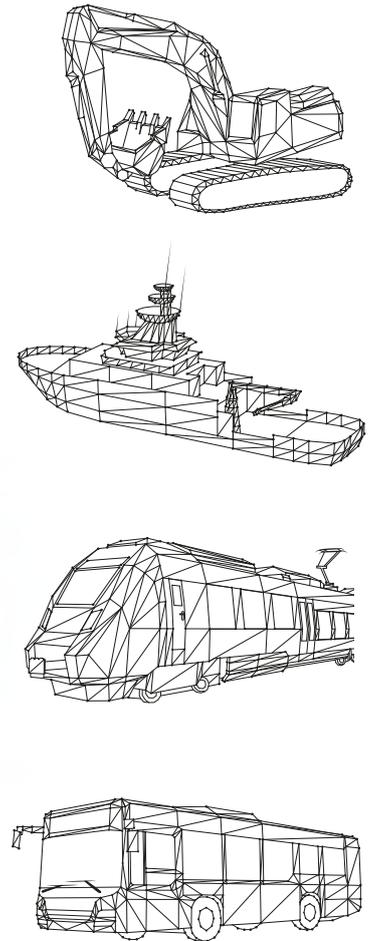
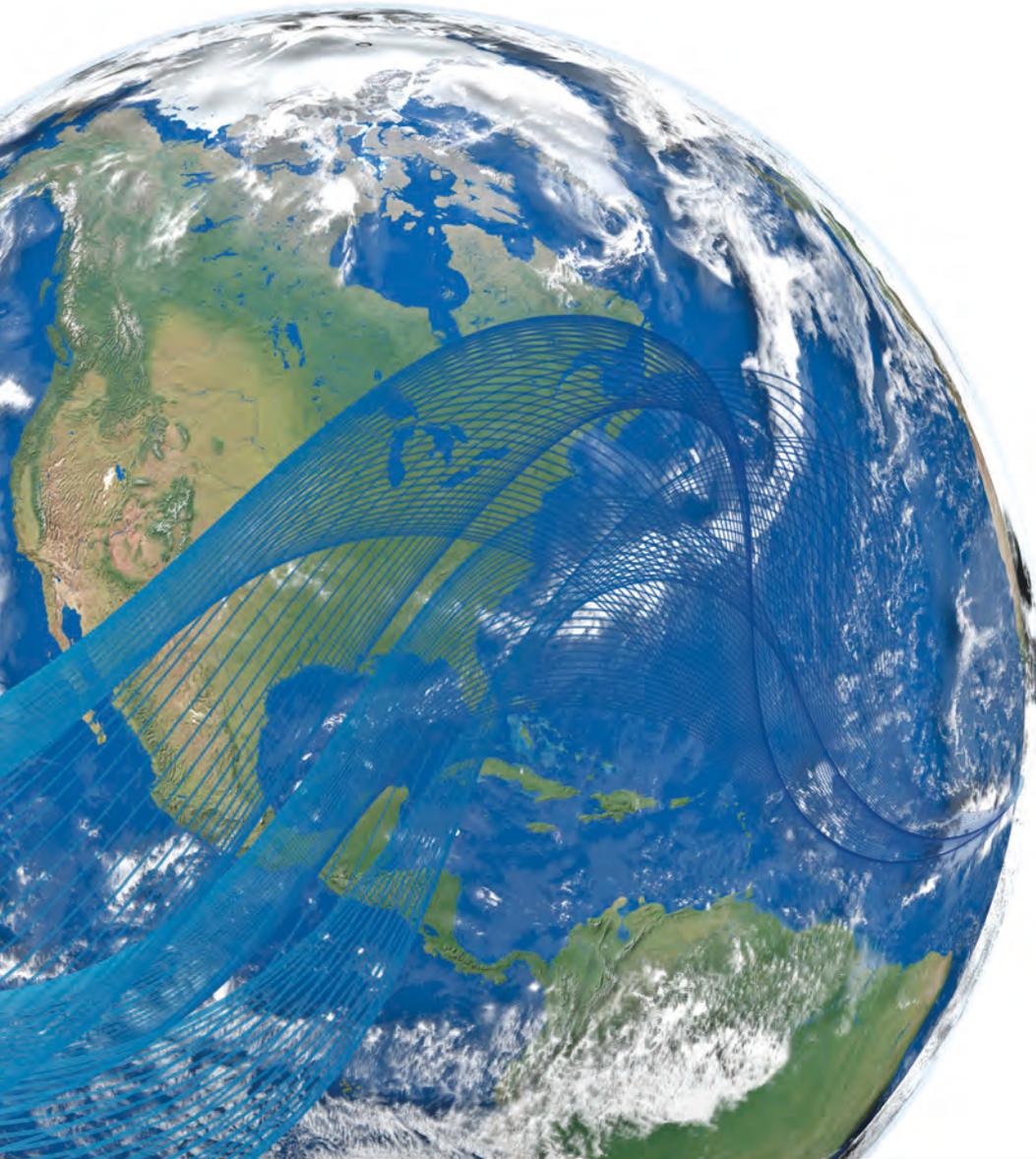


Electrification of commercial vehicles



ARADEx

Experts for power electronics

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Our responsibility

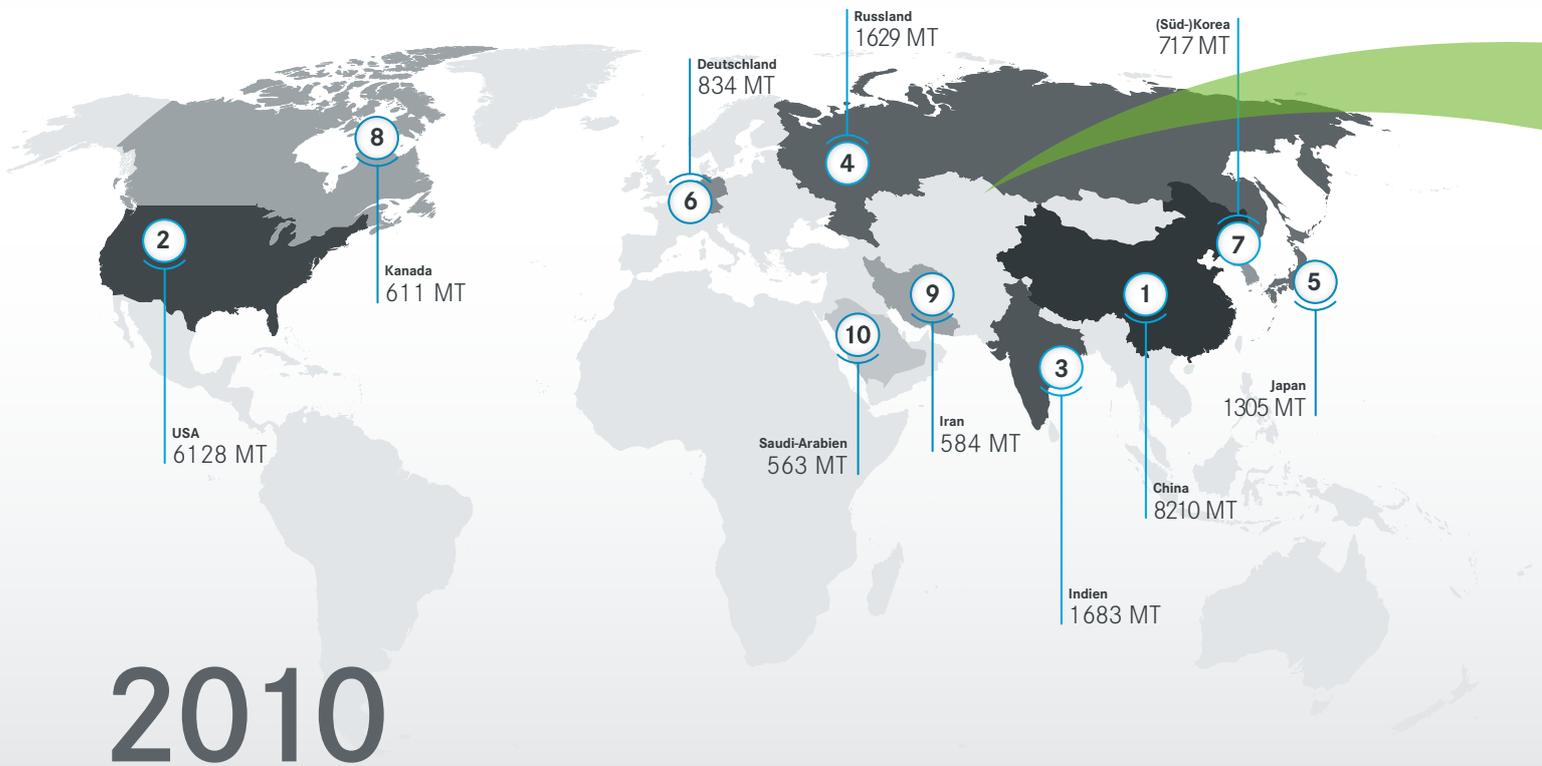
We live in a world that is changing faster than it has ever done before. Mankind faces challenges that we can only surmount by working together. One of these challenges is limiting climate change so that the next generation can also enjoy a healthy environment. Therefore, we believe that everyone can take responsibility to the best of his ability.

Even if many tasks seem impossible today, individuals or companies can do a lot to make our world a better place.

Lorch, August 2016
Thomas Vetter
CEO, ARADEX AG



The task



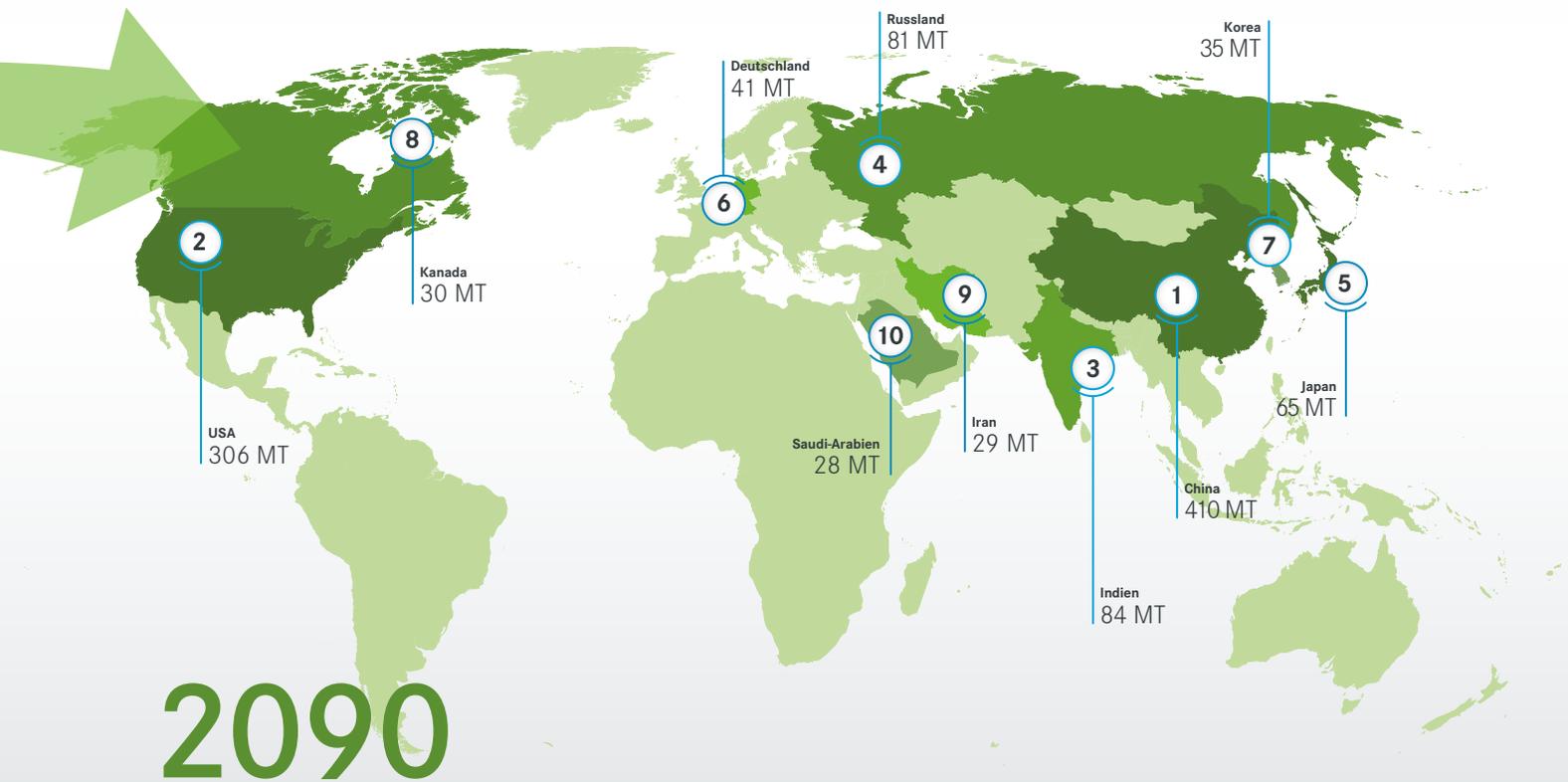
An approach is the efficiency

Combustion engine up to 50%

Electric motor up to 97%



We must halve CO₂ emissions by 2050 and by 2090 almost eliminate them.



The objective: maximum 2° C climate warming

33040 MT* CO₂ 2010

2050

2090

*MT (millions tonnes)

The technical challenge

The biggest technical challenge lies in the generation and use of energy in a form and manner that generations to follow us have a chance of survival.

Electrification of transportation is obviously not the complete solution but should be seen as a first step that is already being implemented.

The total efficiency of a vehicle is not just confined to the motor. However, in certain load profiles up to 30% energy savings (and therefore also CO₂) are already possible today when compared to combustion engines.

The technology



Electric energy is clean, quiet and has an efficiency of up to 99%.



iii.1 VECTOPOWER

ARADEx technology increases efficiency

What is the reason that installations and commercial vehicles with ARADEx technology consume less energy than other solutions?

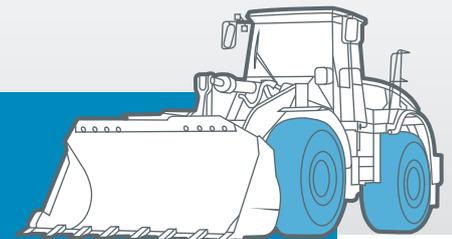
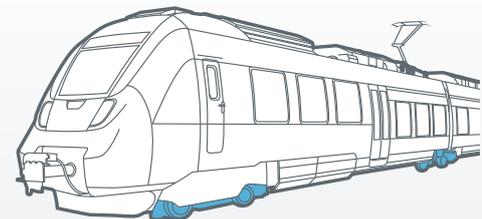
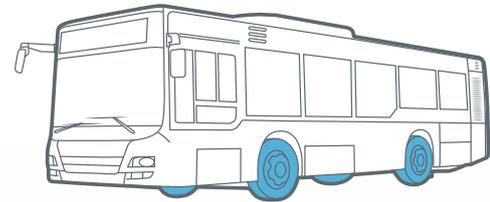
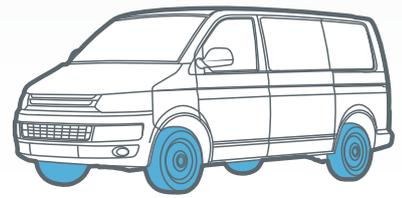
“Energy consumption“ is, according to the physical definition, the development of heat. Heat is created by friction, for example, but also during the conversion from one energy form to another e.g. when charging a battery.

Many mechanical processes can be implemented with electricity, which has the advantage that at least some of the energy remains in the system.

Let’s take brakes as an example. These in actual fact produce a mechanical energy conversion: If we succeed in producing this energy when the inverter is braked (recuperation) and not by friction (brake shoes), then the energy is not lost as heat.

Another example, if we can save energy when an inverter requires less cooling power as another with the same power, then it functions more efficiently.

Power electronics for efficient electric motors



Power electronics ...

... is, amongst other things, the connection between electric motor and battery. The so-called traction inverter controls the current and voltage for the electric motor and determines the speed and the torque.

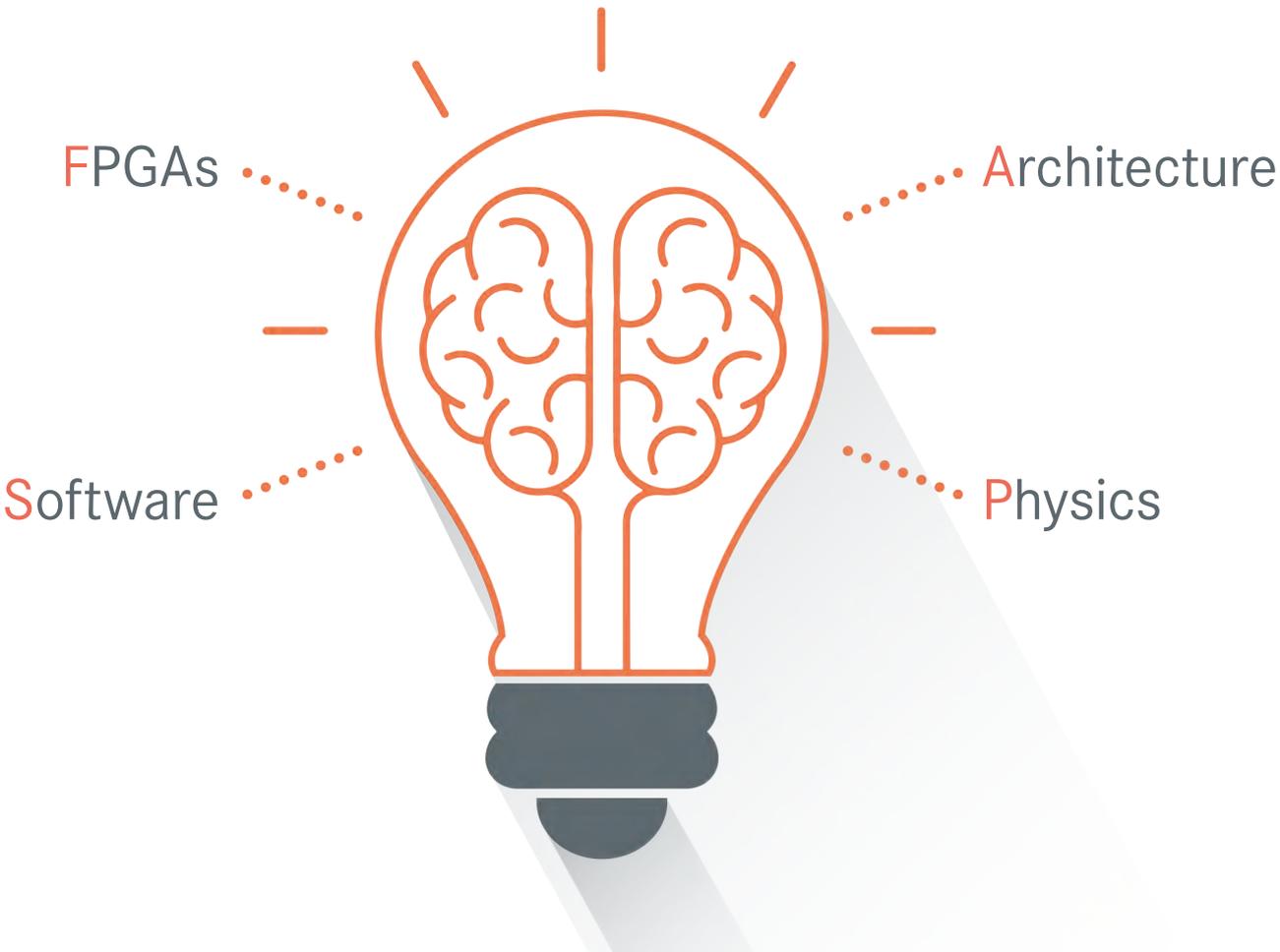


VP VECTOPOWER
by ARADEX AG



Technically, this means the conversion of direct current to 3 phase alternating current or vice-versa without mechanical moving parts.

Your expert





for control electrics
with maximum traction

FPGA

With FPGA we implement our own super-fast control algorithms with deterministic cycle times under 10 μ s - **for more dynamics.**

Architecture

Using our system architecture our products are absolutely deterministic and isochronic with a jitter < 1 μ s - **for more precision.**

Physics

Our own semi-conductor models allow us to reset the limits of power electronics - **for more efficiency.**

Software

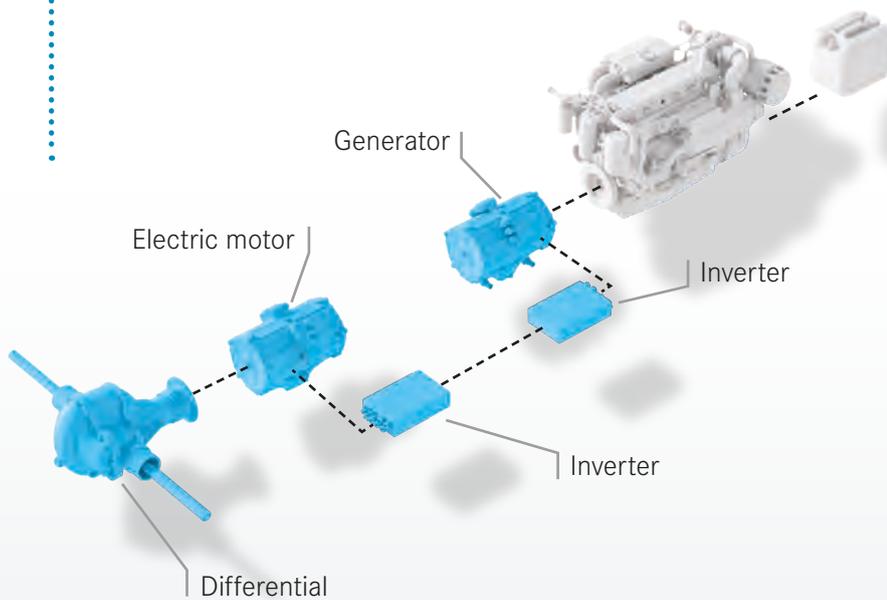
Our analysis software with several thousand variables allows deep insights into the drive in real time - **for more process control.**

Uniquely innovative

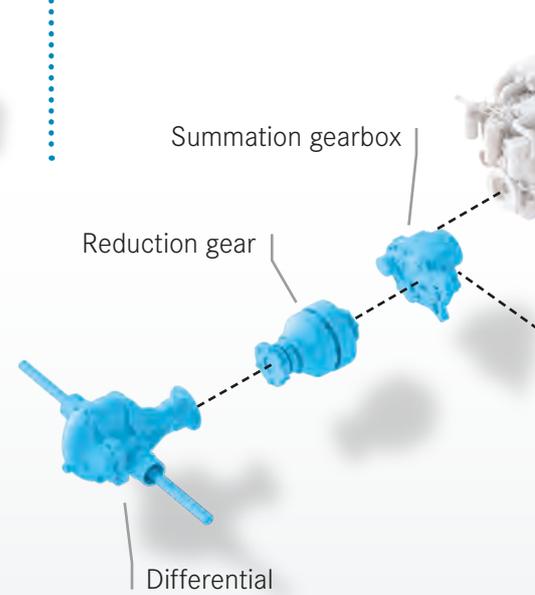
Employees from the most diverse backgrounds and cultural groups work at ARADEX. This means that we view new developments from all aspects. When philosophers, archaeologists and physicists discuss new technologies this may not seem very productive at first. However, we are obligated to innovation and customer value and so these discussions often produce previously unthought of solutions. Only by thinking outside the box can noteworthy market advantages be achieved nowadays - if our salesmen think the development is economically viable.

Components and services

diesel-electric



hybrid



Profit from our experience

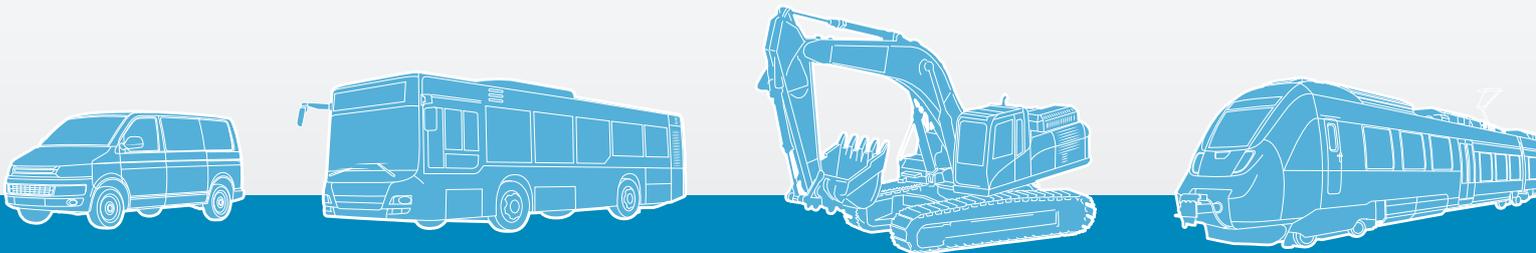
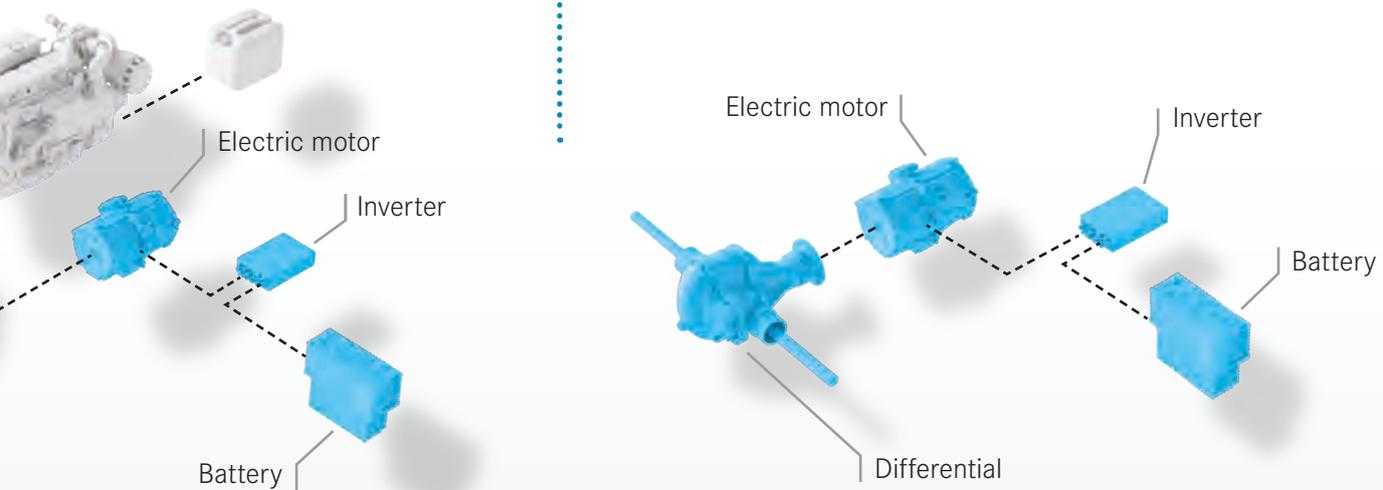
It is our aim that our customers are able to commission and maintain their machines on their own. Our experts are happy to show you procedures with which you can save time and energy.

Our engineers are available for commissioning, workshops and training courses.

We are also happy to support you with the dimensioning of the complete system. You know the technology, we are experts in electronics and fundamental physics. Together we create products for your market advantage.

for the most diverse
drive concepts

fully electric



We consider ourselves as a
partner for our customers
and deliver just as much as
you require.

Series production together with our customers



Electronics make a difference

The biggest power challenge for an electric vehicle is usually not the maximum speed but start-up. Motor and inverter should be so matched that they raise the maximum possible torque at 0 Hz rotary frequency. On the other hand, the projected maximum speed must also be attainable. This used to be achieved using manual transmissions, nowadays field-weakened motors are usually used. These save money and increase the electrical efficiency. We can achieve a high torque over the whole speed range with field-weakened motors and thus achieve maximum efficiency even in partial load.

The battery electric bus

Manufacturer: Sileo GmbH, Germany, SOP 2014

Consumption: 0.7 kWh/km

Range: up to 500km, 200km+ are guaranteed

Power: 2 x 120kW

Charging: in the bus depot

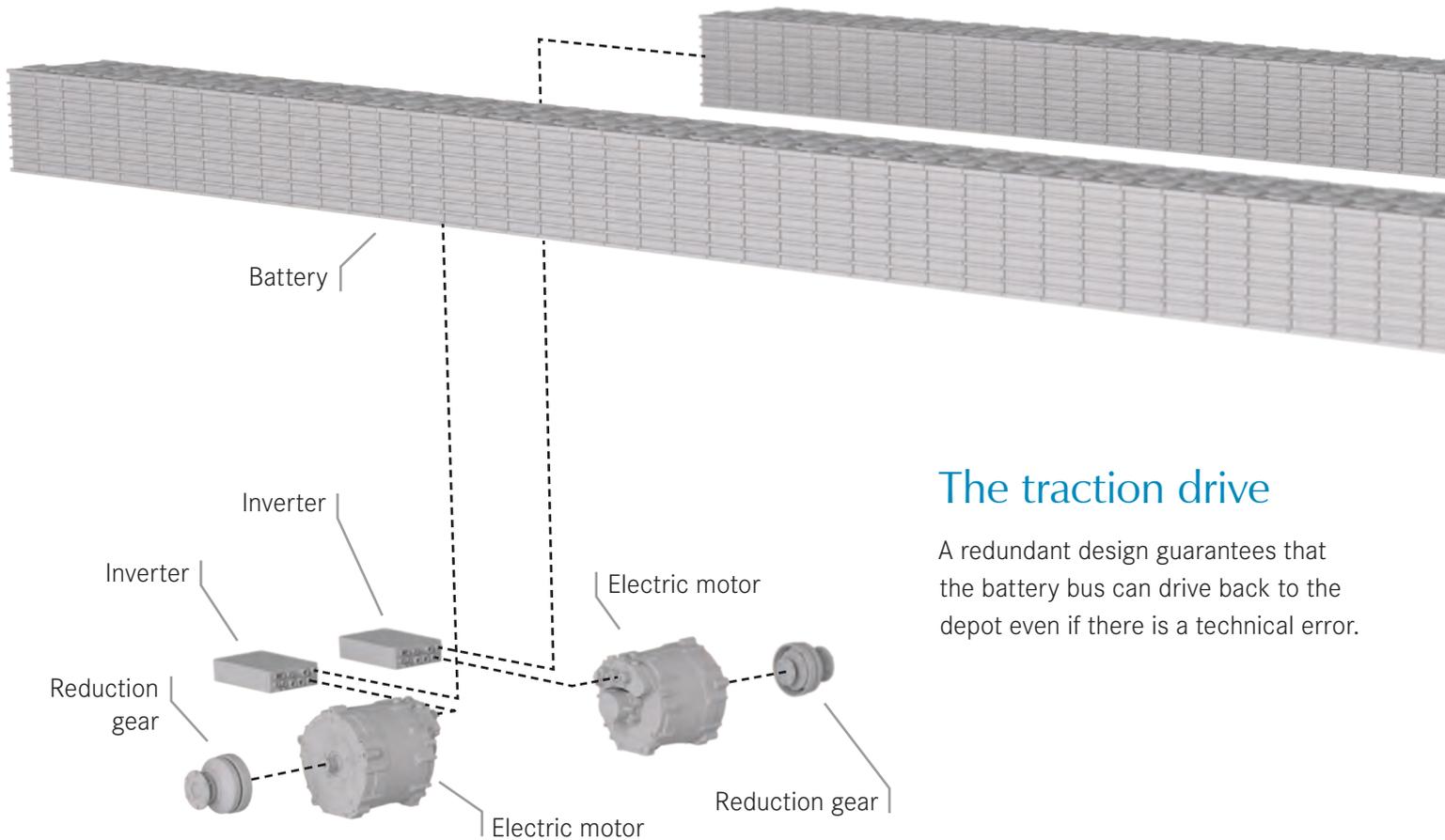
Charging time: min. 4h for complete charging

Characteristics: low maintenance electronic differential; redundant design of drive train; recuperation of up to 80% of braking energy.

* in normal line operation with 500,000 km recorded mileage.



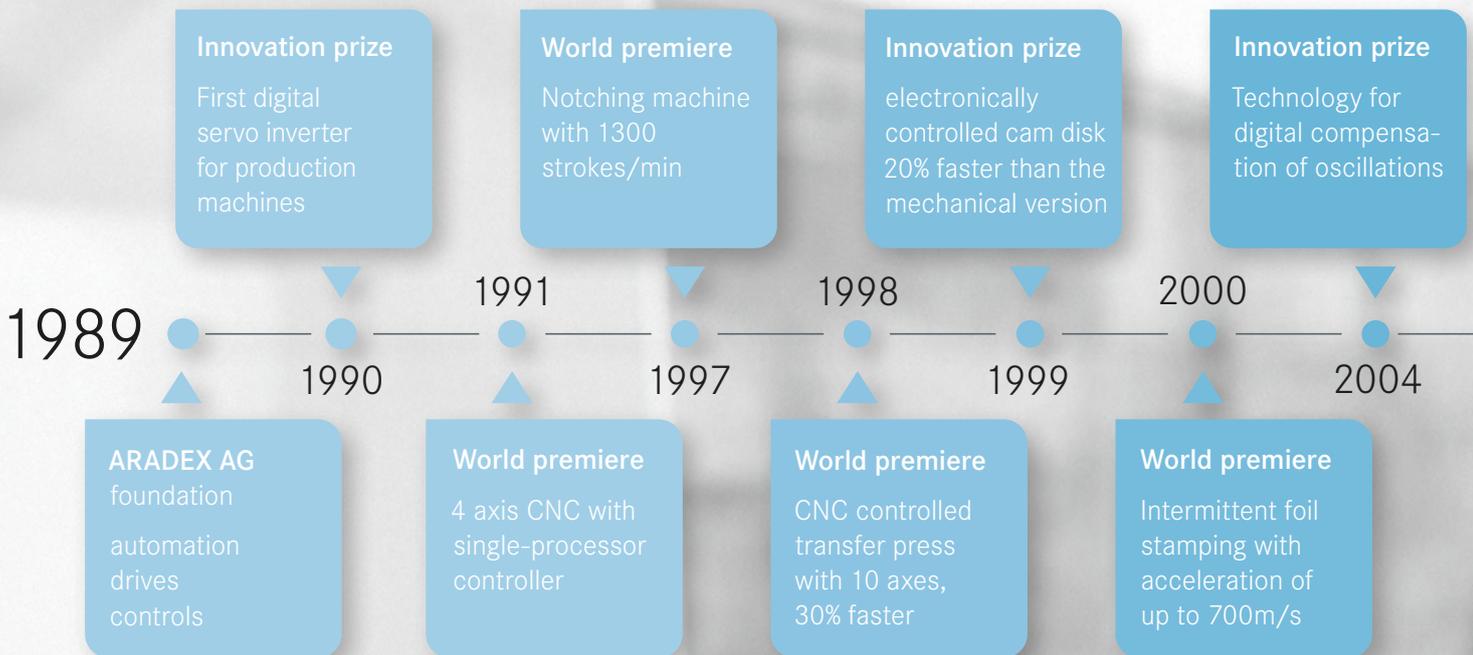
iii.2 fully electric public transport bus Sileo



The traction drive

A redundant design guarantees that the battery bus can drive back to the depot even if there is a technical error.

ARADEX AG



About us

ARADEX has been a pioneer in the area of high-performance drive technology for almost 30 years. Shortly after founding the company we presented the world first industrial CNC controller based on an industrial PC. After this we introduced fast inverters, field busses and peripheral products.

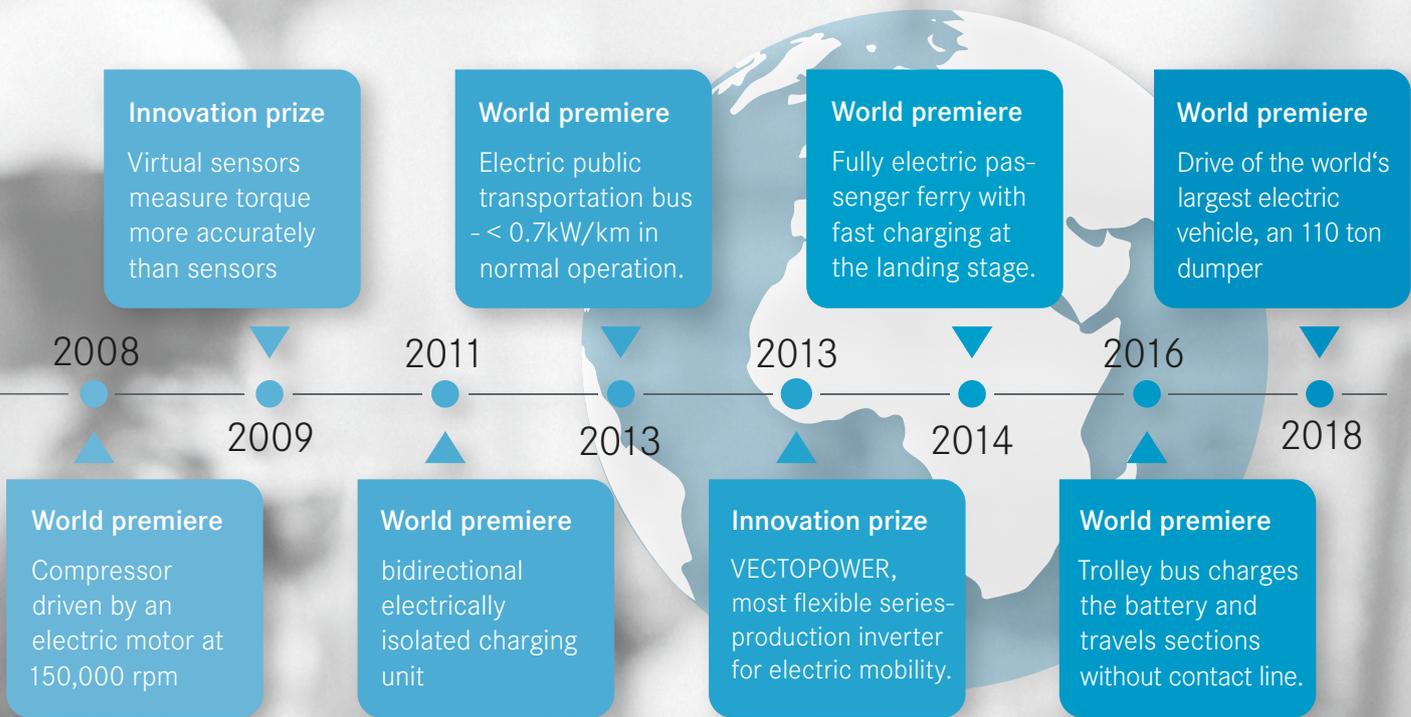
Today, ARADEX is a system supplier in industrial automation and is still a technological leader regarding accuracy and speed in our products. In addition to drive technology for control cabinets, in the last few years, we have introduced VECTOPOWER, a range for mobile applications.

We outsourced the production to specialised companies close to our headquarters so that we

can concentrate on development and sales of our products. We advise our customers not only on the design of their projects but also support them during commissioning and also provide service.

Partnerships with other companies plays an important role for increasing efficiency and completing our portfolio. Functioning networks are very important for the success of our projects. The variety and quantity of our applications requires the help of external specialists and helps us to focus on our core competencies.

for almost 30 years



We deliver you technology so that you remain world leader.



ill.3 managing board ARADEX AG

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