
MOBI SEMINAR 2023
BEYOND THE STATE OF THE ART IN E-MOBILITY

1


WELCOME
Prof. Dr. ir. Joeri Van Mierlo
Director of MOBI - Electromobility Research Centre

2


1979 - Vrije Universiteit Brussel

4


MOBI IN NUMBERS
50 years
EV pioneer research
122
team members
30
nationalities
8 M€
turnover 2022
200 projects
over last 5 years
25
current EU Projects
MOBI
SEMINAR
2023

5


MOBI IS THE LARGEST ELECTROMOBILITY RESEARCH HUB IN EUROPE
ELECTRIC & AUTONOMOUS VEHICLES
Socio-economic aspects & technologies for Electric and Autonomous Vehicles
BATTERY INNOVATION CENTRE
Battery prototyping, testing and modelling
EPOWERS
Efficient Power Electronics, Powertrain & Energy Solutions
EVERGI
Accelerating the energy transition
LIGHTING
Development of smart light sources for vehicles and infrastructure
MOBI
SEMINAR
2023

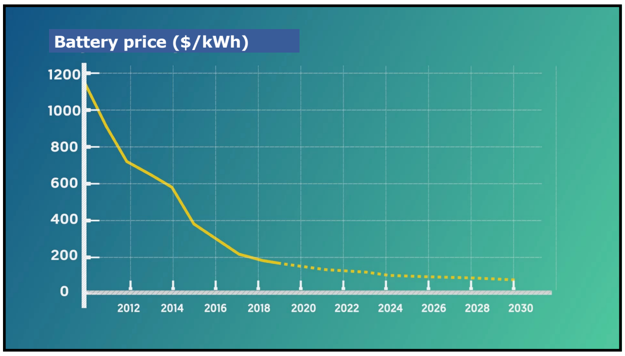
6


SETTING THE SCENE
Prof. Dr. ir. Joeri Van Mierlo
Director of MOBI - Electromobility Research Centre

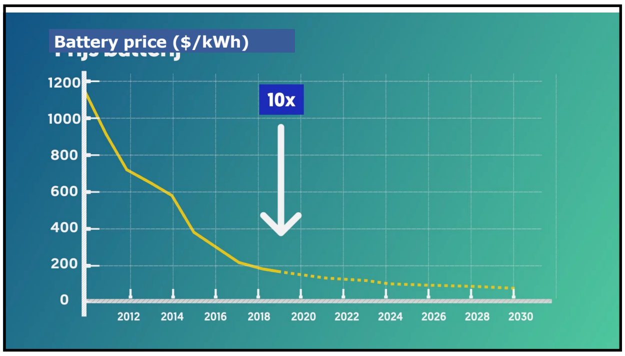
7

8

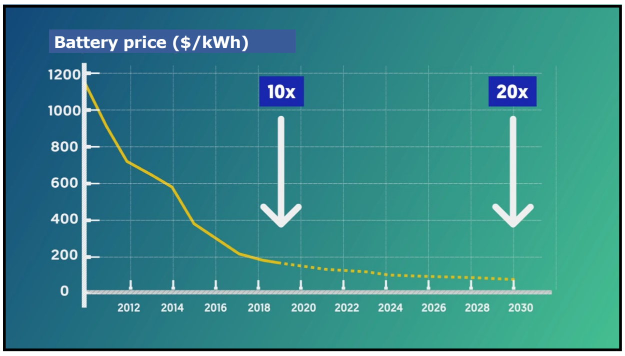
9


Battery price ($/kWh)
1200
1000
800
600
400
200
0
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030

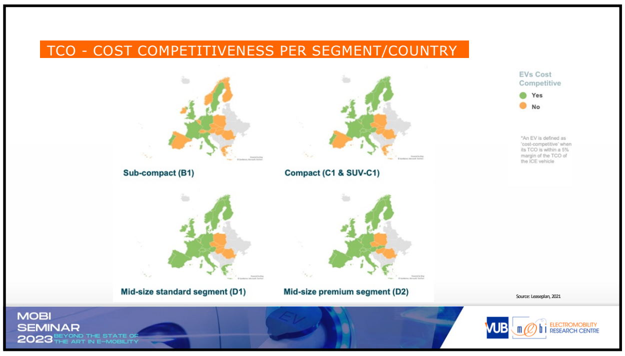
10


Battery price ($/kWh)
10x
1200
1000
800
600
400
200
0
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030

11

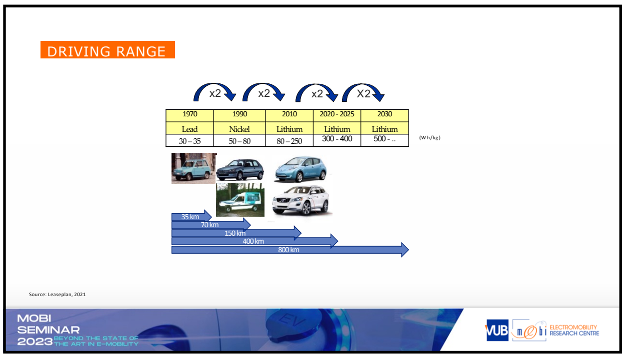

Battery price ($/kWh)
10x
20x
1200
1000
800
600
400
200
0
2012
2014
2016
2018
2020
2022
2024
2026
2028
2030

12

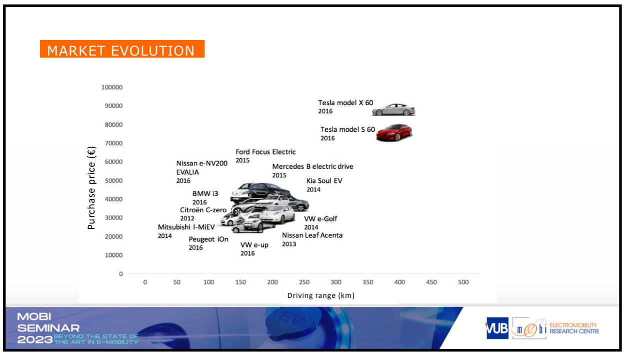

TCO - COST COMPETITIVENESS PER SEGMENT/COUNTRY
EVs Cost Competitive
Yes
No
*An EV is defined as 'cost-competitive' when its TCO is within a 5% margin of the TCO of the ICE vehicle
Sub-compact (B1)
Compact (C1 & SUV-C1)
Mid-size standard segment (D1)
Mid-size premium segment (D2)
Source: Leaseplan, 2021
MOBI SEMINAR 2023
BEYOND THE STATE OF THE ART IN E-MOBILITY
VUB
ELECTROMOBILITY RESEARCH CENTRE

13

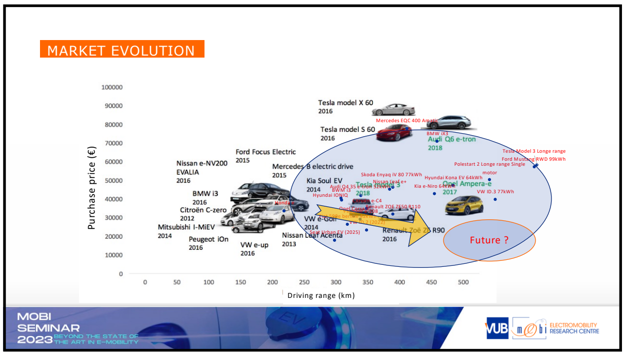
14



15

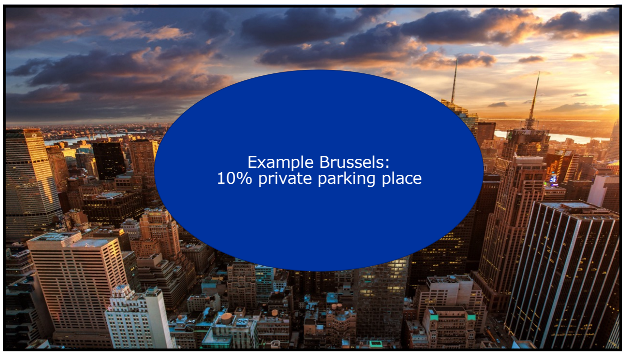


16



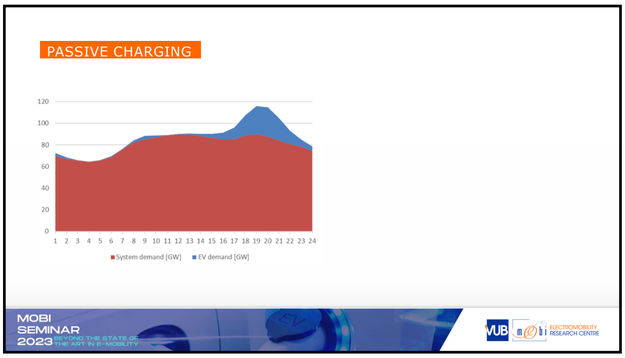
17

18

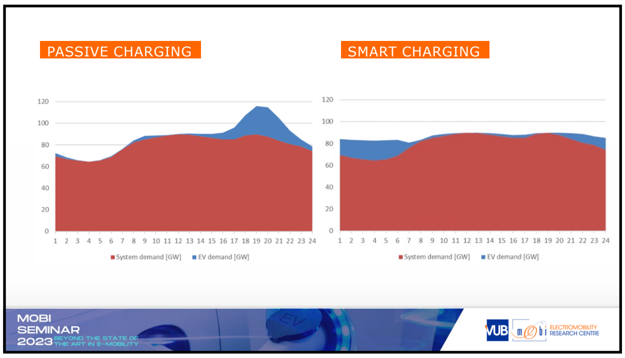


20

ELECTROMOBILITY RESEARCH CENTRE



21



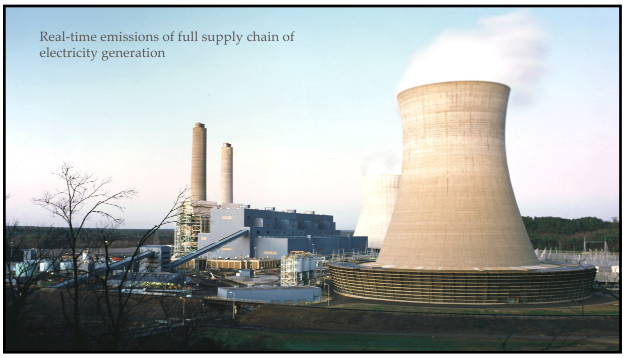
22

23

24

25

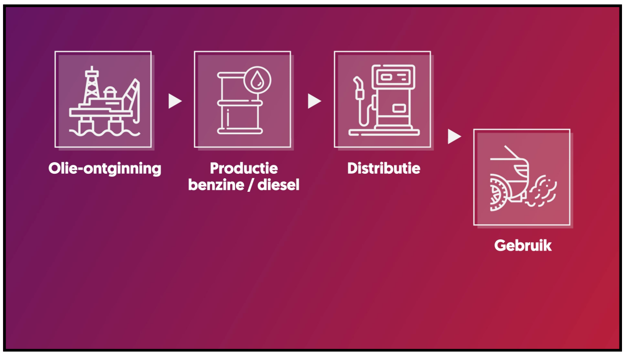
26



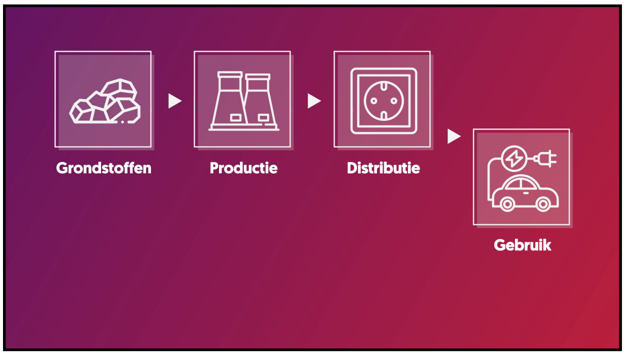
27

28

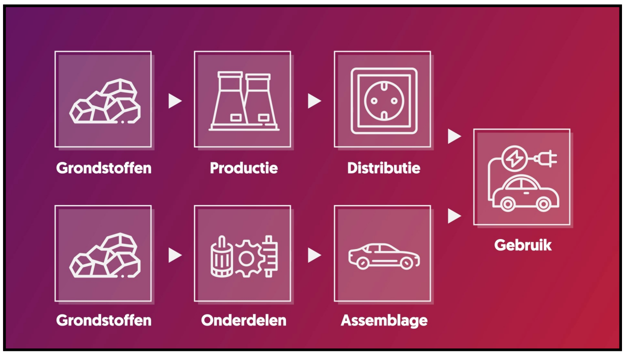
29



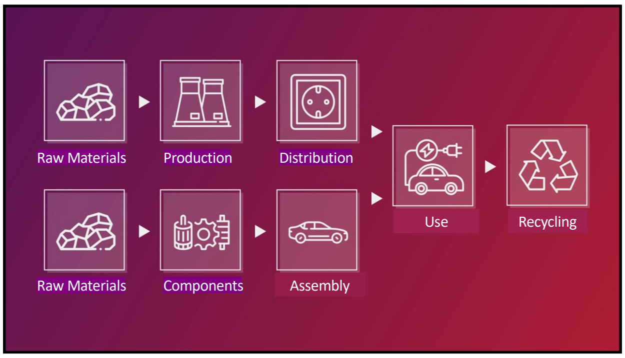
30



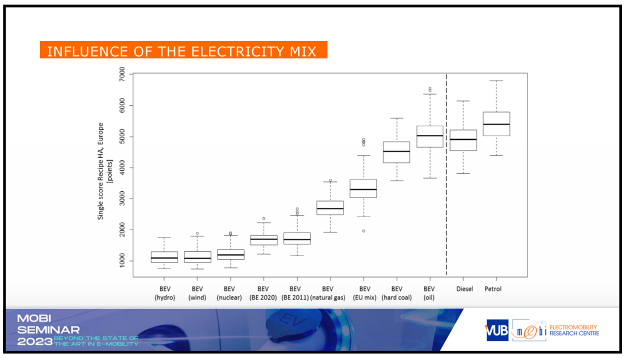
31



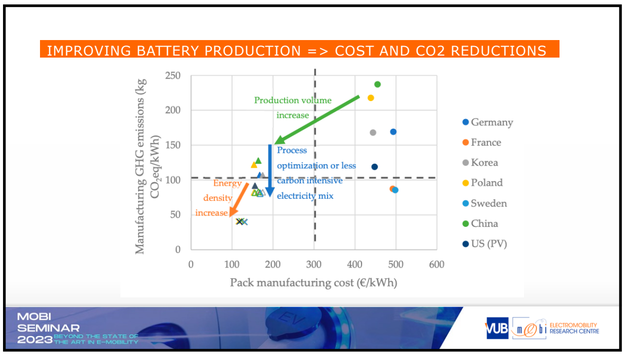
32



33



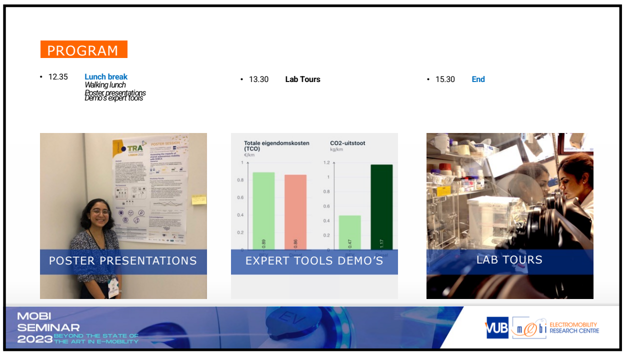
35



36

38

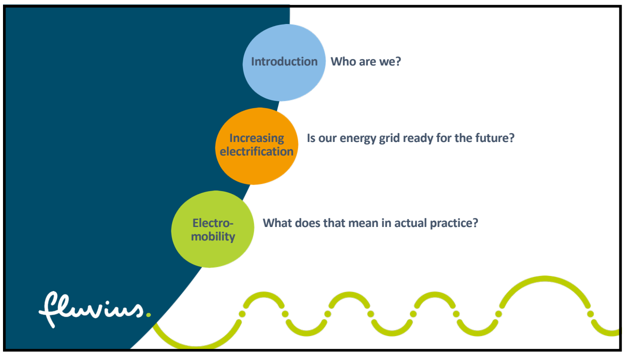
39



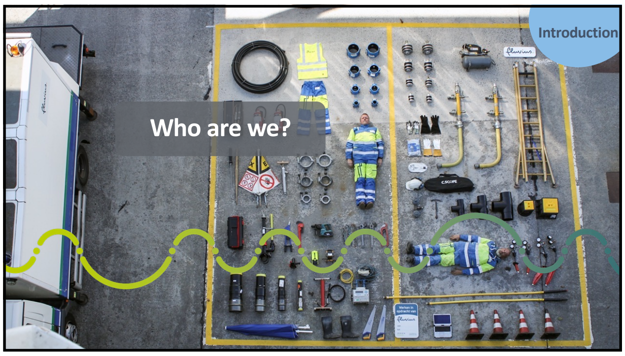
40

42

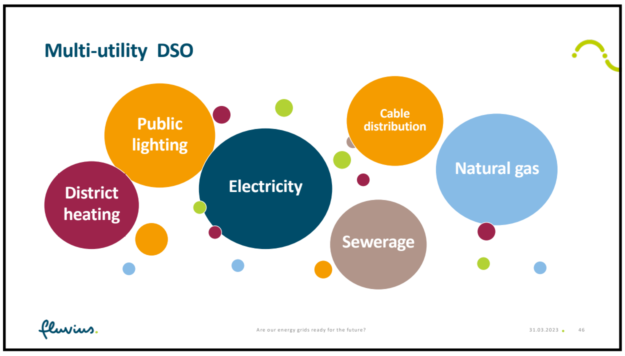
43



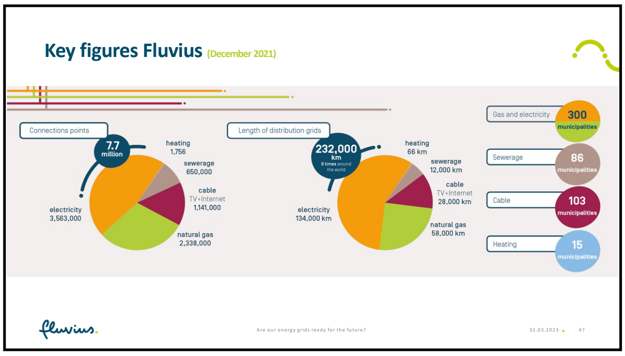
44



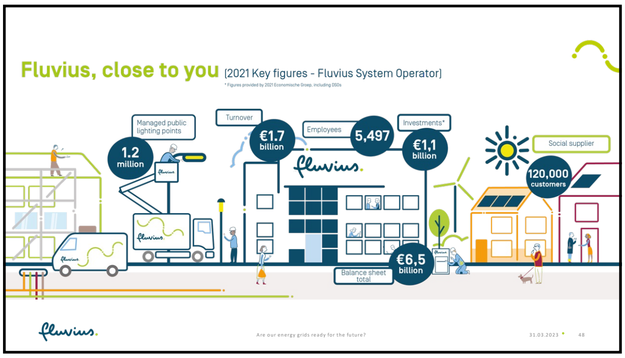
45



46



47

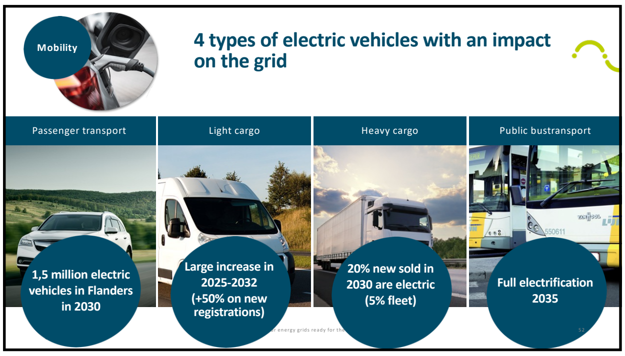


48

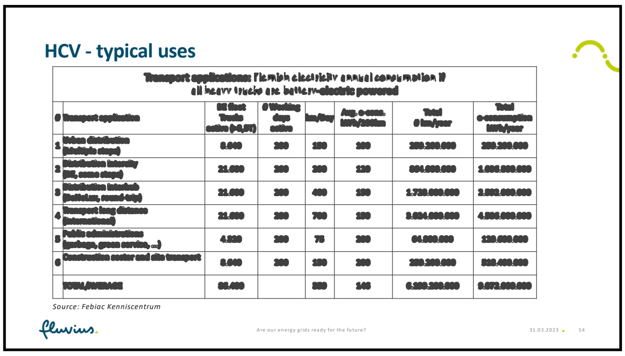
49

50

51



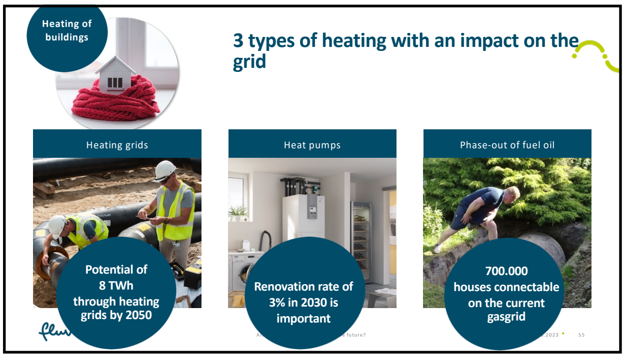
52



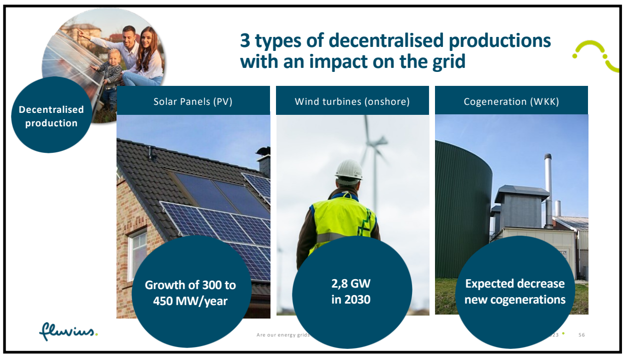
Transport applications: Flemish electricity annual consumption if all heavy trucks are battery-electric powered

#	Transport application	BE fleet Trucks active (>3,5T)	# Working days active	km/Day	Avg. e-cons. kWh/100km	Total # km/year	Total e-consumption kWh/year
1	Urban distribution (multiple stops)	8.640	200	150	100	259.200.000	259.200.000
2	Distribution intercity (BE, some stops)	21.600	200	200	120	864.000.000	1.036.800.000
3	Distribution interhub (Benelux, round-trip)	21.600	200	400	150	1.728.000.000	2.592.000.000
4	Transport long distance (international)	21.600	200	700	150	3.024.000.000	4.536.000.000
5	Public administrations (garbage, green service, ...)	4.320	200	75	200	64.800.000	129.600.000
6	Construction sector and site transport	8.640	200	150	200	259.200.000	518.400.000
	TOTAL/AVERAGE	86.400		280	146	6.199.200.000	9.072.000.000

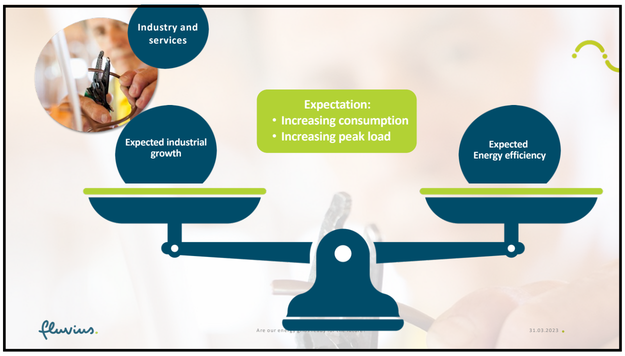
54



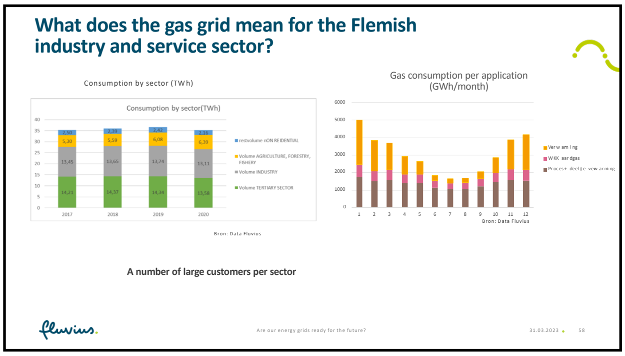
55



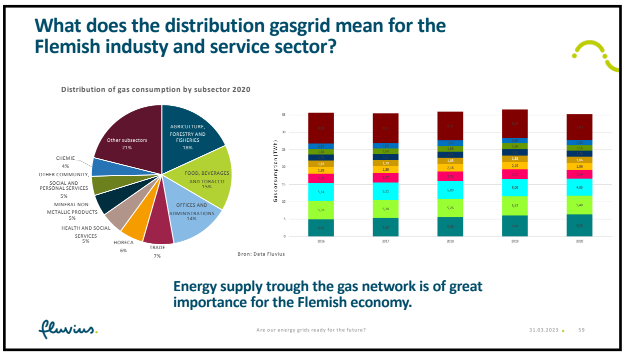
56



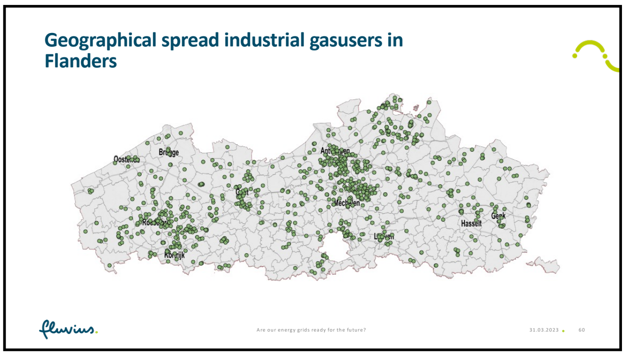
57



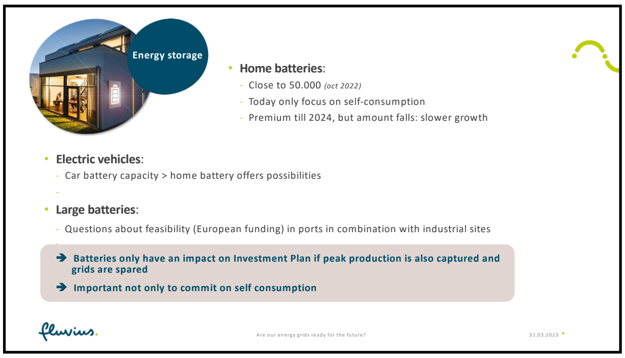
58



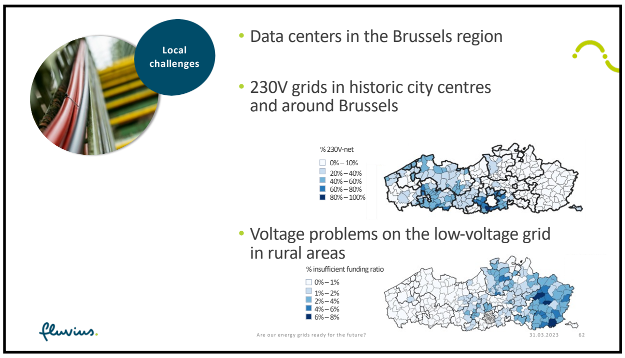
59



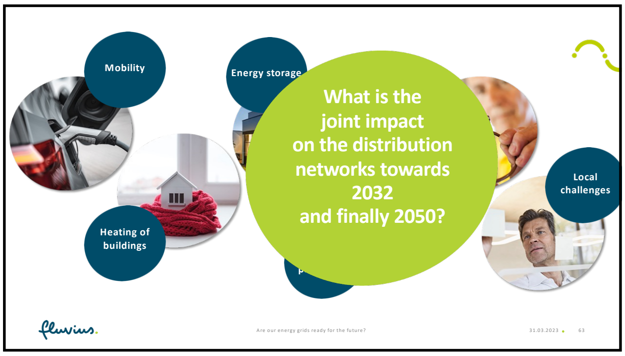
60



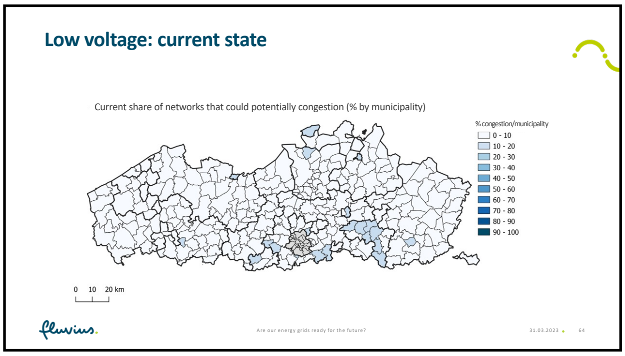
61



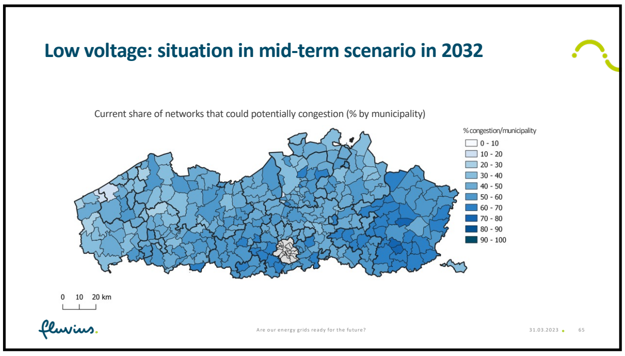
62



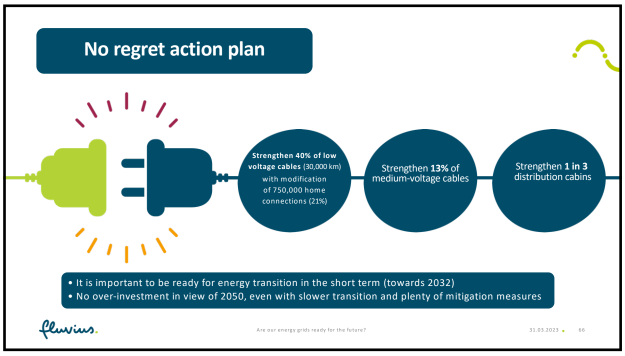
63



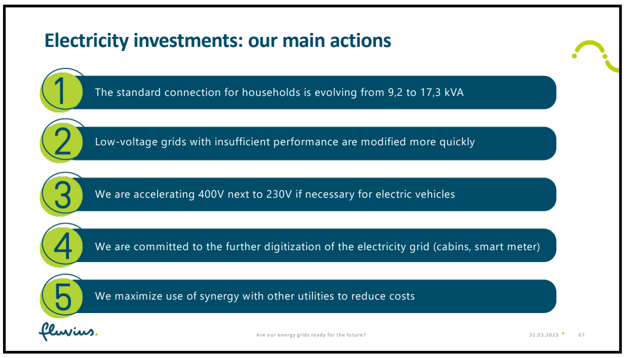
64



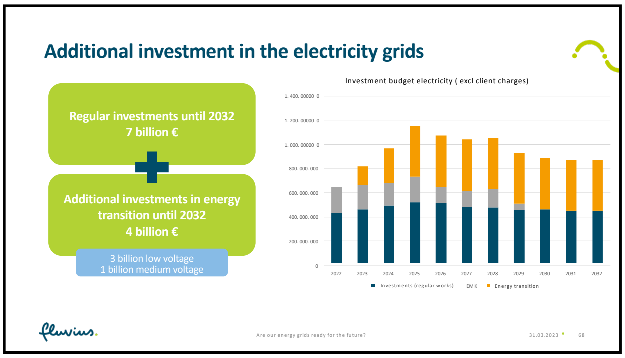
65



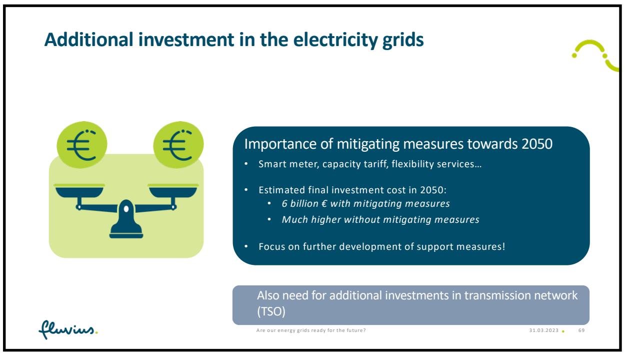
66



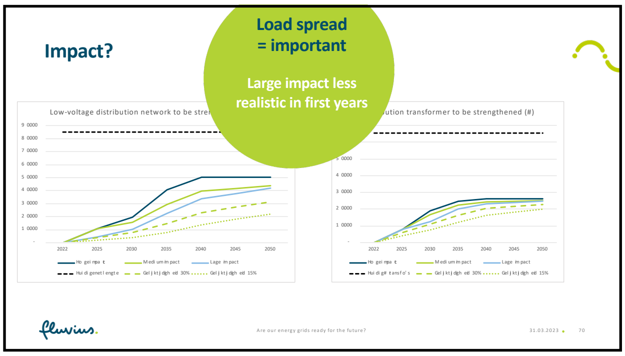
67



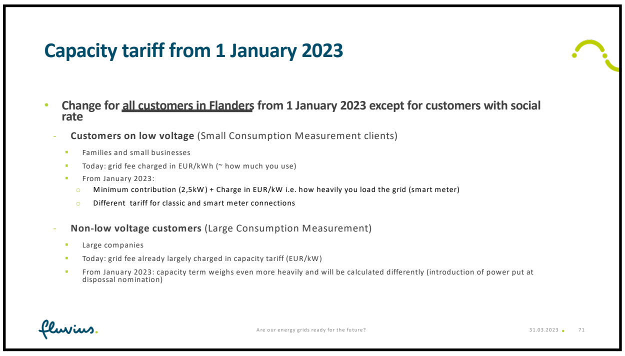
68



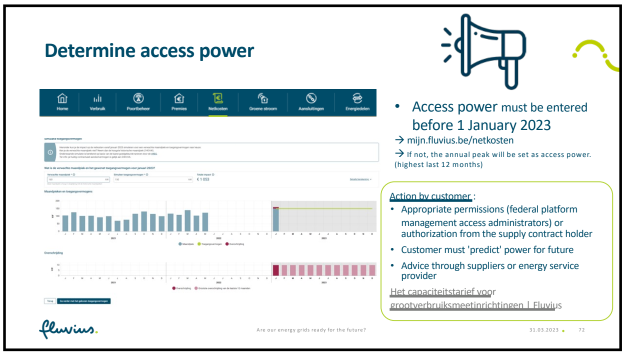
69



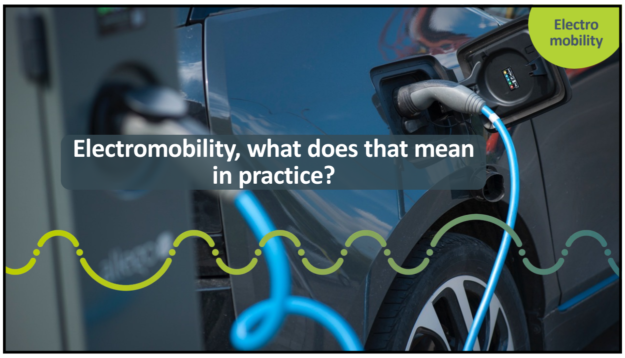
70



71



72



73

An electric vehicle is not 'just' an electric consumer

Current average reference consumption per family

3.500 kWh/year

Electric vehicle consumes 20 kWh/100 km

If the car drives 15.000 km annually, this corresponds to 3.000 kWh/year

Of this, about 70% will be done at home, i.e.

2.100 kWh/year

fluvius. Are our energy grids ready for the future? 31.03.2023 74

74

Electric charging ? Anywhere!

The EV driver mainly wants to charge at home and at work and, if necessary, recharge on the go

Charging at home	Charging at work	Fast charging on the go
(in urbanized area at a charging station in the immediate vicinity, in accordance with the vision of the Local Government)		
70%	20%	10%

fluvius. Are our energy grids ready for the future? 31.03.2023 75

75

Home charging

Comfortable charging at an acceptable price

76

Home charging, an overview

Comfortable loading speed for any profile

	Socket (1) single-phase – 10A	Charging point (2) single-phase - 16A	Charging point (2) three-phase - 16A
Power and charging speed	2,3 kW max. 10 km/u	3,7 kW max. 15 km/u	11 kW max. 50 km/u
Type PHEV	✓	✓	
Type BEV	✓	✓	✓
	applicable with standard home connection 9,2 kW		three-phase connection with possible increase

(1) via a charging cable, the charging speed is limited to 10 A - 2.3 kW for safety
(2) via a charging point, the charging speed varies from faster at the beginning to slower at the end (at 80% charged)

fluvius. Are our energy grids ready for the future? 31.03.2023 77

77

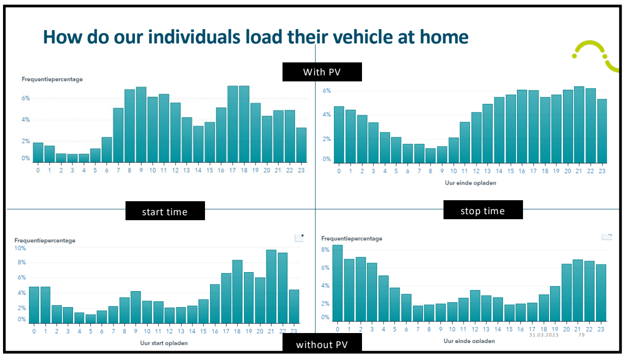
Impact on consumption costs

- 1 January 2023 introduction of capacity tariff; will reward smart charging behaviour
- 1 January 2023 a standard connection is three-phase 17.3 kVA
- Customer benefits from loading slowly and spread over time

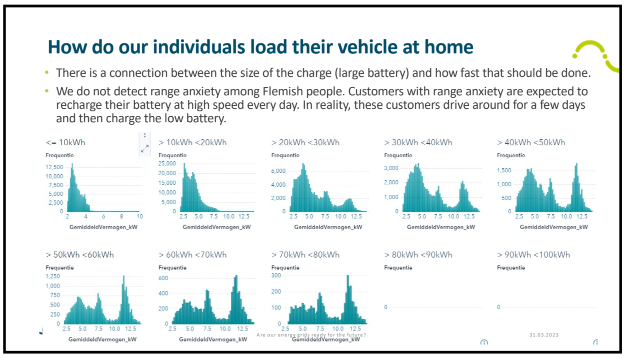
fluvius. Are our energy grids ready for the future? 78

78

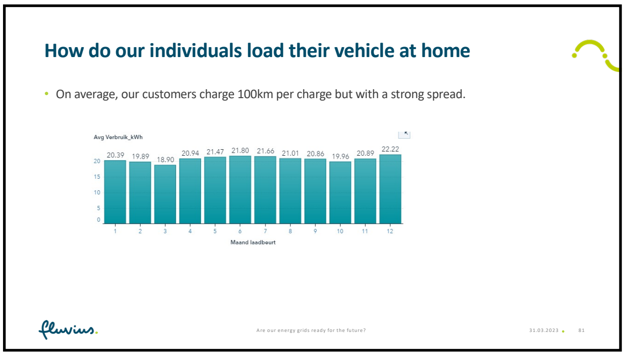
VUB mobi ELECTROMOBILITY RESEARCH CENTRE



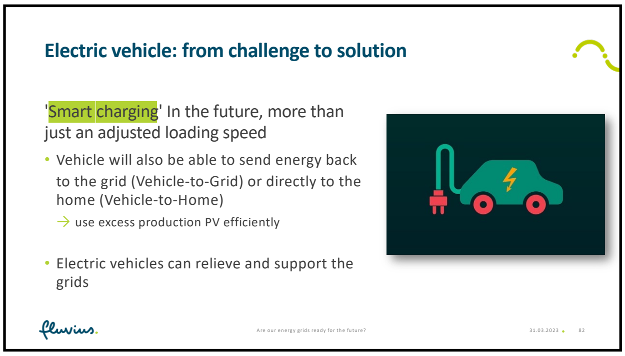
79



80

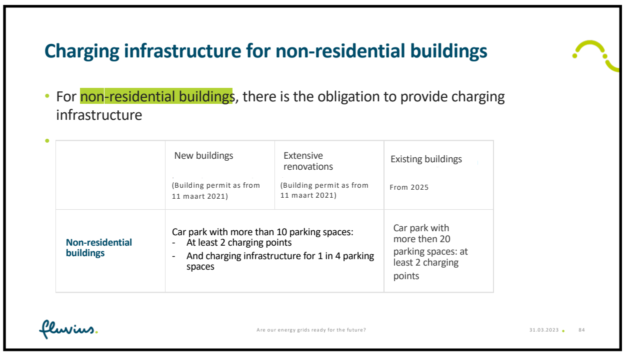


81



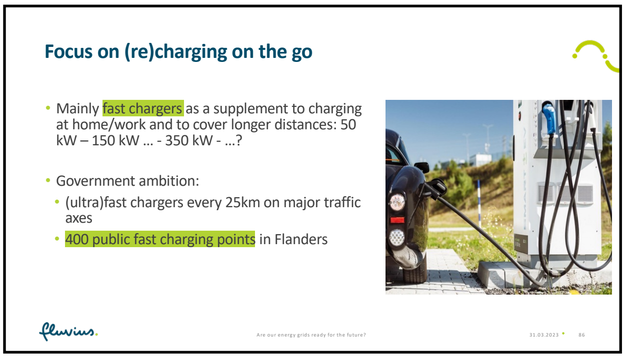
82

83

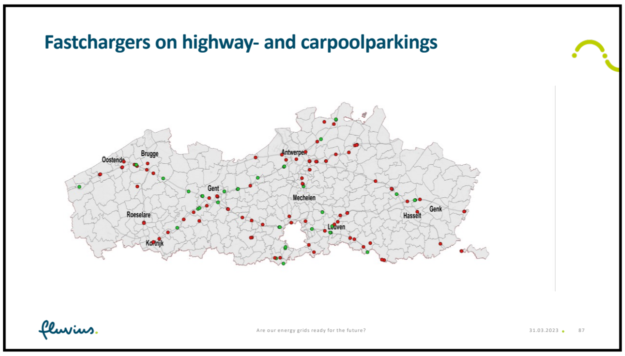


84

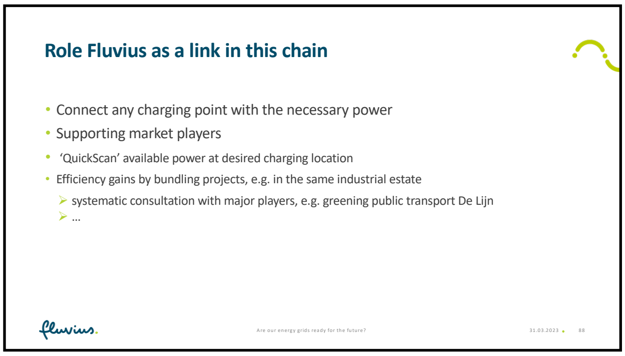
85



86

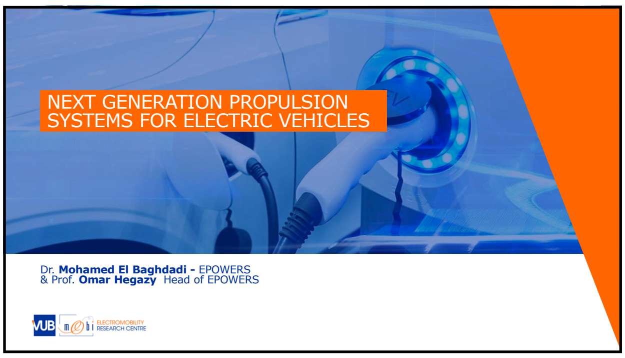


87

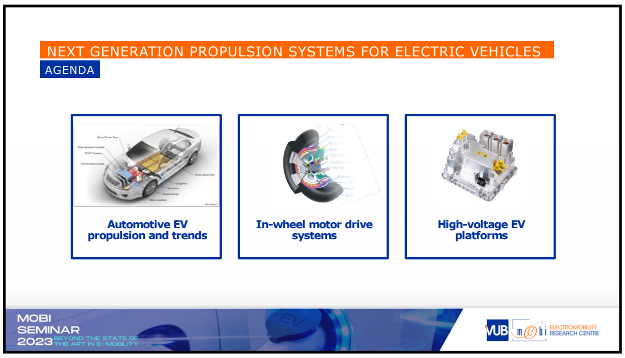


88

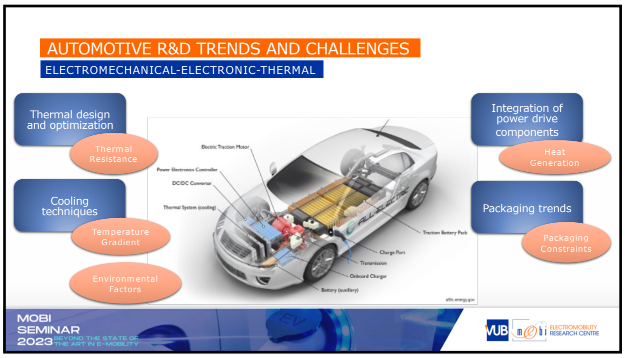
89



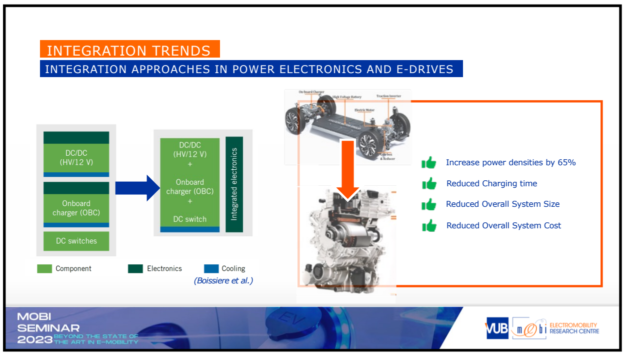
90



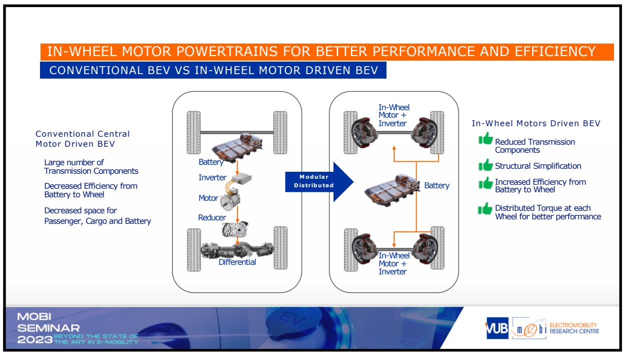
91



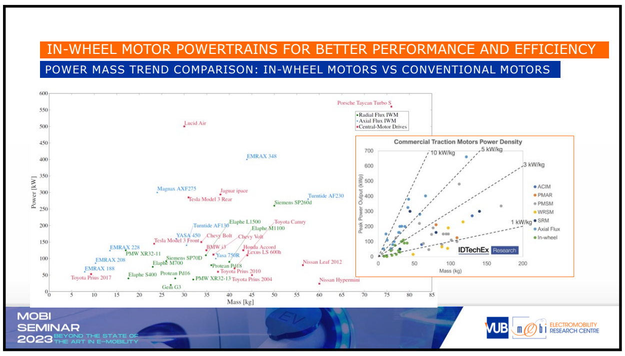
92



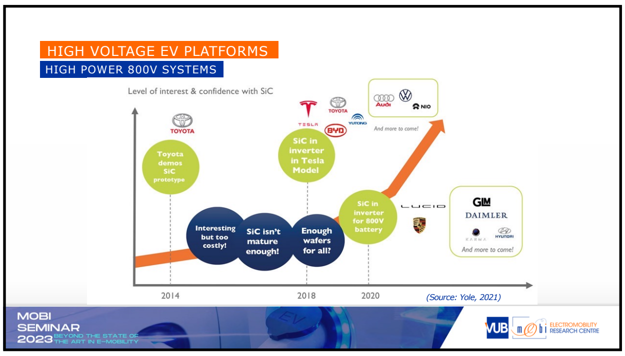
93



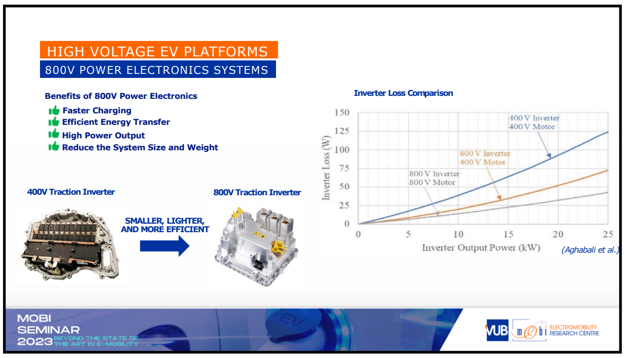
94



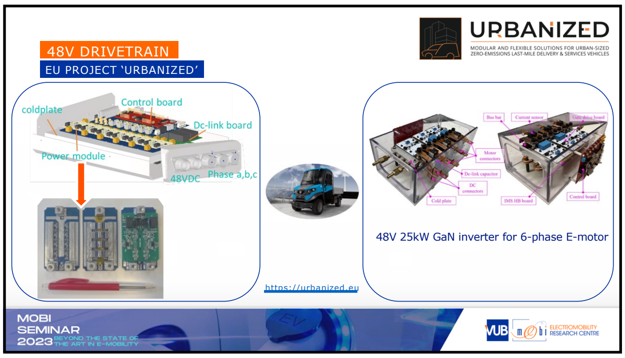
95



96

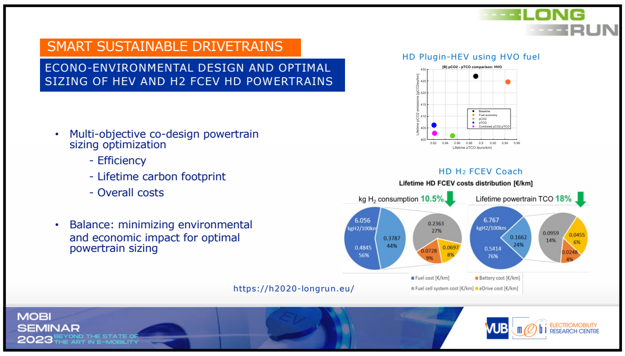


97



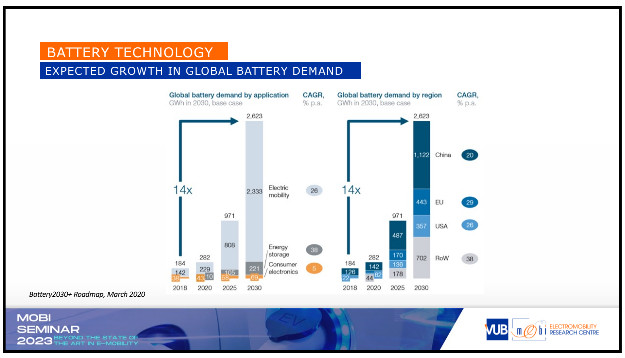
98

99

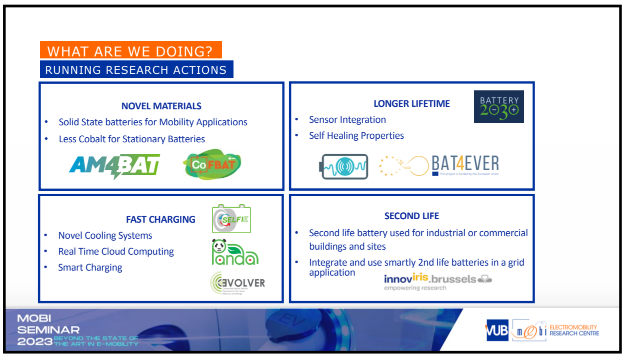


100

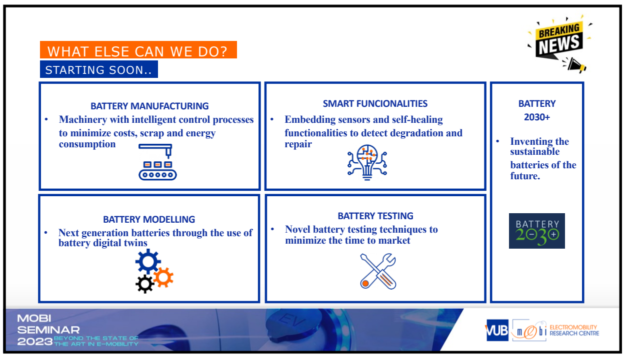
101



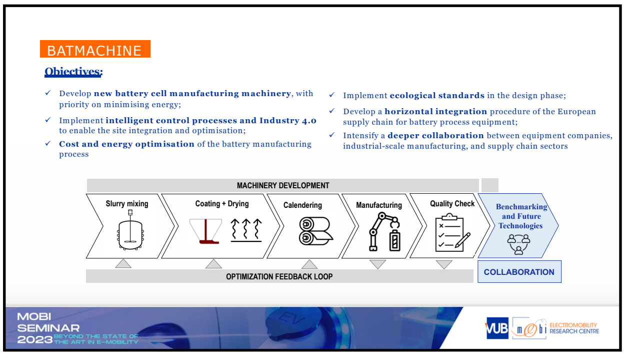
102



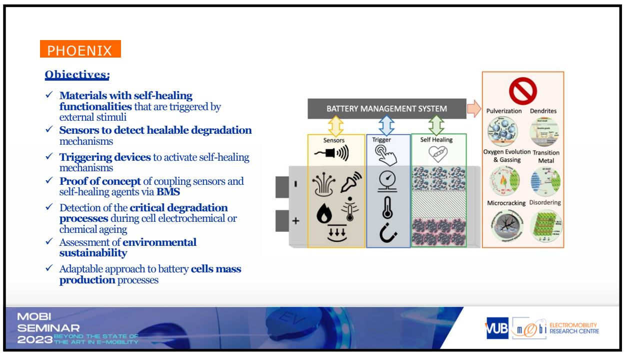
103



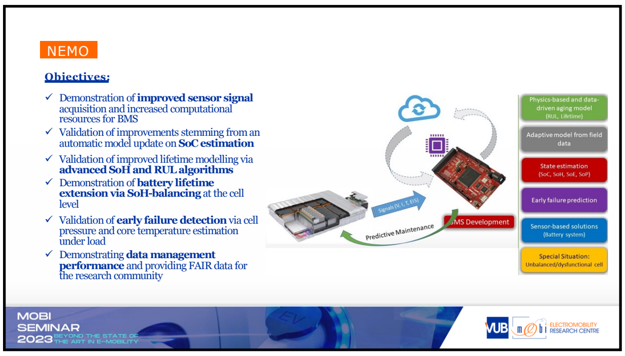
104



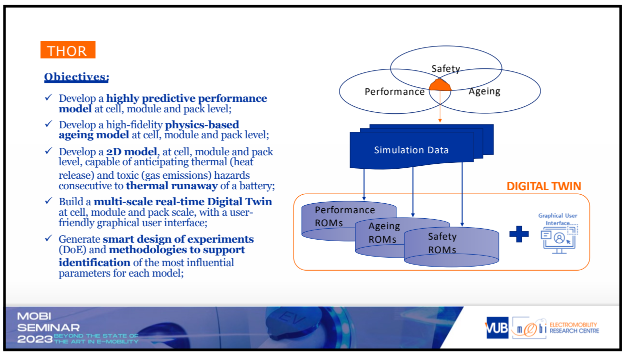
105



106

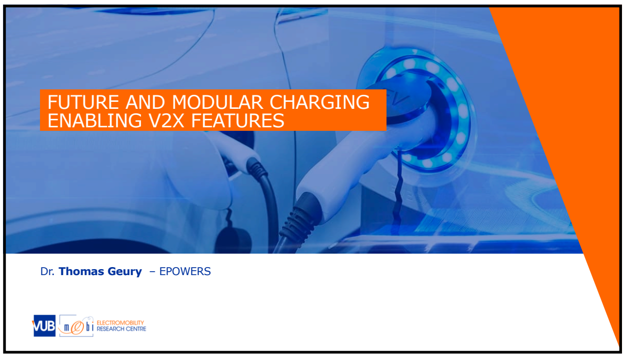


107

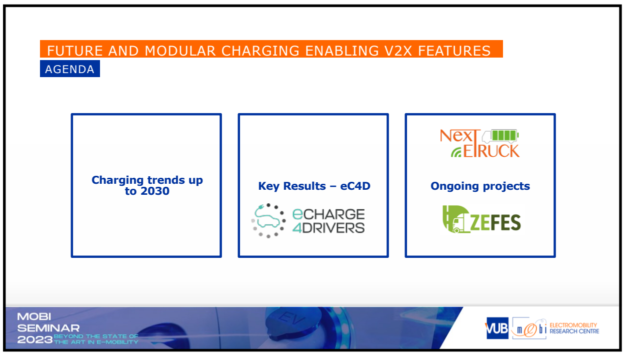


108

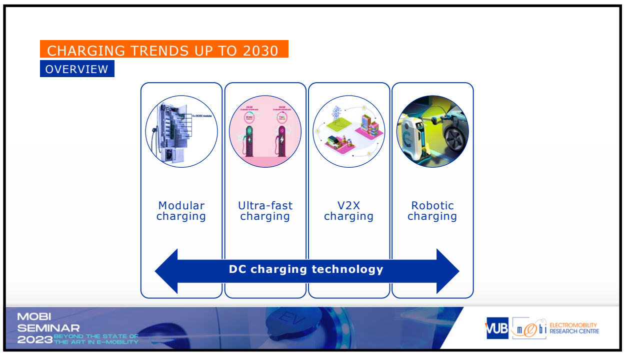
109



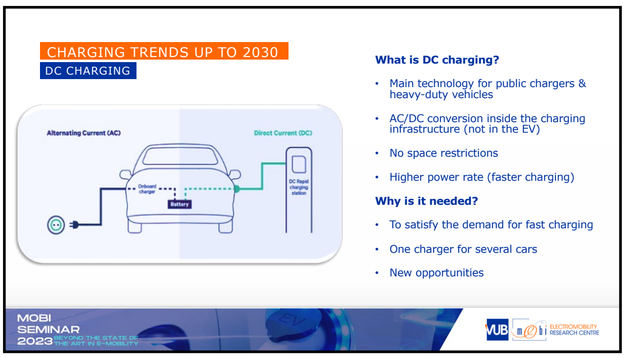
110



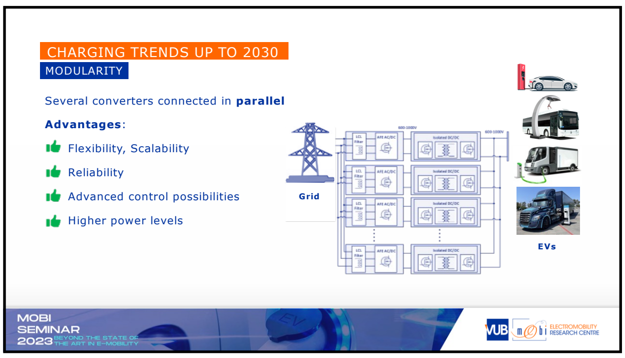
111



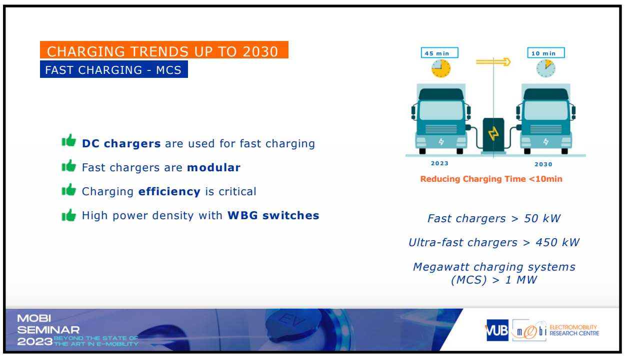
112



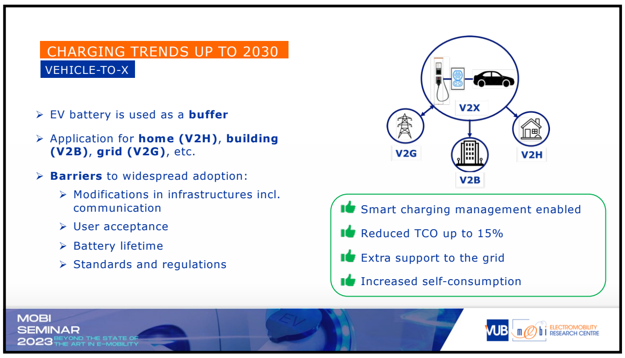
113



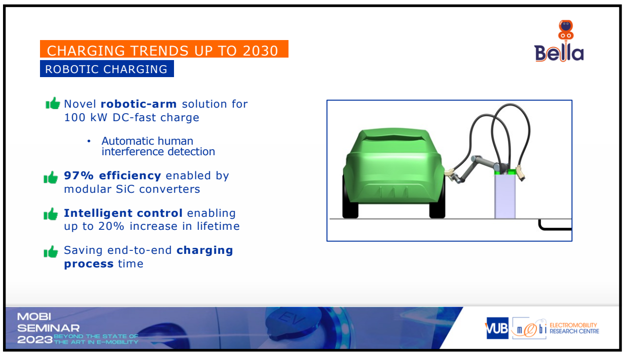
114



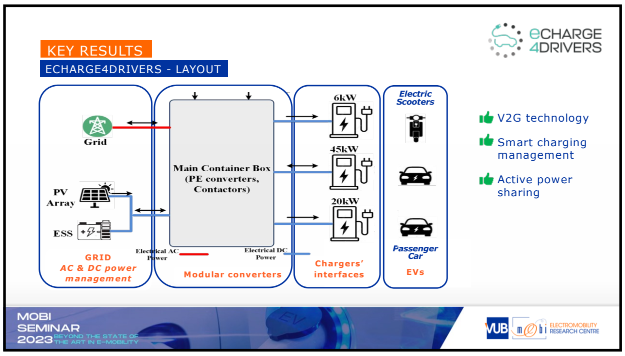
115



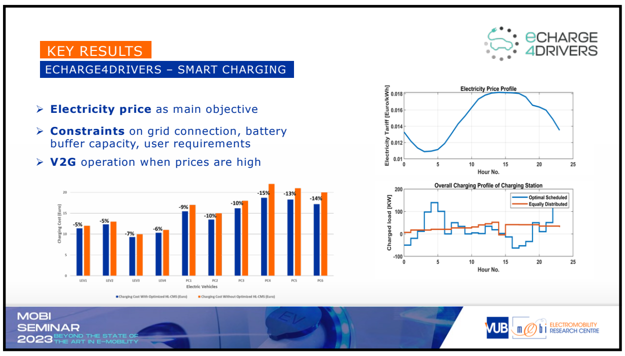
116



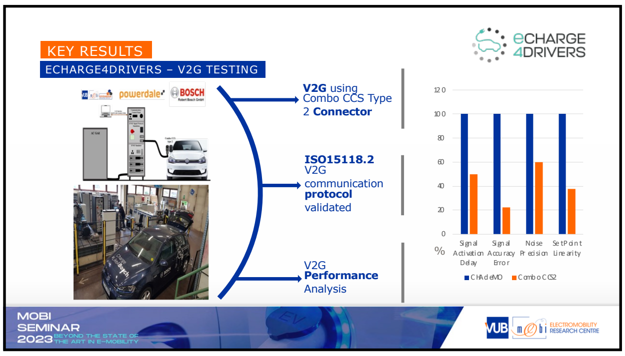
117



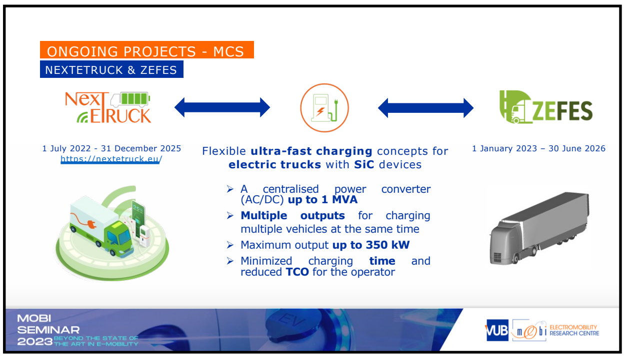
118



119



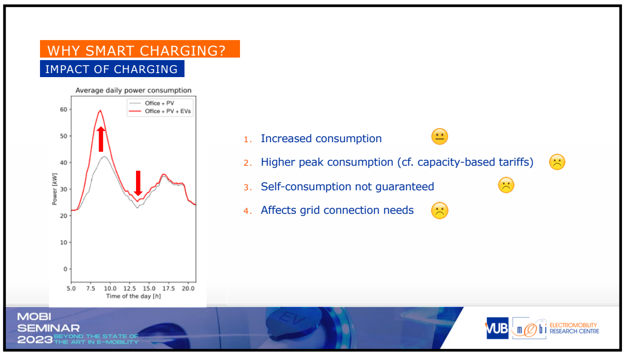
120



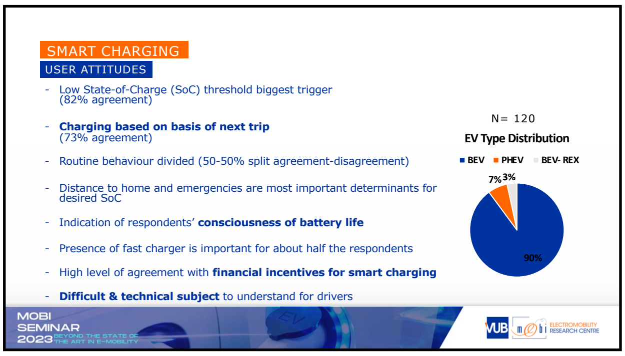
121

122

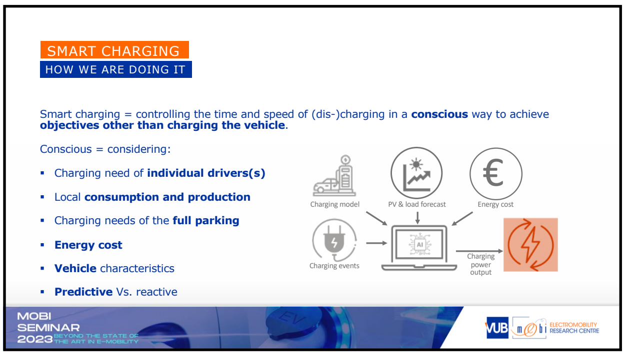
123



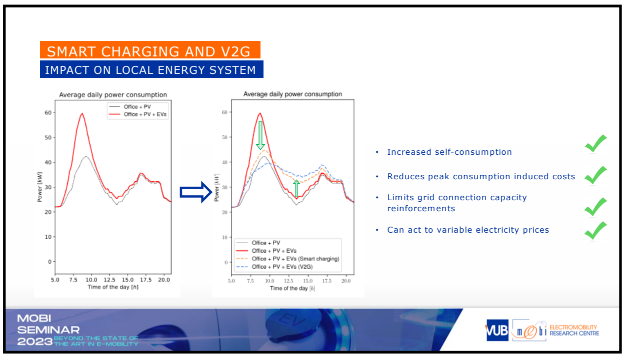
124



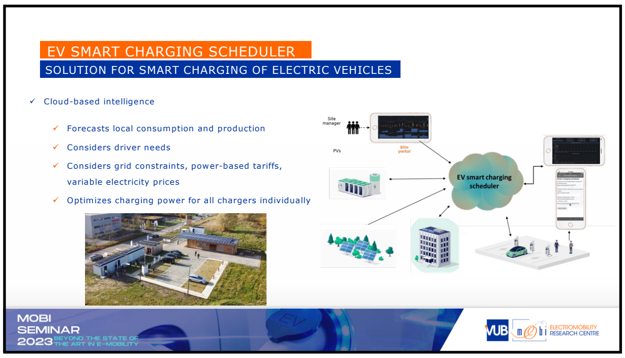
125



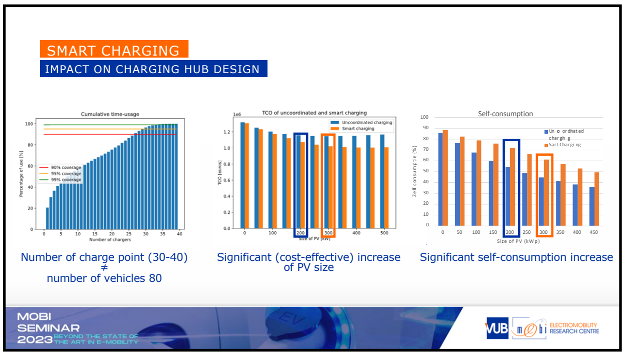
126



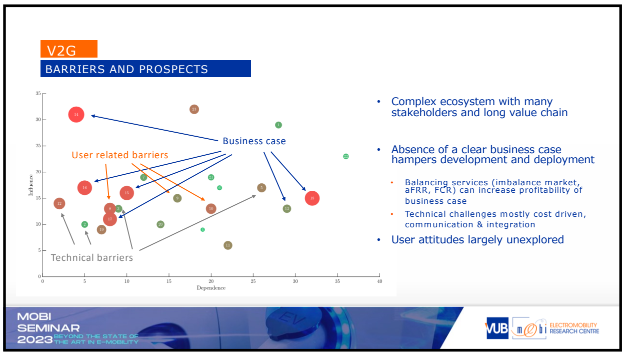
127



128



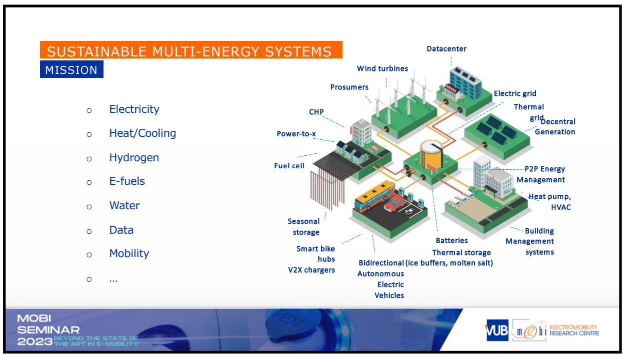
129



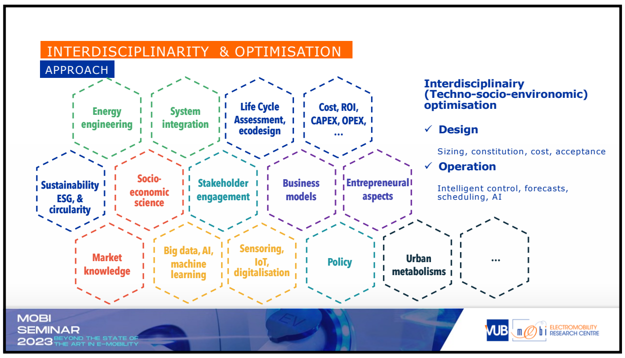
130

131

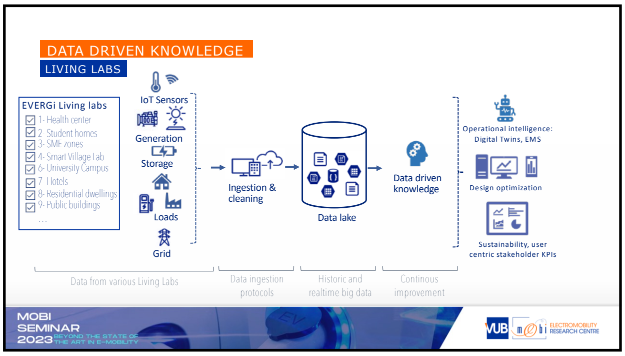
132



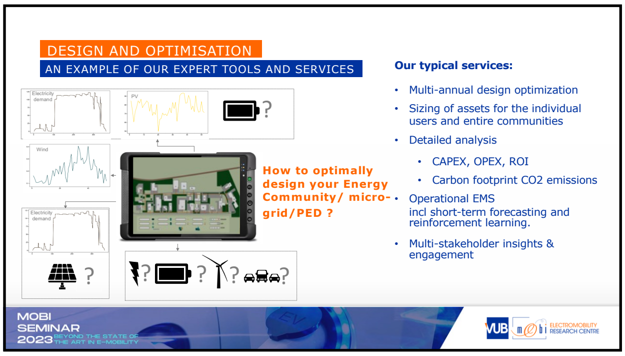
133



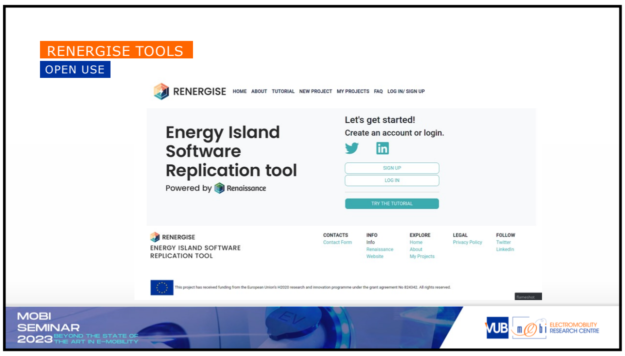
134



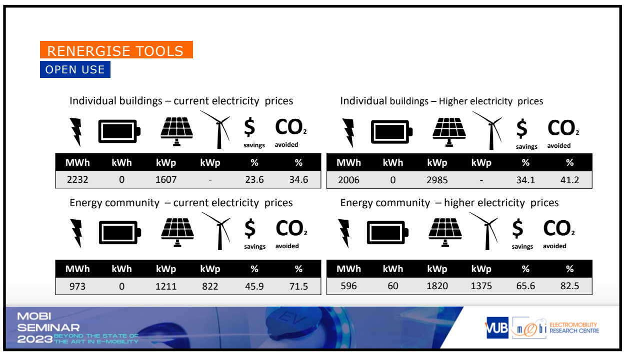
135



136



137



Individual buildings – current electricity prices

MWh	kWh	kWp	kWp	% ($ savings)	% (CO_2 avoided)
2232	0	1607	-	23.6	34.6

Individual buildings – Higher electricity prices

MWh	kWh	kWp	kWp	% ($ savings)	% (CO_2 avoided)
2006	0	2985	-	34.1	41.2

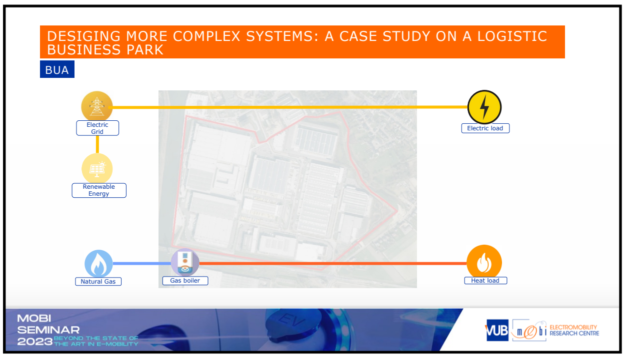
Energy community – current electricity prices

MWh	kWh	kWp	kWp	% ($ savings)	% (CO_2 avoided)
973	0	1211	822	45.9	71.5

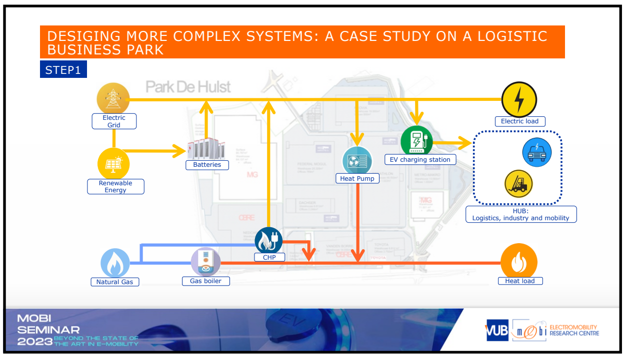
Energy community – higher electricity prices

MWh	kWh	kWp	kWp	% ($ savings)	% (CO_2 avoided)
596	60	1820	1375	65.6	82.5

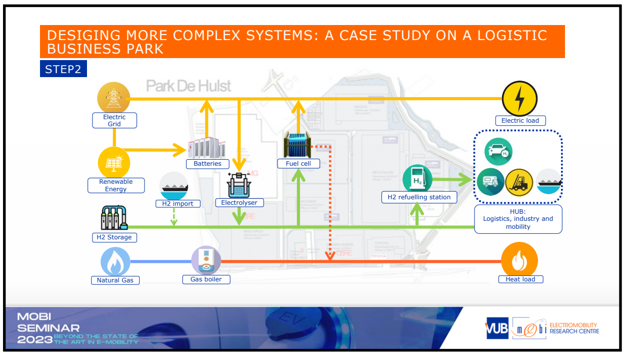
138



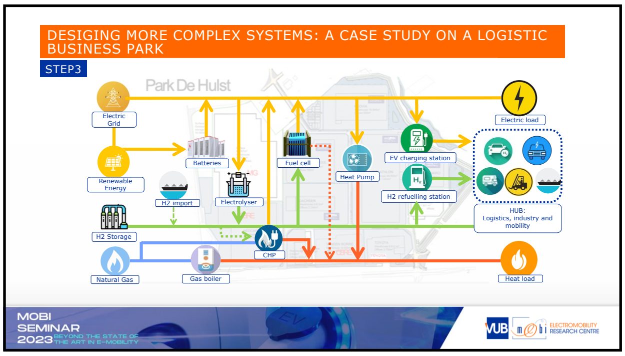
139



140



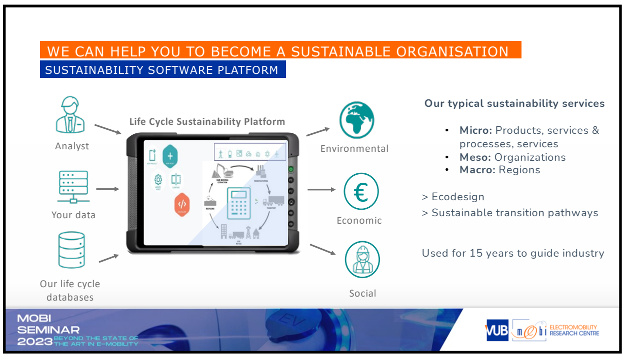
141



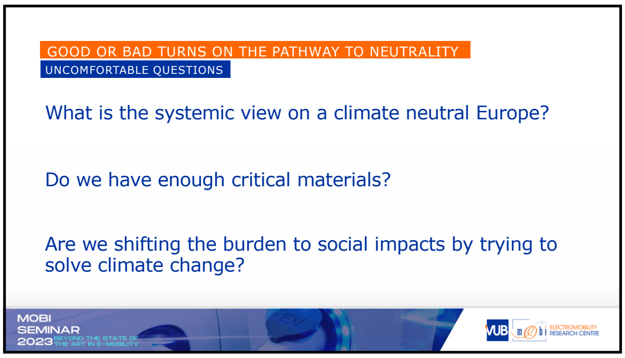
142

143

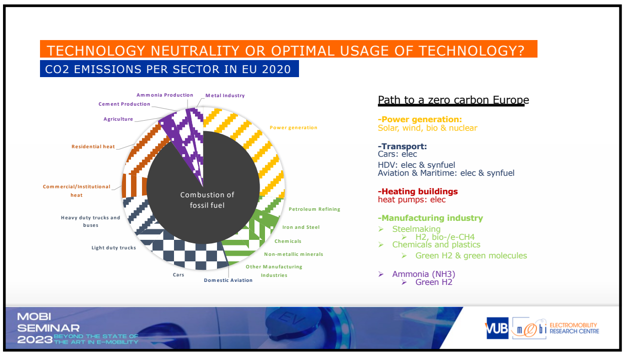
144



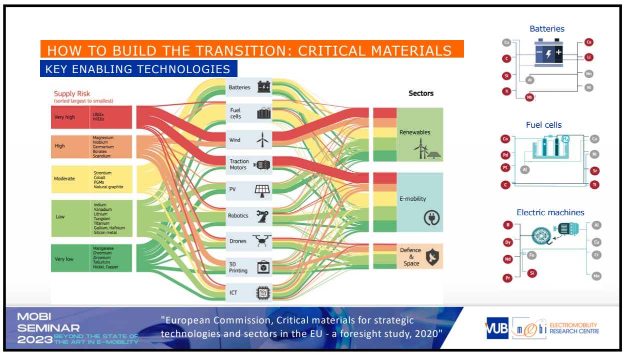
145



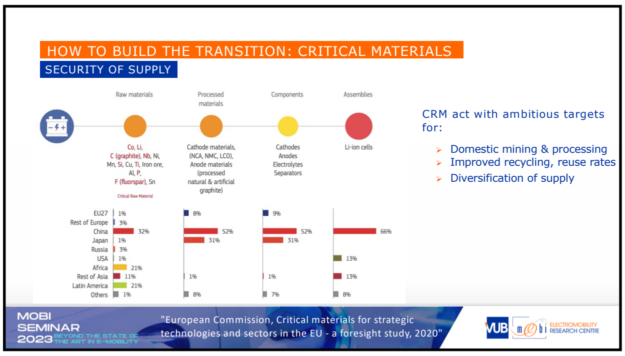
146



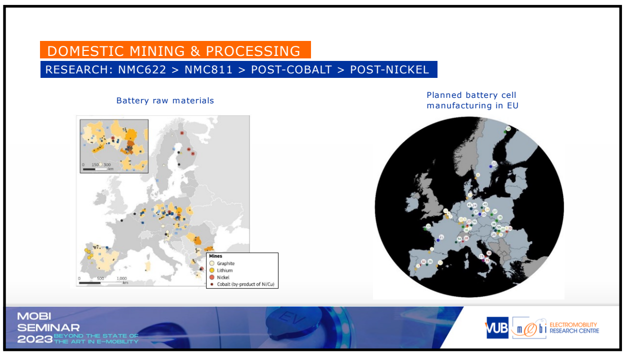
147



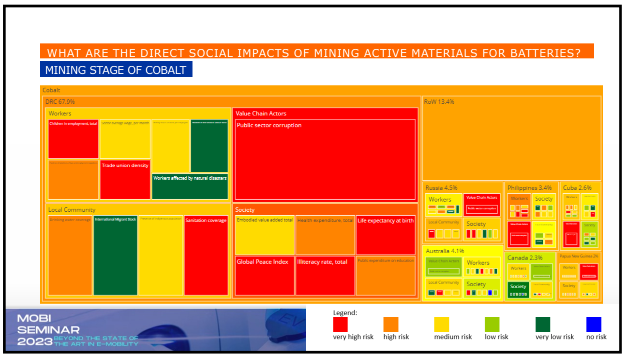
148



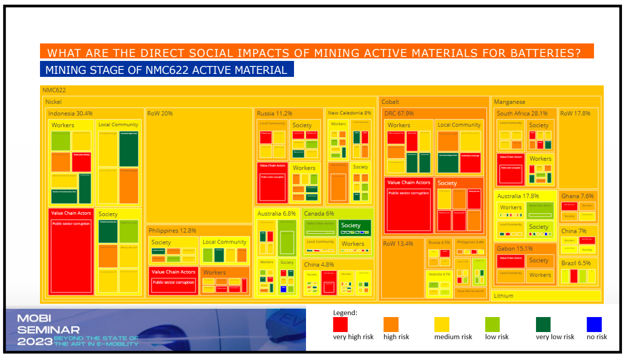
149



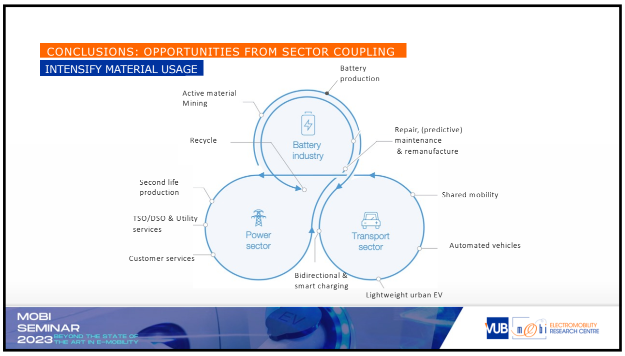
150



151

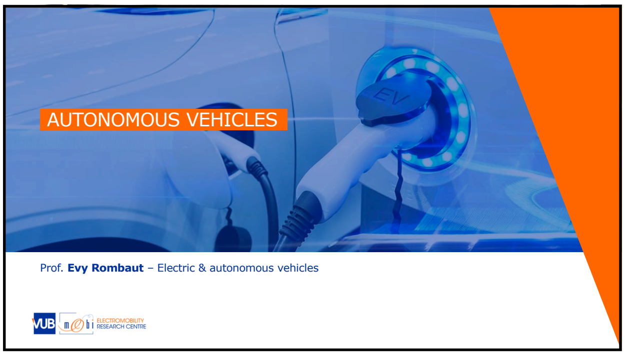


152



153

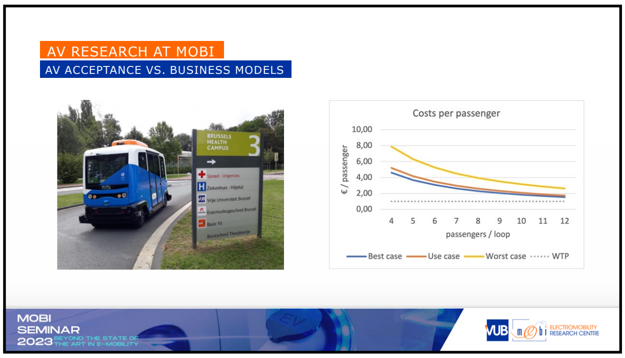
154



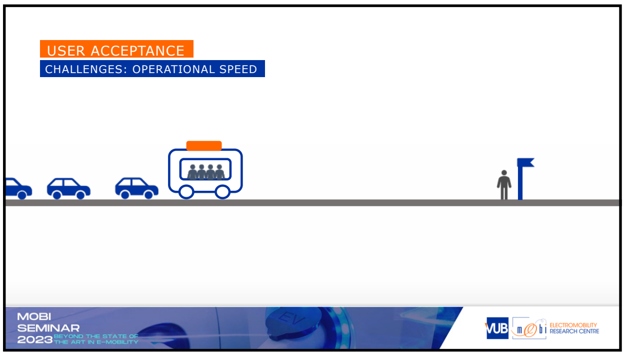
155

156

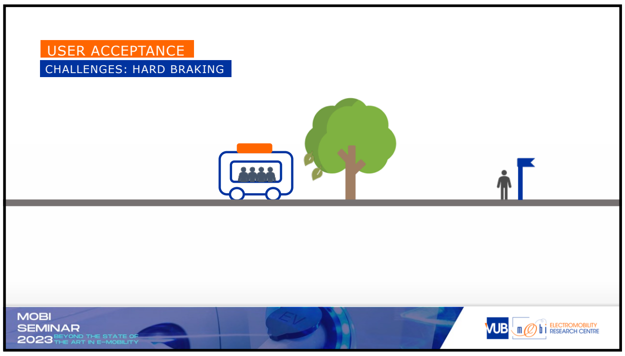
157



158

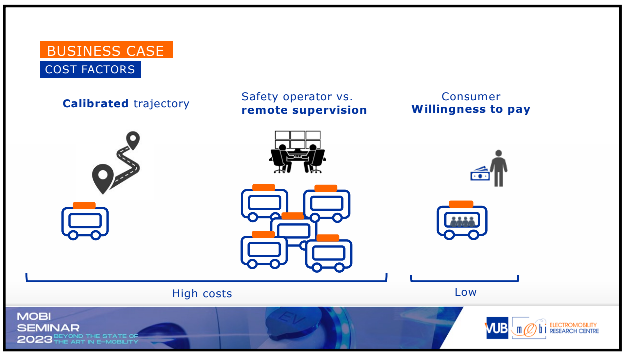


159

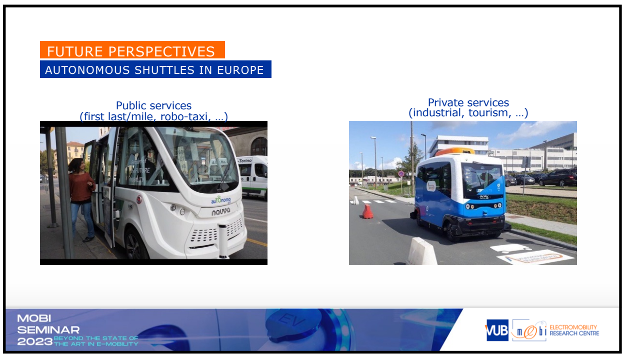


160

161

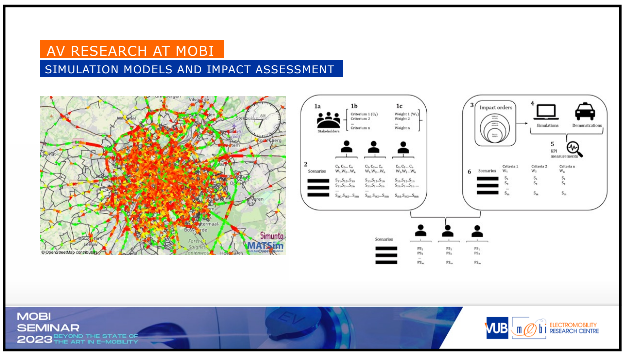


162



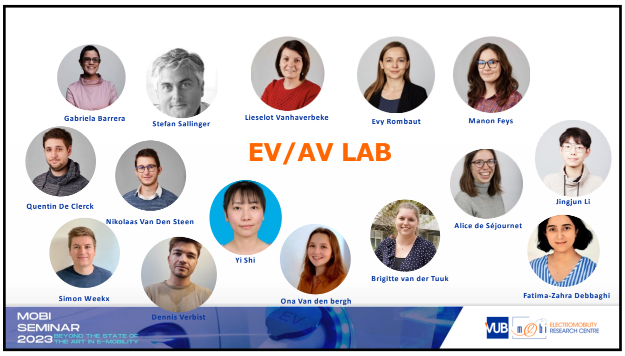
163

164



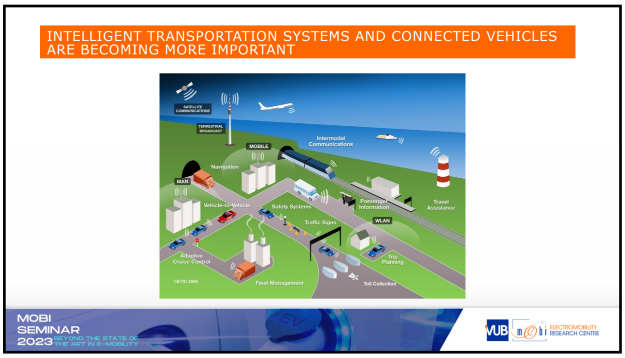
165

166

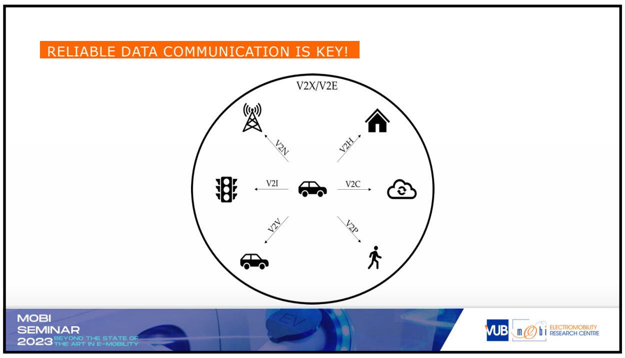


167

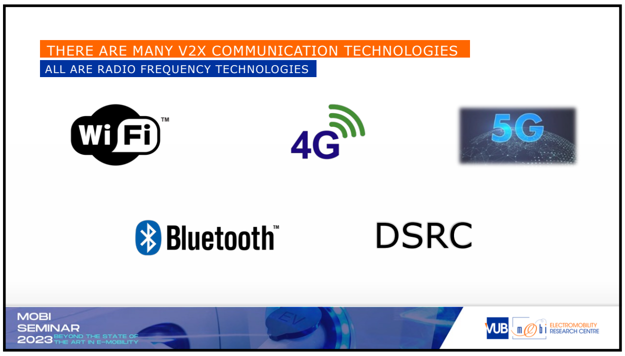
168



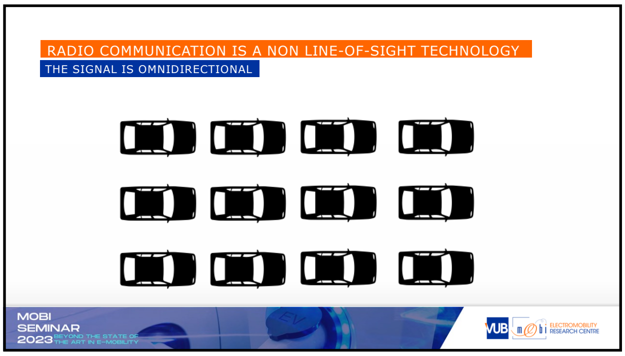
169



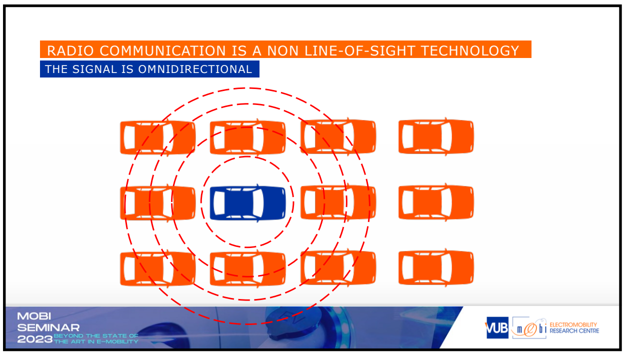
170



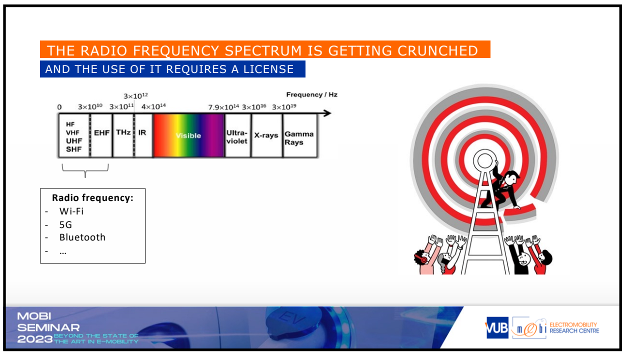
171



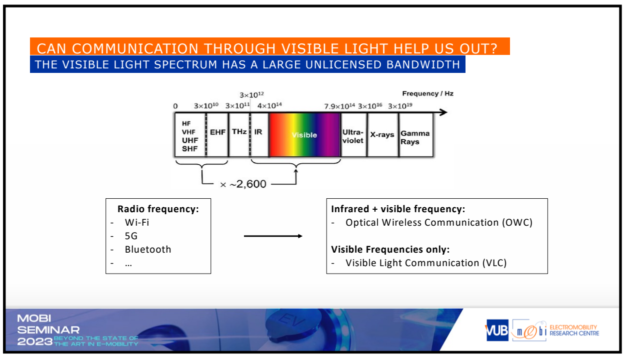
172



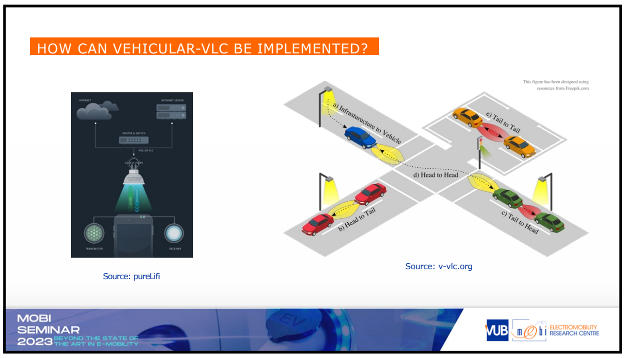
173



174

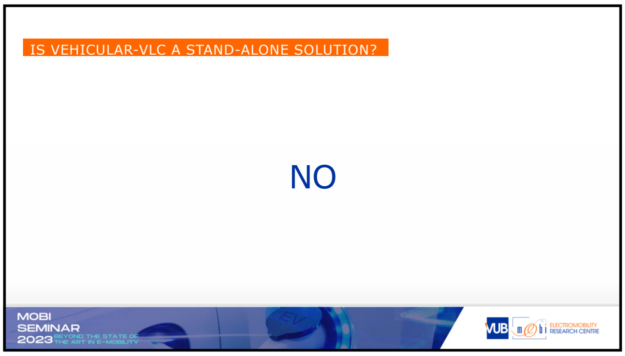


175

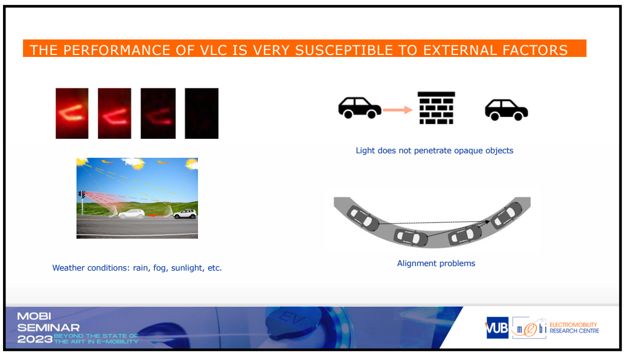


176

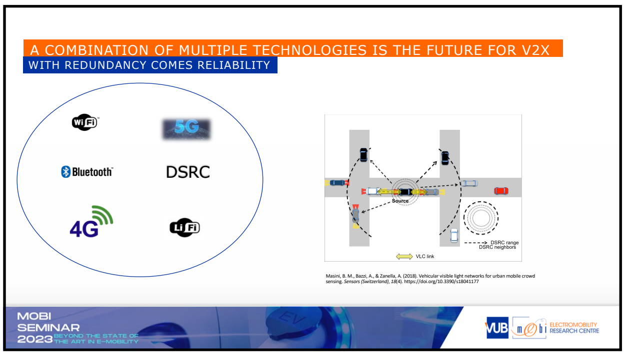
177



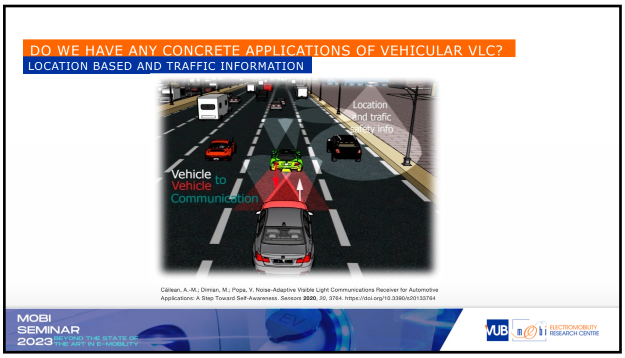
178



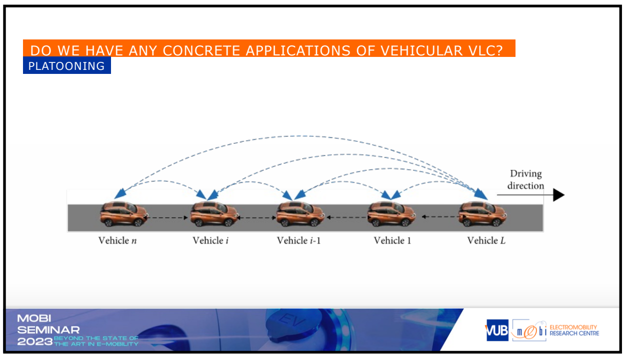
179



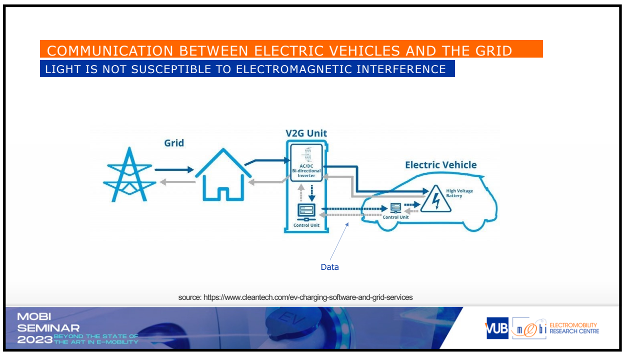
180



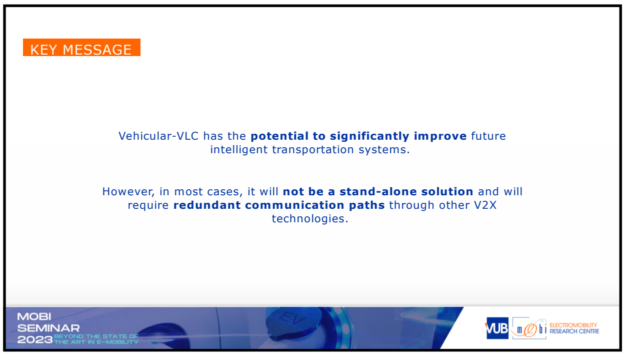
181



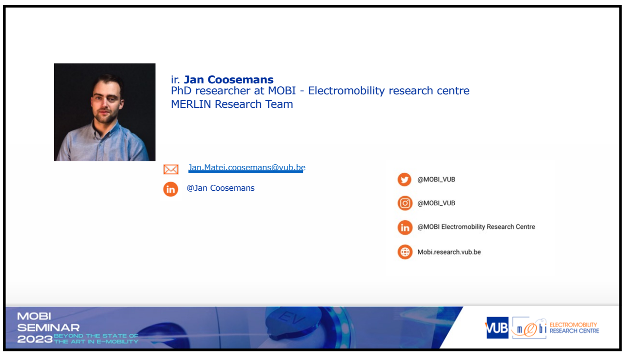
182



183

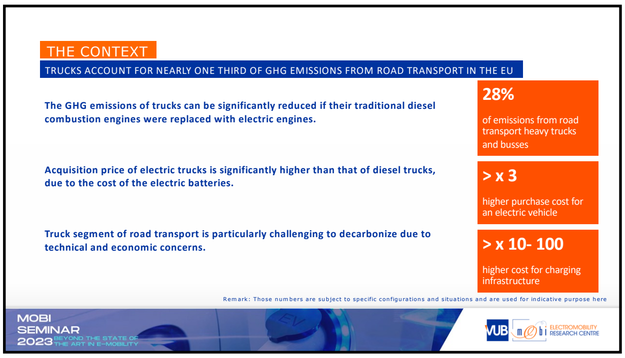


184

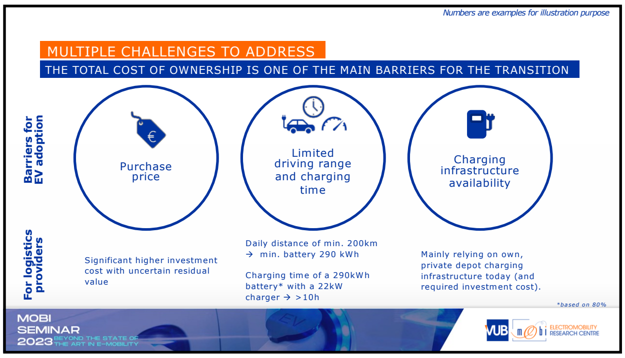


185

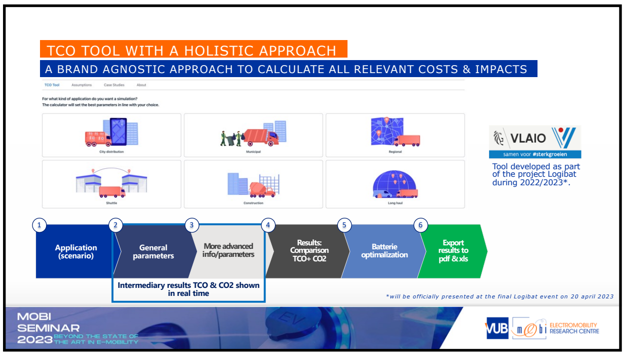
186



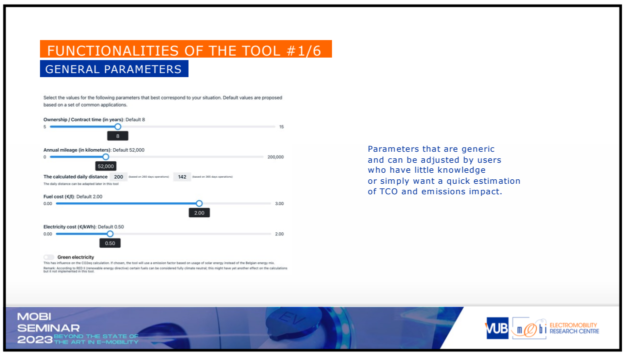
187



188

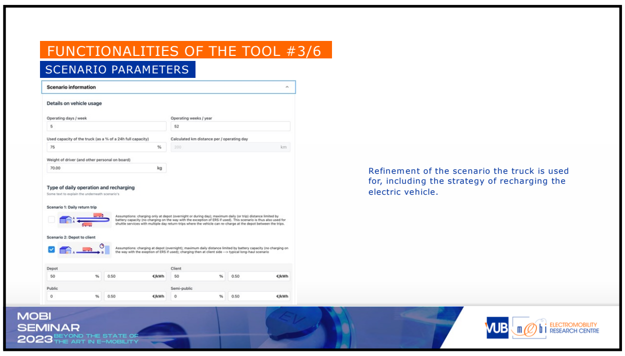


189

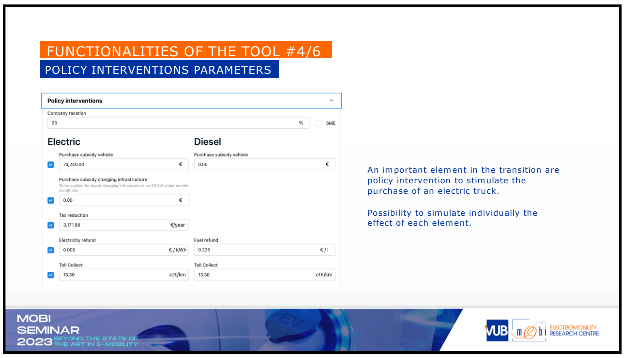


190

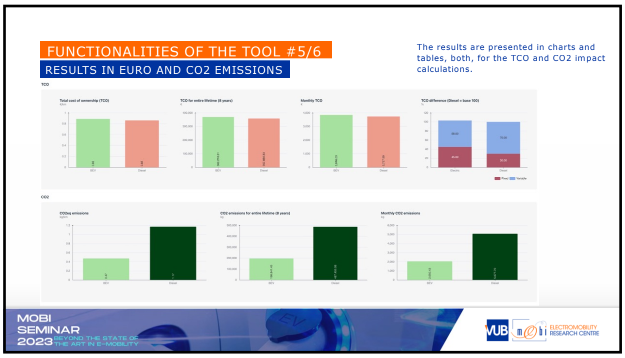
191



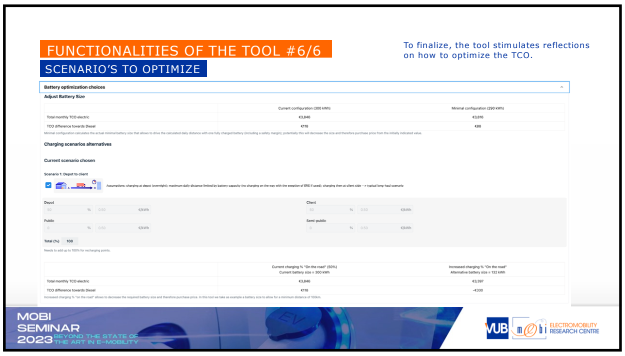
192



193



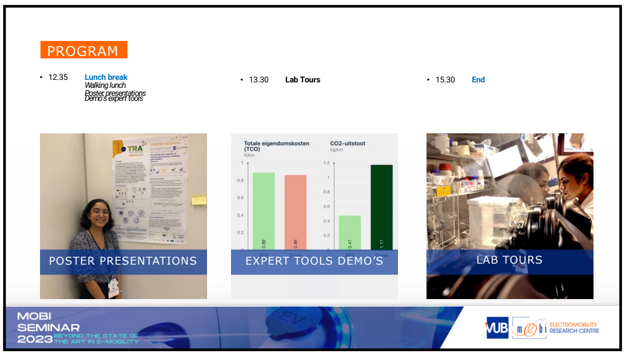
194



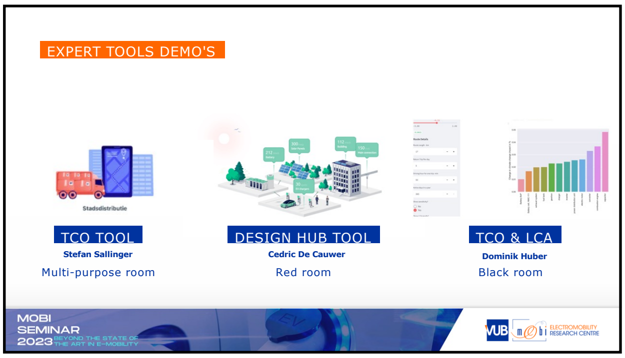
195

196

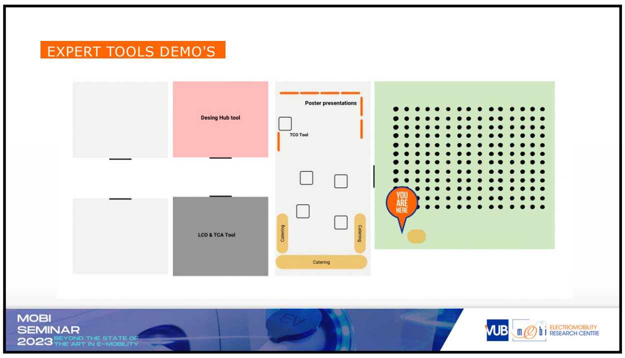
197



198

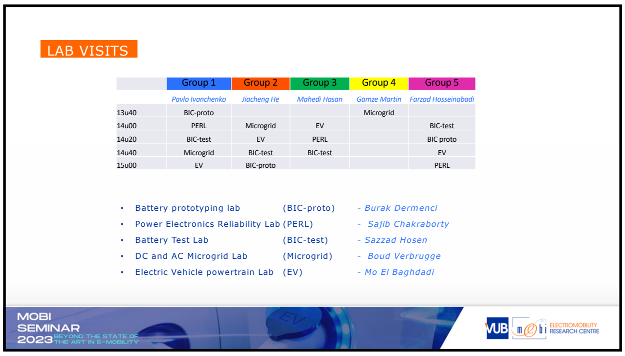


199



200

201



202

203