Economic Cost-Effectiveness of TDM-Measures regarding their Environmental Impact

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Content

- Methodology
- Measures bundles
- Cost-effectiveness, Reduction potential } of environmental impacts
- Conclusion

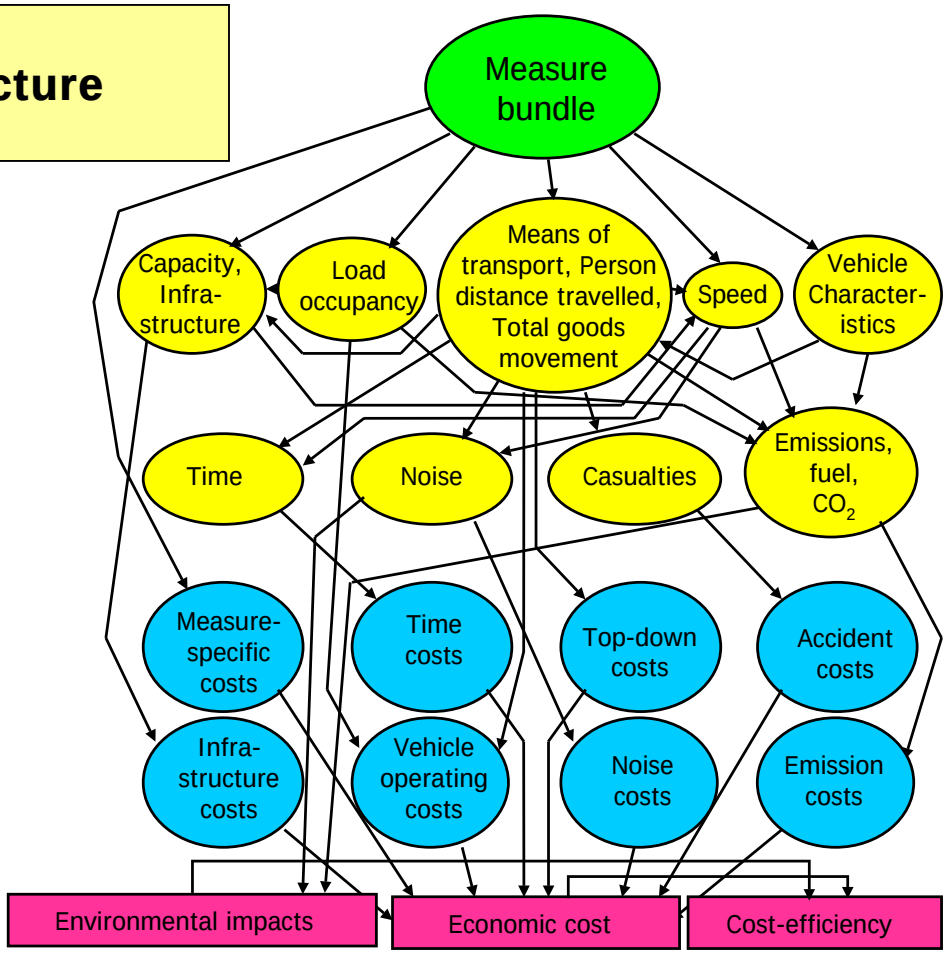
Methodological Framework of Model

Key variables:
- car ownership rate
- mileage/vehicle and year
- car occupancy/commercial vehicle loading
- population
- energy prices

Calibration: total fuel consumption of Austria

Measure impact:
- reference area: Austria
- reference year: 2005
- run-up phase of measures: 5 - 7 years
- economic cost and benefit

Model Structure



Bundles of TDM Measures

No.	
1	Speed enforcement
2	Lower speed limits
7	Extension of parking management
8a	Eco-bonus (→ doubling of fuel price, redistribution to population)
8b	Environmental extra fuel charge (→ doubling of fuel price)
8c	Area wide road pricing (→ doubling of fuel price)
9	Extra charge for air transport take offs and landing ()
11	Area-wide promotion of bicycle use (hard- and software)
15	Improvement of freight logistic (“Intermodal Logistic Association”)
16	Intensification and extension of ITS for road traffic
22	Voluntary travel behaviour change

Bundles of Measures included in the Analysis for Comparison

No.	*Type of Measures:* ***Land use and regional planning***
4	Avoidance of urban sprawl (accessibility charge)
5	Residential building subsidy, dependent on distance to p.t.
6	Subsidy for land purchase, dependent on distance to p.t.

No.	*Type of Measures:* ***Road and railway extension***
10	Extension of pedestrians precincts, restriction to car traffic
12	Extension of intermodal freight transport (terminals, network)
13	Extension of passenger transport of railways (regular headways)
14	Extension of urban public transport (tram, bus, underground, etc.)

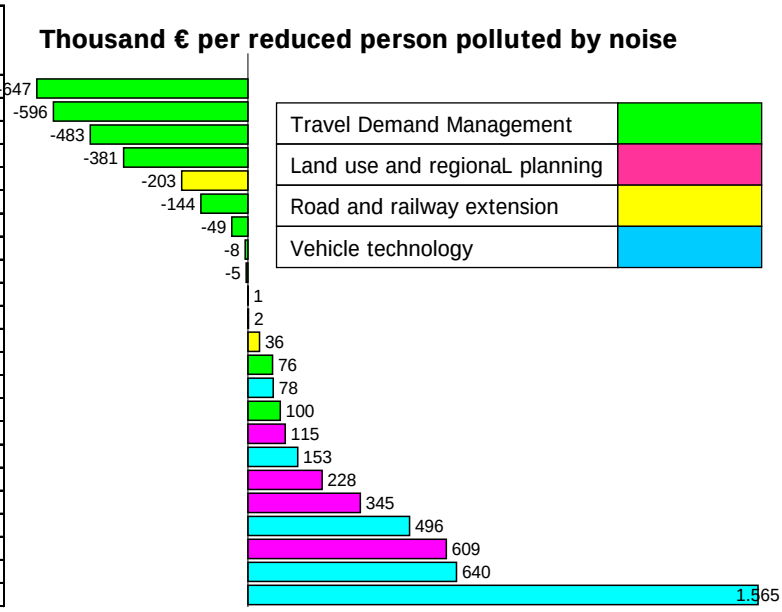
Bundles of Measures included in the Analysis for Comparison

No.	*Type of Measures:* ***Technology of powered vehicles***
17a	Reduction of fuel consumption for cars (ECE 1/3-mix)
17b	Reduction of fuel consumption for cars (3 litres consumption/1000 km)
18a	Zero-emissions vehicles (electric cars for public sector)
18b	Zero-emissions vehicles (electric cars for 3 % of new registration)
19	Extension of trolley buses (exchange of 20 % of urban buses)
20	Bio-fuel (Austrian capacity of 210.000 tons/year)
21	Intensification of vehicle inspection

Cost-effectiveness of a Reduction of the number of People Polluted by Traffic Noise

Austria, Reference year: 2005

Number of Measures	Measures bundle
11	Area-wide promotion of bicycle use
8b	Environmental extra fuel charge
8a	Eco-bonus
8c	Area-wide road pricing
4	Avoidance of urban sprawl
15	Improvement of freight logistic
9	Extra charge for taking off and landing
22	Voluntary travel behaviour change
2	Lower speed limits
5	Residential building subsidy
1	Speed enforcement
6	Subsidy for land purchase
16	Extension of ITS for road traffic
18a	Zero-emissions vehicles (public sector)
7	Extension of parking management
12	Extension of intermodal freight transport
18b	Zero-emissions vehicles (3 %/year)
13	Extension of passenger transport of railways
14	Extension of urban public transport
17a	Reduction of fuel consumption
10	Extension of pedestrians precincts
17b	Reduction of fuel consumption
19	Extension of trolley buses



Reduction Potential regarding People Polluted by Traffic Noise

Austria, Reference year: 2005

Number of Measures	Measures bundle
11	Area-wide promotion of bicycle use
8b	Environmental extra fuel charge
8a	Eco-bonus
8c	Area-wide road pricing
4	Avoidance of urban sprawl
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9	Extra charge for taking off and landing
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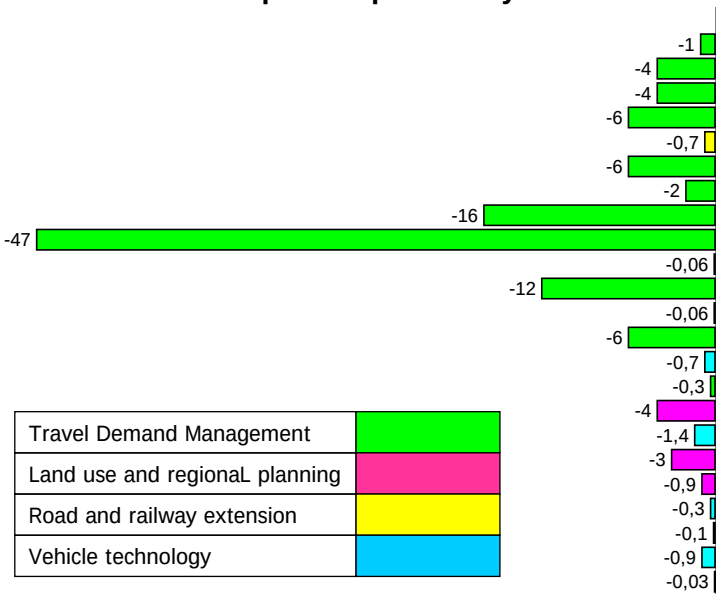
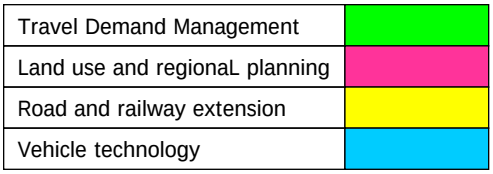
7	Extension of parking management
12	Extension of intermodal freight transport
18b	Zero-emissions vehicles (3 %/year)
13	Extension of passenger transport of railways
14	Extension of urban public transport
17a	Reduction of fuel consumption
10	Extension of pedestrians precincts
17b	Reduction of fuel consumption
19	Extension of trolley buses

Reduced persons polluted by noise in 1000



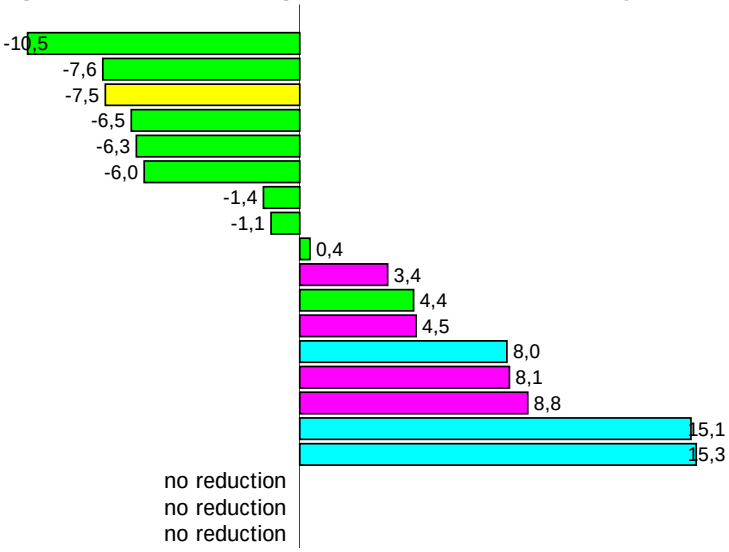
Cost-Effectiveness of a Reduction of Particle Emissions

Austria, Reference year: 2005



Number of Measures	Measures bundle
11	Area-wide promotion of bicycle use
8c	Area-wide road pricing
4	Avoidance of urban sprawl
8b	Environmental extra fuel charge
15	Improvement of freight logistic
8a	Eco-bonus
22	Voluntary travel behaviour change
2	Lower speed limits
1	Speed enforcement
12	Extension of intermodal freight transport
16	Extension of ITS for road traffic
13	Extension of passenger transport of railways
18a	Zero-emissions vehicles (public sector)
10	Extension of pedestrians precincts
14	Extension of urban public transport
19	Extension of trolley buses
18b	Zero-emissions vehicles (3 %/year)
17a	Reduction of fuel consumption
17b	Reduction of fuel consumption
20	Bio-fuel

€ per reduced tons of particle emission in 1000/year



Reduction Potential regarding Particle Emissions

Austria, Reference year: 2005

Travel Demand Management	
Land use and regionaL planning	
Road and railway extension	
Vehicle technology	

Number of Measures	Measures bundle
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17a	Reduction of fuel consumption
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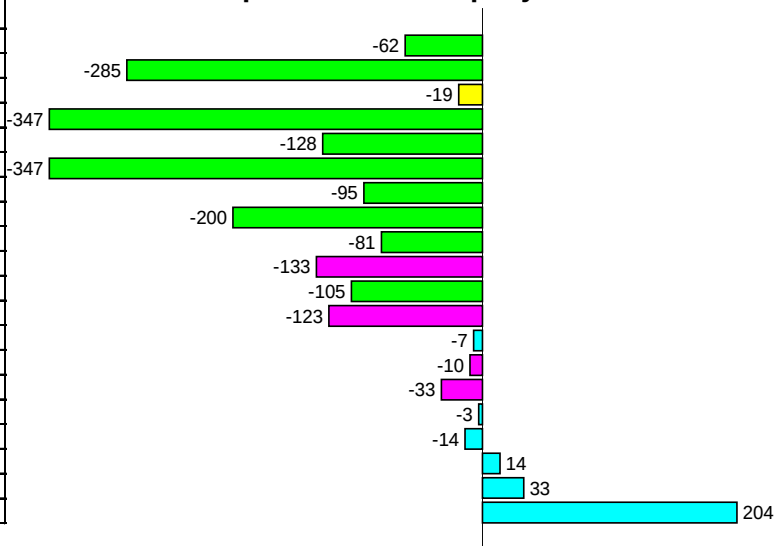
20	Bio-fuel

Reduced tons of particle emission per year

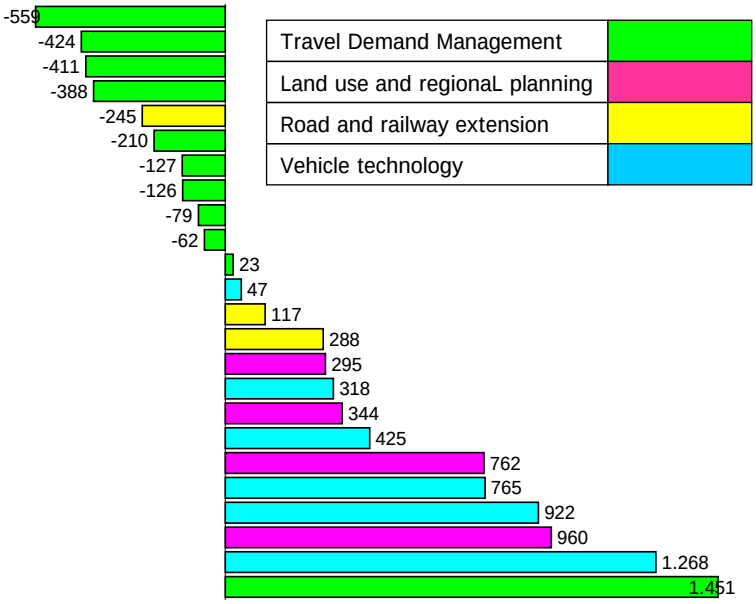


Cost-effectiveness of a Reduction of Nitrogen Oxide Emissions (No_X)

Austria, Reference year: 2005

Number of Measures	Measures bundle
11	Area-wide promotion of bicycle use
8b	Environmental extra fuel charge
8a	Eco-bonus
8c	Area-wide road pricing
4	Avoidance of urban sprawl
15	Improvement of freight logistic
7	Extension of parking management
22	Voluntary travel behaviour change
9	Extra charge for taking off and landing
2	Lower speed limits
1	Speed enforcement
20	Bio-fuel
6	Subsidy for land purchase
5	Residential building subsidy
12	Extension of intermodal freight transport
19	Extension of trolley buses
14	Extension of urban public transport
18a	Zero-emissions vehicles (public sector)
13	Extension of passenger transport of railways
17a	Reduction of fuel consumption
17b	Reduction of fuel consumption
10	Extension of pedestrians precincts
18b	Zero-emissions vehicles (3 %/year)
16	Extension of ITS for road traffic

€ per reduced ton of NO_X-emission in 1000



Reduction Potential regarding Nitrogen Oxide Emissions (No_X)

Austria, Reference year: 2005

Number of Measures	Measures bundle
11	Area-wide promotion of bicycle use
8b	Environmental extra fuel charge
8a	Eco-bonus
8c	Area-wide road pricing
4	Avoidance of urban sprawl
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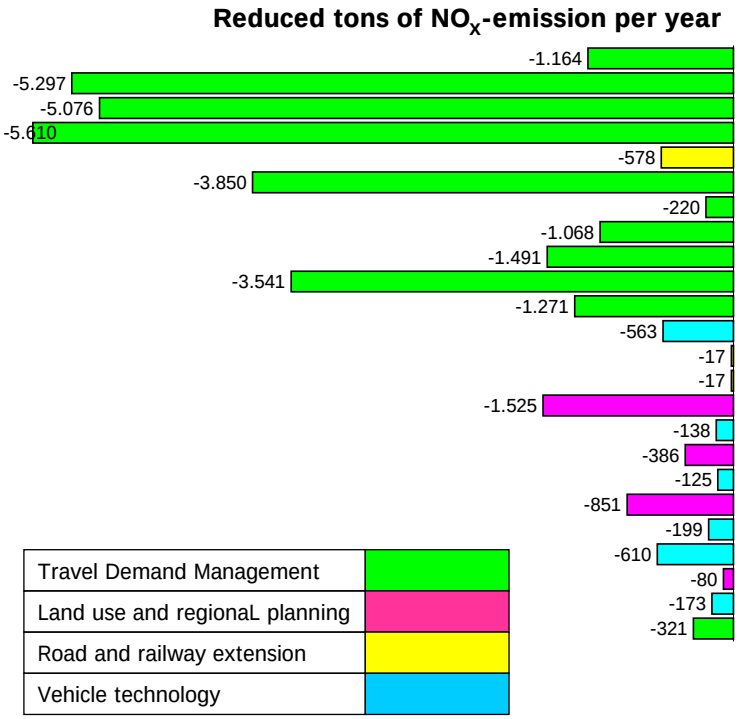
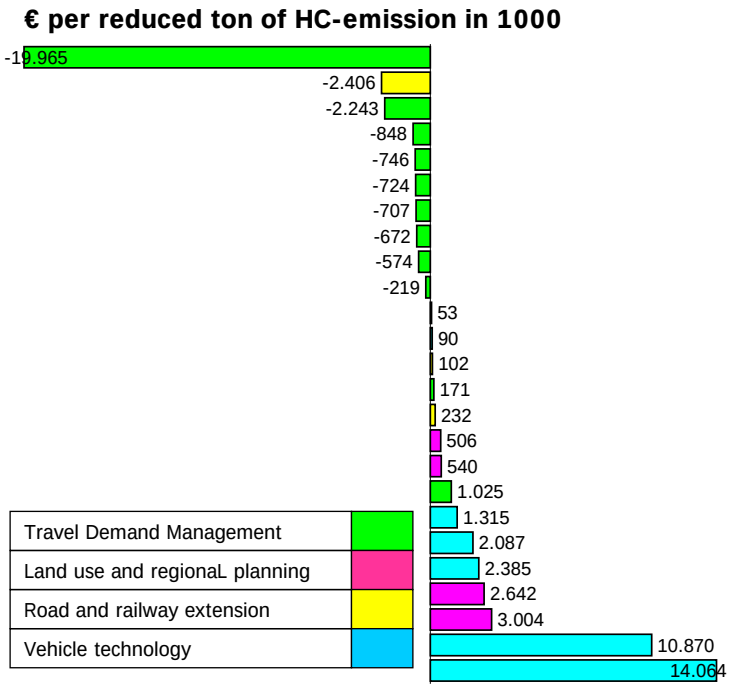


Cost-effectiveness of a Reduction of Hydro-Carbon Emissions (HC)

Austria, Reference year: 2005

Number of Measures	Measures bundle
2	Lower speed limits
4	Avoidance of urban sprawl
15	Improvement of freight logistic
8c	Area-wide road pricing
8b	Environmental extra fuel charge
16	Extension of ITS for road traffic
8a	Eco-bonus
9	Extra charge for taking off and landing
11	Area-wide promotion of bicycle use
22	Voluntary travel behaviour change
20	Bio-fuel
21	Intensification of vehicle inspection
6	Subsidy for land purchase
7	Extension of parking management
5	Residential building subsidy
14	Extension of urban public transport
10	Extension of pedestrians precincts
1	Speed enforcement
18a	Zero-emissions vehicles (public sector)
19	Extension of trolley buses
18b	Zero-emissions vehicles (3 %/year)
12	Extension of intermodal freight transport
13	Extension of passenger transport of railways
17a	Reduction of fuel consumption
17b	Reduction of fuel consumption



Reduction Potential regarding Hydro-Carbon Emissions (HC)

Austria, Reference year: 2005

Number of Measures	Measures bundle
2	Lower speed limits
4	Avoidance of urban sprawl
15	Improvement of freight logistic
8c	Area-wide road pricing
8b	Environmental extra fuel charge
16	Extension of ITS for road traffic
8a	Eco-bonus
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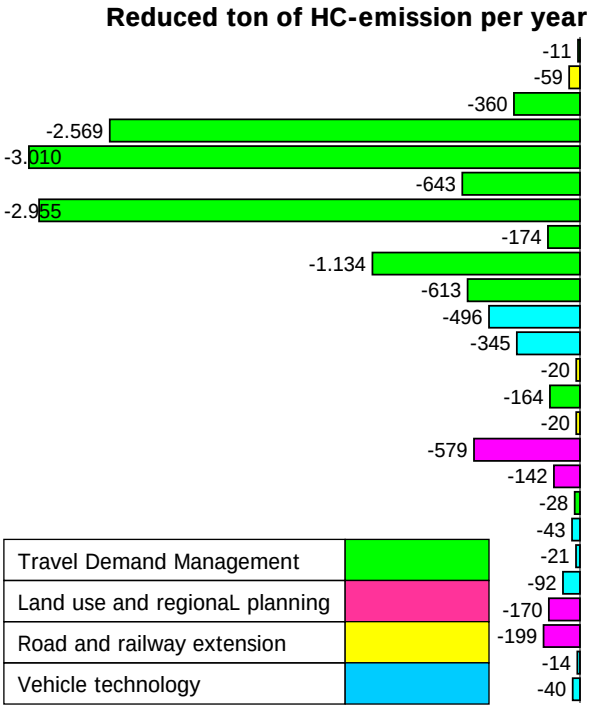

Cost-effectiveness of a Reduction of Greenhouse Gas Emissions (CO_2)

Austria, Reference year: 2005

Number of Measures	Measures bundle
4	Avoidance of urban sprawl
15	Improvement of freight logistic
11	Area-wide promotion of bicycle use
8c	Area-wide road pricing
8b	Environmental extra fuel charge
8a	Eco-bonus
2	Lower speed limits
22	Voluntary travel behaviour change
9	Extra charge for taking off and landing
20	Bio-fuel
1	Speed enforcement
6	Subsidy for land purchase
7	Extension of parking management
17b	Reduction of fuel consumption
17a	Reduction of fuel consumption
5	Residential building subsidy
18a	Zero-emissions vehicles (public sector)
14	Extension of urban public transport
10	Extension of pedestrians precincts
18b	Zero-emissions vehicles (3 %/year)
12	Extension of intermodal freight transport
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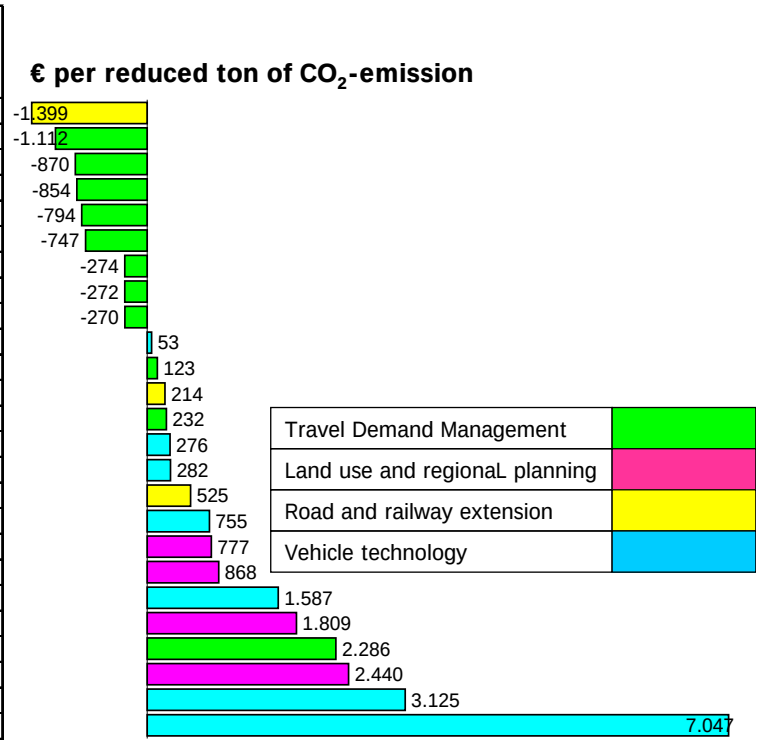
13	Extension of passenger transport of railways
19	Extension of trolley buses
21	Intensification of vehicle inspection



Reduction Potential regarding Greenhouse Gas Emissions (CO_2)

Austria, Reference year: 2005

Number of Measures	Measures bundle
4	Avoidance of urban sprawl
15	Improvement of freight logistic
11	Area-wide promotion of bicycle use
8c	Area-wide road pricing
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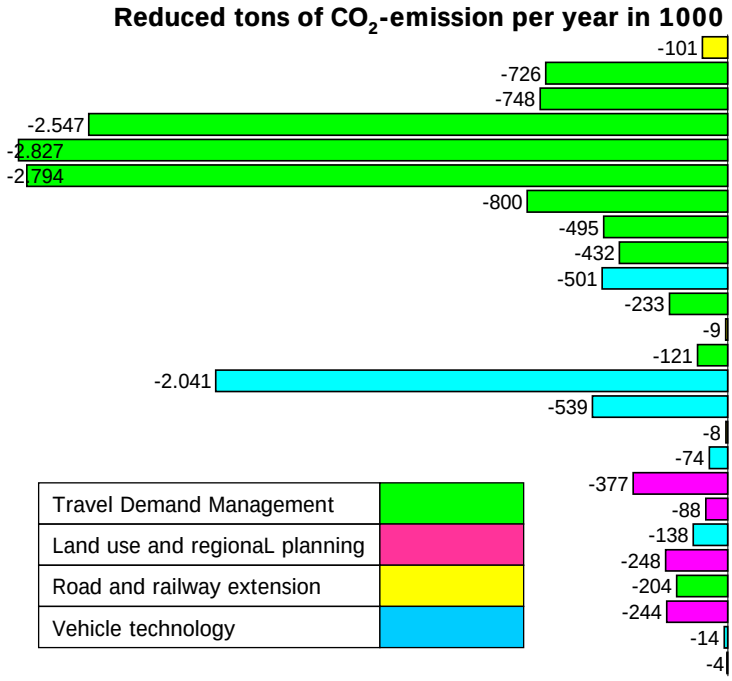

Conclusion I

TDM measures:
- best economic cost-effectiveness
- diverse reduction potential
- pricing measures optimal in both, public acceptance ?

Land-use measures:
- avoidance of urban sprawl
- best economic cost-effectiveness
- but low reduction potential

Road and railway extension:
- week cost-effectiveness
- week reduction potential
- good public acceptance in general (except neighbourhood)

Vehicle technology measures:
- week cost-effectiveness
- week reduction potential

Conclusion II

Noise protection:
- high cost-effectiveness but low potential of improvements: pricing measures and bicycle promotion
- high potential of improvement but low cost-effectiveness: lower speed limit

Extension of ITS:
- medium reduction potential on NO_X
- very low cost-effectiveness on NO_X

Future needs:
- integrative bundles of measures
- development of operable evaluation technique for sustainable development

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