Study on costs and benefits of the sustainable urban mobility transition - *Preliminary Simulation for **Prague (CZ)***

EIT Urban Mobility - Mobility for more liveable urban spaces

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Premise

The study has produced a quantified analysis of the costs and benefits of the transition to sustainable urban mobility in European cities by 2030 and 2050. The objective has been accomplished using a quantitative assessment tool (MOMOS[1]) which allowed to simulate the impacts of different mobility transition scenarios.

MOMOS is a strategic and aggregated model, adaptable under several assumptions to different city circumstances in different European countries, and enabling for a rapid identification, development, screening, and assessment of different measures and policy scenarios and of their expected impacts. This tool does not intend to replace sophisticated transport models but allows for an evaluation of alternative solutions.

Within this study, the use of this tool and the simulation of the scenarios has allowed to fairly represent the entire EU27 context, while considering differences among cities in terms of size and geography, as well as per capita income, motorisation rates, fleet composition, energy prices, and value of travel time among other indicators. In fact, the tool has been applied to 12 "City Prototypes". Each of them features a different combination of city dimension (Large, Medium, and Small) and geographic area (Northern, Central/Western, Southern, and Eastern Europe). 30 reference cities have been used to approximate relevant urban and transport variables (as input data) that define the prototypes at base year 2019.

Three transition scenarios have been considered: Scenario 1 "Promote and Regulate" which stimulates more sustainable travel behaviour through information, regulations, and promotions as well as the incentivization of innovative and shared mobility services; Scenario 2 "Plan and Build" which is centred on investments in technology and infrastructure and changes in the urban environment, with a focus on public transport[2]; Scenario 3 "Mixed" which is a mix between the two previous approaches: regulations and behavioural incentives as well as the provision of infrastructures and services.

[1] http://www.trt.it/en/tools/momos/

[2] Scenario 2's investments in public transport are focussed on metro/tram in Large cities, tram/buses in Medium cities, and buses in Small cities.

In this factsheet, the model has been preliminarily applied to a single city context to produce an initial estimation of the costs[3] and benefits of the sustainable mobility transition scenarios in that urban context. Importantly, two clarifications are needed to explain these preliminary results.

The first one is related to the data input collection. In total, 43 inputs (see Table 1) have been used to feed the model and to represent the city's characteristics at base year by reproducing different circumstances, related to its socio-demographic aspects as well as mobility features (public transport infrastructure, innovative services, parking, traffic management solutions, etc.). Of all data collected, 20 inputs were publicly available through desk research (sources include, for example, reports of public transport operators, service provider websites, national statistics databases, previous sectorial studies, etc.) and 23 inputs have been estimated considering other similar contexts (e.g., a city with similar characteristics for which such data is available) or through the expertise and professional judgement of the author. Therefore, the production of a more realistic picture would only be possible through a tailored collaboration with local authorities and operators willing to share precise input data that could better describe the city's initial situation and parameters.

The second element concerns the implementation of policy measures and the construction of the three transition scenarios. In fact, most of the policies have been defined by taking into account the EIT Urban Mobility strategic objectives, as well as the targets of the Green Deal and of the EU Smart and Sustainable Mobility Strategy. However, each city also has its own vision and specific roadmap towards sustainable mobility transition (e.g., some policies could be preferred than others, local incentives might favour the development of infrastructure rather than the promotion of innovative services, etc.). Once again, a collaboration with local authorities would be necessary to tailor the city's transition simulation according to its own vision and path towards the future.

With these important considerations that need to be factored in, this factsheet presents a preliminary simulation for the city of **Prague (CZ)** (*Large City Eastern Europe*) and offers, through some Key indicators, an initial estimation of the cost and benefits of the city's transition to sustainable urban mobility by the years 2030 and 2050 for the assumed scenarios.

[3] The three scenarios are simulated considering a penetration of innovative vehicle technologies inspired to the EU "Fit for 55" Strategy (as an example, it is assumed a share of about 85% of car electric vehicles in total European fleet by 2050). That said, the study considers only the costs affecting local authorities (administration, public transport operators, service providers) such as costs for the green fuel recharging urban infrastructure to support the evolution of vehicle technologies. Other relevant costs associated (government incentives, costs for the automotive sector, etc.) belonging to external entities are not considered within the study.

Input Data

Table 1: List of collected data inputs (either publicly available or estimated)

Group	Input data	Description	Available/Estimated
Urban Characteristics	Population	Population of the city	Publicly available
	Population Structure	Age distribution of the city population	Publicly available (at NUTS3 level)
	Population Growth	Expected trend of the population growth	Publicly available
	Population Distribution	Population distribution between city centre and outskirts	Estimated
	Urban Growth	Population shifts between city centre and outskirts	Estimated
	Average Income	Average income of the city population	Publicly available
	Economy	Economy city type, representing the relevance of industrial sector for the city in terms of employees working in manufacturing, construction and public utilities	Estimated
Urban Mobility Characteristics	Motorization Rate	Number of private cars per capita	Publicly available (at Country level)
	Motorization Rate Change	Annual growth of the motorization rate	Publicly available (at Country level)
	Modal Split	Modal split with respect to the urban area only (walk, bike, car, motorbike, bus, tram, metro)	Estimated
	Modal Split Change	Modal split trend over time in absence of policy activation	Estimated
	Congestion Level	Qualitative description of road congestion in the city (significant, only during rush hour, negligible)	Publicly available
	Incoming Trips	Share of incoming trips in the urban area, with respect to the total amount of trips within the area	Estimated
	Modal Split of the Incoming Trips	Modal Split of the incoming trips into the urban area (private car, bus, train)	Estimated
	Freight Vehicles Rate	Share of freight vehicles with respect to the total vehicles (freight and cars) travelling in the urban area	Estimated
	Freight Vehicles Rate Change	Annual change in the share of freight vehicles with respect to total vehicles travelling in the area	Estimated
Public Transport Characteristics	Ticket price	Ticket price for monthly passes and single tickets	Publicly available
	Cost	Implementation and management costs for public transport operators	Estimated
	Network	Length of the network	Publicly available
	Average Speed	Average speed of the vehicles	Estimated
	Transport Service	Annual vehicle-kilometre	Estimated

Group	Input data	Description	Available/Estimated
	Offer		
	Bus Vehicle Fleet	Composition of the fleet, with respect to the fuel type	**Publicly available**
Park & Ride	**Parking Capacity**	Number of parking lots	**Estimated**
	Network Extension	Length of the public transport routes connected with P&R park	**Estimated**
	Public Transport Frequency	Frequency of Park & Ride connection service	**Estimated**
	Tariff	Tariff for single use or subscription related to parking only (the cost of using PT not considered)	**Estimated**
Infrastructure and Traffic Management	**Paid Parking**	Number of paid parking lots in the urban area	**Estimated**
	Parking Price	Average hourly parking price	**Publicly available**
	Public Transport Reserved Lane	Length of the public transport reserved lanes	**Estimated**
	Bike Lane	Length of the bike lanes in the urban area	**Publicly available**
	Electric Charging Stations	Number of electric charging stations	**Publicly available**
	Hydrogen Charging Station	Number of hydrogen filling stations	**Publicly available**
Car Sharing	**Subscribers**	Number of subscribers	**Estimated**
	Type	Station Based or Free-Floating service	**Publicly available**
	Tariff	Fixed and hourly average tariff	**Publicly available**
	Vehicle Fleet	Number of car sharing vehicles	**Publicly available**
Bike Sharing	**Vehicle Fleet**	Number of bicycles of the bike Sharing service	**Publicly available**
	Electric Fleet	Share of electric bicycles in the fleet	**Publicly available**
	Tariff	Fixed and hourly average tariff	**Publicly available**
Vehicle Access Regulation	**Limited Traffic Zone**	Qualitative quantification of the share of urban area under Limited Traffic Zone	**Estimated**
	Pedestrian Areas	Qualitative quantification of the share of urban area with pedestrian areas	**Estimated**
Traffic Calming Measures	**Traffic Calming Area**	Share of the urban area under 30 km/h speed limit	**Estimated**
Road vehicle fleet composition	**Vehicle fleet**	Vehicle fleet composition by fuel type and emission standard (for conventional fuels) for private cars, car sharing cars, Light Duty Vehicles and Heavy Goods Vehicles. It is assumed that national data can be used as representative data for vehicle fleet composition also at urban level.	**Estimated**

Source: Own elaboration

Preliminary Simulation: PRAGUE

EMISSIONS OF CO_2 (TANK-TO-WHEEL), CAR OWNERSHIP, FATALITIES

Emissions of CO_2 (Tank-to-wheel) [t CO_2 eq / capita per year]

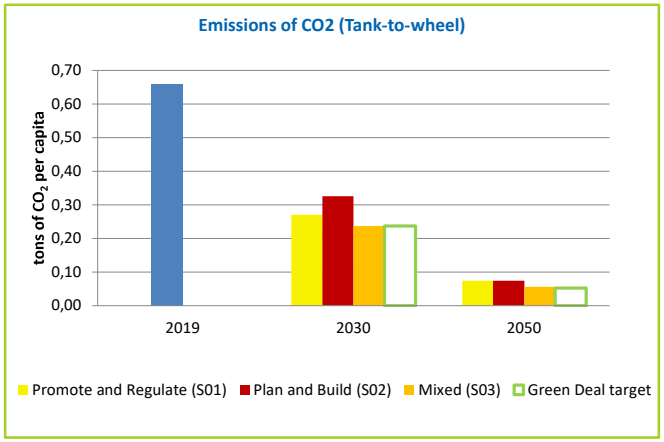
Scenario	2019	2030	2050
Promote and Regulate (S01)	0,657	0,270	0,074
Plan and Build (S02)	0,657	0,326	0,074
Mixed (S03)	0,657	0,237	0,056
Green Deal target		0,237	0,053

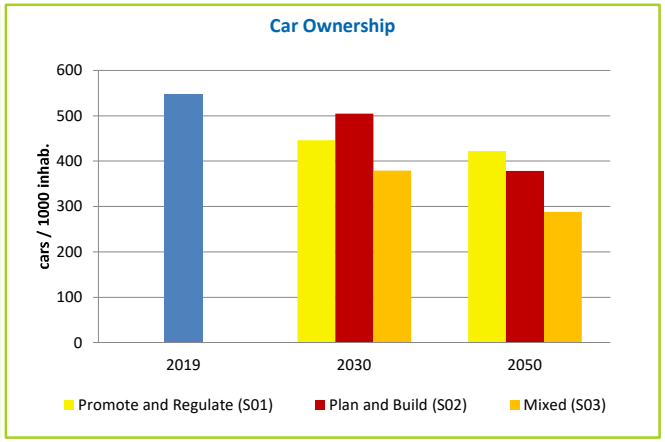
Car ownership level [cars / 1000 inhab.]

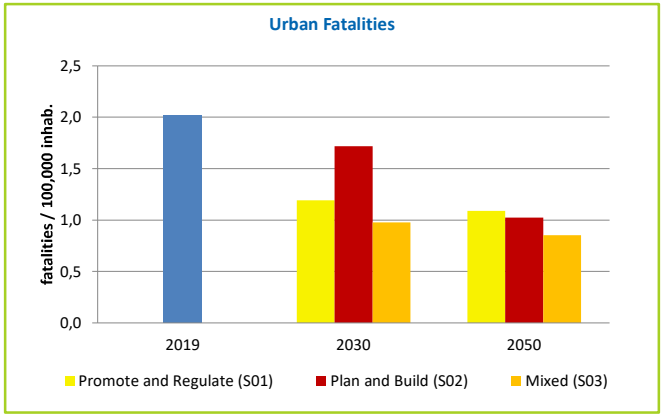
Scenario	2019	2030	2050
Promote and Regulate (S01)	547	446	422
Plan and Build (S02)	547	505	378
Mixed (S03)	547	379	288

Urban Fatalities [fatalities / 100,000 inhab.]

Scenario	2019	2030	2050
Promote and Regulate (S01)	2,015	1,191	1,090
Plan and Build (S02)	2,015	1,720	1,024
Mixed (S03)	2,015	0,977	0,854







KEY INDICATORS

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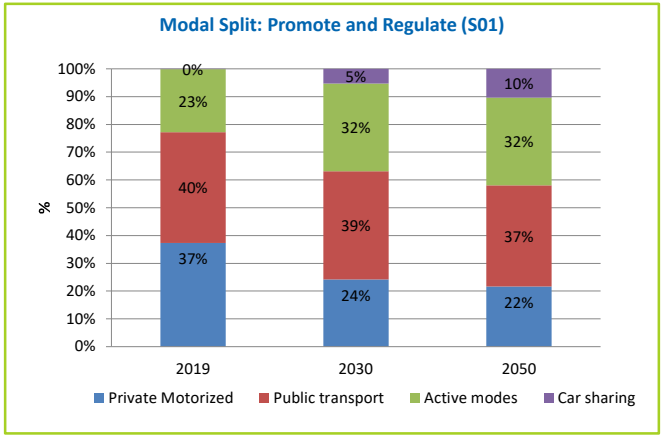
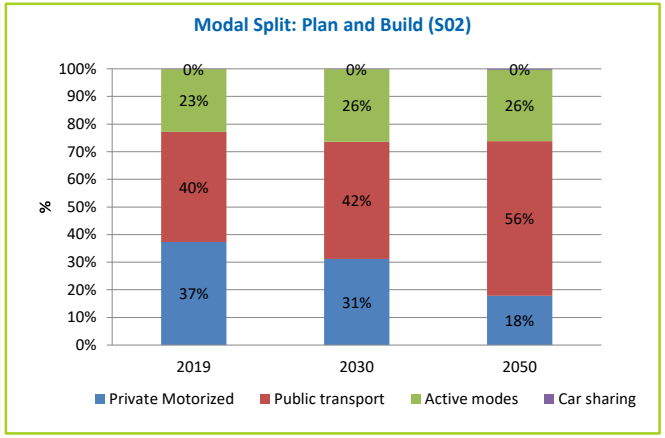
Preliminary Simulation: PRAGUE

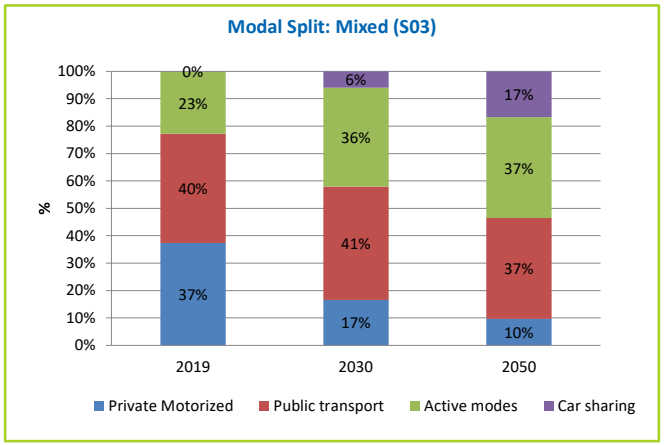
MODAL SPLIT

Aggregate mode split [%]

Scenario	Mode	2019	2030	2050
Promote and Regulate (S01)	Private Motorized	37%	24%	22%
Promote and Regulate (S01)	Public transport	40%	39%	37%
Promote and Regulate (S01)	Active modes	23%	32%	32%
Promote and Regulate (S01)	Car sharing	0%	5%	10%
Plan and Build (S02)	Private Motorized	37%	31%	18%
Plan and Build (S02)	Public transport	40%	42%	56%
Plan and Build (S02)	Active modes	23%	26%	26%
Plan and Build (S02)	Car sharing	0%	0%	0%
Mixed (S03)	Private Motorized	37%	17%	10%
Mixed (S03)	Public transport	40%	41%	37%
Mixed (S03)	Active modes	23%	36%	37%
Mixed (S03)	Car sharing	0%	6%	17%







KEY INDICATORS

Preliminary Simulation: PRAGUE

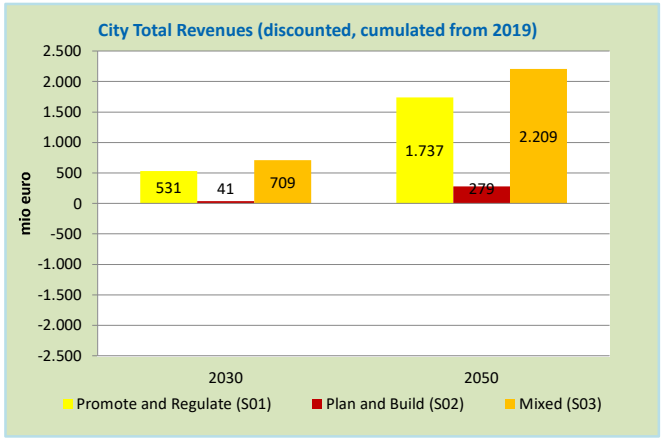
ECONOMIC OUTPUTS (discounted, cumulated from 2019)*

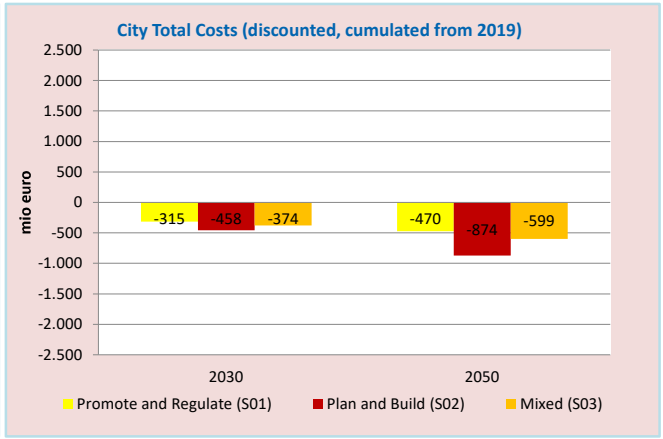
City total revenues [mio euro]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	531	1.737
Plan and Build (S02)	0	41	279
Mixed (S03)	0	709	2.209

City total costs [mio euro]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	315	470
Plan and Build (S02)	0	458	874
Mixed (S03)	0	374	599



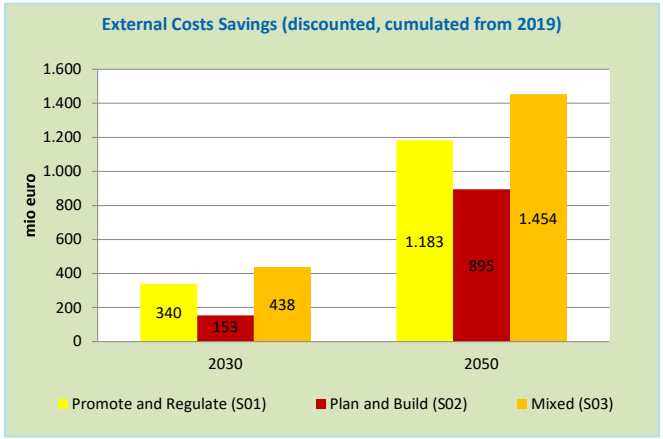


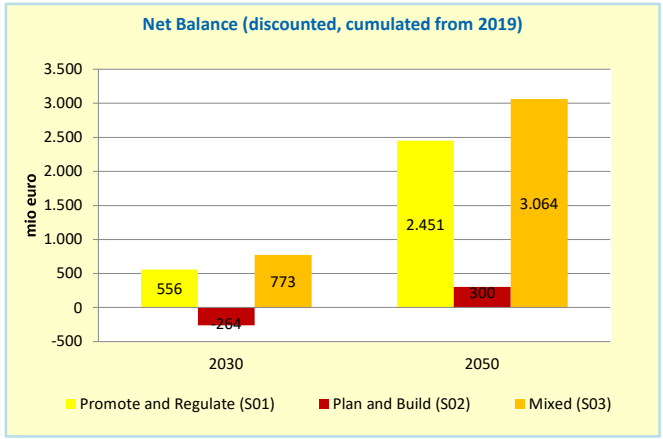
External costs savings [mio euro]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	340	1.183
Plan and Build (S02)	0	153	895
Mixed (S03)	0	438	1.454

Net balance [mio euro]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	556	2.451
Plan and Build (S02)	0	-264	300
Mixed (S03)	0	773	3.064





KEY INDICATORS

* Costs and Revenues are the incremental ones associated with the implemented policies and with respect to the BAU (in which no policy measures are activated)

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Preliminary Simulation: PRAGUE

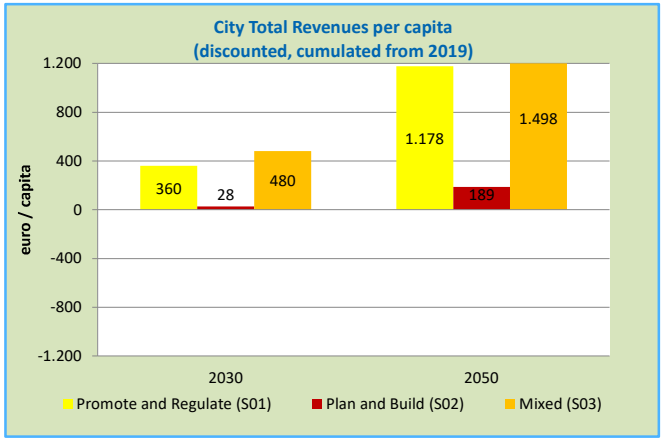
ECONOMIC OUTPUTS PER CAPITA (discounted, cumulated from 2019)*

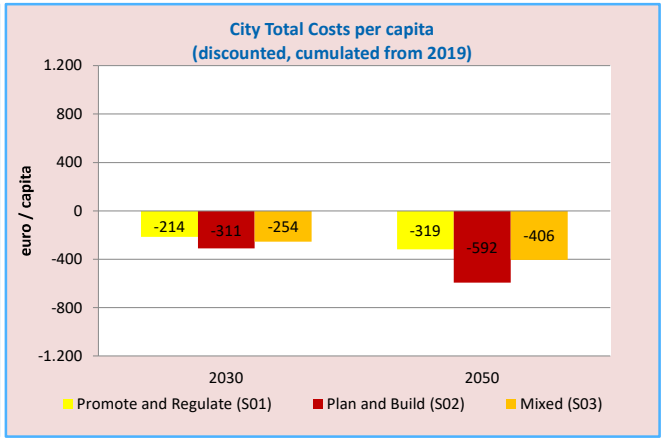
City total revenues [euro / capita]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	360	1.178
Plan and Build (S02)	0	28	189
Mixed (S03)	0	480	1.498

City total costs [euro / capita]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	214	319
Plan and Build (S02)	0	311	592
Mixed (S03)	0	254	406



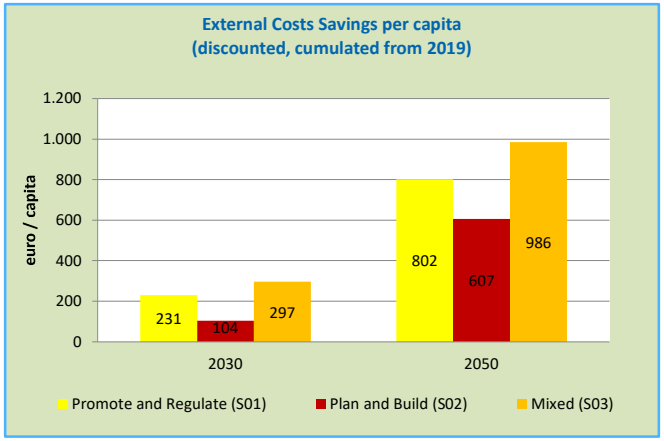


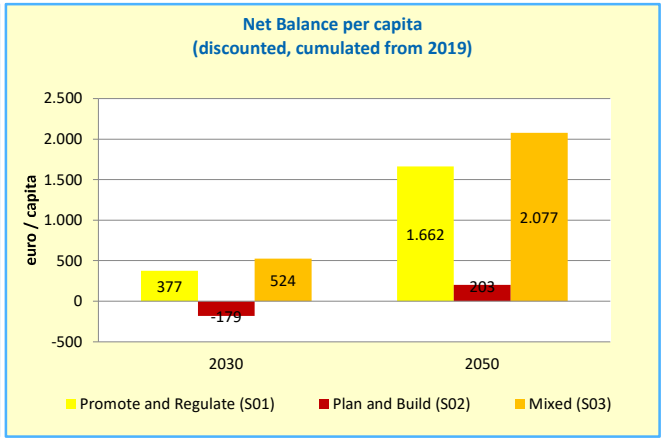
External costs savings [euro / capita]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	231	802
Plan and Build (S02)	0	104	607
Mixed (S03)	0	297	986

Net balance [euro / capita]

Scenario	2019	2030	2050
Promote and Regulate (S01)	0	377	1.662
Plan and Build (S02)	0	-179	203
Mixed (S03)	0	524	2.077





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