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ENGINEERING AND PRODUCT DEVELOPMENT

Present and Future of EV Charging in Portugal

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WOKRSHOP "SISTEMAS DE ESTRADAS ELÉTRICAS: UMA SOLUÇÃO PARA O FUTURO!"

Sede da IP, Pragal, Almada

17.April.2019

ABOUT CEiiA

CEiiA is a Centre of Engineering and Product Development that designs, implements and operates innovative products and systems alongside its partners in the automotive, mobility, aeronautics, sea and space industries.

CEiiA offers complete solutions, covering all product development phases from concept to the production of small series, and operates intelligent systems.

+250
Engineers

+10
Years in complex projects

Largest R&D investment in Portugal
(nonprofit organisations – IPCTN 2016)

THIS IS OUR HEADQUARTERS

OUR FOCUS INDUSTRIES

AUTOMOTIVE

AERONAUTICS

MOBILITY

OCEAN

SPACE

THE MOBILITY CHALLENGE

GLOBAL DRIVERS

Connectivity

Electrification

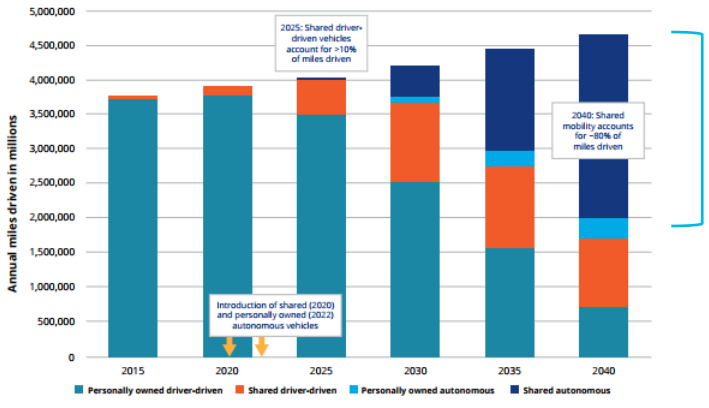
Autonomous driving

Integrated, flexible and on-demand

AUTONOMOUS DRIVING

RESHAPING URBAN MOBILITY

Figure 2. Forecast of total miles driven in the United States



Source: Deloitte analysis based on publicly available information. See appendix for data sources.

Graphic: Deloitte University Press | DUPress.com

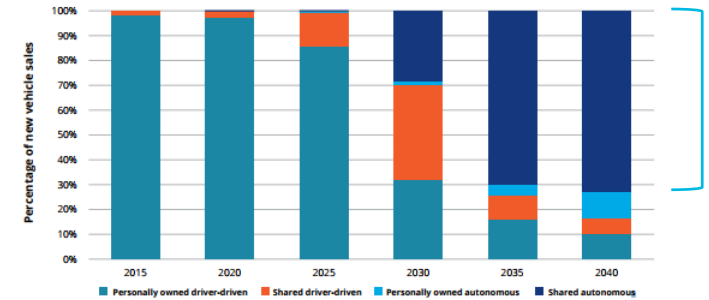
Distance travelled based on electric autonomous vehicles through flexible and on-demand services

ap. 60%-95%+ in 2040

Unit mobility costs to be

reduced by a factor of 4 to 10

Figure 3. Forecast of new vehicle sales distribution in urban areas in the United States



Source: Deloitte analysis based on publicly available information. See appendix for data sources.

Graphic: Deloitte University Press | DUPress.com

Shared autonomous vehicles to account for majority of sales

1 shared vehicle = 7-10 private cars

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CONNECTED AND AUTONOMOUS MOBILITY

INTEGRATION CHALLENGES (EXS.)

Integration with users / pedestrians

— Maas
— Infotainment

V2I
Vehicle-to-vehicle

— Event propagation
— New vehicle based services

Embedded intelligence

— Advanced sensing
— Augmented reality
— Machine learning / AI

Integration with energy systems

— Intelligent energy management
— Autonomous EV charging
— Wireless EV charging

V2I
Vehicle-to-infrastructure

— Smart road infrastructure / road signs
— Traffic management
— Blockchain

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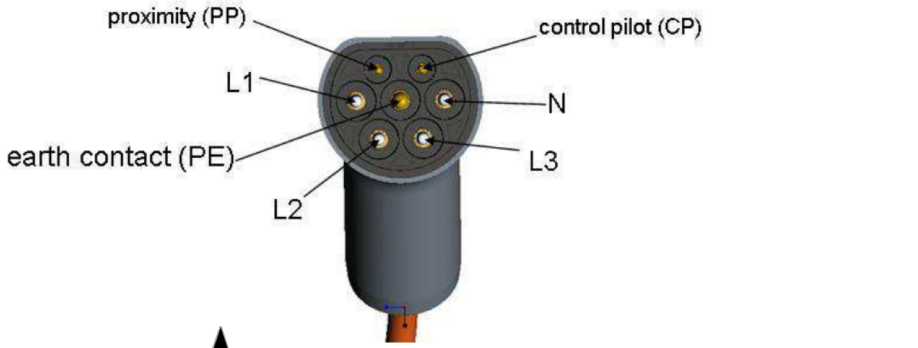
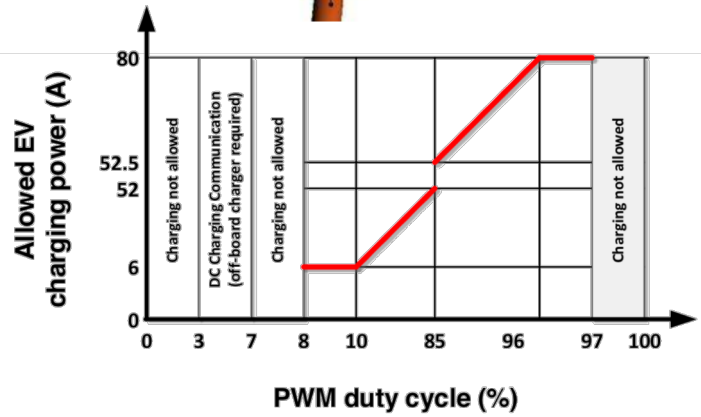
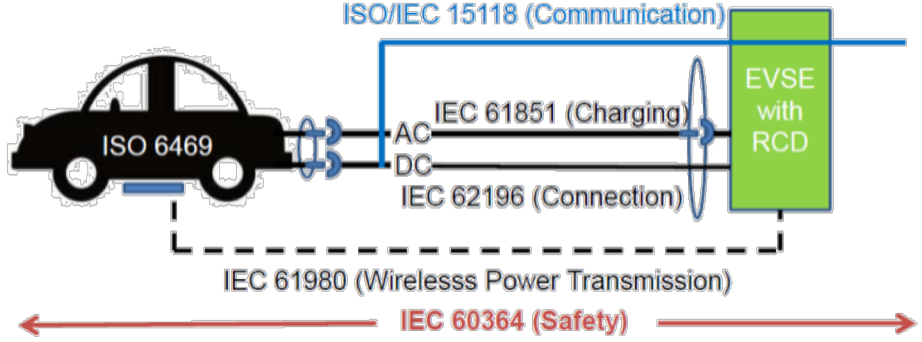
CHARGING TODAY

EXISTING STANDARDS

- ISO 62196 for plug definition (and still there are are more than one per type of charging)
- EVSE – EV "Communication": ISO 61851 Mode 3 Charging: the EVSE signals to the EV onboard charger how much it is capable of supplying and the EV controls the process within the boundaries provided by the EV
- Open (*de facto*) Standard for EVSE to backend communication relying on the **Open Charge Point Protocol (OCPP)** versions 1.5-1.6
- Without standards focusing on specific value-added use cases there will not be widespread dissemination

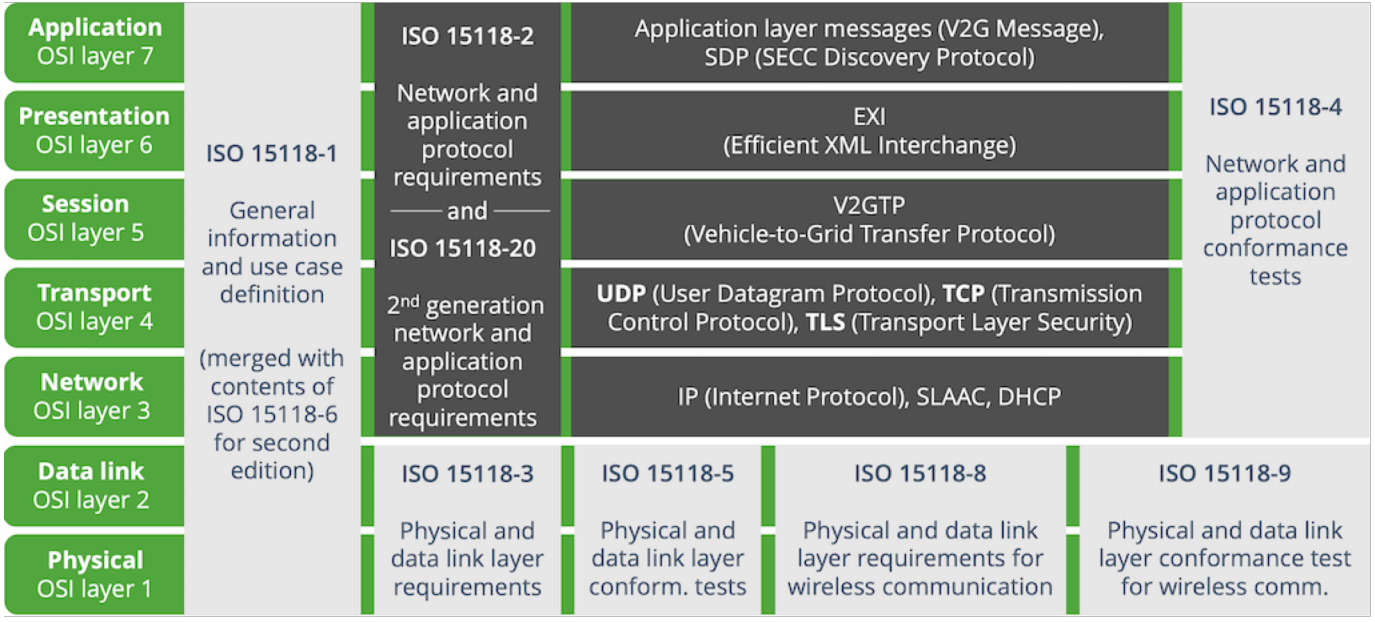






NEW EV STANDARDS: ISO 15118

RESHAPING URBAN MOBILITY



In a nutshell, ISO 15118 is an international standard that outlines the digital communication protocol that an electric vehicle (EV) and charging station should use to recharge the EV's high-voltage battery. As part of the Combined Charging System (CCS), ISO 15118 covers all charging-related use cases across the globe. This includes wired (AC and DC) and wireless charging applications and the pantographs that are used to charge larger vehicles like buses.

NEW EV STANDARDS: ISO 15118

MAIN USE CASES

- Automated identification and authorization via Plug & Charge
- Manual identification and authorization (e.g. via RFID card or QR code)
- Wired charging—both alternating and direct current
- Wireless charging (Ed. 2)
- Bidirectional power transfer, which allows the EV to provide energy to the grid (Ed. 2)
- Charging buses via pantographs (Ed. 2)
- Load management (smart charging) for all charging modes
- Renegotiation of charging schedules while charging to react upon unforeseen changes in the grid
- Value-added services that allow additional information to be exchanged via separate communication channels such as HTTP, HTTPS, FTP

Status: Published in April 2013 (Worth noting: publication of ISO 15118-1 Ed. 2 is planned for Q4/2019)

KEY PRINCIPLES TODAY

EV CHARGING SETTLEMENT IN PORTUGAL

- Energy measurement is performed by the DSO
- Electricity market integration is ensured by the incumbent DSO (EDP-D)
- Active Energy (and Active Power) is distributed per delivery point in 15 minutes intervals per all the electricity retailers supplying CEMEs whose EV customers are charging
- Grid access costs are included and distributed throughout the EV market (Important: no fixed costs for the deployment of new installations!)
- Settlement between OPC and CEME is ensured by MOBI.E

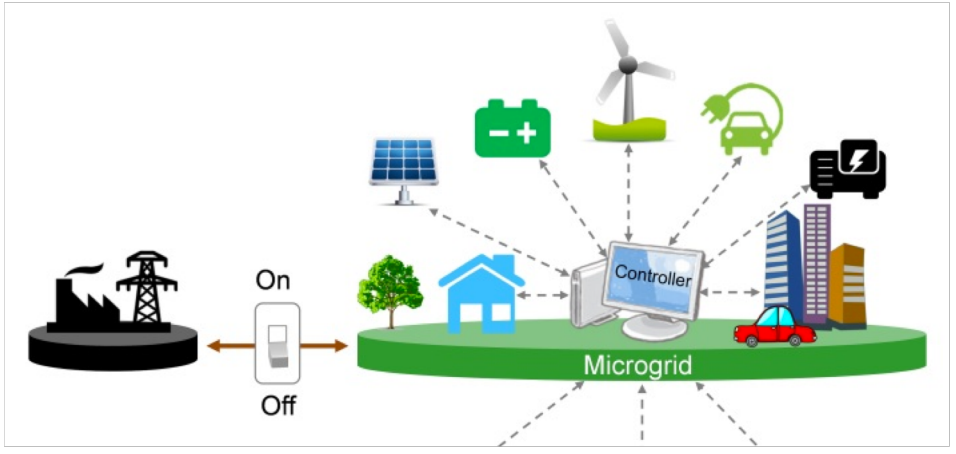
YOUR ELECTRICITY CONTRACT CAN BE USED VIRTUALLY ANYWHERE…. provided that you are connected to the grid…

MISSING PIECES

REGULATION AND MARKET MODEL EVOLUTION

- **PRIORITY**
  - Who sells me energy first? Local producer directly or grid?
  - …
- **BIDIRECTIONALITY**
  - To whom (and how) do I sell my energy to?
  - …
- **DEFERRED CHARGING**
  - How do I (should I?) account for overnight energy storage and charging during day from storage?

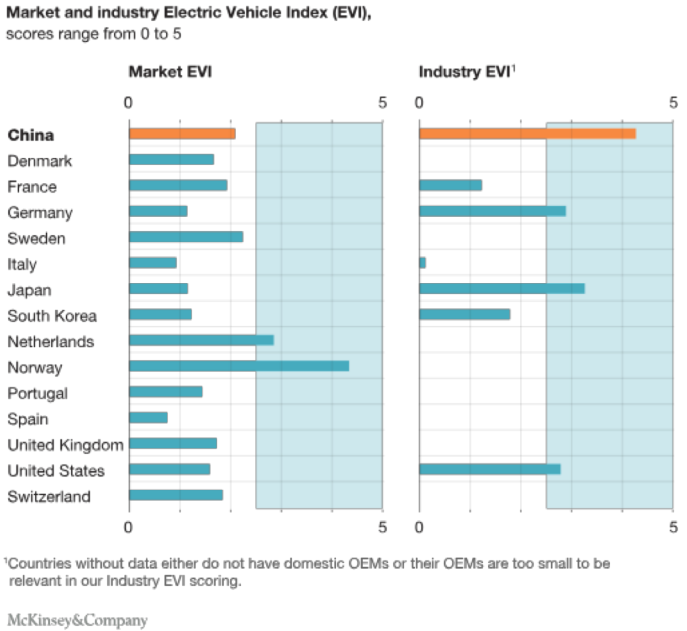
- And all of the above mixed!
- Leading the way to true microgrids and the creation of local energy communities



EV MARKET UPTAKE IN PORTUGAL AND GLOBALLY

RESHAPING URBAN MOBILITY

From a global perspective, China is on its way to becoming the overall market and industry leader in electric mobility.



[1]Countries without data either do not have domestic OEMs or their OEMs are too small to be relevant in our Industry EVI scoring.

McKinsey&Company

Country	Total scoring	EV maturity	Charging maturity	Government incentives	LeasePlan maturity
Norway	34	12	7	7	8
Netherlands	33	9	8	8	8
Sweden	29	9	6	7	7
Austria	28	7	6	9	6
Finland	26	7	6	6	7
Germany	25	7	5	8	5
United Kingdom	25	5	6	7	7
Portugal	24	7	5	5	7
Belgium	23	7	5	5	6
Luxembourg	23	7	6	5	5
Ireland	23	7	5	8	3
France	22	7	5	4	6
Switzerland	22	8	6	3	5
Denmark	20	6	6	1	7
Spain	20	4	4	6	6
Hungary	19	5	5	6	3
Italy	17	5	4	3	5
Romania	12	2	4	5	1
Slovakia	12	2	5	4	1
Czech Republic	11	4	5	1	1
Greece	10	2	2	4	2
Poland	9	3	3	2	1

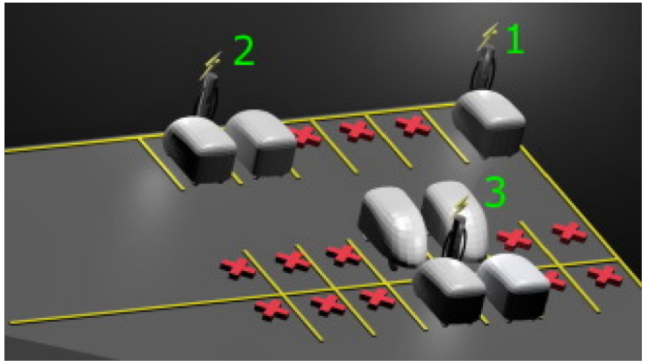
Source: Leaseplan, 2019

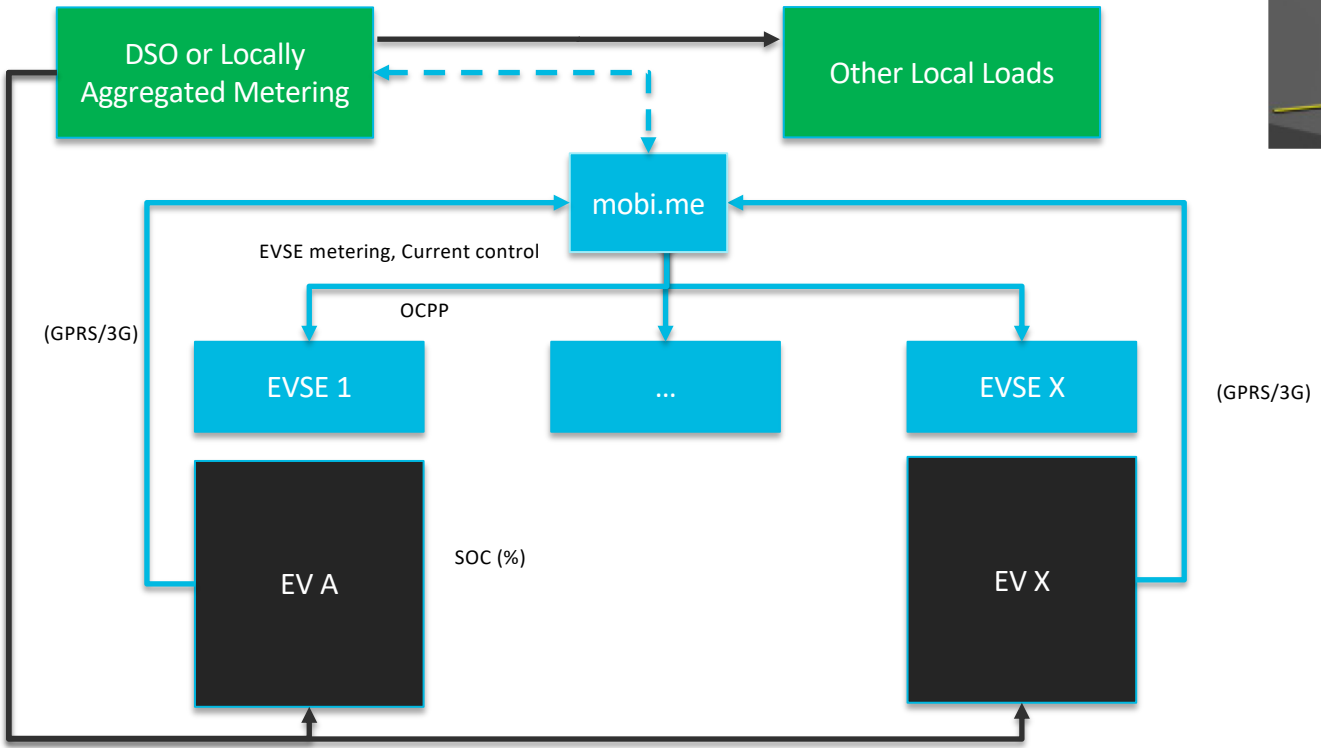
Will we get to more than 20,000 registered cars by the end of 2020? YES

“DAY 1” Advanced Use Cases

SMART CHARGING AND RESERVATION

Not suitable (yet) for public charging stations since they imply either individual user service level degradation (smart charging) or restrictions of access to a public space and/or service.





Load Balancing for:

- Cost optimization
- Overall efficiency
- Differentiated charging (profiling)

THE FUTURE IS COMING

FROM 30 TO 5 MINUTES CHARGING (ALMOST)

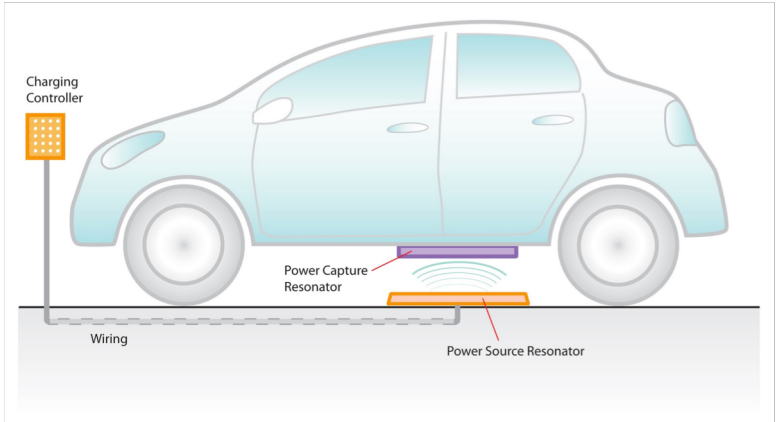
- European Consortium between BMW, Daimler, Ford, and VW (counterpart in the US: Electrify America)
- Ultra Fast Charging (up to 350 kW) – not for all cars and not at the beginning
- Average of 6 Ultra Fast Chargers per service station with 400 stations in Europe
- Planned start of operations in Portugal in 2019

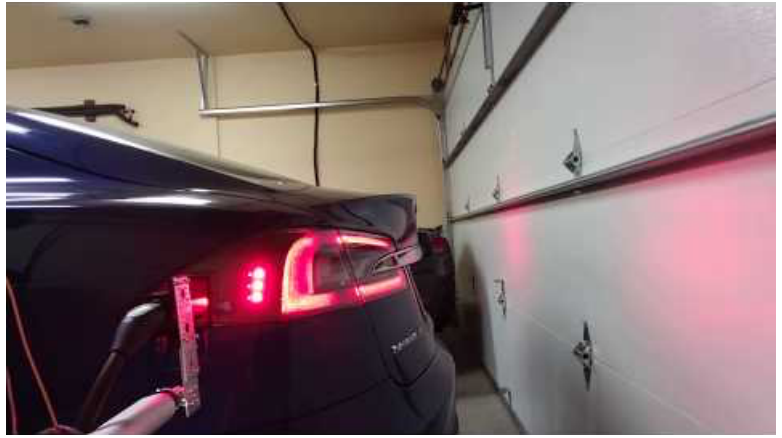
THE FUTURE IS COMING

AUTONOMOUS CHARGING

- Autonomous Charging is essential for autonomous vehicles

- ERS and mainly Wireless Charging (Induction) leading to:
  - Concept of full autonomy
  - No need for charging stations
  - Smaller battery units with the increase in charging stations access





DRAFT DEFINITION

Physical spaces that gather and replicate the real conditions of city ecosystems for the purpose of development of activities of research, demonstration and testing of technologies with different states of maturity in full security, privacy and confidentiality

FREE TECHNOLOGY ZONES

MATOSINHOS LIVING LAB

One of 12 living labs approved by Min Environment

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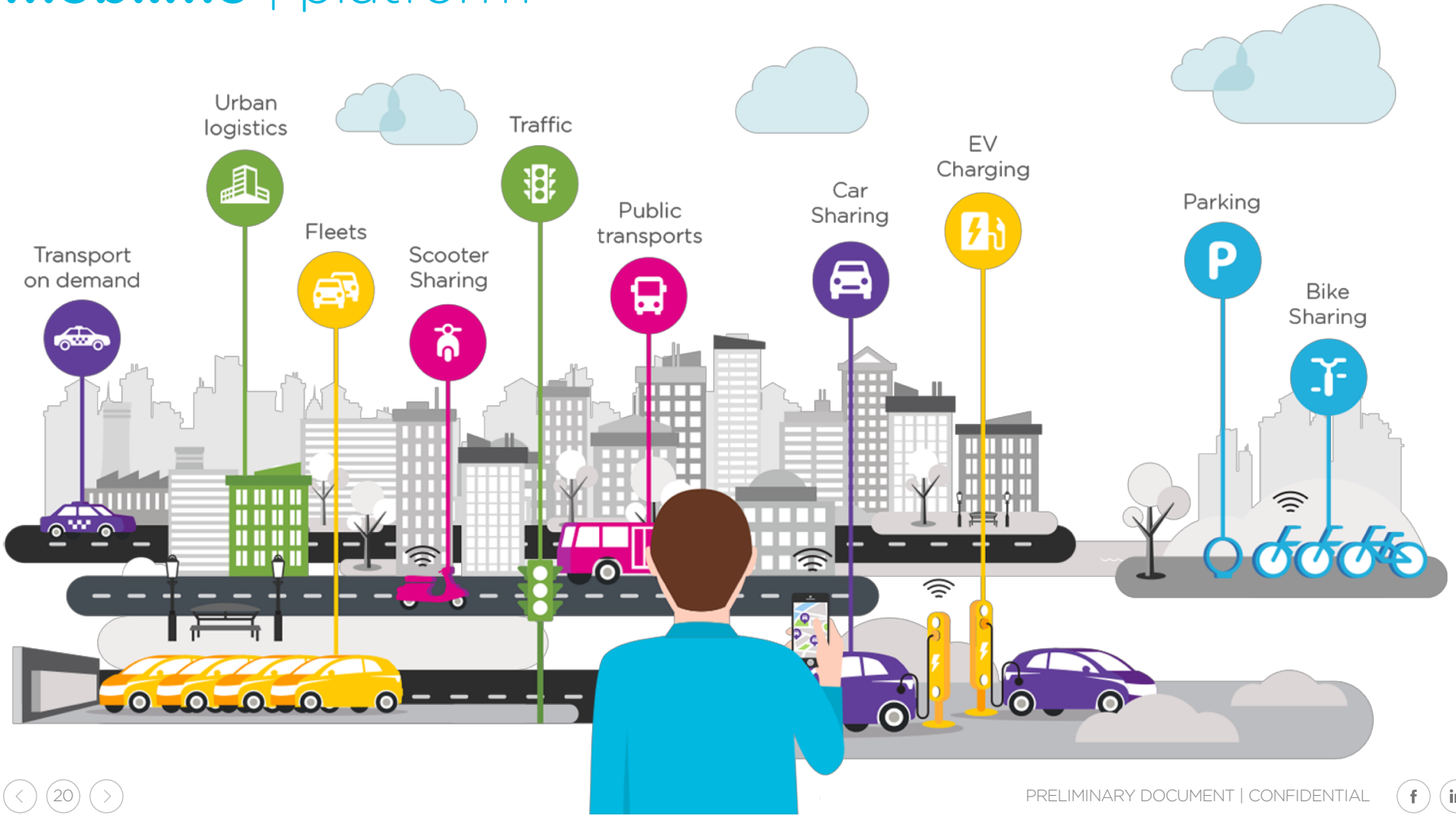
mobi.me | platform



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