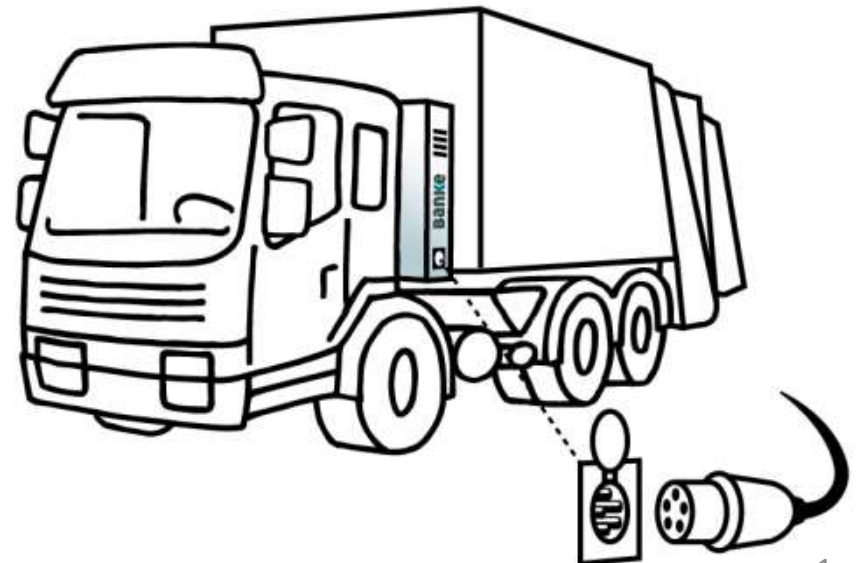


BATTERY TECHNOLOGIES FOR ELECTRO MOBILITY AND SMART GRID PURPOSES –  
REGIONAL RESEARCH ACTIVITIES AND BUSINESS DEVELOPMENT OPTIONS  
28 November 2013, ISIT, Fraunhofer, Itzehoe

# Experiences with production and application of battery packages for accessory drives in heavy duty refuse collection vehicles

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Banke Accessory Drives



# Overview

1. Introduction to Banke and E-PTO
2. Concept & Exampels
3. Tech talk
4. Experiences

# 1. Introduction to Banke and E-PTO

## **Banke** - *Accessory Drives*

Electrical **P**ower **T**ake-**O**ff (E-PTO)  
enabling electric drive of working equipment on  
Refuse Collection Vehicles (RCV).



## About Banke

- › Established 2010
- › A company trusted by Danfoss
- › Situated on the premises of Danfoss' headquarter in Denmark
- › From April 2012 to September 2013: **46** E-PTOs sold in 4 countries



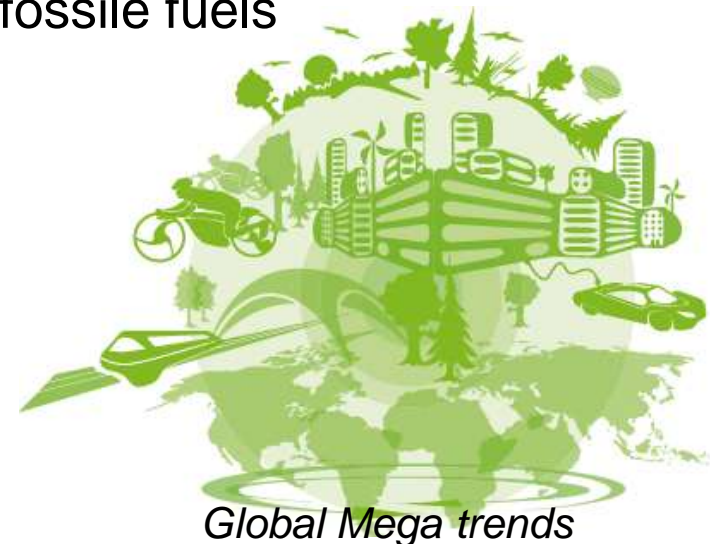
*Danfoss' Headquarter*

## Concept drivers



### Increased demand for:

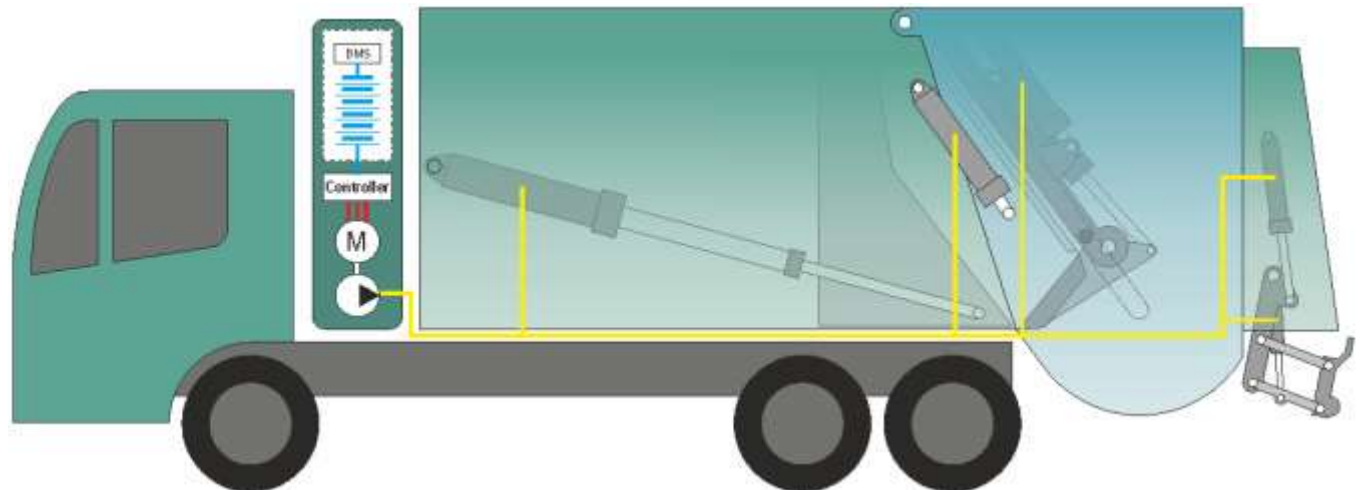
- › Reduction of fuel use, CO<sub>2</sub> & particle emissions
- › Reduction of traffic jams the pollutants in exhaust gases of the increasing number of cars in cities
- › Reduction of noise in cities
- › Independence in the power supply – less fossile fuels
- › Increasing oil prices



*Global Mega trends*

## E-PTO - Concept & Idea

- › General solution that fits all concepts
- › Plug-in system - for easy and fast battery charging
- › Easy to install, easy to use and very little maintenance
- › Suitable for all types of chassis and all types of fuels
- › No chassis interference



# Exampels





# Exampels

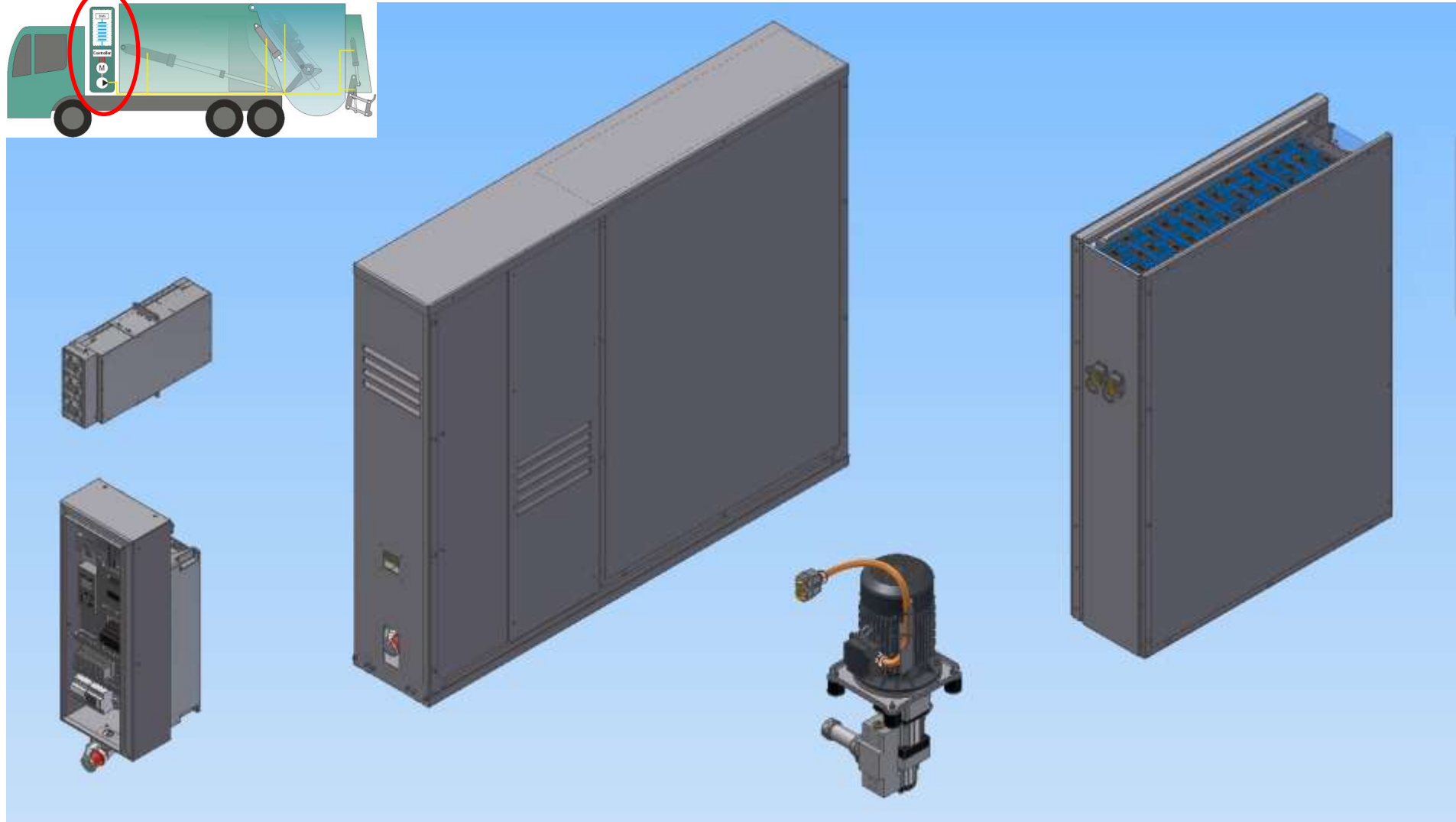
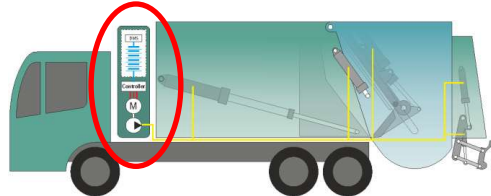


# Exampels



## Example. Banke's E-PTO on Rotopress and FE-hybrid





## Technical Specifications (1/2). E-PTO Large

Energy storage	43 kWh effective
Power levels	0-30 kW, continuously, peak power 50 KW
Battery technology	LiFePO <sub>4</sub>
Battery lifetime	+2500 full cycles
Battery heating	Electric 400W forced air, to enable charging at very low temperatures
Battery voltage	560-700V, galvanic isolated
Battery cell protection	Balancing and active protection on all cells
Battery pack protection	Fully protected against overcurrent, over-, and under-voltage, excessive temperature use and charging
Motor technology	3*400V PM-motor with variable RPM control
Control interface	CAN, analogue, PWM and logic I/O
Charging	On-board 7,5KW 3*400V AC standard 3*16 A CE-plug
Charging time	4-6 hours

## Technical Specifications (2/2). E-PTO Large

AC installation requirements	3 phases & neutral & PE. 3*400V AC 50 Hz, fuses 16A with RCD.
+24V supply from body or chassis/	16-32 VDC 10A normal automotive fuse
Hydraulics interface	Options: Single or dual string pump technology, fixed or variable
Temperature range	-20° C to +45° C (above 35° C derating)
Cooling	Forced air
IP-grade	IP65, allowing high pressure wash down
Dimensions (L,W,H)	363 * 2006 * 1664 mm.
Weight	885 kg.
Options	24 Volt DC output
Options	Remote surveillance and data transfer module

All specifications are subject to change without further notice



# Experiences



## As a startup company, we decided to:

- › One application only
- › Quality as #1 priority
- › Focus strategy

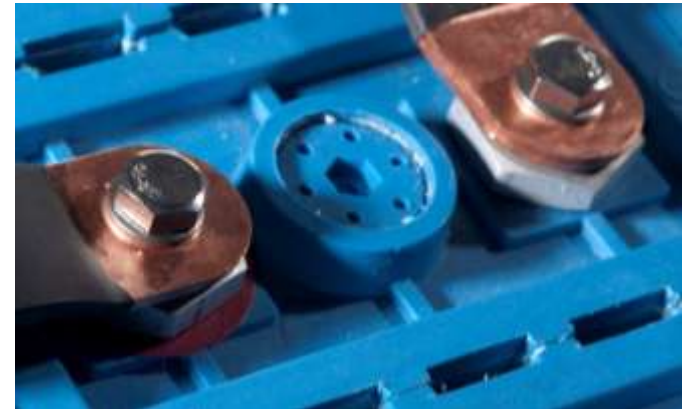
## Meaning that:

- › Thorough application study => specifications & reviews
- › Develop mechanics, control and SW ourselves, everything else is purchased
- › Finding the right partners and suppliers
  - › Looking at batteries
    - › Chemistry
    - › Safety
    - › Supply safety
    - › Support
    - › Application (cooling/heating and servicability)



## Application & Manufacturing

- › Keeping interfaces simple
- › New technology by nature leads to uncertainty
- › Service and support is absolutely mandatory
- › Deep technical dialogue needed
- › Be present in the field
- › Any supplier can have issues, and we have seen and felt that we have had to dig much deeper into these than expected
  
- › Low volume, high price, high quality products
- › Safety when handling batteries



Thank you for your attention

