



ČEZ E-MOBILITY PILOT PROJECT

February 2, 2017

Tomáš Chmelík

Head of Clean Technologies

ČEZ, a. s.

POLITICS IS THE KEY DRIVER IN THE POWER SECTOR BUSINESS



1. Environmental regulation

- Climate Change
- Other environmental pollution (air, water, waste)

2. Security of supply

- Renewables
- Energy Efficiency
- New Technologies

THE POWER SECTOR IS LIKELY TO CHANGE – „TRADITIONAL“ ENERGY WILL MAKE ROOM FOR „NEW“ TECHNOLOGIES



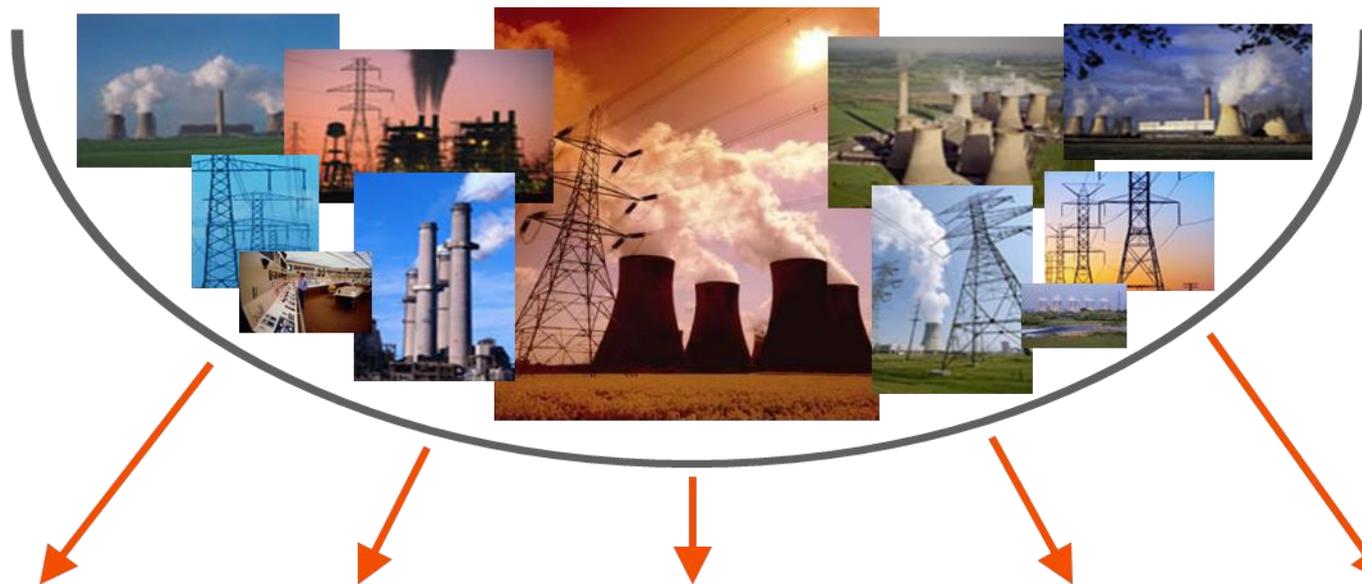
2010:



2020:



NEW OPPORTUNITIES WILL EMERGE AS A RESULT...



Energy Storage

End-user Energy Efficiency

Clean Coal

Traditional Renewables

E-mobility

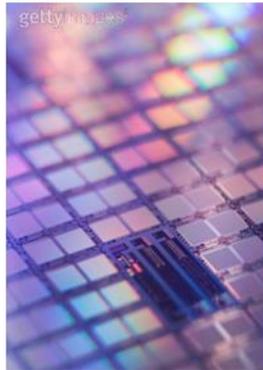
Small-sized CHP

Advanced Renewables

Improvements in production efficiency

Smart Grids

LONG-TERM APPROACH IS NEEDED



OUR VISION



SMART GRID – A KEY STONE IN BUILDING THE ENERGY INFRASTRUCTURE



FULFILMENT OF CUSTOMERS' MOBILITY NEEDS IS DETERMINED BY A LIMITED NUMBER OF KEY DRIVERS



Main drivers pulling electric vehicles demand

Customers' needs	Key drivers	Key drivers description
Mobility needs	Driving range 	<ul style="list-style-type: none"> > Current typical range of up to 150 km may constraint EV usage > No range disadvantages expected for PHEVs when compared to ICEs
	Unrestricted mobility 	<ul style="list-style-type: none"> > Need for flexibility in mobility requirements > EVs to be used as one of two cars in HH, no limitations to PHEVs
	Infrastructure coverage 	<ul style="list-style-type: none"> > Availability of a safe, convenient and widespread infrastructure influences usage of Electric Vehicles
Cost needs (TCO)	Market drivers 	<ul style="list-style-type: none"> > The expected battery cost regressions and development of fuel prices will be the key market drivers affecting attractiveness of xEVs
	Regulation drivers 	<ul style="list-style-type: none"> > Long-term CO₂ taxes, xEVs purchase incentives or other incentives (e.g. non-monetary) have the potential to increase attractiveness of Electric Vehicles
Image/comfort needs	xEVs offering (segments, brands) 	<ul style="list-style-type: none"> > Availability of segments will be key to fulfill different customers' comfort, size and performance needs > Availability of electric vehicles by several brands is crucial to fulfill different customers' image needs

Source: Roland Berger

ESTIMATES OF ELECTRIC VEHICLES SALES POTENTIAL HAVE TO CONSIDER INFRASTRUCTURE, MOBILITY AND COST FACTORS



Methodology for the Electric Vehicles market projection

Market size	- Addressable market						7
	1	2	3	4	5	6	
	×	×	×	×	×	×	
	LV Sales volume	Driving range	Unrestricted mobility	Infrastructure coverage	TCO (valid mileage)	xEVs offering	Capture ratio
EV	✓	✓	✓	✓	✓	✓	✓
PHEV	✓	✓	✓	✓	✓	✓	✓
Description	> Domestic new light vehicle sales (215 ths vehicles in 2020)	> % of drivers with common single trip of defined distance	> % of HH with 2+ cars (EVs) > % of HH with single car (PHEV)	> Infrastructure limited to cities fulfilling defined population size criteria	> Share of drivers exceeding the break-even mileage (TCO based)	> % of segments with xEV offering > Width of offering	> Target market share for addressable market
		Mobility needs			Cost needs	Image needs	

1) Applies only to EVs, assumes that the EV is the 2nd car in the household

2) Total Cost of Ownership

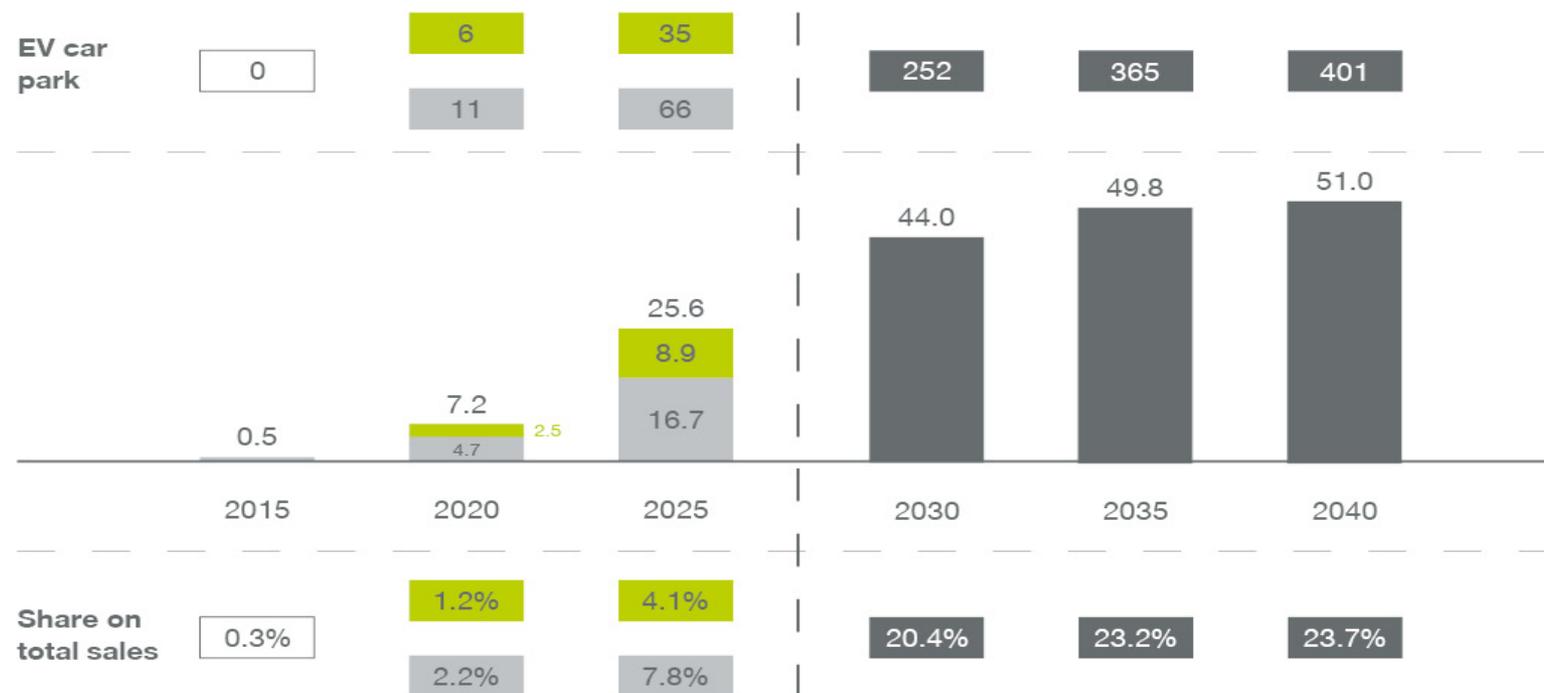
3) Light vehicles

Source: Roland Berger

CZECH REPUBLIC: IN THE BASE CASE SCENARIO, EV AND PHEV SALES ARE EXPECTED TO TAKE OFF AROUND 2020...



Base case scenario *(light vehicles in thousands)*



EV Electric Vehicle PHEV Plug-in Hybrid Electric Vehicle

Note: Technology split only until 2025, vehicle life-time of 8 years assumed

Source: Roland Berger

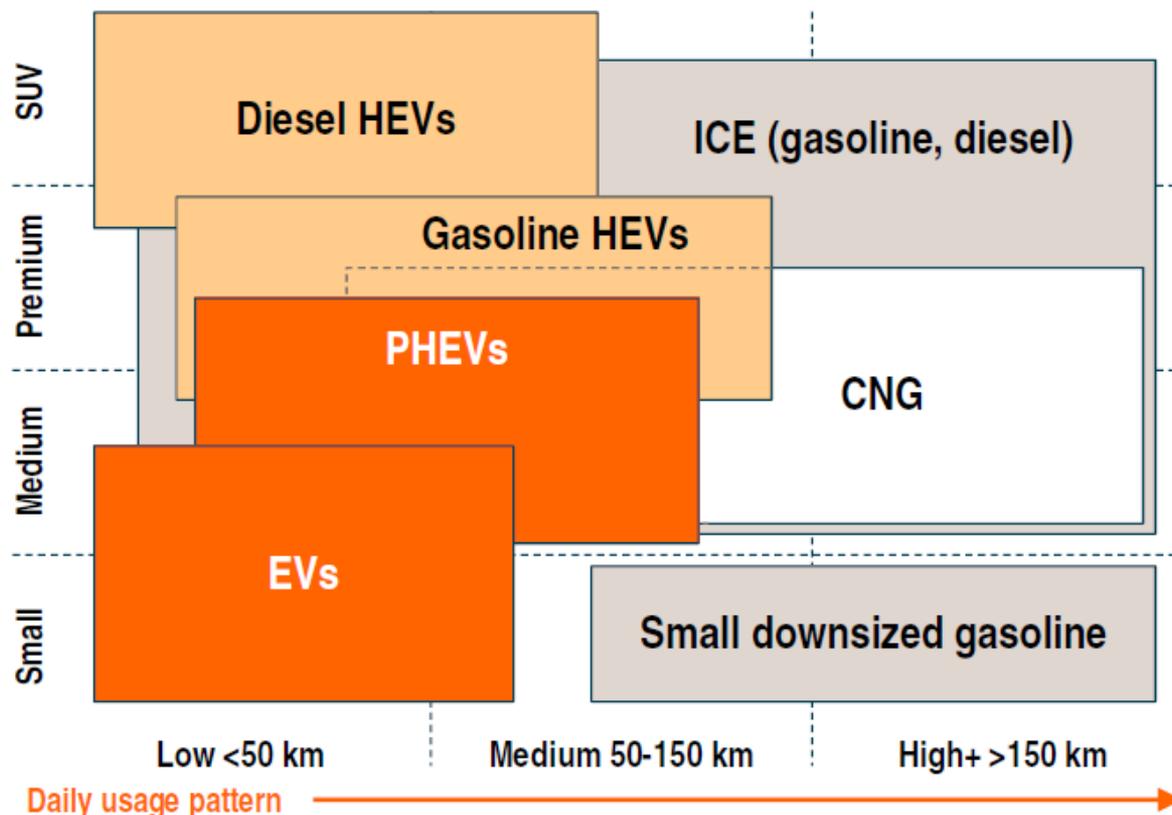
...WHICH WILL INCREASE THE DEMAND FOR PUBLIC CHARGING



BOTH CNG & E-MOBILITY ARE EXPECTED TO CO-EXIST IN MID-TERM WITH SPECIFIC AND RELATIVELY SEPARATE FIELD OF APPLICATION



EV/PHEV/CNG use case Europe – Expectations 2020/2025 (mainstream application)



- > EVs to remain dominant in small & medium segments with rather low daily mileage, however, will be present in other segments too (e.g. Tesla S/X in premium/SUV segment)
- > CNG with significant overlaps to ICE but with focus on lower segments – Strong alternative mainly to diesel engine
- > Both diesel and gasoline HEVs serving as next step of downsizing for premium brands to meet EU CO2 regulation targets

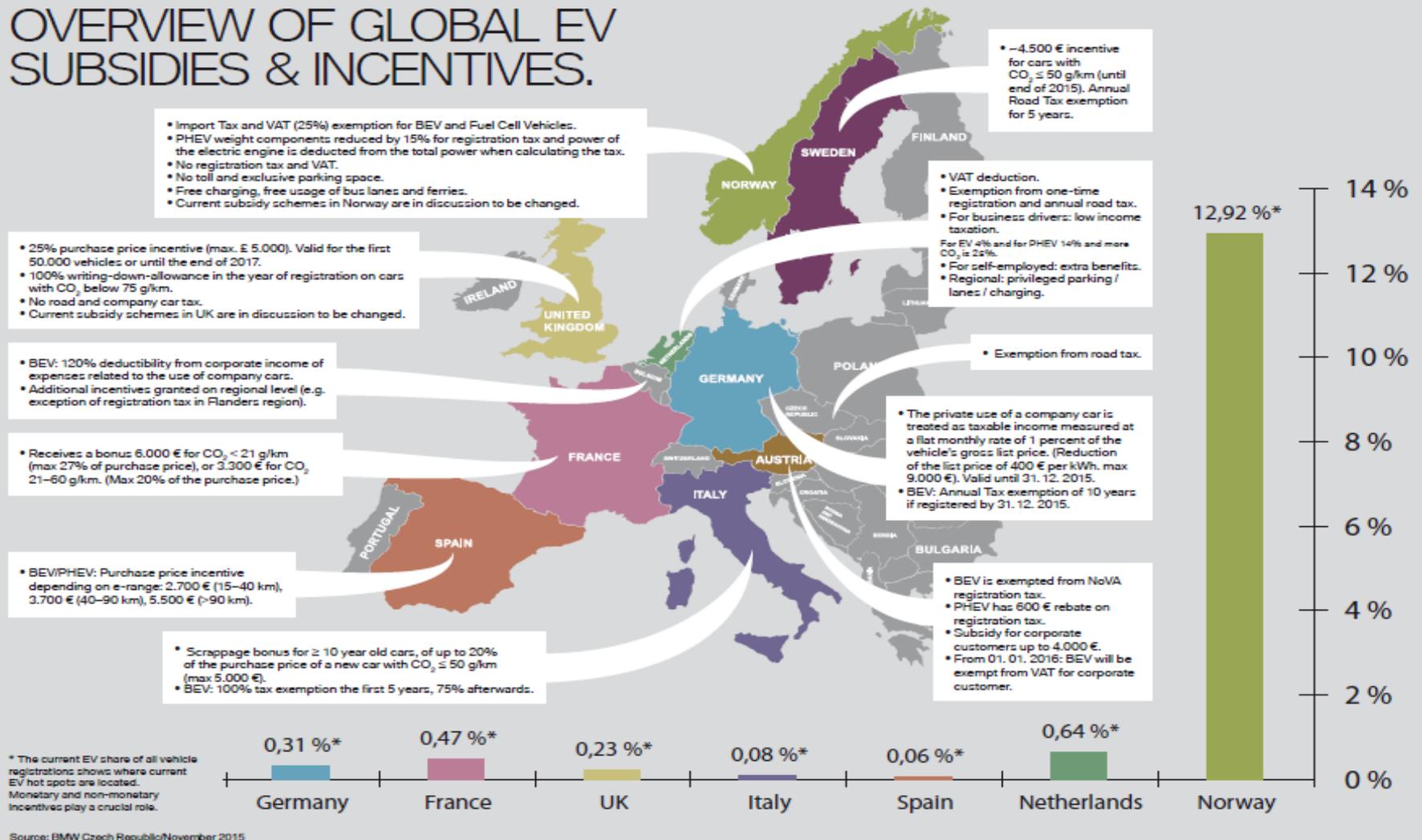
EV: electric vehicle, PHEV: Plug-In Hybrid electric vehicle

Source: Roland Berger

NUMBER OF EU MEMBER STATES HAS ALREADY IMPLEMENTED INCENTIVES FOR ELECTRIC VEHICLES



OVERVIEW OF GLOBAL EV SUBSIDIES & INCENTIVES.



NATIONAL ACTION PLAN ON CLEAN MOBILITY IS THE FIRST GOVERNMENTAL STRATEGY OF THIS TYPE



NAP CM ambitions:

- **Reduce emissions from transport, especially in municipalities,**
- **Reduce dependence on liquid fuels and oil imports, diversify the energy mix and energy efficiency of transport,**
- **Implement the EU directives and strategies,**
- **Support the development of Czech industry.**

NAP CM describes assumptions (legislative framework, transport sector predictions, expected development of technologies) and also expected development of clean mobility in the Czech Republic. It focuses on e-mobility, CNG and partially hydrogen.

NAP CM defines ambitions by 2020 and contains list of measures to be implemented to achieve them.

NAP CZ DEFINES TARGETS FOR PUBLIC CHARGING STATIONS FOR ELECTRIC VEHICLES



„Backbone“ network:

- 500 DC fast charging points (= 500 DC fast charging stations) with output at least 40 kW
- Covers primarily highways and key roads and regional centres
- Assumes installation of several charging stations (up to 5) at one site (number of expected locations is around 100)

„Thickening“ network:

- 800 AC normal charging points (= 400 AC charging stations, each with two independent sockets) with output up to 22 kW for each charging point (in case of 22 kW charging points, instead of AC a DC technology can be used)
- To be installed in towns/cities and places where charging time correlates with parking time
- 2 or more stations on each location = number of locations around 200

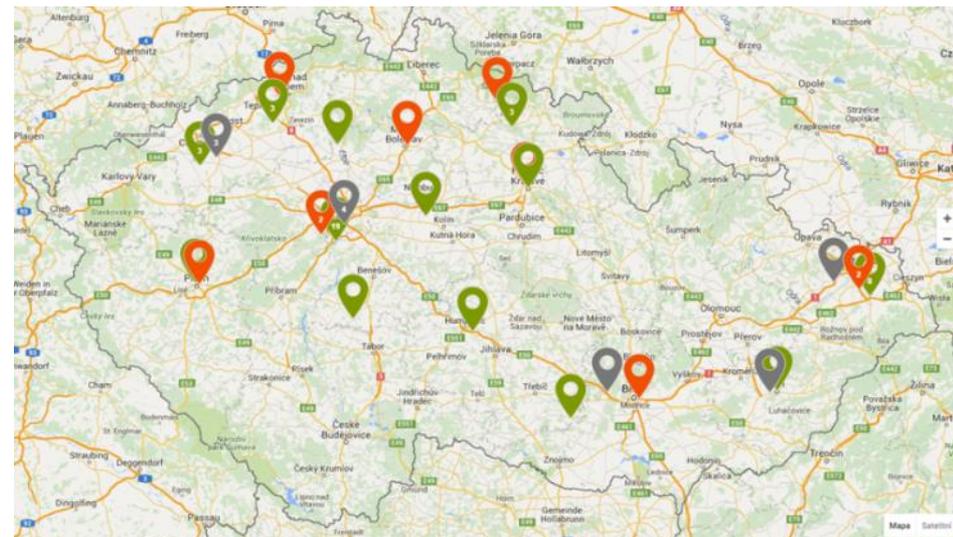
National funding (Operation program „Transport“) will be set to comply with these targets.

Public charging stations will have to comply with relevant legislation (Directive on deployment of alternative fuels infrastructure).

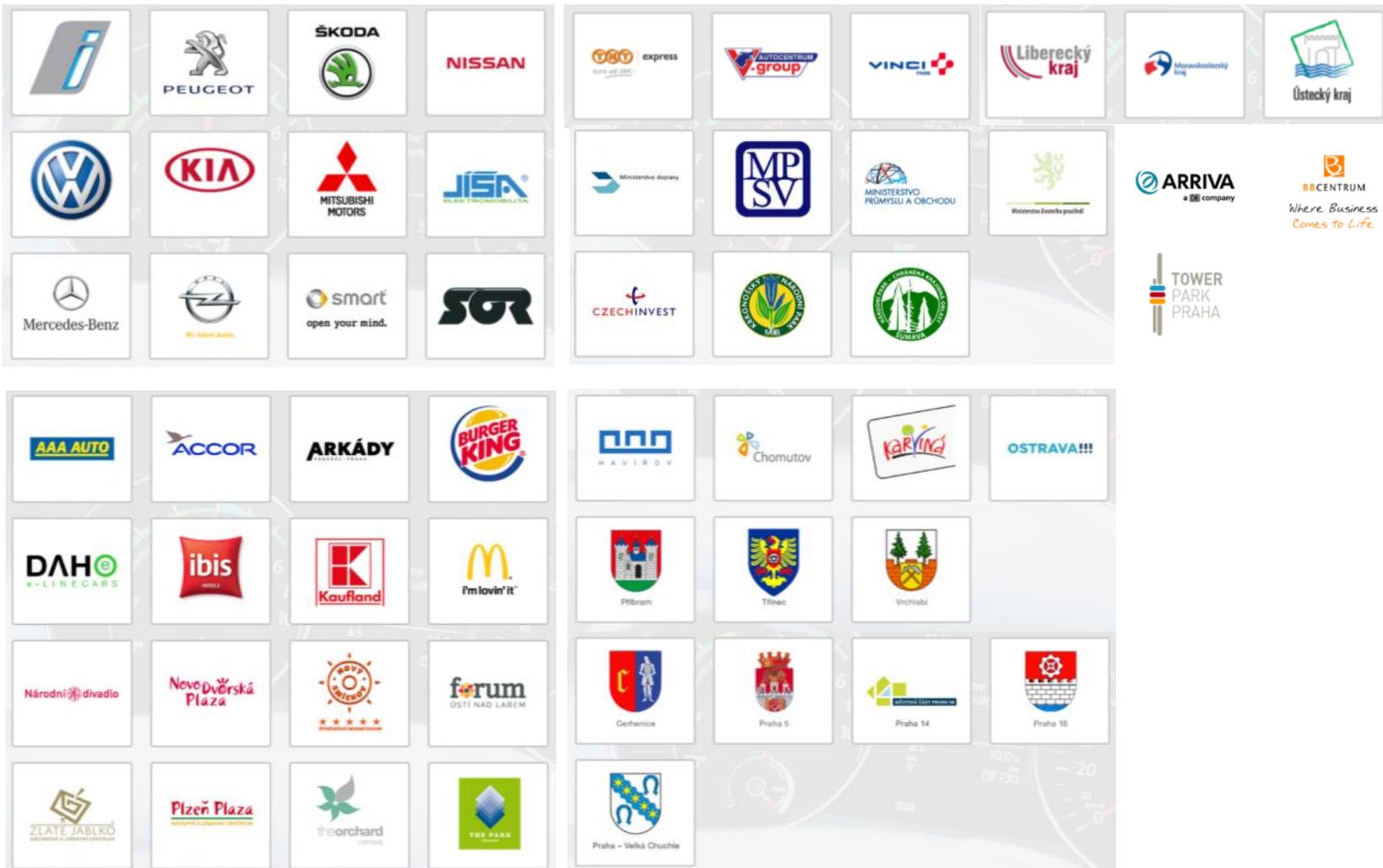
ČEZ E-MOBILITY IS THE BIGGEST EV PROJECT IN THE CZECH REPUBLIC AND CENTRAL EUROPE



- **More than 35 EVs**, in total more than 1 million km driven
- **75 public charging stations in operation (out of them 25 DC fast)**, goal is to install a backbone charging network in CZ.
- **Partnership with 9 OEMs**
- **More than 50 business, public and governmental partners**



OUR PARTNERS



CEZ DC FAST CHARGER IS EQUIPPED WITH MULTIPLE CHARGING STANDARDS



CEZ DC fast chargers are equipped by all three standards (2 DC and one AC) and are therefore universal



ČEZ AC CHARGER



AC chargers are (will be) equipped by two independent sockets with AC standard (Mennekes)



WHY DO UTILITIES ENGAGE IN E-MOBILITY?



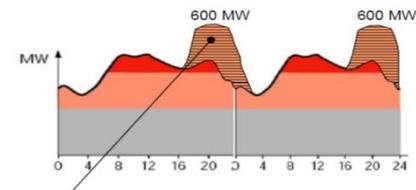
1. To use the market opportunity

- Reliable and easily accessible charging network is one of the key drivers in this dynamically growing new segment.
- E-mobility services and public charging infrastructure are logical answers to increasing demand from EV users.
- There is a large potential for bundling products and services related to electricity supply and sales with e-mobility.



2. To manage the risks related to e-mobility

- EV charging will become an issue for utilities as the number of EVs on the streets increases and will require a sophisticated solution for managing the energy flows



ČEZ PROJECT – SUMMARY AND KEY GOALS



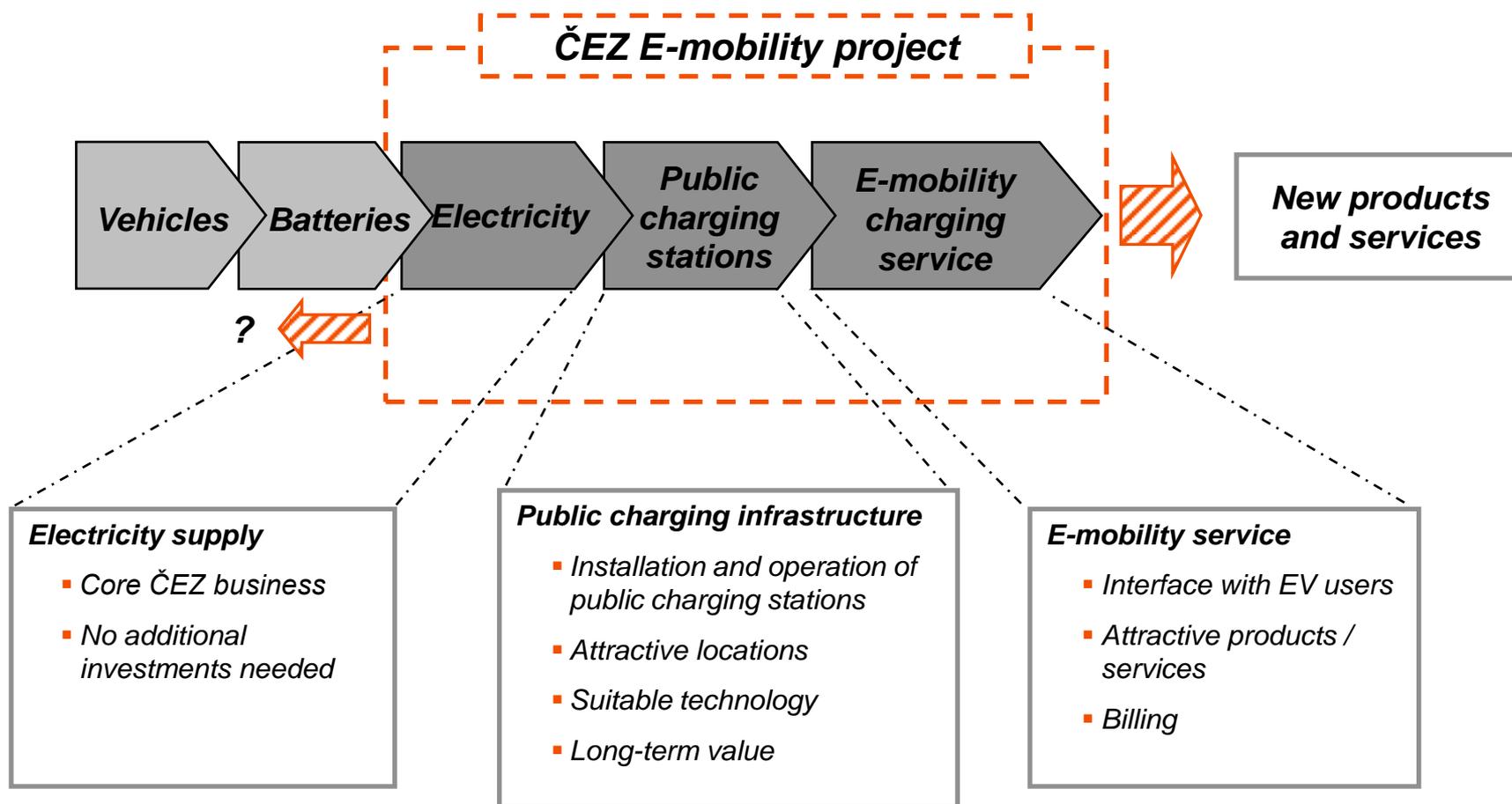
Key goals in the pilot phase

- 1 **Validate the business model**
(infrastructure installation, cooperation with partners)
- 2 **Understand customer needs**
(motivation, behaviour)
- 3 **Get ready internally**
(organisation, processes)
- 4 **Validate technology** (charging, data collection, communication, billing)
- 5 **Modify and validate the long-term business concept 2020+**

Key goals in the long-term

- 1 **Building a backbone charging infrastructure** (charging stations in strategic locations)
- 2 **Long-term partnerships** (long-term synergies between CEZ and its partners)
- 3 **Customer relations** (wide offering of bundled products)
- 4 **Sophisticated e-mobility products** (complex solution for e-mobility needs offered through traditional and new sales channels)

PUBLIC CHARGING INFRASTRUCTURE IS THE CORE OF THE CEZ E-MOBILITY PROJECT, WITH POTENTIAL TO EXPAND TO OTHER AREAS OF VALUE CHAIN



IN THE LONG RUN, E-MOBILITY WILL HAVE TO BECOME A COMMERCIAL BUSINESS



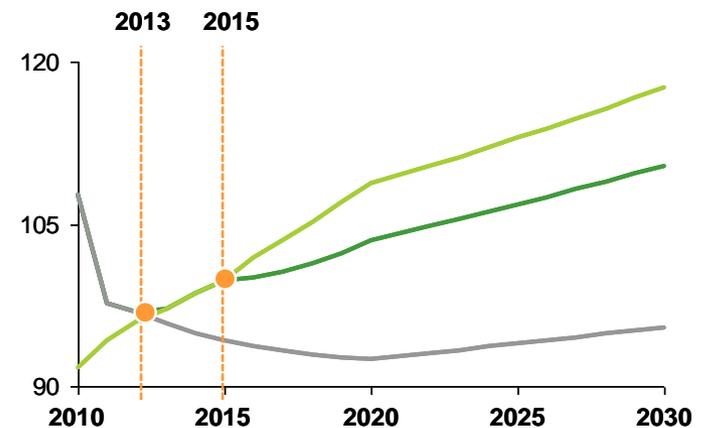
Key parameters of an E-mobility offering from the customer's point of view:

- Widespread and user friendly charging infrastructure
- Convenient and automated billing
- Attractive price

While e-mobility pricing should be attractive for the customer, it must provide a reasonable return on investment for the infrastructure provider

Investment in the infrastructure should be based on TCO (Total Cost of Ownership) calculation

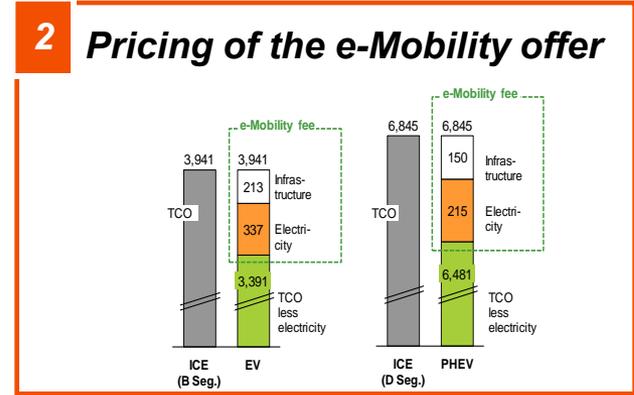
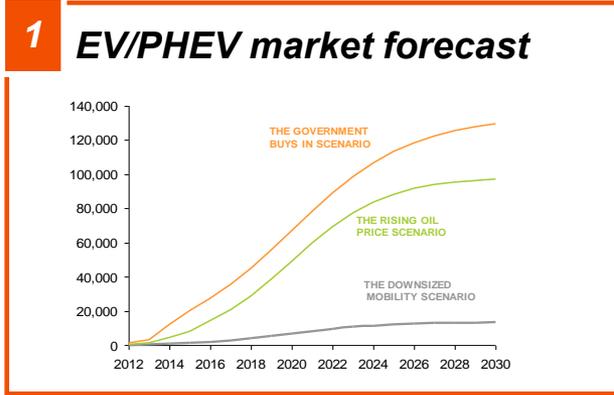
- Primarily the difference between the TCO of an ICE vehicle and an EV
- High sensitivity to oil prices and battery costs
- Tax policy and/or other incentives might become an issue



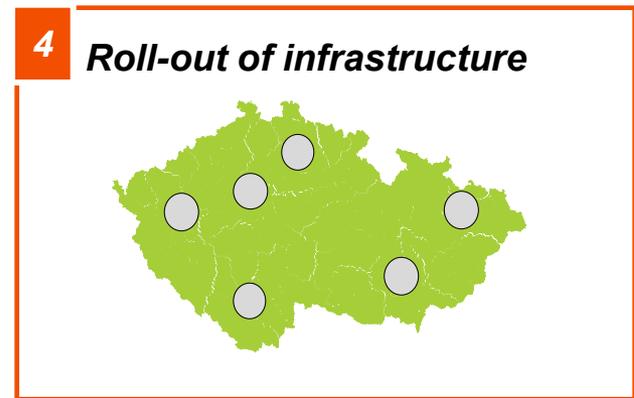
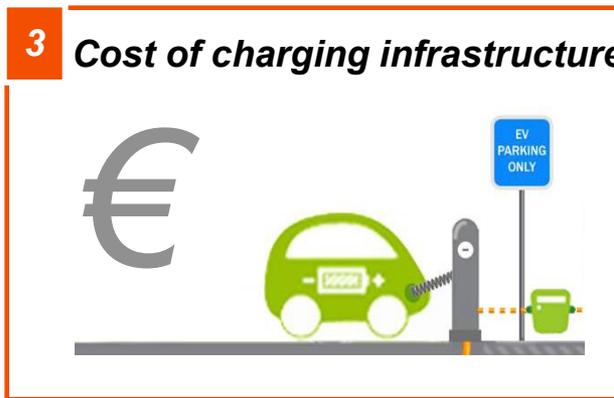
KEY DRIVERS OF THE LONG-TERM BUSINESS CASE



REVENUES



COSTS/ INVESTMENT



Source: CEZ; Roland Berger

THE COSTS OF THE CHARGING INFRASTRUCTURE ARE DRIVEN BY A NUMBER OF FACTORS



Connection:

- Ground works
- Grid connection fees



Technology and functionality:

- Type of charging station (ultra fast / normal / home)
- Communication and data collection
- Service and maintenance



Customer services:

- Visualisation (parking lot, navigation, signs...)
- Customer relations (help line, www pages...)

Administrative procedures



BUSINESS MODEL VALIDATION WILL BE ESSENTIAL FOR DECISION ABOUT THE NEXT STEPS



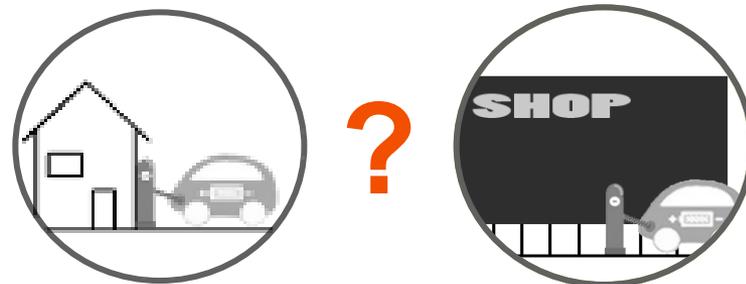
E-mobility market

- What is the right business model for public / at home / at work charging?
- Who will be the market players (utilities, retailers, technology producers, TELCO providers)?
- Grid balancing – grid stability versus comfort of users in charging anytime anywhere
- Role of governments and municipalities (regulated versus free market; public support, subsidy and tax policy; legal requirements)
- Matching user expectations will be crucial



Charging network

- What is the optimal size and structure of the charging network?
- Are publicly accessible charging stations the key part of an e-mobility offering?
- Will the charging speed be the key difference between public and private charging (public = fast, private = slow)



LESSONS LEARNT SO FAR



- 1. Clear regulatory framework is essential for long-term business (regulated/non regulated part of e-mobility business, administrative procedures...).**
- 2. Reasonable public support is important for speeding up e-mobility adoption.**
- 3. Fast and ultra fast charging hold the most commercial potential, though with possible detrimental impact on grid stability and battery lifetime.**
- 4. Early adopters and those who consider using EVs are calling for a public charging infrastructure. Will they be ready to pay for its use?**
- 5. High price of EVs discourages buyers despite significantly lower fuel and maintenance costs.**