E-troFit
sustainable solution
empowering e-mobility

The future of E-mobility and Urban Planning in Egypt
EV Developments in the context of Sustainable Cities
### in-tech Group

The parent company offers access to a large expert pool in the automotive sector and sales cooperation worldwide.

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**Mother company in-tech at a glance**

<table>
<thead>
<tr>
<th>Who we are</th>
<th>Germany: Munich/Garching, Ingolstadt, Leipzig, Wolfsburg, Brunswick, Renningen, Weissach-Flacht, Kirchheim-Nabern, Friedrichshafen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solution provider for digitalization in mobility and industry.</strong></td>
<td>USA: Greenville (SC), Woodcliff Lake (NJ), New Jersey (NJ)</td>
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<tr>
<td>Automotive</td>
<td>Mexico: San Luis Potosí</td>
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<tr>
<td>Smart Mobility</td>
<td>China: Shenyang, Beijing</td>
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<tr>
<td>Smart Factory</td>
<td>Europe: Vienna (Austria), Nottingham (UK), Warwick (UK), Brașov (Romania), Prague (Czech Republic)</td>
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<td>Electrified</td>
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**in-tech** is a **German-based engineering company focusing on electronics and software**

Within just a few years, **in-tech has developed into a successful mid-sized company with offices and project locations worldwide**

Being an expert in validation and testing of automotive components, sub-systems and full-systems, **e-troFit buys this service from in-tech** and benefits greatly for the product development.

It is always possible for e-troFit to obtain **additional R&D and administration services to enable scalability**

### Key Figures (2018)

- **1500** Staff members
- **17+** Project locations
- **8** Countries
- **108 Mio.€** Revenue
**Root**

Political pressure for zero-emission traffic creates a high demand for electric utility vehicles.

- Emission problems especially in metropolitan regions:
  - Nitrogen oxides (NOx) values often exceeded
  - Diesel driving bans in inner cities
- EU sets Clean Vehicles Directive:
  - Complete decarbonization of road transport by 2050
  - Forces operators to electrify their fleets

-15% emissions by 2025
-30% emissions by 2030
-100% emissions by 2050

**Cause**

OEMs cannot meet market demand.

- Low quantities available: Only a few hundred electric buses available per year
- Long delivery times: Current delivery times are at least 18 months
- High costs: New electric commercial vehicles are expensive

**Consequence**

Gap of Electrification

Vehicle operators face driving bans or penalties if they cannot buy new electric vehicles or electrify existing ones.

Vehicle manufacturers lose their market position if they cannot offer new, reasonably priced electric vehicles.

**Gap of Electrification**

The CV market is challenged by high demand for electrification and low supply.
Urban Bus Market in Detail
Especially urban buses are in the focus of the electrification discussion

Facts about the global urban bus market

According to the International Association of Public Transport (UITP), buses are the most widely-used form of public transport worldwide – with a 63% share, it was a higher sum of all other modes (metro, tram and suburban rail) combined in 2015.

Buses are a primary target for reducing emissions in cities.
In some cities, buses account for 2% of vehicles in inner city traffic, while causing up to 30% of emissions.

30% of emissions
2% of vehicles

Urban electric buses constitute the fastest-growing part of the EV market with a CAGR of more than 100% since 2013.

Sources: ACEA; UITP; McKinsey; European Commission

Global demand of electric urban buses

Status Quo

All over the world there are about 385,000 electric buses, which means 13% of the global bus fleet.

Forecast 2040

The demand for electric buses rises rapidly: Until 2040 80% of all global urban buses are estimated to be electrified, which means 2.34 millions electric buses worldwide.

Sources: ZeEUS; Bloomberg New Energy Finance
Market Dynamics

The electrification of CVs is therefore a fast-growing and sustainable market.
Rising demand

for electric commercial vehicles in general and specifically electric city buses.

Gap of Electrification

Vehicle operators face driving bans or penalties if they cannot buy new electric vehicles or electrify existing ones.

Vehicle manufacturers lose their market position if they cannot offer enough new, reasonably priced electric vehicles.

e-troFit can address both issues by

1. Electrifying existing vehicles for operators
2. Enabling OEMs to quickly bring new electric vehicles to the market
3. Enabling OEMs to convert the repurchased fleet into electric saleable vehicles

e-troFit

e-troFit as a solution for the demand-and-supply dilemma in the CV market
CO₂ Emission of the e-troFit
The e-troFit has a lower CO₂ emission than a diesel bus over the whole lifecycle

Retrofitting makes a diesel bus a clearly climate-friendly vehicle
This is particularly noticeable when operating the e-troFit bus with 100% green energy
This results in a CO₂ saving of almost 75% over the lifetime compared to a diesel bus.
Even when operating the e-troFit bus with the current German electricity mix, CO₂ savings of almost 35% are achieved.
The usage of the bus battery in stationary operation means that the e-troFit can continue to be used even after the “second life” phase, making it even more environmentally friendly.

<table>
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<th>kg CO₂ / km</th>
<th>Green energy</th>
<th>German electricity mix</th>
<th>Diesel</th>
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<tr>
<td>0.053</td>
<td></td>
<td></td>
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<tr>
<td>0.572</td>
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<td></td>
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<td>1.309</td>
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e-troFit consists of an electric axle or electric central motor, scalable battery system including battery management system (BMS) and battery cooling, various auxiliary units, air conditioning system and the Vehicle Control Unit (VCU).

As the central IP of e-troFit, the in-house developed VCU connects all vehicle components, resulting in a perfectly balanced system which applies to functional safety ISO 26262.

On-board charging unit is used from e-troFit’s sister company smart charging GmbH, which is a market leader for communication modules in DC charging Stations in Europe (80% Market share).

The e-troFit Kit already allows fast charging (up to 150 kW) by plug today while high power charging solution (HPC) via pantograph will be developed in 2020.

Easily adaptable charging strategy due to multiple cells chemicals without adjustment on the battery pack itself. The construction and development of battery packs is made for multiple battery cell chemicals (for example: NMC, LTO, LFP).

Every e-troFit Kit contains a Telematic module from Openmatics (a ZF company) enabling Over the air updates (OTA), Predictive maintenance, Full battery surveillance (State of Health, State of Charge) and Connectivity to the customers’ in-house fleet management.

State-of-the-art technology: On par with well-known premium OEM solutions thanks to own IP as well as tried-and-tested premium components.

**Technical Approach: Example Urban Buses**

The e-troFit combines own intellectual property (IP) with premium components.
e-troFit and ZF Friedrichshafen

The world’s 3rd largest automotive supplier is e-troFit’s strategic partner.
**e-troFit stands for sustainable mobility**

e-troFit GmbH is certified according to ISO DIN 9001 and works according to the highest quality standards.

e-troFit® was awarded the **German Mobility Prize 2018**. The Federal Ministry of Transport honors groundbreaking best practice projects for sustainability in transport.

Furthermore the e-troFit® concept was awarded with the **International busplaner Sustainability Award 2019** in the category Service and Parts by the trade journal busplaner.

**e-troFit awards**
Thank you!

Andreas Hager
CEO
Mobil: +49 (0)173 - 575 41 53
E-Mail: andreas.hager@e-trofit.com