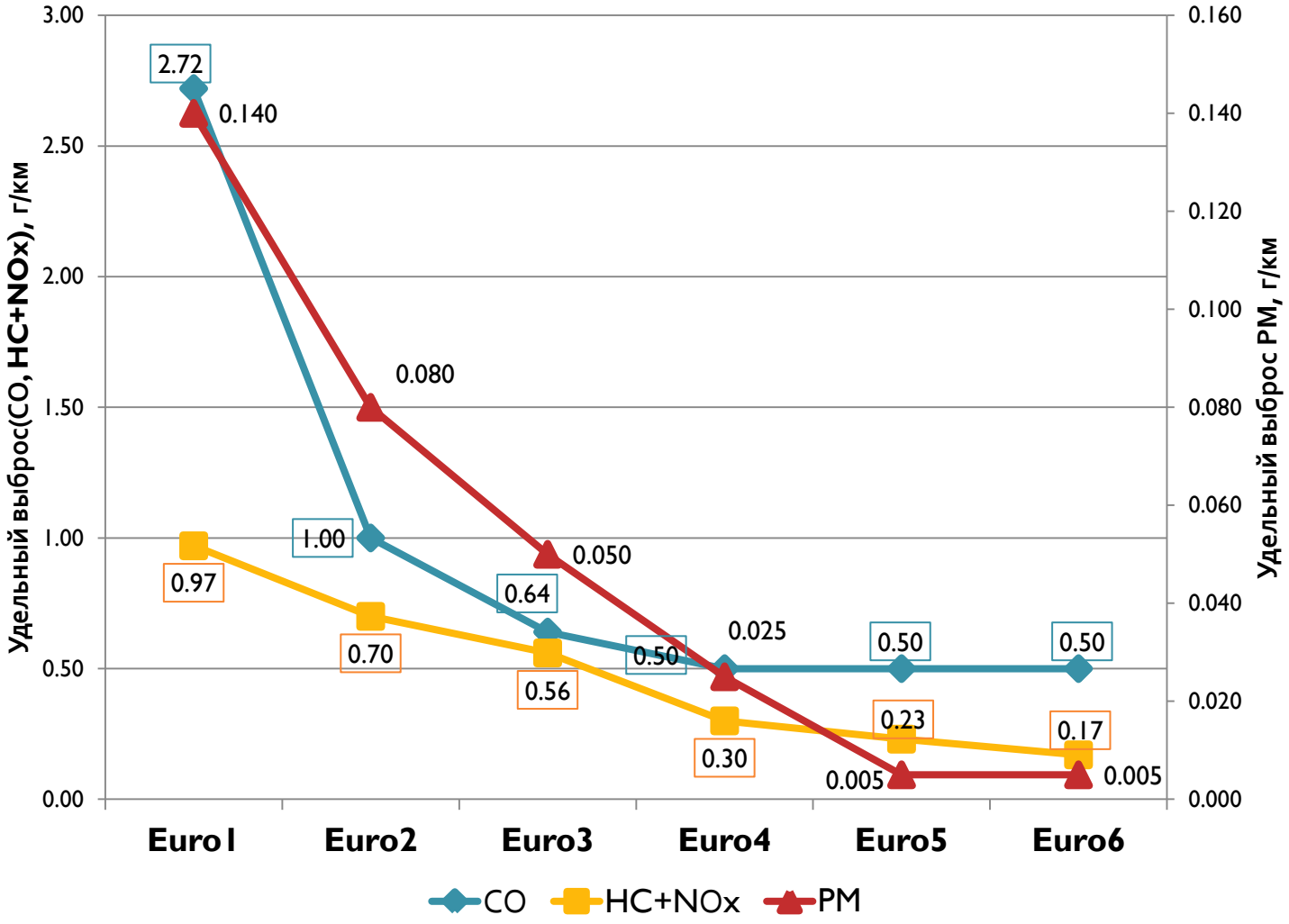
*City planning is not mentioned

Emission characteristics of PC fleet in Moscow



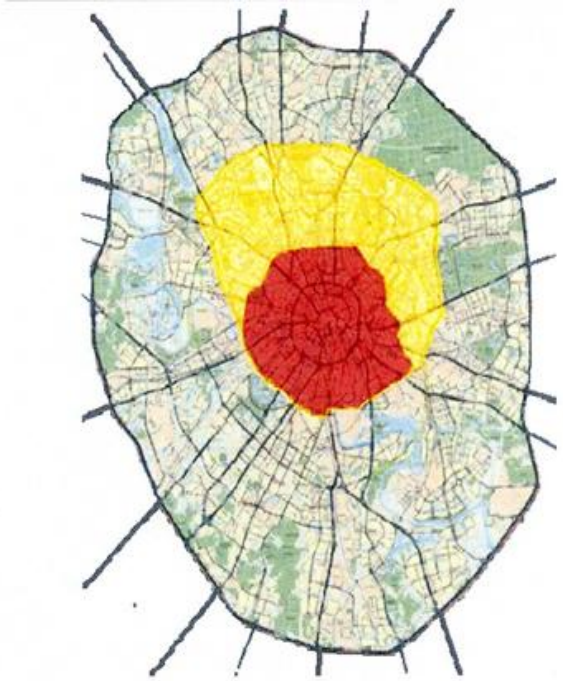
In traffic conditions of 2012 if PC fleet in Moscow consisted of the same vehicles as it did in 2004 emissions would have been by 45% higher.

Perspectives to reduce emissions by promoting new vehicles with lesser emissions



Limits for compression ignition PCs

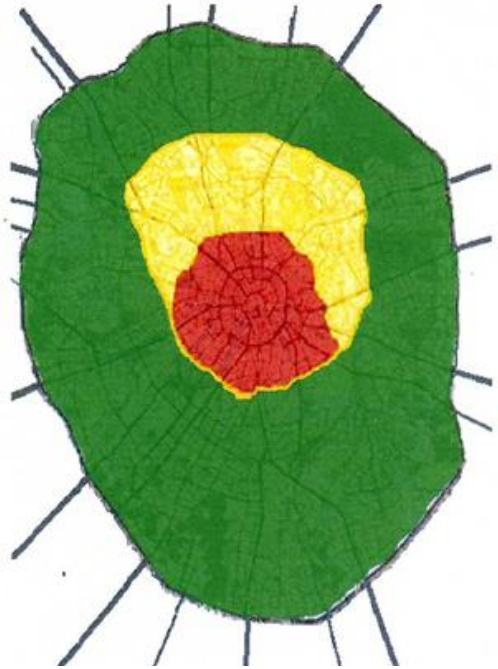
Possible configurations of LOW EMISSION ZONES in Moscow



Existing restrictions

territory	ТТК*	МК МЖД-ТТК	МКАД-МК МЖД
emission standard	Euro 2	-	-
total mass of HDV or LDV	> 1,0 тн.	> 7,0 тн.	-
time of day	07.00-22.00	07.00-22.00	-

* - в том числе в пределы Садового кольца



Proposed restrictions-2014

territory	ТТК	МК МЖД-ТТК	МКАД-МК МЖД*
emission standard	Euro 3	Euro 3	Euro 3
total mass of HDV or LDV	-	> 12 тн.	>12,0 тн.
time of day	-	-	-

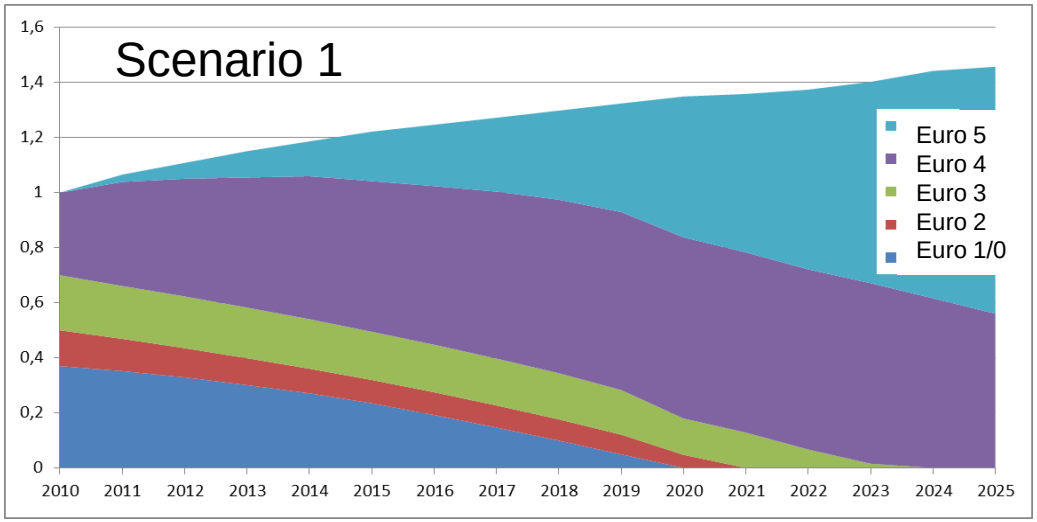
* - в том числе и по МКАД
** - до 1 января 2013 г. действуют ограничения ниже ЕВРО-2

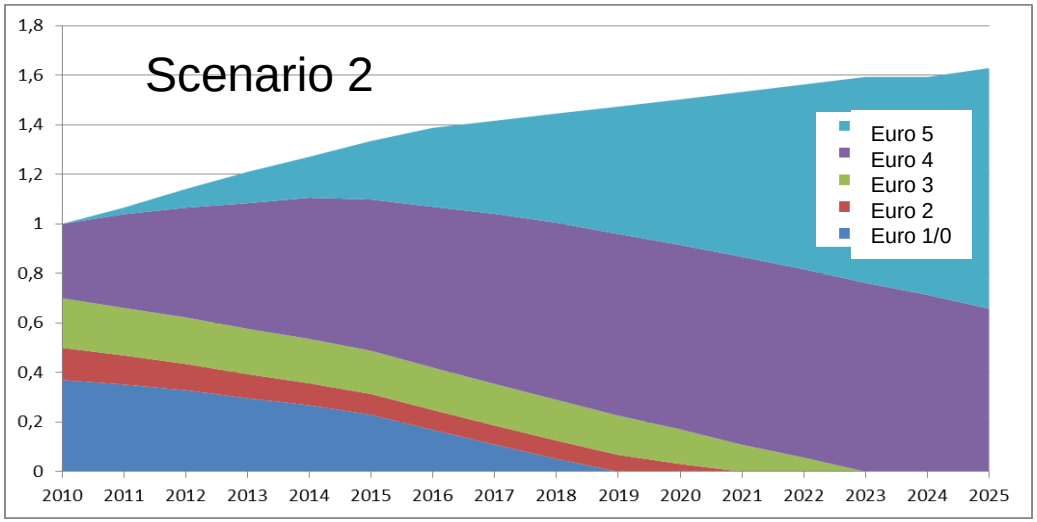
Emission reduction for some of the possible LOW EMISSION ZONES configurations

Scenario	Restriction	HDV		LDV		PC		Emission reduction (compared to scenario without restrictions), %			
								CO	VOC	NO_x	PM
1	Emis. standard	EURO 2		EURO 2		no		3,3	4,6	5,4	5,7
	Zone	МК МЖД		ТТК							
	Vehicle type	< 7 tons (wight)		< 1 tons (load)							
	Hours	7-22 hours		7-22 hours							
2	Emis. standard	EURO 2	EURO 3	EURO 3		EURO 2		35,9	34,2	-7,9	3,6
	Zone	МКАД	МК-МЖД	ТТК		СК					
	Vehicle type	>12 tons	<3,5 tons	all		all					
	Hours	24 hours		24 hours		24 hours					
3	Emis. standard	EURO 3		EURO 2	EURO 3	EURO 2		48,4	53,3	35,4	23,3
	Zone	МКАД		МКАД	ТТК	СК+ТТК					
	Vehicle type	all		bus	all	all					
	Hours	24 hours		24 hours		24 hours					
4	Emis. standard	EURO 3		EURO 3		EURO 2	EURO 3	59,8	64,5	36,8	31,7
	Zone	МКАД		МКАД		МКАД	МК-МЖД				
	Vehicle type	all		all		all					
	Hours	24 hours		24 hours		24 hours					
5	Emis. standard	EURO 3		EURO 3		EURO 3	EURO 4	62,6	66,9	31,5	34,3
	Zone	МКАД		МКАД		МКАД	СК				
	Vehicle type	all		all		all					
	Hours	24 hours		24 hours		24 hours					

Fleet forecast for Moscow by 2025 (assessment by MSARTU)

Two scenarios: 1) motorization by 2025 is 400 vehicles per 1000 persons – with state incentives to restrict motorization mobility; 2) motorization by 2025 is 450 vehicles per 1000 persons – without state intervention.



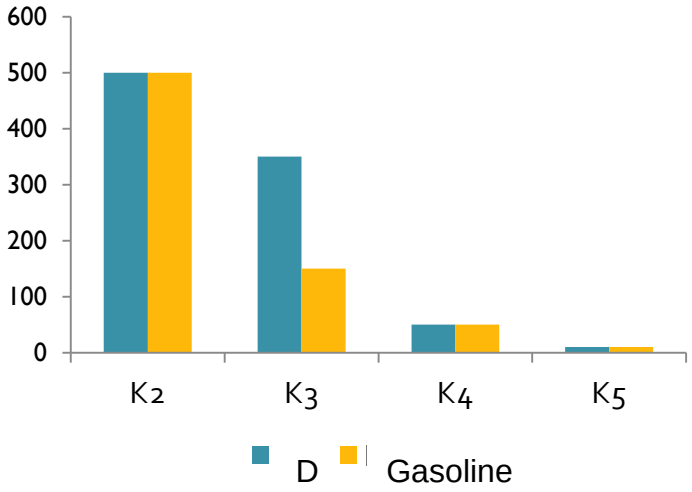


Perspectives of emission reduction due to improvement of fuel quality

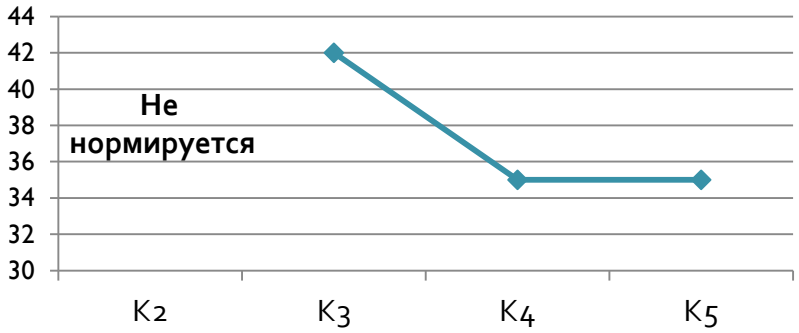
Since 1 January 2013 new fuel quality standard is introduced in Moscow – all fuel must meet EURO 4 requirements (environmental effect – emission reduction: sulfur dioxide by 70%, benzo(a)pyrene- by 22 %, particulate matter - by 9 %)

27 August 2013 Moscow City Government and JRC “Gasprom” have signed an agreement to further increase use comprised nature gas as motor fuel in Moscow

Permissible portion of sulfur, mg/kg



Permissible portion of aromatic hydrocarbons in gasoline, %



Projected improvement of Moscow transport system by 2016

	2011	2016
Road density	3,95 km/km²	4,28 km/km²
Road length	3600 km	4000 km
Mean length of overloaded roads	533,5 km	491 km
Over-run index	1,58	1,42
Portion of public transport in total transportation volume	74%	74%

Emission reduction by up to 25% (depending on the scenario of traffic growth)

Moscow City Government programs aimed at decreasing vehicle emissions

- State program «Transport system development» for 2012-2016 ;
- State program «City planning&design policy» for 2012-2016 ;
- State program «Energy efficiency in Moscow» for 2012-2016.

Major priorities (State programs for 2012-1016)

- Development of special lanes for public transport (increase in average speed during rush hours from 11 to 18 km/h);
- Development of electric transport (trams, trolleybuses);
- Development of underground railway;
- **Renewal of public transport – purchase of 5500 buses meeting Euro 4 and 5 requirements;**
- **Reduction in transit rate through the city by 20% (including change from HDV to rail and water transportation);**
- Setting up an Intellectual transport system (improvement of traffic situation);

Major priorities (State programs for 2012-1016)

- Construction of 72,8 km cycle lanes;
- Construction of 399,6 km new motorways and road infrastructure;
- Integration of transport systems of Moscow and Moscow region;
- New standards in city planning: construction of blocks of flats with a view to lessen the distance from dwellings to places of work;
- **Reduction of disproportions in location of dwellings and working places in peripheral areas of Moscow;**
- Use of underground area for road and parking space building;
- A project to subside residents who buy hybrid and low-capacity cars.

Negative impact of transport system development in Moscow

- soil sealing;
- cutting down of trees (not always can be replanted in the same place);
- decrease of lawn area;
- noise emission.

Incentives to promote use of environmentally friendly vehicles

- **paid parking/paid entrance** to the city centre and/or in the overloaded areas, with discounts for environmentally friendly vehicles (for example, hybrid cars, electric cars, cars using natural gas, euro-5 cars);

- **fuel tax**, with lower rates for high quality fuels (diesel and gasoline) and for natural gas;

- **transport tax**, with lower rates for environmentally friendly vehicles;

- **import tax**, with lower or null rates for environmentally friendly vehicles and higher rates for used vehicles;

- **subsidies/one-time tax discounts** for purchase or registration of environmentally friendly vehicles.

Perspective ways to reduce emissions from transport in Moscow

- Polycentric development of the city;
- Improvement of communication between peripheral areas of the city;
- Intensive development of public transport, including special bus lanes;
- Expansion of the paid parking zone to TTK;
- Restriction of traffic of the oldest vehicles (low emission zones);
- Incentives to promote environmentally friendly vehicles (hybrids, electric cars, cars on natural gas etc.)

MOSCOW CITY GOVERNMENT

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THANK YOU FOR ATTENTION!

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