eMove 360° Europe 2019

Why inductive charging drives the transition to battery electric mobility!

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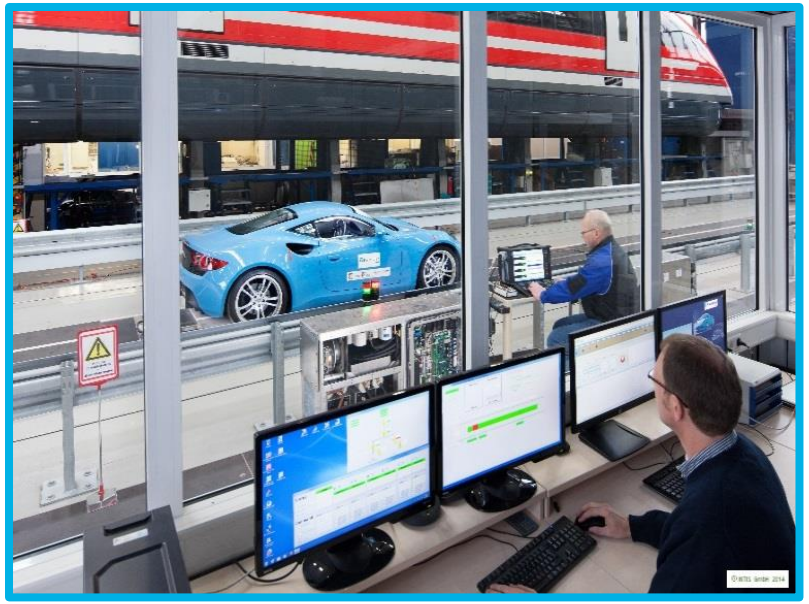
INTIS

Our Company

- INTIS has been founded in December 2011 in Hamburg and is 100% owned by IABG mbH near Munich
- 15 years experience of inductive charging technology
- Renowned project “Transrapid-Versuchsanlage Emsland” maglev test track (in use for more than 30 years)



Our Focus

Charging Technology for e-Mobility:

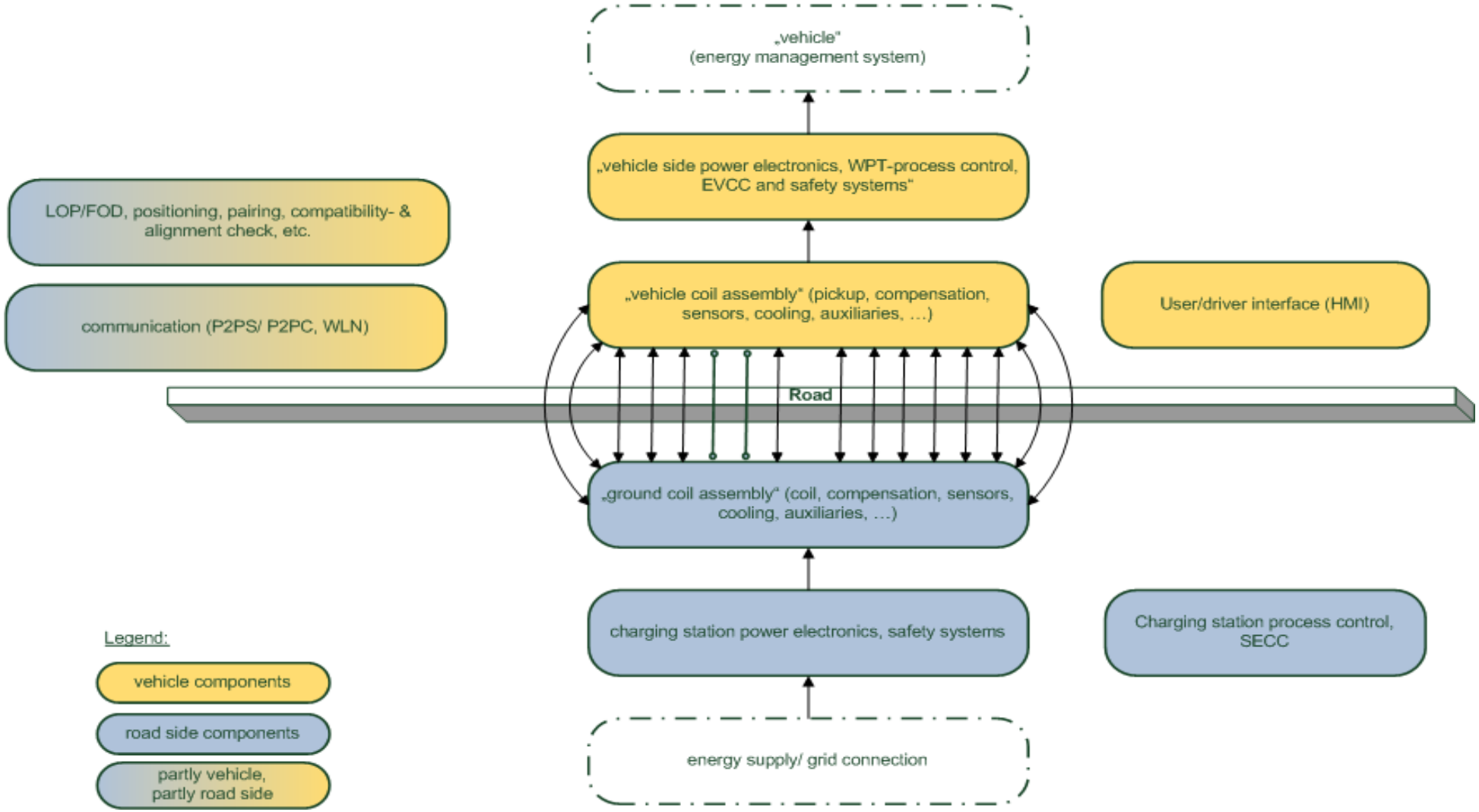
- Wireless (WPT, inductive)
- Combined (WPT & DC-conductive)
- Public and industrial (road) applications
- WPT-standardization
- Turn-key solutions for stationary and (in the future) dynamic wireless charging
- Energy storage and -management systems

inductive charging station with retrofitted BMW-i3 (11kW)

Our Conviction – why INTIS focuses on Inductive Power Transfer

- The limited mileage and the large size (and cost) of batteries are still inhibiting electric propulsion from playing a significant role in the transport & mobility sector.
- Cable charging is only possible while stationary, dedicated charging time slots as well as "driver interaction" are required.
- This is where Wireless Power Transfer can help, even while the vehicle is on the move (known as Dynamic Wireless Power Transfer – DWPT)
- Wireless Power Transfer allows electric vehicles to become as flexible as their internal combustion engine counterparts
- In combination with intelligent energy solutions, Wireless Power Transfer will mobilise the "renewably powered smart city" and will pave the way for autonomous driving.
- We have experienced that Inductive Power Transfer is a key technology in making the journey to electric mobility a success.

How Inductive Power Transfer works



Availability of WPT-Technology

… at INTIS:

	Inductive charging		Cable charging
Specification	IEC/ ISO or SAE	others	CCS, CHAdeMO
Charging power	up to 22 kW (in preparation for WPT 4)	according to customer / application requirements (up to 60 kW tested, higher powers with development effort)	up to 50 kW tested, higher powers with development effort
Air gap	Z-class 1 to 3		-
Coil type	to IEC-/ ISO or SAE specification		-
Frequency	80 … 90 kHz	36 … 40 … 90 kHz	-
Efficiency	above 90%		
Safety and assistance systems	detection of living- and foreign objects, positioning assistance, pairing, alignment check and many more		Overvoltage and overcurrent protection, galvanic separation of vehicle from grid
Vehicle internal communications	CAN or other (customer specific)		-
Communications with road infrastructure	WLAN ISO 15118, 868 MHz Near-Field, or customer specific		-
Vehicle high voltage interface (DC)	CCS, CHAdeMO, or directly with vehicle battery management system		CCS, CHAdeMO
Back-end connection	Internet connection via standard interface		
Application fields	passenger and light commercial vehicles	heavy and light vehicles, industrial vehicles, ships, etc.	All vehicles with a DC quick charging interface
Integration	Can be integrated with battery storage and renewable energy generation		

currently undergoing field testing …

… industrial application

… application on private property

Application Examples (stationary or semi-dynamic)

- Automated industrial vehicles
  - High flexibility in case of infrastructure modifications → move your inductive charging stations with a minimum of construction
  - Higher availability → fewer back-up vehicles due to more frequent opportunity charging
  - Reduced Life Cycle Costs → Frequent opportunity charging allows to reduce the number of back-up vehicles
  - Reduce maintenance and increase longevity → no wearing parts, operate your battery at optimum state of charge
- Autonomous shuttle
  - Reduce operational costs → completely autonomous charging with no need for personnel
  - Reduce costs and weight → smaller batteries possible with frequent opportunity charging
  - Increase longevity → optimum charging pattern for the vehicles' batteries
- Bus
  - Reduce costs and weight → smaller batteries possible with frequent opportunity charging
  - Increase longevity → reduced battery stress with more frequent, lower-power charging
  - Low maintenance → no moving parts for minimum wear and tear
- Taxi waiting lane
  - High charging power → charge approx. 100 km in 20 minutes
  - Maximise up-time → fewer breaks for charging needed, use dead-time to charge
  - Reduce costs → drive using EV mode, minimise fuel consumption of PHEV's

Standardization

The roll-out of inductive charging on public ground/ for public use requires the finalisation of WPT-standards, e.g. covering:

- requirements and validation procedures (testing)
- electric & magnetic interoperability, reference designs
- communication means
- auxiliary systems & services (LOD, FOD, Compatibility check, alignment, etc.)

→ most of the technical aspects are already covered

#	title	focus
IEC 61980-1	*Electric vehicle wireless power transfer (WPT) systems Part 1: general requirements*	COM
IEC 61980-2	*Part 2: Specific requirements for communication between electric road vehicle (EV) and infrastructure with respect to wireless power transfer (WPT) systems*	COM
IEC 61980-3	*Part 3: Specific requirements for the magnetic field wireless power transfer systems*	COM
ISO 19363	*Electrically propelled road vehicles – Magnetic field wireless power transfer – safety and interoperability requirements*	COM
ISO/IEC 15118	*Road vehicles – vehicle to grid communication interface*	COM
SAE J2954	*Wireless charging of electric and plug-in hybrid vehicles*	COM

Source: Nationale Plattform Elektromobilität

Finalization of standards (e.g. at IEC → Roadmap):

Reference - Electric vehicle wireless power transfer (WPT) systems		Planning
61980-1	Part 1: General requirements	mid 2020 (new edition)
61980-2	Part 2 specific requirements for communication between electric road vehicle (EV) and infrastructure with respect to wireless power transfer (WPT) systems	end 2020 (first edition)
61980-3	Part 3: Specific requirements for the magnetic field wireless power transfer systems	end 2020 (first edition)

Our expectations about WPT-implementation (stationary appl.)

Taking into account the availability of technology, progress in field testing and standardization roadmaps:

WPT-application field	What	Roadmap
Industrial	Material handling, etc.	In operation for many years
Rail	e.g. Maglev, Bombardier's PRIMOVE	In operation for several years
Road - specific applications in private environment	e.g. Gen. 1 WPT	2019 +
Road - specific applications in public environment	e.g. Bus, Taxi, city logistics, autonomous driving	In operation for many years (Bus) 2020 + (Taxi & city logistic) 2022 + (autonomous driving)
Road - general public	All others	2024 +

Availability of WPT-Technology – some frequently asked questions

Is WPT an AC- or a DC-Technology?

- although the energy is fed into the vehicle's propulsion battery as DC, the power transfer via the magnetic field takes place at e.g. 85kHz AC
  → AC-Technology

How long does a WPT-charging sequence last?

- as for any other charging technology this depends on the charging power (e.g. 11kW - WPT3), the battery capacity and the battery state of charge when charging starts

What is the efficiency of inductive charging?

- standardization requires an efficiency of ≥ 85%
- our systems - with the same coil-topology on both sides - achieve an efficiency above 90% for automotive applications

What about EMC, EMF and temperature limits?

- applicable limits will not be exceeded, additional detection means may have to be implemented (e.g. Living Object Detection - LOD, Foreign Object Detection - FOD)

Availability of WPT-Technology – some frequently asked questions

How difficult is the positioning of the vehicle over the roadside coil and what is the influence of coil displacement on efficiency?

- current standardisation requires a max. coil displacement of ±75mm (X-) and ±100mm (Y-direction)
- a positioning assistant helps to achieve a position within these limits, for efficiency see above

When will inductive charging be available for operation in a public environment?

- The technology is available for use in public spaces now
- However standards must be finalised before WPT can be used as a “public application” (e.g. after the end of 2020)

What will inductive charging cost?

- final cost figures can not be given yet as mass production and industrial manufacturing processes have not started yet and not all requirements are known
  (→ standardisation) has not been fixed yet; we aim at WPT-system costs comparable to the costs for DC-fast charging systems
  (→ synergies, WPT-/DC-combined charging)

Application Areas – Stationary Charging

- Automatic
- Low maintenance
- Out of sight
- „Enabler“
- Reduce barriers to electrification
- „just drive“

Logistics, CEP → 3 - 11 kW

Source: IAV GmbH

Autonomous shuttles → 8 - 30 kW

Taxis → 20 - 50 kW

100 W | 500 W | 1 kW | 5 kW | 11 kW | 20 kW | 50 kW | 100 kW | 200 kW | 1 MW

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Application Areas – Stationary Charging

- Automatic
- Low maintenance
- Out of sight
- „Enabler“
- Reduce barriers to electrification
- „just drive“

HGV's → 50 - 200 kW

Source: eforce

Buses → 50 - 200 kW

100 W | 500 W | 1 kW | 5 kW | 11 kW | 20 kW | 50 kW | 100 kW | 200 kW | 1 MW

Application Areas – Dynamic Charging

- Automatic
- Low maintenance
- Out of sight
- „Enabler“
- Reduce barriers to electrification
- „just drive“

AGVs → 3 kW

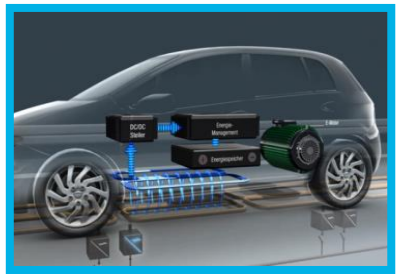
Taxi → 20 - 30 kW

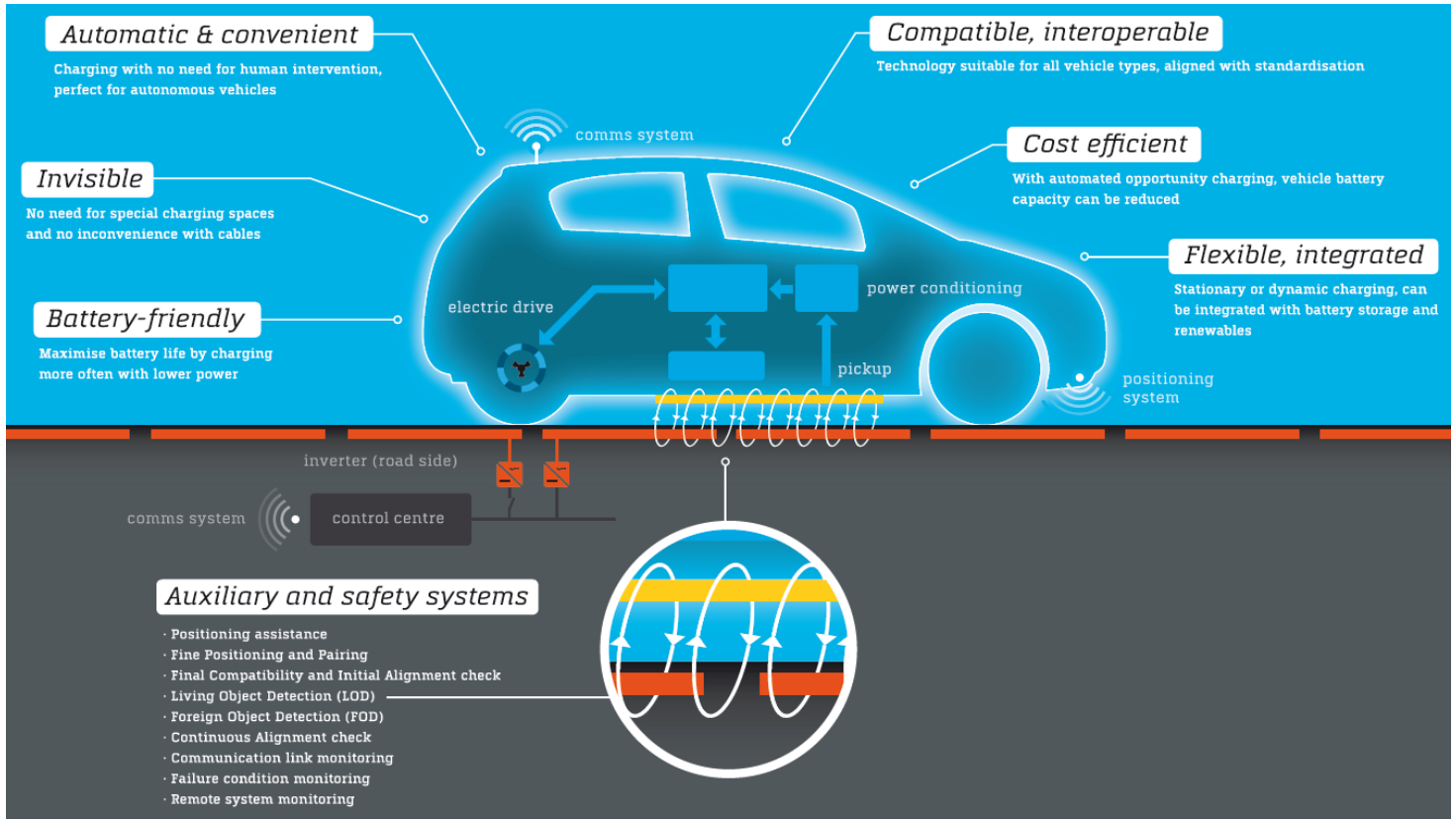
Bus → 50 - 80 kW

100 W | 500 W | 1 kW | 5 kW | 11 kW | 20 kW | 50 kW | 100 kW | 200 kW | 1 MW

Inductive Charging driving transition to battery electric mobility

++ automatic ++ invisible ++ reliable ++ scalable ++ efficient ++ competitive ++
++ extending mileage with smaller batteries ++ supporting smart grid implementations ++





Thank You!

➤➤➤ Visit INTIS at eMove360 in Munich
from 15.10.-17.10.19, Hall A5, Booth No. 108

eMove 360°

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Driving inductive charging innovation

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