



**eCitaro**  
**AKASOL ELECTRIFIES**  
**THE CITY BUS**

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MADE IN GERMANY



# eCITARO - ELECTRIFIED BY AKASOL

Daimler's subsidiary EvoBus GmbH has had a very successful city bus on the market for years: the Citaro. With 50,000 units sold the vehicle is considered Europe's most successful city bus. AKASOL has been working closely with EvoBus since 2015 and believes that the Citaro's success story of safe and reliable operation in public transport will continue with electric drive.

The Citaro doesn't just stand for a diesel engine: Back in 2002, EvoBus launched the first alternative drive models. For example, the first fuel cell bus and the BlueTec hybrid with electric motors close to the wheel hub. Because of this successful history, it's only logical that in 2018, for the first time, a fully electric Citaro, the eCitaro, has been launched. Thanks to improved battery technology, opportunities to develop fully electric utility vehicles are growing. Travelling as quietly as a whisper and without local pollutant emissions is now possible and inner cities are becoming increasingly clean.

EvoBus' early commissioning of AKASOL is testimony to their close relationship. Together, AKASOL and the market leader for city buses want to be at the forefront of sales and reliable operation of zero-emission electric vehicles.

“In addition to improved battery cells, many small optimization steps in the battery management system and in the mechanical pack structure play a role in the development of the second generation.”

—SVEN SCHULZ, CHIEF EXECUTIVE OFFICER

Flexible battery size:

**6-10**

BATTERY  
PACKS PER  
BUS

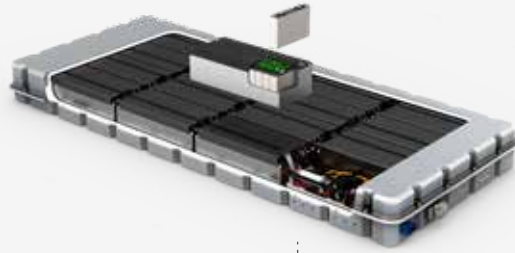
**28**  
Months

TIME  
PROJECT  
REALIZATION

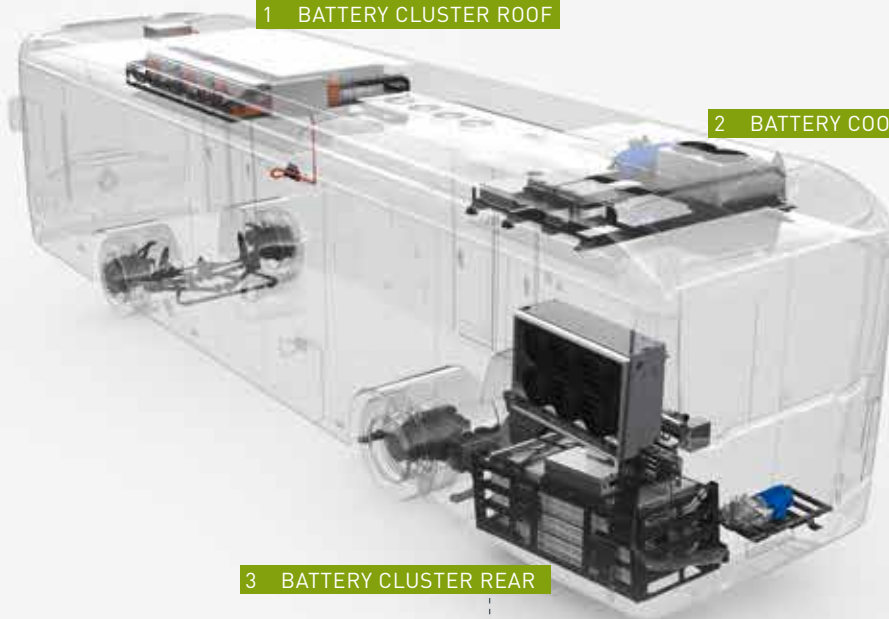
**250**  
kilometers

RANGE  
UNDER IDEAL  
CONDITIONS





1 BATTERY CLUSTER ROOF



2 BATTERY COOLING SYSTEM

3 BATTERY CLUSTER REAR

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## CONSULTING

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### COLLABORATION SINCE 2015

The requirements of a Daimler subsidiary such as EvoBus on an in-house supplier such as AKASOL and its products are extremely high. Battery systems for the eCitaro, the first electrified bus by the market leader based in Mannheim, Germany, had to be robust, durable and fast charging. At the same time, they had to provide the range expected by Daimler customers and supply energy to additional units such as air conditioning and electrical systems.

In 2015 cooperation between EvoBus and AKASOL began with the development, testing and validation based on the AKASYSTEM OEM battery system. The focus was always on meeting the high demands placed on one of the most important components of the electric powertrain with the aim of being able to start series production of the battery systems. AKASOL's nearly 30 years of experience with battery systems for electric vehicles stood it in good stead.



## PLANNING & IDEA

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### eCITARO - GENERATION 2018

The first generation of the eCitaro was launched at the end of 2018. Six to ten batteries of the AKASYSTEM OEM type with a total capacity of up to 243 kilowatt hours are installed both on the roof and in the rear of the electric bus. The battery systems use lithium-ion battery cells by Samsung, which were jointly selected by AKASOL and EvoBus. Efficient water-cooling, which guarantees stable tempering at 25 degrees, is essential for meeting the bus's life expectancy.

The eCitaro of the first generation enters the market with a reliable, year-round range of 150 kilometers, based on SORT2 cycles in medium-heavy city traffic. Under ideal conditions, the eCitaro's range is already 200 kilometers.





## DEVELOPMENT

### eCITARO – GENERATION 2020

In summer 2018, even before series production of the battery systems for the first generation had started, AKASOL began developing the next generation. In addition to improved battery cells that fit in the same space as the first generation, many other small optimizations, for instance in the battery management system and the mechanical architecture, contribute to the improvements of the second generation systems.

“Our battery systems performed well both during winter tests in freezing cold and summer rides in the Spanish desert of Sierra Nevada, thanks to liquid cooling.”

—SVEN SCHULZ, CHIEF EXECUTIVE OFFICER



## PRODUCTION

The second generation of the eCitaro will launch in 2020. Its battery systems offer 35 percent more energy. Installing the improved battery packs is possible due to the identical spatial design of the battery systems (upward compatibility). Instead of the initial 25 kilowatt hours of storage capacity per battery pack, the second generation will be able to store 33 kilowatt hours per pack. This means an increase of 35 percent per vehicle from up to 243 to up to 330 kilowatt hours - in the same space and with the same weight. Thus, the range increases to 200 kilometers in SORT2 and up to 250 kilometers under ideal conditions.

The high performance battery systems are manufactured in Langen, in Europe's largest factory for commercial vehicle battery systems, which AKASOL officially opened at the end of 2017. The production facility has an annual capacity of 300 megawatt hours. Series production finally started in the fall of 2018.

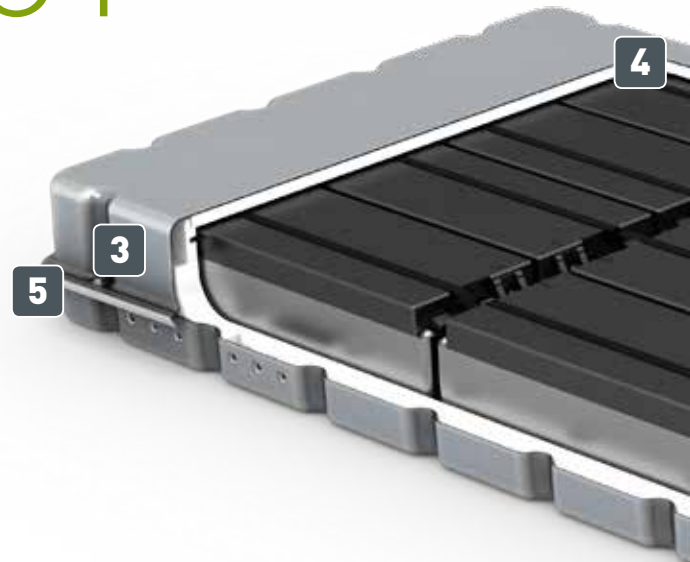
# SERIAL TECHNOLOGY

## FOR BUS APPLICATIONS.

With very high energy densities on system level and in our view the most compact liquid cooling, AKASOL battery systems have very low space requirements and emit only little heat. These are the ideal preconditions for a long battery life with high power output for a safe, reliable and durable operation.

## SERIAL PRODUCTION ACCORDING TO IATF 16949.

To fulfill our clients' automotive standards, AKASOL battery systems for bus applications are developed and produced in an automotive IATF 16949 compliant environment at our headquarter in Darmstadt and our serial production plant in Langen. And where necessary, we fulfill additional, project-specific requirements.



### MAIN CHARACTERISTICS



› ROBUST



› LIQUID COOLING



› FREELY SCALEABLE



› CERTIFIED & VALIDATED



› VERY LONG CYCLE LIFE

### SPECIFIC CHARACTERISTICS



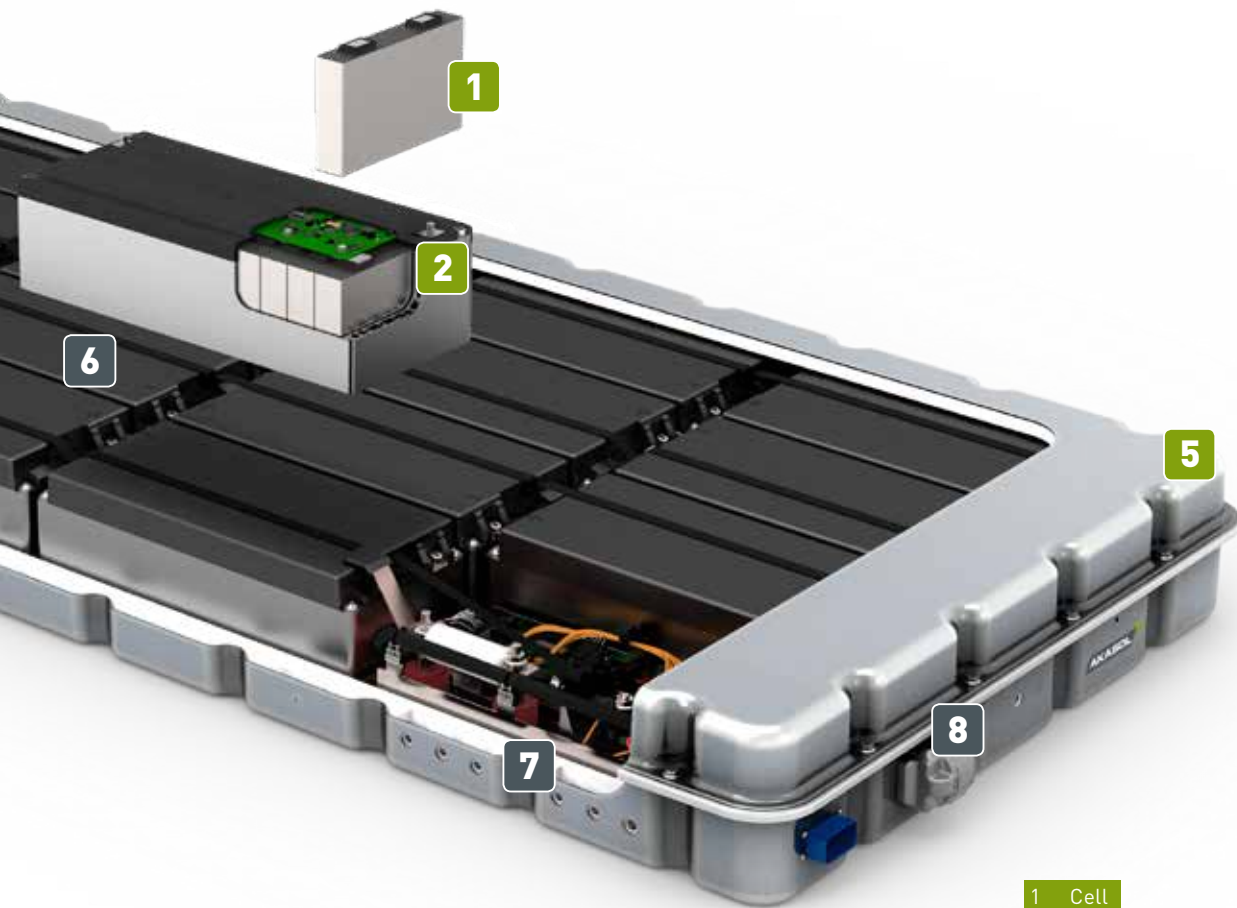
› AUTOMOTIVE PHEV BATTERY MODULES



› DESIGNED AND VALIDATED FOR AUTOMOTIVE SERIAL APPLICATIONS



› LONG-TERM TECHNOLOGY ROADMAP BASED ON STANDARDIZED MODULES



1 Cell

2 OEM MODULE

3 Robust and safe housing

4 Thermal isolation

5 Liquid coolant ports (hidden)

6 Electrical interconnects

7 Main contactor and fuse box incl.  
Battery Management Unit (BMU)

8 High voltage connector

## APPLICATION FOCUS

- › Technology for high cycle and high power applications
- › Especially buses and commercial vehicles with fully electric and hydrogen fuel cell powertrains, small and mid-sized industrial vehicles, marine applications, opportunity charging





**PLEASE DON'T HESITATE TO CONTACT US**

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