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Cleaner and better transport in cities

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Implementation status report on hybrid vehicles

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1. Measure 1.12-LJU Green procurement of public fleets

Within measure 1.12 LJU a new approach was planned for introduction of a clean fleet at the local level. Along with replacing the whole old city owned car fleet with rented new hybrid vehicles, the deployment of clean, energy-efficient hybrid cars to represent one tenth of the entire city fleet was planned. One of the aims of this deployment was also to get experience on hybrid car use in practice. Additionally, it should have an information spreading purpose as well as attracting public and private interest to use hybrid cars.

For the first time reduced fuel consumption and energy efficiency was defined among the award criteria in public procurement in Ljubljana. The inputs from the debate on the EC's Green Paper on Urban Transport, e.g. suggestions that "the award criteria for vehicle procurement for public transport service could include, in addition to other criteria, the cost for energy consumption, the cost of CO₂ emissions, and the cost of pollutant emissions, all compounded over the life-time of a vehicle" would be introduced.

The development of a small fleet of clean vehicles in Ljubljana started with the decision of the Government of the Republic of Slovenia, in 2007, of tax relieves/ reduction for hybrid technology vehicles. The choice of this technology relies on a large scale and a long term use of hybrid technology that promises to reduce considerably the operational costs and reduce the environmental impact.

So far, no hybrid vehicles were in use, neither in the city administration nor in public companies. There were only two taxi service hybrid vehicles. The city has adopted a decree by which hybrid taxi vehicles are exempted from paying the annual tax on assigned parking spaces.

Beside hybrid car introduction several activities were planned to improve the efficiency of the city's fleet car use in general as well as to promote alternative means of transportation where possible.

The main measure objectives are:

- To implement the green procurement principle in practice by renting hybrid personal vehicles for the city's fleets
- To lower fuel consumption
- To improve air quality by lowering emissions
- To promote the use of hybrid vehicles in the public and private sector by giving good examples and raise their acceptance
- To help extend a market for hybrid vehicles
- To improve the acceptance of hybrid vehicles and check the impact on public procurement activities

2. Background information on the City of Ljubljana and its car fleet

2.1. The municipality of Ljubljana

The municipality of Ljubljana (Mestna občina Ljubljana – MOL) manages local matters of public importance, manages the municipality's property, promotes economic development, creates the conditions necessary for building new public housing, manages the local public services, promotes better day-care for preschool children, educational activities and the development of sports and leisure activities. It also strives to improve the health and social security services, promotes research and cultural and social activities, cares for preservation of the air, earth and water, combats noise pollution, deals with the refuse and carries out other activities for environmental protection. It ensures protection against natural and other disasters, keeps the public order in the municipality and deals with other local matters of public importance. The municipality consists territorially of 17 neighbourhoods, shown on the picture below.

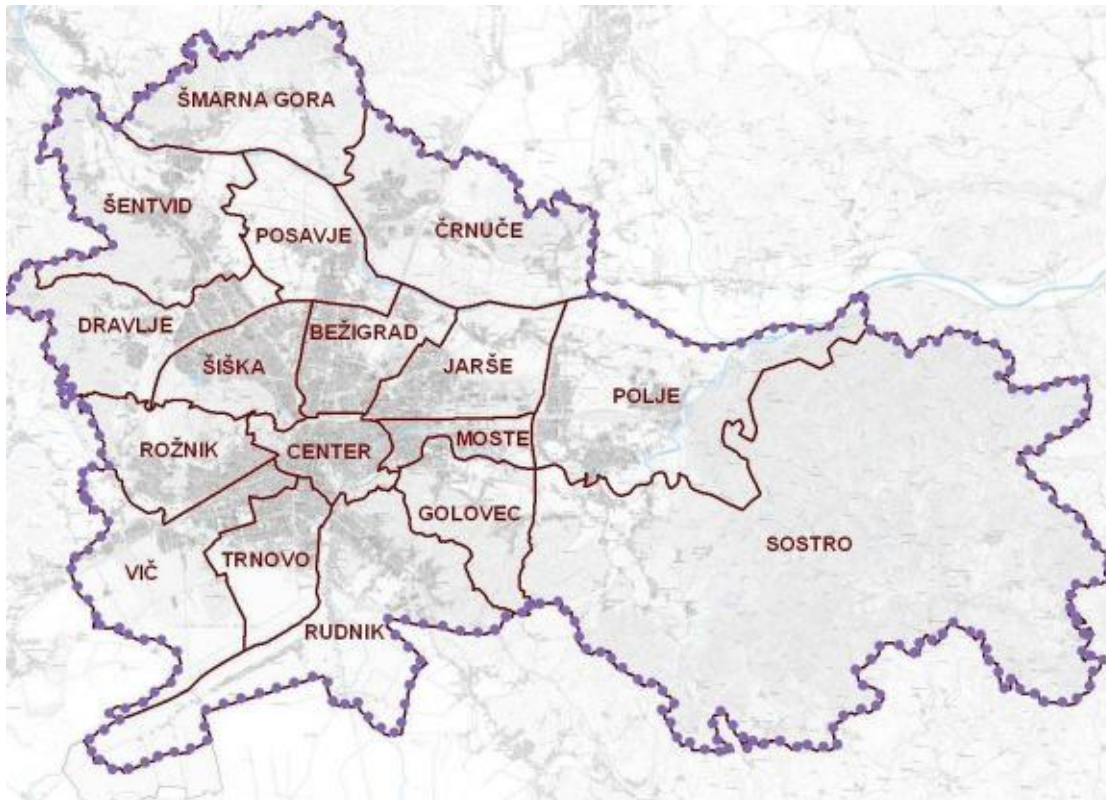


Fig.1 City of Ljubljana, its boundaries and local communities, source: <https://urbanizem.ljubljana.si/UrbinfoWeb/profile.aspx?id=Urbinfo2@Ljubljana>

The municipality administration is organised in 20 departments and offices, currently located on 11 different locations within the city centre. Plans are being made to unite all administrations at a single location within a new municipal and governmental administration centre in the future. However, due to the current financial situation these plans seem to be postponed in more distant future.

MOL Department	Location
City Administration Secretariat	Adamič-Lundrovo nabrežje 2
City Council Administration Office	Adamič-Lundrovo nabrežje 2
Development Projects and Investments Office	Adamič-Lundrovo nabrežje 2
Internal Audit Office	Adamič-Lundrovo nabrežje 2
Legal Affairs Office	Adamič-Lundrovo nabrežje 2
Real Estate Department	Adamič-Lundrovo nabrežje 2
Department of Culture	Ambrožev trg 7
Local Government Office	Ambrožev trg 7
Department of Health and Social Security	Cigaletova 5
Finance and Accountancy Department	Dalmatinova 1
Public Procurement Office	Dalmatinova 1
Mayor's Office	Mestni trg 1
Department of Spatial Planning	Poljanska cesta 28
City Inspectorate	Proletarska 1
Traffic Warden Department	Proletarska 1
Department of Pre-School Development and Education	Resljeva 18
Department of Sport	Staničeva 41
Department of Commercial Activities and Transport	Trg mladinskih delovnih brigad 7
Department of Disaster Management	Zarnikova 3
Department of Environmental Protection	Zarnikova 3

Fig.2 City of Ljubljana, administrative departments and their addresses
Source: Ljubljana in numbers, 2003-2008.

2.2. Physical location of departments of the City administration of Ljubljana

The city administration is located at 11 different locations within the city centre. The actual physical position of departments within the map of the city centre is presented in the picture below. The cars of the City car fleet are not located at all departments. The actual distribution is included in Fig. 3. The central administrative part consisting of City Administration Secretariat, City Council Administration Office, Development Projects and Investments Office, Internal Audit Office, Legal Affairs Office and Real Estate Department is located on Adamič-Lundrovo nabrežje 2 (red point) and is very close to the Mayor's office within the City Hall (orange point). The location of the Finance and Accountancy Department with the Public Procurement Office (Dalmatinova 1) and the Department of Health and Social Security (Cigaletova 5) are marked with blue and light green points. At greater distance there are four departments: The Department of Pre-School Development and Education (Resljeva 18) marked with a dark green point, the Department of Culture and Local Government Office (Ambrožev trg 7) marked with a magenta colour point, the Department of Disaster Management and the Department of Environmental Protection on (Zarnikova 3) marked with a white point and the Department of Spatial Planning (Poljanska cesta 28) marked in brown. Three departments are at the outskirts of town: the City Inspectorate and Traffic Warden Department (Proletarska 1), marked with a yellow point, the Department of Sport (Staničeva 41), marked with a cyan coloured point and the Department of Commercial Activities and Transport (Trg mladinskih delovnih brigad 7), marked with a bordeaux coloured point.

For the communication within the departments a courier is delivering and exchanging mail twice a day by car.

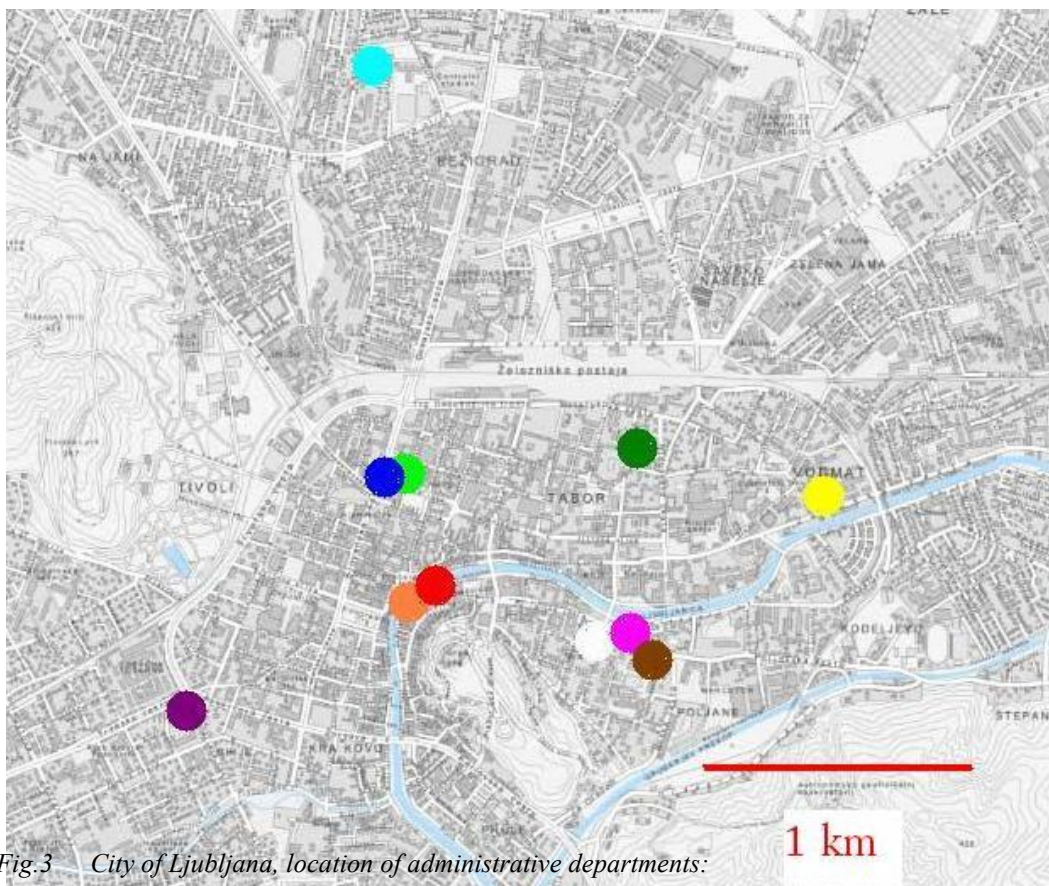


Fig.3 City of Ljubljana, location of administrative departments:

- **Mayor's Office** (City hall, Mestni trg 1) – 4 cars
- **City Administration Secretariat, City Council Administration Office, Development Projects and Investments Office, Internal Audit Office, Legal Affairs Office, Real Estate Department** (Adamič-Lundrovo nabrežje 2) – 19 cars

- **Department of Culture, Local Government Office** (Ambrožev trg 7) - 2 cars
- **Department of Health and Social Security** (Cigaletova 5) – 1 car
- **Finance and Accountancy Department, Public Procurement Office** (Dalmatinova 1) – 3 + 1 car
- **Department of Spatial Planning** (Poljanska cesta 28) – 2 cars
- **City Inspectorate, Traffic Warden Department** (Proletarska 1) – 8 + 9 cars
- **Department of Pre-School Development and Education** (Resljeva 18) – 2 cars
- **Department of Sport** (Staničeva 41) – 2 cars
- **Department of Commercial Activities and Transport** (Trg mladinskih delovnih brigad 7) – 7 cars
- **Department of Disaster Management, Department Of Environmental Protection**
(Zarnikova 3) – 5 + 1 car

2.3. Car usage in the City of Ljubljana

The vehicles of City of Ljubljana's fleet are located within specific departments according to its function, daily needs and specific usage. Most of these cars are intended to be used by different people within one or several departments during working hours only and are parked within the defined parking lots of each department. In case an employee who does not use a car on a daily basis needs a car it must be ordered a day or two in advance and the car must be returned on the same working day. If an employee needs to drive to a meeting or workshop outside of Ljubljana a car can be reserved for more than one day for the duration of the workshop. Employees who use cars on a daily basis are circulating them during the entire working day. Some cars of the city fleet, however, are intended for personal use of high officers especially for the purpose of their availability and readiness in urgent situations during weekends and around the clock when necessary.

3. The city fleet before CIVITAS-ELAN

In June 2009 the city car fleet consisted of 56 personal cars of lower and lower-medium class, with predominantly gasoline engines of 40-125 kW power, purchased between 1996 and 2001 (in average 1998), owned by the City of Ljubljana. None of them were hybrids.

The majority of the former COL vehicles performed adversely to the environment. A typical usage is short distance travel which by itself is not very efficient (cold engines, high fuel consumption, resulting also in very high CO₂ emission factor for today's standards). The average impacts depend somewhat on vehicle type (e.g. the Renault Clios (lower class) have lower consumption than Renault Megane and VW Golf (lower-medium class)).

In average, a car from the old fleet, purchased in 1996, had a fuel consumption of 9,7 l/ 100 km and very high specific CO₂ emissions of 233gCO₂/ km.

The development of a small fleet of clean vehicles in Ljubljana started with the decision of the Government of the Republic of Slovenia, in 2007, of tax relieves/ reduction for hybrid technology vehicles. The choice of this technology relies on a large scale and a long term use of hybrid technology that promises to reduce considerably the operational costs and reduce the environmental impact.

4. Activities within the CIVITAS-ELAN project

During the preparation phase for the first “green procurement” of vehicles for the City administration's car fleet, a brief survey on hybrid vehicles in Slovenia was performed based on checking several publications on hybrid vehicles available on the market of the Republic of Slovenia. The enquiry has shown that at the time of the survey the only two hybrid vehicles of the category of vehicles in question, available on the Slovenian market were **Honda civic 1.4i hybrid** (in the lower middle class category) and **Toyota prius HBL4/4** (middle class category).

For the public procurement for the rental of the new City administration's car fleet, six hybrids, representing roughly 10% of the entire fleet, were included. During the public procurement process, which was finished in June 2009, Porsche Leasing was chosen as the best offer. Among other vehicles six Toyota prius HBL 4/4 were rented.

At the end of June 2009 the car fleet was completely changed and renewed. The entire old city fleet was sold and new cars were rented. It was decided to rent cars rather than to buy them because of much lower economic burden in short-term as well as reduction of personnel needed for managing the car fleet for regular service, repair appointment, winter and summer tyre changes, etc. Instead of two persons before only one person is managing the new fleet now.

Within the green public procurement process 6 hybrid cars (of altogether 63 cars) were introduced. Based on the survey conducted at the start of the project no suitable electric car was available on the market. Of the two available hybrid cars it was decided to rent six new Toyota hybrid cars. They were incorporated in the City Inspectorate's Traffic Warden Department located on Proletarska 1 in July 2009. Since then they are being used on a daily basis.



Fig.4 Three of six hybrids cars rented within measure 1.12-LJU of the CIVITAS-ELAN project on the parking lot of the City Inspectorate's Traffic Warden Department on Proletarska 1, Ljubljana (photographed by the author)



Fig.5 Close up of the picture above with some details of the CIVITAS-ELAN label and EU logo on the car (photographed by the author)

5. Eco-driving training

An eco-driving course was prepared and held for 35 participants of the city administration. They were chosen on a basis of distance they make by car during their everyday work, among them 1 driver of the Mayor's Office, 9 drivers of the City Administration Secretariat (Courier, housekeeper, technical maintenance staff), 20 drivers of the City Inspectorate and Traffic Warden Department and 5 drivers of the Department of Disaster Management.

For the eco-driving course the Centre for Safe Driving (<http://cvv.amzs.si/>) in Vransko was chosen as the best and most economical solution. Vransko is a small town located some 50 km from Ljubljana in direction to Maribor.

This centre (http://www.youtube.com/watch?v=phdE9cF2QY8&feature=player_embedded) is the first training centre for safe driving and also the official centre for the training of safe driving, which all new drivers are obligatory to pass within the first year after they obtain their driving licence. In this centre they make courses also for drivers which have nearly or completely lost their driving permit due to severe breaking of the driving rules.

The eco-driving course was held as a one working day activity (8 hours) consisting of (a) first driving, (b) theoretical part, (c) second driving (after lunch) and (d) conclusive part. Six to eight persons participated in the course on the same day. The courses took place on 22 May, 23 May, 31 May, 4 June and 20 June 2012.

Two vehicles (VW Golf and VW Tiguan), equipped with special monitoring equipment were used for the driving course. The first step was the driving as usual taking some twenty five minutes for each participant on the predefined route to drive. The second step was the theoretical part. In the third step each driver drove exactly the same route as previously. The instructor was driving closely behind the vehicles with participants in the first drive and in front of them in the second tour commenting and explaining details to the participants by wireless radio.

The results of the course have astonished even the most experienced drivers. With a slight change of driving habits fuel consumption was lowered between 2% and over 40%, the engine rpm was also

lowered during the drive. But most astonishing was the fact that the second drive was even faster and less time consuming than the first one beside all mentioned benefits. The eco-driving course was hence regarded as very successful. That was also the overall opinion of the majority of participants.

6. Preliminary evaluation results

6.1. Operation of hybrid vehicles

On a regular basis data on the operation and fuel consumption as well as on costs and effects of the city fleet, including the new hybrid cars, has been collected.

The data was then compared to the data on the City fleet vehicles for the years 2007-2008 (fuel consumption, emission of CO₂ and noise) which had been collected at the start of the project.

The positive effect of the measure is considerable comparing statistical data of the average before and after the implementation of the hybrid vehicles into the city fleet. The percentage of green vehicles rose from 0% to 10% and the percentage of diesel fuelled vehicles decreased from 18% to 13%.

The average Ecoscore (see below) improved from 49 to 64 and the average Euronorm of engines within the cars of the city fleet increased from 1,68 to 4,11.

If we count by environmental standards, this is a big step toward cleaner fleet. The EuroNorm figure with hybrids is however lower than without them, because seven non-hybrids listed have engines of EuroNorm 5a, exceeding Hybrid car engines with Euronorm 4 standards.

By inputting the data of the old city fleet for calculating the Ecoscore, big differences were found considering existing combinations of car models/ engine type combinations for the same year of production between Slovenian car fleet and the car fleet being built in the Ecoscore database. It was found that the car of the same brand and type produced in the same year from the same manufacturer can have quite a different engine adapted for the emission standards of every particular market, to where it is planned to be sold.

About The Ecoscore concept

Ecoscore is an environmental score for vehicles, provided by the Belgian website (www.ecoscore.be/en). This score provides an indication of the overall environmental friendliness of a vehicle. The Ecoscore is expressed as a value between 0 and 100: the higher the score, the more environmentally friendly the vehicle is. The applied environmental review allows combining different effects (global warming, air quality, health effects and effects on ecosystems and noise) into one single numerical indicator. The method used in this perspective is the well-to-wheel approach. This takes into account both tank-to-wheel (exhaust emissions caused by driving a vehicle) and well-to-tank emissions (emissions from production and distribution of the fuel (petrol, diesel, LPG, electricity, etc.)) The great advantage of this method is that vehicles with different fuels and different technologies can be compared with the same indicator. The emissions associated with the production of the vehicle and the recycling or after use-processing, are not taken into account. More info about how the ecoscore is calculated can be found on <http://www.ecoscore.be/en/how-do-we-calculate-ecoscore>.

About the Euronorm emission standard concept

Emission standards for passenger cars are summarised in the following table. Since the Euro 2 stage, EU regulations introduce different emission limits for diesel and petrol vehicles. Diesels have more stringent CO standards but are allowed higher NO_x emissions. Petrol-powered vehicles are exempted from particulate matter (PM) standards through to the Euro 4 stage, but vehicles with direct injection engines will be subject to a limit of 0.005 g/km for Euro 5 and Euro 6. A particulate number standard (P) or (PN) is part of Euro 5 and 6, but is not final. The standard is to be defined as soon as possible and at the latest upon entry into force of Euro 6.

All dates listed in the table below refer to new type approvals. The EC Directives also specify a second date - one year later - which applies to first registration (entry into service) of existing, previously type-approved vehicle models.

European emission standards for passenger cars (Category M*), g/km

Tier	Date	CO	THC	NMHC	NO _x	HC+NO _x	PM	P***
Diesel								
Euro 1†	July 1992	2.72 (3.16)	-	-	-	0.97 (1.13)	0.14 (0.18)	-
Euro 2	January 1996	1.0	-	-	-	0.7	0.08	-
Euro 3	January 2000	0.64	-	-	0.50	0.56	0.05	-
Euro 4	January 2005	0.50	-	-	0.25	0.30	0.025	-
Euro 5	September 2009	0.500	-	-	0.180	0.230	0.005	-
Euro 6 (future)	September 2014	0.500	-	-	0.080	0.170	0.005	-
Petrol (Gasoline)								
Euro 1†	July 1992	2.72 (3.16)	-	-	-	0.97 (1.13)	-	-
Euro 2	January 1996	2.2	-	-	-	0.5	-	-
Euro 3	January 2000	2.3	0.20	-	0.15	-	-	-
Euro 4	January 2005	1.0	0.10	-	0.08	-	-	-
Euro 5	September 2009	1.000	0.100	0.068	0.060	-	0.005**	-
Euro 6 (future)	September 2014	1.000	0.100	0.068	0.060	-	0.005**	-

* Before Euro 5, passenger vehicles > 2500 kg were type approved as light commercial vehicles N1-I

** Applies only to vehicles with direct injection engines

*** A number standard is to be defined as soon as possible and at the latest upon entry into force of Euro 6

† Values in brackets are conformity of production (COP) limits

6.2. Public acceptance of hybrid vehicles

A survey about the public acceptance of the hybrid vehicles was held. The results of the survey show that most people have no experience of using hybrids. In order to list three key advantages of them, hybrid cars were found to be (1) environmentally friendly, (2) economic and (3) less noisy. The three most noticeable disadvantages of hybrid cars were found to be (1) their price, (2) the limited durability of their batteries and (3) the costs of their maintenance. The question “if they would buy a hybrid car” was answered by 18/19 with “certainly”, 23/33 with “yes – possible”, 10/6 with “no intention” and 13/5 with “do not know”. The future use of hybrid cars in the city was answered by 33/39 with “very much”, by 40/36 with “yes”, by 10/9 with “neither – nor”, by 3/2 with “no” and by 1/1 with “absolutely not”.