DELIVERABLE

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EXISTING INFRASTRUCTURE AND ENERGY SOURCES REPORT: **Slovenia**

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Authors:

Jure RATEJ – ETREL d.o.o.

Uršula KRISPER – Elektro Ljubljana, d.d.

Elektro Ljubljana OVE, d.o.o.

Božidar GOVEDIČ – Elektro Maribor, d.d.

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Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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1 SUMMARY

1.1 Objective of document

The objective of this deliverable is to analyse the existing infrastructure in the cities, including a study on the energy sources that will be used to charge the electric vehicles

1.2 Content and structure of document

The document is structured in three parts, one by each Pilot action:

D1.1a: Pilot 1 - Bristol

D1.1b: Pilot 2 – Pamplona-Vitoria

D1.1c: Pilot 3 – Ljubljana-Maribor

1.3 Abbreviations and acronyms

Item	Description
EV	Electric Vehicle
RFID	Radio Frequency Identification
UID	User ID
GPRS	General Packet Radio Service
UMTS	Universal Mobile Telecommunications System

2 INTRODUCTION

At the moment of starting this project, there is already an existing infrastructure for recharging electric vehicles available in each of the participating cities. This infrastructure will be described in further detail in order to plan the adaptations needed in each case to provide each pilot with the necessary capabilities to perform satisfactorily roaming demonstrations.

As an additional part of this work package, a study of the different energy sources for each scenario will be performed.

3 ANALYSIS OF EXISTING INFRASTRUCTURE: PILOT 3 (LJUBLJANA AND MARIBOR)

3.1 Objective of the pilot

The pilot will check the present ICT charging infrastructure solutions in both regions and try to identify present capabilities for data collection, compare them, and suggest changes in order to develop the state-of-the-art ICT system capable of safe, reliable, and fast data exchange needed for roaming and billing purposes. An important output will be a standardised set of data, protocol for data exchange and the semantic definition of a charging station, an EV and an EV user/owner.

3.2 Charging infrastructure of Elektro Ljubljana

Currently Elektro Ljubljana owns and operates 11 charging stations, 6 of them in city of Ljubljana and 5 of them in other cities in Ljubljana region. During the next years Elektro Ljubljana plans to expand its charging infrastructure with installation of 3 charging stations in 2012, 2 in 2013 and 2 in 2014.

Elektro Ljubljana has 1 EV in its car park. Another 2 EVs are planned to be purchased in 2013.

3.2.1 Location of charging stations

No.	Name	City	Street	ID	Type
1	PP Trubarjeva 1	Ljubljana	Trubarjeva ulica	SI03001	1
2	PP Trubarjeva 2	Ljubljana	Trubarjeva ulica	SI03006	1
3	PP Cigaletova	Ljubljana	Cigaletova ulica	SI03003	1
4	PP Kotnikova	Ljubljana	Kotnikova ulica	SI03004	1
5	PP Slomškova	Ljubljana	Slomškova ulica	SI03005	1
6	PP Vrhnika	Vrhnika	Tržaška cesta	SI03007	1
7	PP Litija	Litija	Ponoviška cesta	SI03008	2
8	PP Miklošičeva	Ljubljana	Miklošičeva ulica		4
9	PP Zagorje ob Savi	Zagorje ob Savi	Cesta 9. avgusta		5
10	PP Kočevje	Kočevje	Trg zbora odposlancev		4
11	PP Grosuplje	Grosuplje	Adamičeva cesta		4
12	PP Trbovlje	Trbovlje	Ulica 1. junija		3

Table 1: Locations of charging stations in Ljubljana region

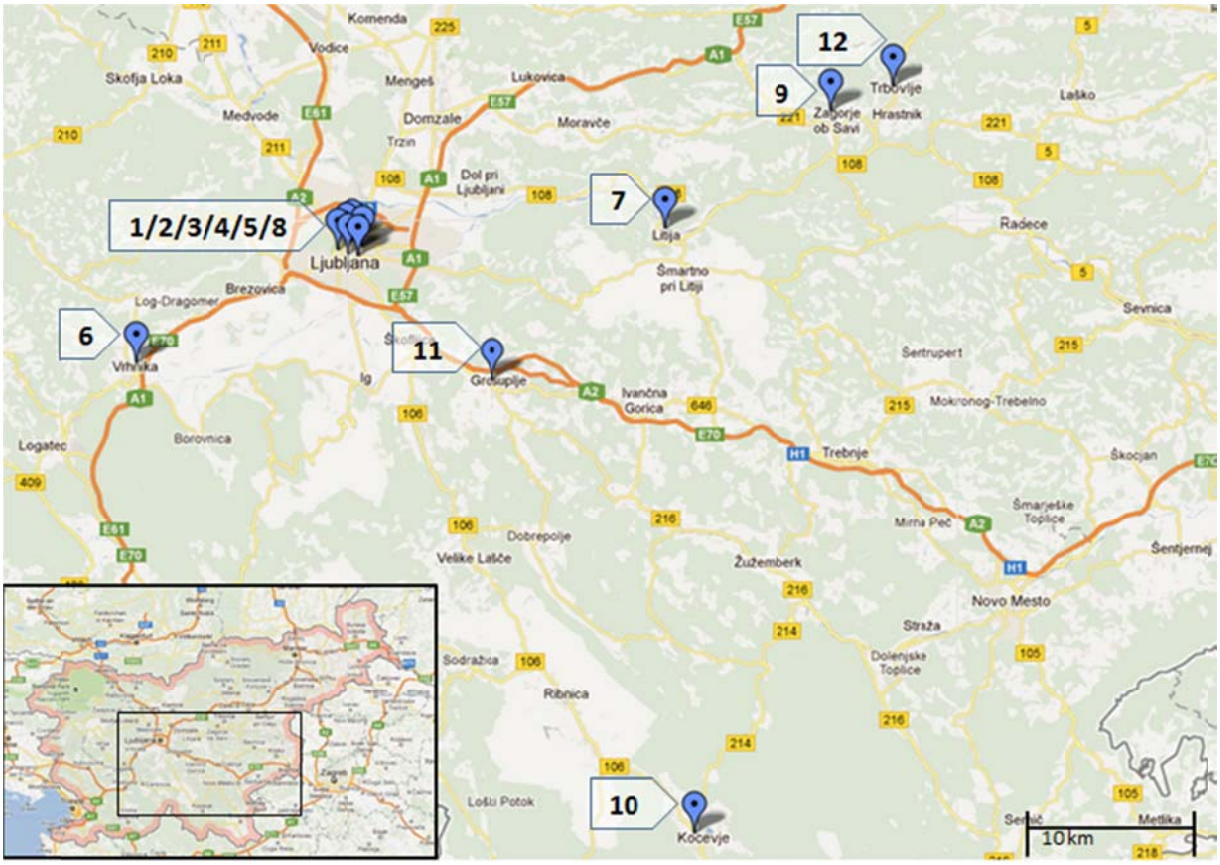

Figure 1: Locations of charging stations in Ljubljana region

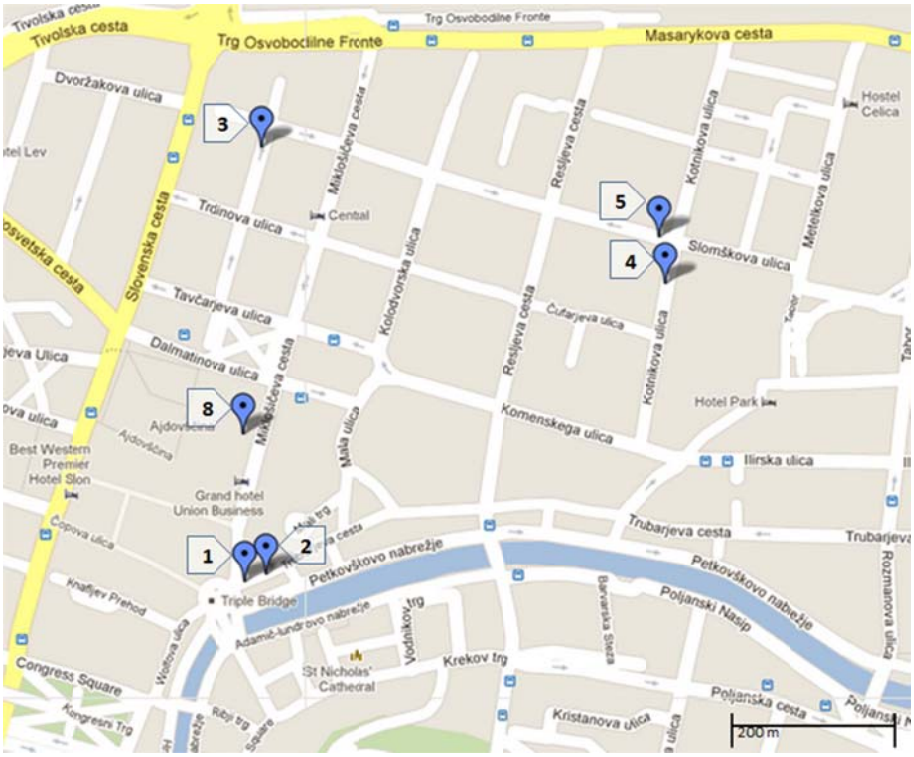

Figure 2: Locations of charging stations in the city of Ljubljana

3.2.2 Technical characteristics of charging stations

Item	Type 1	Type 2	Type 3	Type 4	Type 5
Stations No. (ref. paragraph 3.2.1)	1, 2, 3, 4, 5, 6	7	12	8, 10, 11	9
Manufacturer	Etrel (SI)	Etrel (SI)	Circutor (E)	RWE (D)	ETI (SI)
Type	Gen 2	Gen 3			
Supplier	Etrel (SI)	Etrel (SI)	Belmet (SI)	Interenergo (SI)	ETI (SI)
Dimensions (w x d x h in cm)	22 x 22 x 160	60 x 25 x 160	21 x 35 x 135	21 x 35 x 135	25 x 25 x 130
Mounting	stand-alone	stand-alone	stand-alone	stand-alone	stand-alone
Connection (acc. to IEC 61851)	A/B	A/B	A/B	A/B	A/B
IK degree					
IP degree	54	54	54	44	44
Number of sockets	2	2	2	2	1
Number of simutaneous charging processes	2	2	2	2	1
Socket 1:					
- type	Schuko with microswitch	Schuko with microswitch	Mennekes	Mennekes	Schuko
- U (V)	230 VAC	230 VAC	230/400 VAC	230/400 VAC	230 VAC
- no. of phases	1	1	3	3	1
- I_{max} (A)	16	16	32	32	16
- energy meter type	LG Flex 2 ZCF120AC	LG Flex 2 ZCF120AC	integrated	integrated	by EL LJ
- electrical protection	FID switch	FID switch	FID switch 30mA/40A	FID switch 30mA/40A	FID switch
Socket 2:					
- type	Schuko with microswitch	Mennekes	Mennekes	Mennekes	
- U (V)	230 VAC	230 VAC	230/400 VAC	230/400 VAC	
- no. of phases	1	3	3	3	
- Imax (A)	16	32	32	32	
- energy meter type	LG Flex 2 ZCF120AC	LG Flex 2 ZMF120AC	integrated	integrated	
- electrical protection	FID switch	FID switch	FID switch 30mA/40A	FID switch 30mA/40A	
User identification (Y/N)	Y	Y	Y	N	N
- type	SMS and RFID	SMS and RFID	SMS and RFID		

Item	Type 1	Type 2	Type 3	Type 4	Type 5
- restriction	members only	members only	members only		
Status signalization (Y/N)	Y	Y	Y	Y	Y
- type	LED	LED	display	LED	LED
- statuses	out of operation, reserved, occupied, free	out of operation, reserved, occupied, free	all statuses	out of operation, occupied, free	out of operation, reserved, occupied, free
Communication with control centre (in/out of operation, not available)	in operation	in operation	out of operation	out of operation	not available
- type	Ethernet, GPRS	Ethernet, GPRS	GPRS		
- status signalization (Y/N)	Y	Y	Y	N	N
- remote control (Y/N)	Y	Y	Y	N	N
- metering data transfer (Y/N)	Y	Y	Y	N	N
- remote parameterization (Y/N)	Y	Y	Y	N	N
Communication protocol between charging spots	not applicable	not applicable	under development	not applicable	not applicable
Payment	electronic*	electronic*	electronic*	no payment	no payment

* ... no payment currently, the stations enable electronic payment

Table 2: Technical data of charging stations in Ljubljana region

3.2.3 Technical characteristics of charging infrastructure control centre

Item	Description
Supplier	Etrel (SI)
Year of commissionning	2011
Quantity of currently controlled charging stations	7
Monitoring and storage of data on individual charging operation (Y/N)	Y
Storage of data on EV user (Y/N)	Y
Possibility of reservation of charging station (Y/N)	Y
Possibility of remote charging power control (Y/N)	N
Estimated quantity of controlled charging stations end 2012	11
Estimated quantity of controlled charging stations end 2013	15

Table 3: Technical data of charging infrastructure control centre of Elektro Ljubljana

3.2.4 System description

3.2.4.1 User identification

Identification by means of RFID card and SMS is implemented in charging stations Type 1, Type 2 and Type 3.

RFID card:

In charging stations Type 1 and 2 the RFID identification conforms to standard ISO 14443A, card type MIFARE DESFire EV1.

In charging stations Type 3 the RFID identification conforms to standard 14443-4 Type A, card type MIFARE Classic.

SMS:

For identification on charging stations Type 1, Type 2 and Type 3 the user shall send to predefined phone number the SMS with the following structure:

VKLOP SI03nnn x (where nnn is 3-digit station code and x denotes the socket number).

3.2.4.2 Actions possible for the users

Charging stations Type 1:

- identification,
- plug and charge,
- unplug or identify again to stop charging.

Charging stations Type 2:

- identification,
- plug and charge,
- identify again to stop charging and after unplug the cable.

Charging stations Type 3:

- identification,
- plug and charge,
- unplug or identify again to stop charging.

Charging stations Type 4:

- plug and charge,
- unplug.

Charging stations Type 5:

- plug and charge,
- unplug.

3.2.4.3 User database and registration process

The registration of the user is carried out at the charging infrastructure operator's information office. The future user can select the mode of identification:

- by SMS: the user declares one or more phone numbers where from the SMS messages will be sent for identification (the SMS itself does not contain any data on user – see Chapter 3.2.4.1). In this case the phone number where from the SMS was received, serves for authorization (charging permitted/denied),
- by RFID: the user can use any of smart card he already owns under condition that the card type is supported by the RFID reader in the charging station. The charging infrastructure operator enters the card ID, which serves for authorization, into the database. The charging infrastructure operator may issue also a new card to the EV user.

The cancellation of user is carried out by deleting a phone numbers (in case of SMS identification / phone number authorization) or a smart card ID from the database.

3.2.4.4 White/black lists at charging points

The white/black list is based on user ID and does not consider charging points. The user is either allowed to use all stations (connected to control centre) or none of them. The option that on particular charging station some EV users have permanent permission to charge and some of them not (for example on semi public spots – charging stations on residential parking places, where only the residents have permission to charge) is not enabled.

3.2.4.5 Communication protocol between charging stations and the infrastructure control centre

For charging stations Type 1, Type 2 and Type 3 dedicated proprietary WEB services are used for bidirectional communication.

For charging station Type 4 the functionality exists, currently is disabled.

3.2.4.6 Communication latency

For charging stations Type 1, Type 2, Type 3 and Type 4 some of communications are event driven with latency approx. 0,5 s. Other communication is cyclic triggered (5 minutes during the charging process, 15 minutes when the station is not occupied).

In charging station Type 5 no data are stored and transmitted to control centre.

3.2.4.7 Security

For charging stations Type 1, Type 2, Type 3 and Type 4 the communication network between charging stations and control centre is private (WAN) and secure.

In charging station Type 5 no data are stored and transmitted to control centre.

3.2.4.8 Charging session registered data

For charging stations Type 1, Type 2, Type 3 and Type 4 the following data are registered:

- user ID,
- start and end time of charging,
- metering values at the beginning and end of charging,
- energy (15 min),
- charging power (5 min),
- events occurred during charging.

In charging station Type 5 no data are registered.

3.2.4.9 Billing

No billing currently. All data required for billing process will be stored in control centre database (user ID, energy purchase contract No., time of charging, consumed energy, tariffs, ...)

3.3 Charging infrastructure in Maribor region

Currently Elektro Maribor owns and operates 7 charging stations, 5 of them in city of Maribor and 2 of them in other cities in Maribor region. For the next years Elektro Maribor does not plan to expand its charging infrastructure.

Elektro Maribor has 2 EVs in its car park and does not plan to purchase new EVs in coming years.

3.3.1 Location of charging stations

No.	Name	City	Street	ID	Type
1	MB1	Lendava	Kolodvorska ulica 5a		1
2	MB2	Murska Sobota	Lendavska ulica 31a		2
3	MB3	Maribor	Vodovodna ulica 2		2
4	MB4	Maribor	Vodovodna ulica 2		2
5	MB5	Maribor	Vodovodna ulica 2		3

Table 4: Locations of charging stations in Maribor region

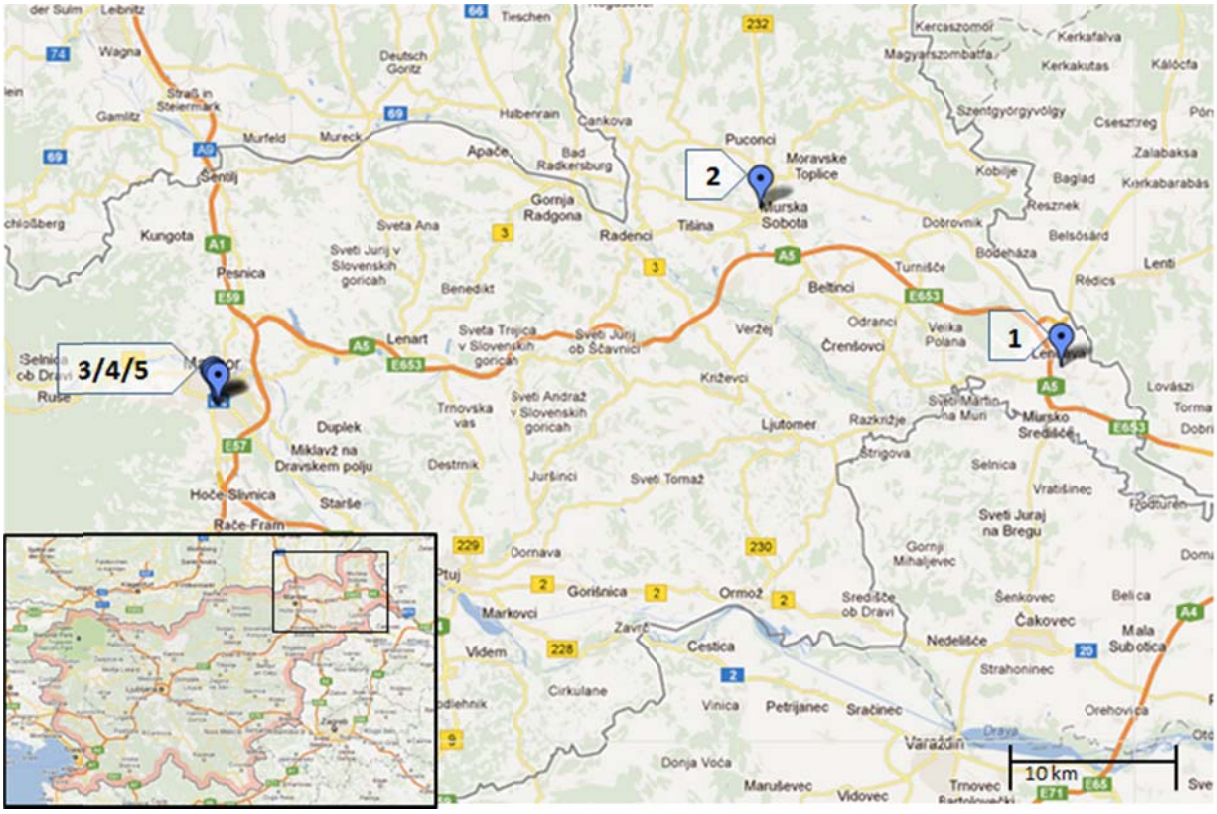

Figure 3: Locations of charging stations in Maribor region

3.3.2 Technical characteristics of charging stations

Item	Type 1	Type 2	Type 3
Stations No. (ref. paragraph 3.3.1)	1	2, 3, 4	5
Manufacturer	ETI (SI)	Etrel (SI)	ABB Epyon
Type		Gen 2	
Supplier	ETI (SI)	Etrel (SI)	ABB Epyon
Dimensions (w x d x h in cm)	22 x 22 x 140	22 x 22 x 160	60 x 96 x 190
Mounting	stand-alone	stand-alone	stand-alone
Connection (acc. to IEC 61851)	A/B	A/B	A/B
IK degree			08
IP degree	44	54	54
Number of sockets	1	2	1
Number of simutaneous charging processes	1	2	1
Socket 1:			
- type	Schuko with microswitch	Schuko with microswitch	CHAdeMO JEVS G105

Item	Type 1	Type 2	Type 3
- U (V)	230 VAC	230 VAC	50-500 VDC
- no. of phases	1	1	1
- Imax (A)	16	16	120 A / 50 kW
- energy meter type	/	certified with DLMS	certified with DLMS
- electrical protection	overcurrent (fuse) in distribution board	differential (FID), overvoltage	overcurrent, short circuit
Socket 2:			
- type		Schuko with microswitch	
- U (V)		230 VAC	
- no. of phases		1	
- Imax (A)		16	
- energy meter type		certified with DLMS	
- electrical protection		differential (FID), overvoltage	
User identification (Y/N)	N	N	N
- type			
- restriction			
Status signalization (Y/N)	Y	Y	Y
- type	LED	LED	LED, color LCD
- statuses	occupied Y/N	occupied Y/N	occupied Y/N
Communication with control centre (Y/N)	N	N	N*
- type			
- status signalization (Y/N)			
- remote control (Y/N)			
- metering data transfer (Y/N)			
- remote parameterization (Y/N)			
Communication protocol between charging spots	not applicable	not applicable	not applicable
Payment	no payment	no payment	no payment

Table 5: Technical data of charging stations in Maribor region

3.3.3 Technical characteristics of charging infrastructure control centre

Item	Description
Supplier	*
Year of commissionning	2012*
Quantity of currently controlled charging stations	/
Monitoring and storage of data on individual charging operation (Y/N)	Y
Storage of data on EV user (Y/N)	Y
Possibility of reservation of charging station (Y/N)	Y
Possibility of remote charging power control (Y/N)	Y
Estimated quantity of controlled charging stations end 2012	10
Estimated quantity of controlled charging stations end 2013	15

* the proces of procurement of control centre is in process. The main functional characteristics are already defined, the commissionning is planned for Q3 2012

Table 6: Technical data of charging infrastructure control centre of Elektro Maribor

3.3.4 System description

3.3.4.1 User identification

There is no user identification in charging stations.

3.3.4.2 Actions possible for the users

Charging stations Type 1, Type 2 and Type 3:

- plug and charge,
- unplug.

3.3.4.3 User database and registration process

The process of procurement of control centre is in process. The main functional characteristics are already defined, the commissioning is planned for Q3 2012.

The registration of the user will be carried out at the charging infrastructure operator's information office. The future user can select the mode of identification:

- by SMS: the user declares one or more phone numbers where from the SMS messages will be sent for identification (the SMS itself does not contain any data on user – see Chapter 3.2.4.1). In this case the phone number where from the SMS was received, serves for authorization (charging permitted/denied),

- by RFID: the user can use any of smart card he already owns under condition that the card type is supported by the RFID reader in the charging station. The charging infrastructure operator enters the card ID, which serves for authorization, into the database. The charging infrastructure operator may issue also a new card to the EV user.

The cancellation of user is carried out by deleting a phone numbers (in case of SMS identification / phone number authorization) or a smart card ID from the database.

3.3.4.4 White/black lists at charging points

The white/black list will be based on user ID and will not consider charging points. The user is either allowed to use all stations (connected to control centre) or none of them. There is no option that on particular charging station some EV users have permanent permission to charge and some of them not (for example on semi public spots – charging stations on residential parking places, where only the residents have permission to charge).

3.3.4.5 Communication protocol between charging stations and the infrastructure control centre

Currently there is no data exchange between the charging infrastructure components.

3.3.4.6 Communication latency

Currently there is no data exchange between the charging infrastructure components.

3.3.4.7 Security

Currently there is no data exchange between the charging infrastructure components.

3.3.4.8 Charging session registered data

Charging stations Type 1, Type 2 and Type 3: no data are registered at charging stations.

3.3.4.9 Billing

No billing currently. All data required for billing process will be stored in control centre database (user ID, energy purchase contract No., time of charging, consumed energy, tariffs, ...)

3.4 Energy sources used for charging the EVs

Not applicable for Pilot 3.

3.5 Routes for the commuters between Ljubljana and Maribor

3.5.1 Common routes between Ljubljana and Maribor

The main route connecting the Ljubljana and Maribor region is highway A1 (E57). The distance between the cities is approx. 130 km.

The deviation from the main route is by using the route Ljubljana - Litija - Zagorje ob Savi - Trojane where the route connects to highway A1 to Maribor. The length of this route is approx. 150 km. On this route two charging stations of Elektro Ljubljana may be used for EV charging: station No. 7 in Litija (distance from Ljubljana 34 km) and station No. 9 in Zagorje ob Savi (distance from Ljubljana 54 km and from Litija 20 km).

The distance between Zagorje ob Savi and Trbovlje, where the charging station No. 12 is located, is 10 km. The shortest route between the station in Trbovlje and Maribor is via Prebold, approximately 90 km.

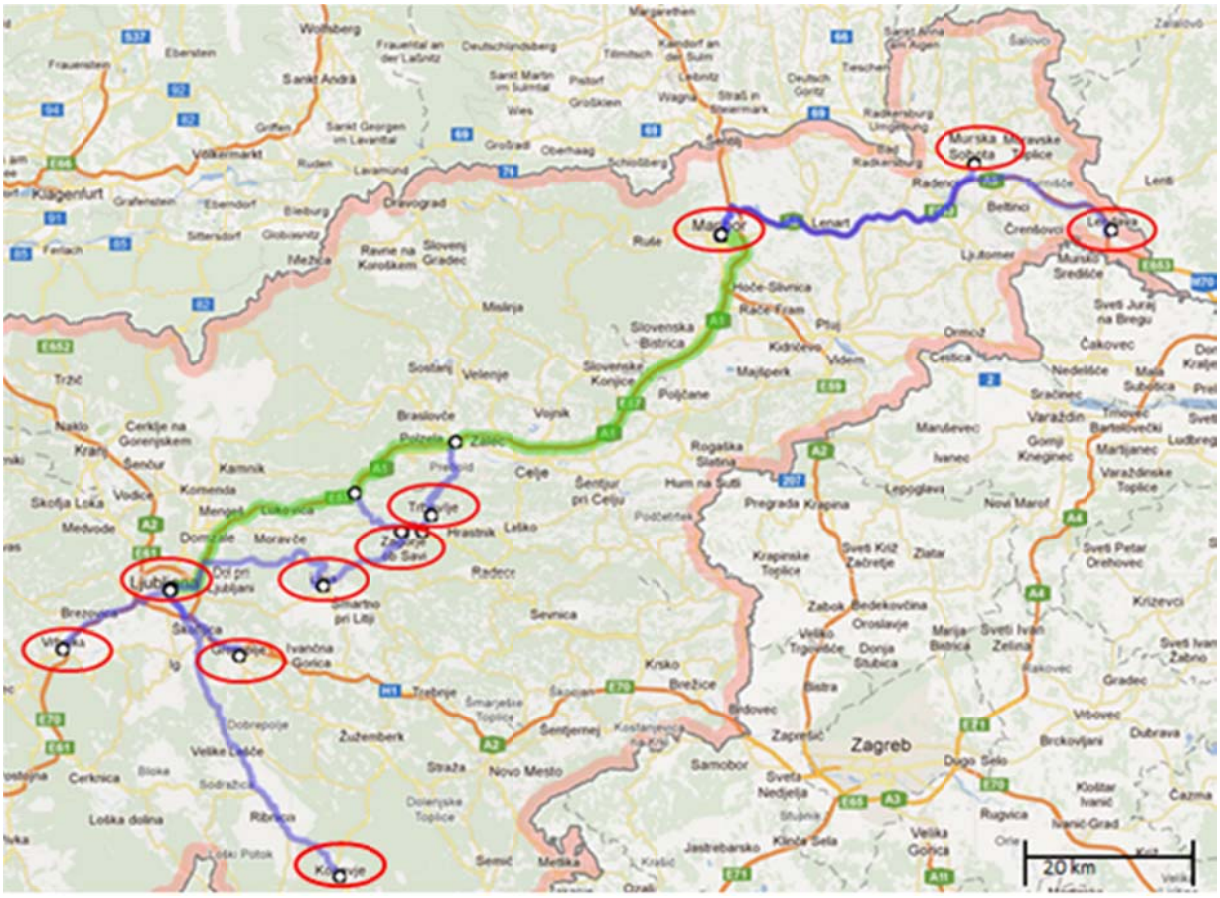

Figure 4: Routes between Ljubljana and Maribor region

The approximate distances between Ljubljana and other charging stations in Ljubljana region are:

- Ljubljana-Vrhnika: 20 km,
- Ljubljana-Grosuplje: 20 km,
- Ljubljana-Kočevje: 60 km.

In Maribor region the shortest route from Lendava to Maribor is app. 80 km. The length of the Lendava – Maribor route with a stop (charge) in Murska Sobota is approximately 85 km, where the distance between Lendava and Murska Sobota is app. 30 km and the distance between Murska Sobota and Maribor is 55 km.

3.5.2 Common routes and autonomy of different EV

The charging stations in individual regions (Ljubljana and Maribor) are all within the range of EVs currently present on the market. The distance between the major cities of the two regions is 130 km, corresponding to the upper limit of currently marketed EVs.

In case the range of the EVs involved in the project will not enable the direct trip between Ljubljana and Maribor the EVs can be charged in one of the existing charging stations along the route or the PHEV with extended range (such as Opel Ampera) can be involved in the pilot.

3.6 EVs included in the project

During the project lifetime the following quantity of EV will be included in the project:

Item	Dec 2012	Jun 2013	Dec 2013	Jun 2014
REGION LJUBLJANA				
EVs of Elektro Ljubljana	1	1	3	3
EVs of other companies	2	3	4	5
Private EVs	3	9	20	20
TOTAL region Ljubljana	6	13	27	28
REGION MARIBOR				
EVs of Elektro Maribor	2	2	2	2
EVs of other companies*				
Private EVs*				
TOTAL region Maribor	8+	15+	29+	30+
TOTAL PILOT SLOVENIA				
Estimated number of EV users	20	20	30	30+

* ... contacts with other companies and private EVs owners established; no exact number of users involved in the project can be defined for now

Table 7: EVs included in the project