

---

# Imagine a battery- centric world

The significance of the electric battery  
in mobility concepts in the context of  
the energy market transition



con | energy | **Atos**

# Foreword

This thought leadership document has been produced in collaboration with Atos Information Technology, Global Manufacturing Consulting, Energy4U and conlenergy in winter 2020/21.

Because electric mobility and power generation are inextricably linked, we would like to further strengthen the dialogue with leading strategists from both industry and the energy sector.

We look forward to future discussions with readers and interested parties, especially forward-thinkers who are thinking strategically about these complex topics and would like to discuss the next steps.

Munich - Karlsruhe - Essen, March 2021



# 1

## Introduction: Battery-centric mobility

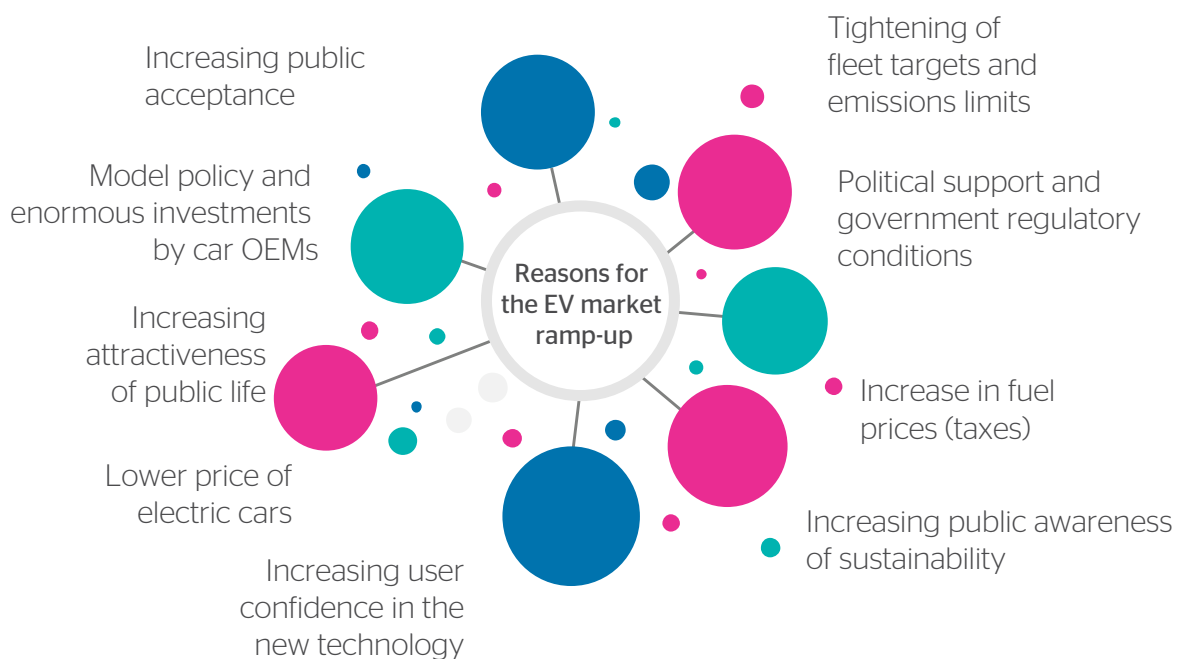
# Battery-centric mobility

In view of current developments, it is becoming increasingly clear that the end of vehicles with internal combustion engines has in fact manifested itself.

Since politicians in many countries have set the course for electromobility and created strong purchase incentives with subsidy measures, electrically powered vehicles have recorded strong growth potential in the automotive market.

Electric vehicles are generally seen as a new technology. It is largely forgotten that the Lohner-Porsche, a practical electric car, was presented to the public at the 1900 Paris Exposition. The vehicle was powered by two wheel hub motors on the front wheels, was 50 km/h fast and had a range of 50 km with a 400 kg lead battery. As is well known, the internal combustion engine presumably prevailed due to its greater range.

Even today, the key figure "range" is widely discussed, although on average only 39 km are covered per vehicle per day in Germany. A large proportion of the journeys made today could easily be managed with the achievable ranges. New mobility concepts are making the options for getting around more flexible, with the car being just one of the possible means of transportation (see Atos White Paper ["Who needs to own a car"](#)).

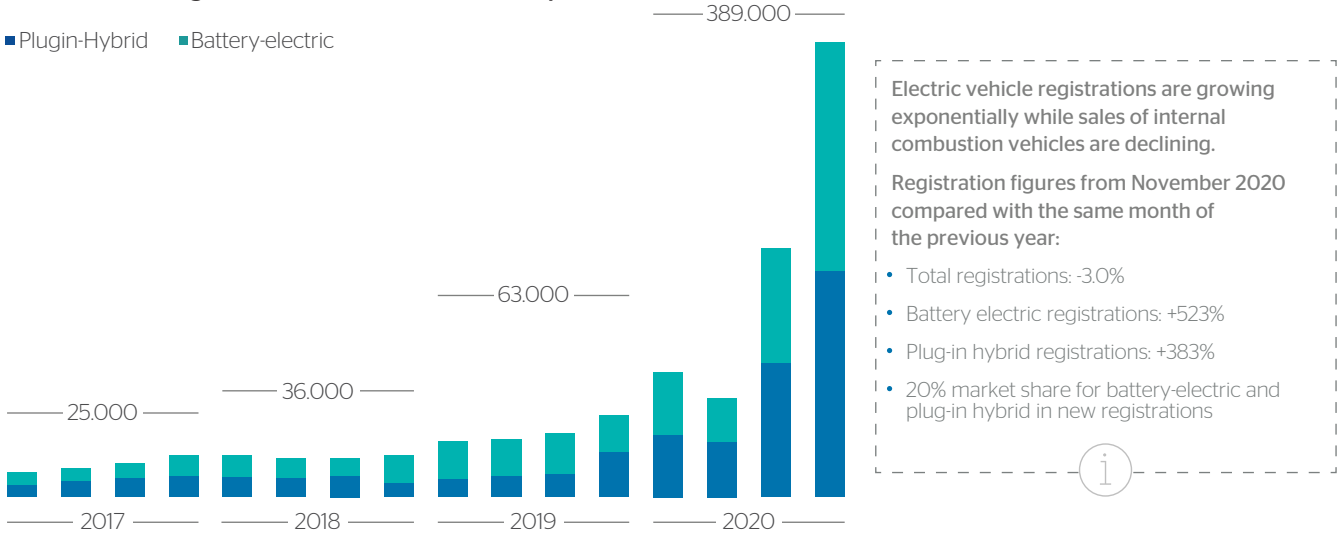


Source: conlenergy

In addition to range, there are other arguments that make electric cars seem attractive:

- The electric drive is energy efficient
- The electric drive is emission-free on site
- The potential to become entirely emission-free is significant if the energy transition is successful
- User-friendly designs can be created due to different components and a different component arrangement
- Electric drives have high torque from the first revolutions and cover a wide speed range
- Electric drives are very quiet
- Pure electric vehicles have a simple structure and are easier to regulate
- Maintenance costs for all-electric vehicles are significantly lower
- Government incentives through current tax benefits and direct grants are available
- The refueling process can be done at home
- New approaches enable charging processes that are within the time range of conventional fuel refueling

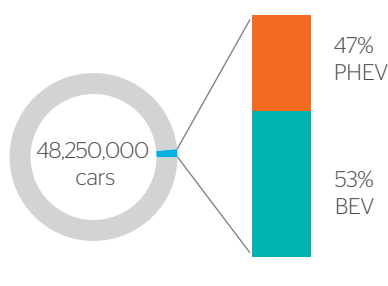
### Number of new registrations of E-vehicles in Germany



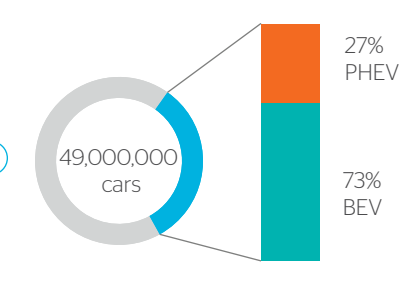
Source-Data: German Federal Motor Transport Authority, Illustration: conlenergy

The number of registered electric vehicles in Germany is rising rapidly. However, the German government's target of putting one million electric cars on the road by the end of 2020 has not been met. In 2020 alone, 389,000 e-vehicles were newly registered. With current government subsidies, an electric vehicle is now priced in the range of a comparable internal combustion vehicle. This means that the hurdle of the high purchase price has also been overcome.

Number of passenger cars (GER, beginning of 2021)



Forecasted number of passenger cars (GER, 2030)



Conventional	98,8 %	PHEV	- 280.000	Conventional	74%	PHEV	- 3,5 Mio
Electric	1,2 %	BEV	- 310.000	Electric	26%	BEV	- 9,5 Mio

Source: German Federal Motor Transport Authority data and authors' estimate based on studies by CAM, Deloitte, BCG, NOW and others





# 2

Further development trends  
for electric vehicles

# Further development trends for electric vehicles

The sharp rise in EV sales leads to an increasing shift from the current predominance of **conversion design** (equipping existing vehicle designs with electric drives) to **purpose design** (changes throughout the vehicle). In conversion design, existing technologies and concepts can be further developed and ongoing processes can be maintained. However, additional functionalities as well as package and ergonomic advantages often cannot be exploited due to the predefined structures. Thus, no real innovations are created.

In purpose design, new drive concepts and additional functionalities are installed, and new ergonomic and operating concepts are developed. Vehicle components are completely rearranged to realize package advantages. Additional components such as electric steering, electric brakes and extended thermal management are integrated and superfluous components are removed. At the same time, lightweight design measures are applied. The chassis can be designed for lower speeds due to the typically lower top speed of battery-powered EVs.

In other words, the vehicle is designed around the battery and built accordingly. It is quite likely that engineering companies will develop a complete vehicle based on off-the-shelf components (such as the battery, electric engine, tires, etc.) and contract an assembly specialist to produce it. An example is the contract between Magna and Fisker. Magna will produce the Fisker Ocean in Europe, while Fisker will focus on development and design (source: electrive.net).

## Connected vehicles: The brain and communication center

There is no causal relationship between connected vehicles (CV) and electric vehicles. However, there are excellent opportunities – especially in purpose design – to use CV technologies to greater benefit.

As such, CVs offer a direct opportunity to improve customer experience, brand positioning and loyalty, making a significant contribution to automobile manufacturers' ambitious growth plans. However, this can only be achieved if CV services directly address the personalized, rapidly changing needs of drivers, owners, fleet operators, dealers, OEMs, suppliers, regulators and partners. Manufacturers should not assume that digital services automatically encourage people to spend more money. Connected vehicles are just one piece of responsible mobility.

Unlike most OEMs, Tesla has a central electronics control element. Tesla owes its current market success primarily to this central control element. In contrast, numerous other OEMs use decentralized control elements that are constantly coordinated with each other to circumvent incompatibilities. Furthermore, supply chains must be managed at great expense. In the medium term, the question will arise as to whether the monolithic approach of a proprietary system will prevail in the long term, or whether a partner ecosystem will accelerate innovation. We have already observed these developments in the IT industry.

Open sources vs. closed systems: There are success stories for both approaches, mostly depending on the market situation or market penetration, available norms and standards, technological leadership and unique selling points.

Figuratively speaking, the control element is thus the brain and communication center of the vehicle, which is networked via CV technologies to enable a range of services.

## The engine: The heart of a vehicle?

In a combustion engine, the engine is heart of the vehicle and justifiably considered the hallmark of quality vehicle engineering, but does the same apply to an electric car? Let's first take a brief look at the electric motors used as drives before answering the question.

It is important that the electric engine produces sufficient torque over a wide speed range. Other necessary properties are high efficiency, sensitive speed and torque control, the possibility of regeneration, low weight and volume, and a good price-to-performance ratio. The engine must be suitable for the expected temperature range and unaffected by typical mechanical loads.

Typically, only three-phase motors meet these requirements. In contrast, simpler DC motors are more suitable for driving electric bicycles, for example. Three-phase motors are available in three different versions, which differ in terms of efficiency, installation space requirements, costs, drag losses during no-load operation, and robustness.

The **permanently excited synchronous motor** is used in the BMW i3, the **current-excited synchronous motor** is installed in the Renault Zoe, while **asynchronous motors** are used in the Tesla. All three types are mature technologies, and major innovations are not currently expected in this area (source: Anton Karle - Elektromobilität, Hander-Verlag).

As a result, the engine becomes more of an accessory – losing its decisive role as an example of great engineering achievement and a central selling point.



## The battery: The new heart of the vehicle

The battery is indisputably one of the central elements in an electrically powered vehicle. Functionality, reliability, service life, charging time and range of the battery are important performance indicators that influence purchasing decisions and determine the success of the product. Furthermore, the battery is the cost driver for today's electric vehicles.

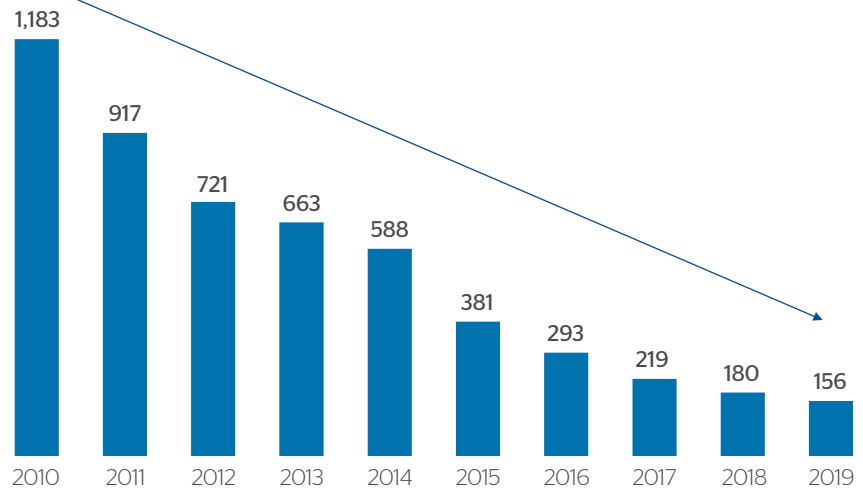
This fundamentally changes the development of new vehicles: electric drives are much easier to design and manufacture than combustion engines.

The development of the lithium-ion battery marked a major step forward in battery development, significantly paving the way for all-electric vehicles suitable for everyday use. Currently, two designs of vehicle batteries have become established. The first is a cylindrical pack design using winding technology, while the other is the large-format prismatic pack developed specifically for automotive use – currently utilized by BMW and VW among others. In addition, there are somewhat lighter pouch packs, which have no rigid housing but a flexible aluminum foil package. This technology is used in the Nissan Leaf, for example. The batteries currently installed have a service life of five to eight years or 100,000 - 160,000 km, although further use in a second lifecycle is quite possible (source: Anton Karle - Elektromobilität, Hander-Verlag).

The price of lithium-ion batteries is forecasted to fall to € 83 per kilowatt hour by 2025. In 2010, the price for energy storage was still € 1,183 per kilowatt hour.

It is very likely that new battery types with new technologies will enter the market, which will significantly improve the KPIs of car batteries, in addition to a constantly evolving battery management system (BMS).

Lithium-ion battery price survey results: Volume-weighted average Battery pack price (real 2019 \$/kWh)



Source-Daten: Bloomberg New Energy Finance Report, Darstellung: conlenergy

The potentials of other metal-ion systems (such as lithium-ion) as well as metal-sulfur and metal-air or metal-oxygen systems are being researched and made available for industrial use. In theory, these alternative battery systems promise primarily low cost and high energy densities. If they can be realized, they may have the potential to compete with lithium-ion batteries in mobile and stationary applications. However, selective approaches – particularly in metal-air or metal-oxygen systems – show that there is still a considerable need for research and development.

The most prominent representatives of metal-sulfur batteries are lithium-sulfur batteries. Prototypes of this technology have already been built and used successfully, but no system has yet reached market maturity. Should this happen, however, we can expect particularly cost-effective batteries. The sulfur used is not only abundant, but is also a waste

product produced during the desulfurization of natural gas and crude oil, which ensures low prices.

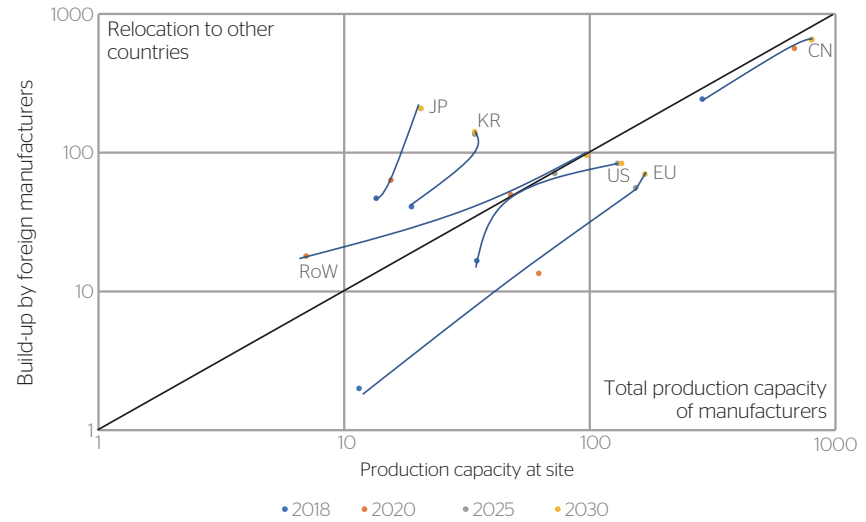
Another promising field of research is in metal-air and metal-oxygen batteries, in which electrical energy is released from the chemical reaction of metals with oxygen. One of the two reaction partners (in this case oxygen) is obtained from the ambient air via a special electrode and does not need to be stored in the battery. As a result, these systems theoretically allow significantly higher energy densities to be realized than with common battery types. Political support has thus been extended to the development of production capacities for automotive batteries.

Increasing attention is being paid to solid-state batteries in all regions. This is indicative of the rapid pace of innovation in the field of automotive batteries. In addition to optimized technical performance, innovation plays a central role in economic development (<https://www.iea.org/reports/global-ev-outlook-2019>).

According to current forecasts, battery production capacities are expected to be well over 1 terawatt hours (TWh) in 2030.

The drop in the price of the central element, the battery, is resulting in less expensive vehicles with longer battery lifetimes. The lifetime can be further increased by utilizing used batteries in the stationary household sector and as energy storage at charging stations, or generally for decentralized energy storage, thereby reducing the recycling problem. These use cases clearly demonstrate that thinking of the battery purely in terms of mobility is short-sighted. Instead, the battery is moving more and more into the center of new business models and our everyday lives.

Lithium-ion battery cell production by location of production vs. location of cell manufacturer (Max announced capacity, in GWh).



Source: Fraunhofer ISI

## The world is going electric - but only with energy storage

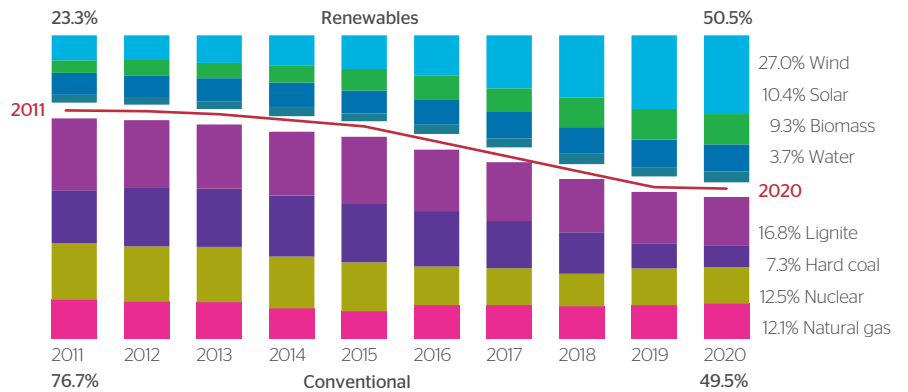
Electric cars are taking on an increasingly important role in terms of overall power consumption. With a typical electricity consumption of 2,000 - 4,000 kWh per electric car per year (equivalent to the electricity consumption of a medium-sized household in Central Europe), a 50% electrification of the European passenger car market would account for around 15% of total electricity demand.

Looking at the power requirements of an EV, it becomes clear that the transition of the global energy system towards renewables is of particular importance. The sustainability of both electricity consumers and of mobility depends on this transition, and the elimination of fossil energy sources is a basic prerequisite for sustainable mobility. The ecological added value of a car is strongly linked to the type of energy source – in the case of EVs, to electricity generation.

One of the foundations of the global energy transition is the Paris Climate Agreement. Under this agreement, 197 countries have pledged to limit the temperature increase caused by climate change to well below two degrees Celsius, compared to pre-industrial levels. According to official figures, achieving this goal will require a global reduction in greenhouse gas emissions of up to 70% by 2050 and 100% by the end of the century.

Although this process is still proceeding slowly and is being pursued more intensively in some countries than others, numerous successes are already evident.

In Germany, for example, the share of renewable energies in total electricity generation (the electricity mix that actually comes out of the outlet), exceeded 50% for the first time in 2020.



Source-Data: Fraunhofer ISE, Illustration: strom-report.de

If the energy transition is successful, we will obtain our electricity almost exclusively from renewable sources such as wind, solar and biomass. However, as explained above, the electricity sector should not be viewed in isolation in the energy system of the future. It will only be possible to achieve our climate protection goals with a similar decarbonization of the heating and transport sectors – and by leveraging synergies to make the switch to renewable energy sources in all three sectors. The energy system of the future requires extensive linking of electricity, heat and mobility, with carbon-based fuels being increasingly substituted by electrical energy in the heat and mobility sectors. Thus, renewable electricity will increasingly become the most important energy source for the heat and transport sectors. Climate protection and a more sustainable way of life for people are the most striking aspects. Achieving the transition in how electricity is provided will be more difficult.

The essential challenges are as follows:

- In the future, electricity will not always be produced where it is consumed. Consequently, electricity will sometimes have to be transported over long distances to reach the consumer, as is the case with conventional power plants.
- Electricity production is sometimes subject to large fluctuations due to dependence on weather conditions.
- The power supply must be ensured, regardless of the weather-related fluctuations that can occur with renewable energies.
- In the future, distributed generation will lead to what is known as reverse load flow, as the energy systems in households and businesses generate more energy than they consume at various times of the day.

From the challenges mentioned, the obvious necessity of both enhancing the power grid and making power consumption more flexible is evident. The demands on power grids will continue to increase due to higher peak loads in the distribution grid, more demanding forecasts of power flows, or even the everyday occurrence of reversed load flows. Several technical solutions are available to overcome these main challenges – by means of grid expansion, grid control and monitoring. However, the problem of fluctuating power availability from renewables cannot be completely solved by these means. Therefore, creating a more flexible energy system is gaining importance as an alternative to grid optimization. We

must always determine the optimum balance between economy and ecology when considering grid optimization and energy system flexibility.

Increasing the flexibility of the energy system involves strengthening demand-side management and using storage facilities. Above all, storage facilities are extensively scalable and controllable. They also serve to decouple electricity generation and consumption. This is of particular importance because electrical energy can only be directly stored in relatively small quantities. In terms of the energy transition, there is a need for local, decentralized intermediate storage of electrical energy, which must be available again at the end of the storage process. For this reason, the energy must generally be converted into another type of energy (at a loss) and if required, converted back again (also at a loss).

Numerous technologies are already available for this purpose, but not all of them meet the requirements of the energy market. Mechanical storage systems lose a great deal of energy during the storage period. Water storage systems have high environmental requirements and need a large amount of space. Thermal storage systems are not sufficiently advanced at present, and are often uneconomical. Therefore, a high potential lies in chemical – especially battery – electric storage. A prominent example is lithium-ion storage, which has applications in home storage or EVs as described in the previous chapter.

The overall energy system will require a mix of already available technologies in addition to new technologies such as ultracapacitors, solid-state batteries or redox flow batteries. The International Energy Agency (IEA) estimates that at least 10,000 gigawatt hours of installed capacity will be needed by 2040 to meet global climate targets. That is 50 times today's installed capacity.

Storage technologies are currently used mainly for short- and medium-term intermediate energy storage. In the future, however, the need for long-term and seasonal storage will grow. Due to this, sector coupling, which aims to couple the three energy-intensive sectors of electricity, heat and mobility, is taking on an increasingly important role. Through coupling, the use of renewable electrical energy (electricity sector) gains importance as a basis for decarbonizing the heat and mobility sectors, and electricity consumption is made more flexible through controllable loads. In addition,

electricity can also be recovered from the heat and mobility sectors in isolated cases where there is a bottleneck in the supply of electricity. The technologies required for all the purposes described are referred to as power-to-X technologies.

For example, power-to-heat describes the use of an intelligently controlled heat pump to convert electricity into heat. Power-to-gas describes the conversion of electricity into gaseous substances that can be stored over the long term, such as hydrogen. Applications in the power-to-mobility field focus on charging electrically powered means of transportation such as EVs or even drones. New developments allow them to be discharged during unused periods, so they function not only as a variable load but also as intermediate storage via dynamic and intelligent charging. These so-called vehicle-to-grid technologies make it clear that the battery has high potential within sector coupling.





3

Imagine a battery-centric world

# Imagine a battery-centric world

Batteries and energy storage systems are of enormous importance and an essential part of the energy and mobility transition. In general, they form the bridge between the generation and consumption of electricity and enable the two processes to be independent of each other in terms of time. On the other hand, they form the bridge between the energy transition and mobility transition by making the battery-powered electric car in its current form possible in the first place and integrating it into the power grid in the future. Battery manufacturers and battery operators are therefore potentially putting themselves at the forefront of the ecosystem.

If we consider the development possibilities for batteries already listed and combine this with changing living conditions and mobility requirements, the scenario seems less alien. As already explained in *“Who needs to own a car,”* mobility is no longer necessarily associated with owning a vehicle. If the mobility compulsion changes to a mobility desire, urban regions will differ from rural areas in terms of mobility supply and mobility needs.

But what unites everyone in our modern world is the need for energy. Therefore, nothing is more obvious than to place the battery at the center of mobility based on this elementary need. The energy storage unit takes its way through different types of vehicles, each adapted to the stage of life according to age, space and mobility requirements, place of residence, etc.. Alternatively, the storage unit becomes a stationary battery in one's own apartment or house if owning a vehicle is not necessary for the individual mobility.

One possible approach could be the virtual lifetime battery. The battery management systems already used in today's vehicles would play a central role in this scenario. If each battery is equipped with a digital twin, almost any amount of data on the battery's status can be tapped and tracked, evaluated and used over its lifetime with the help of data analytics and artificial intelligence (AI). Depending on the time and type of use, charging times, battery lifetime and charging state can be optimized. Availability can be optimized through predictive maintenance such as planned maintenance intervals and weak point analyses.

The term digital twin is used very widely these days. Therefore, we will briefly explore the meaning of the term and describe the different variations. Fundamentally, a digital twin is a virtual image of one or more physical objects that exist now or in the future. There are three main types:

## Product Twin



Developing products with simulations that employ real world data

## Production Twin



Optimizing the production process and use of resources by using a virtual image of the production facility

## Service Twin



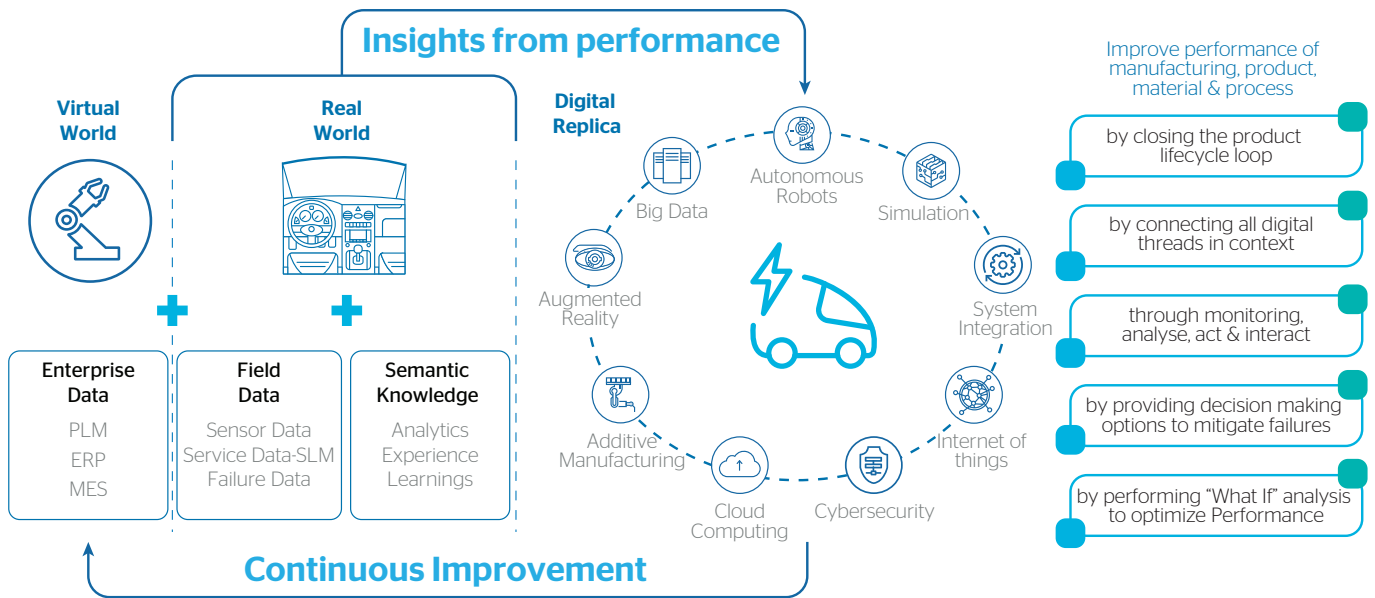
Optimizing product performance and service quality with a virtual replica of the product

Source: Atos - Digital Twin

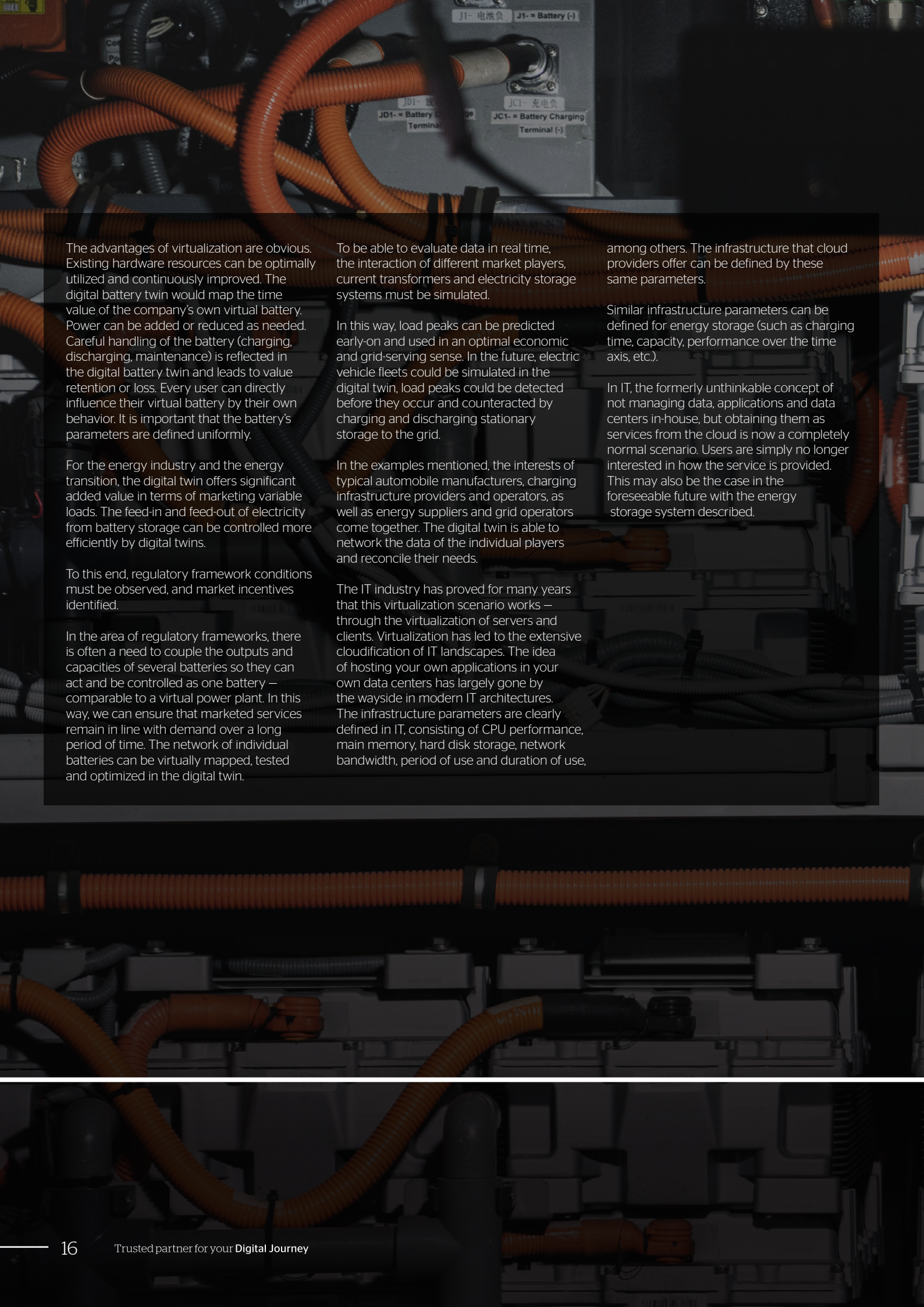
All three digital twin approaches are relevant for the complete lifecycle of a battery. The product twin is created in the development phase even before the product exists in the real world. Tests are carried out on the virtual image to facilitate and accelerate the development cycle. The production twin is an image of the production lines and processes to improve production handling. The service twin maps the actual product (each individual battery) and represents it as a virtual battery. It is crucial that the physical battery is equipped with sensors that capture relevant status information and transmit it to a central location.

On this yet-to-be-defined platform, real-time data and historical data are enriched with additional data about the object and the object's environment, resulting in a complete virtual image of the battery. Real-time data is processed directly in apps and is used to directly control all events related to the battery. Data on the history of the object is collected and can be used for evaluation, to create forecasts, and is the basis for each digital twin.

The multitude of incoming data from each individual battery object can be combined and analyzed in a data lake. Insights can be incorporated into the development cycle and the production process, as well as used to improve the individual battery.



Source: Atos - Digital Twin



The advantages of virtualization are obvious. Existing hardware resources can be optimally utilized and continuously improved. The digital battery twin would map the time value of the company's own virtual battery. Power can be added or reduced as needed. Careful handling of the battery (charging, discharging, maintenance) is reflected in the digital battery twin and leads to value retention or loss. Every user can directly influence their virtual battery by their own behavior. It is important that the battery's parameters are defined uniformly.

For the energy industry and the energy transition, the digital twin offers significant added value in terms of marketing variable loads. The feed-in and feed-out of electricity from battery storage can be controlled more efficiently by digital twins.

To this end, regulatory framework conditions must be observed, and market incentives identified.

In the area of regulatory frameworks, there is often a need to couple the outputs and capacities of several batteries so they can act and be controlled as one battery – comparable to a virtual power plant. In this way, we can ensure that marketed services remain in line with demand over a long period of time. The network of individual batteries can be virtually mapped, tested and optimized in the digital twin.

To be able to evaluate data in real time, the interaction of different market players, current transformers and electricity storage systems must be simulated.

In this way, load peaks can be predicted early-on and used in an optimal economic and grid-serving sense. In the future, electric vehicle fleets could be simulated in the digital twin, load peaks could be detected before they occur and counteracted by charging and discharging stationary storage to the grid.

In the examples mentioned, the interests of typical automobile manufacturers, charging infrastructure providers and operators, as well as energy suppliers and grid operators come together. The digital twin is able to network the data of the individual players and reconcile their needs.

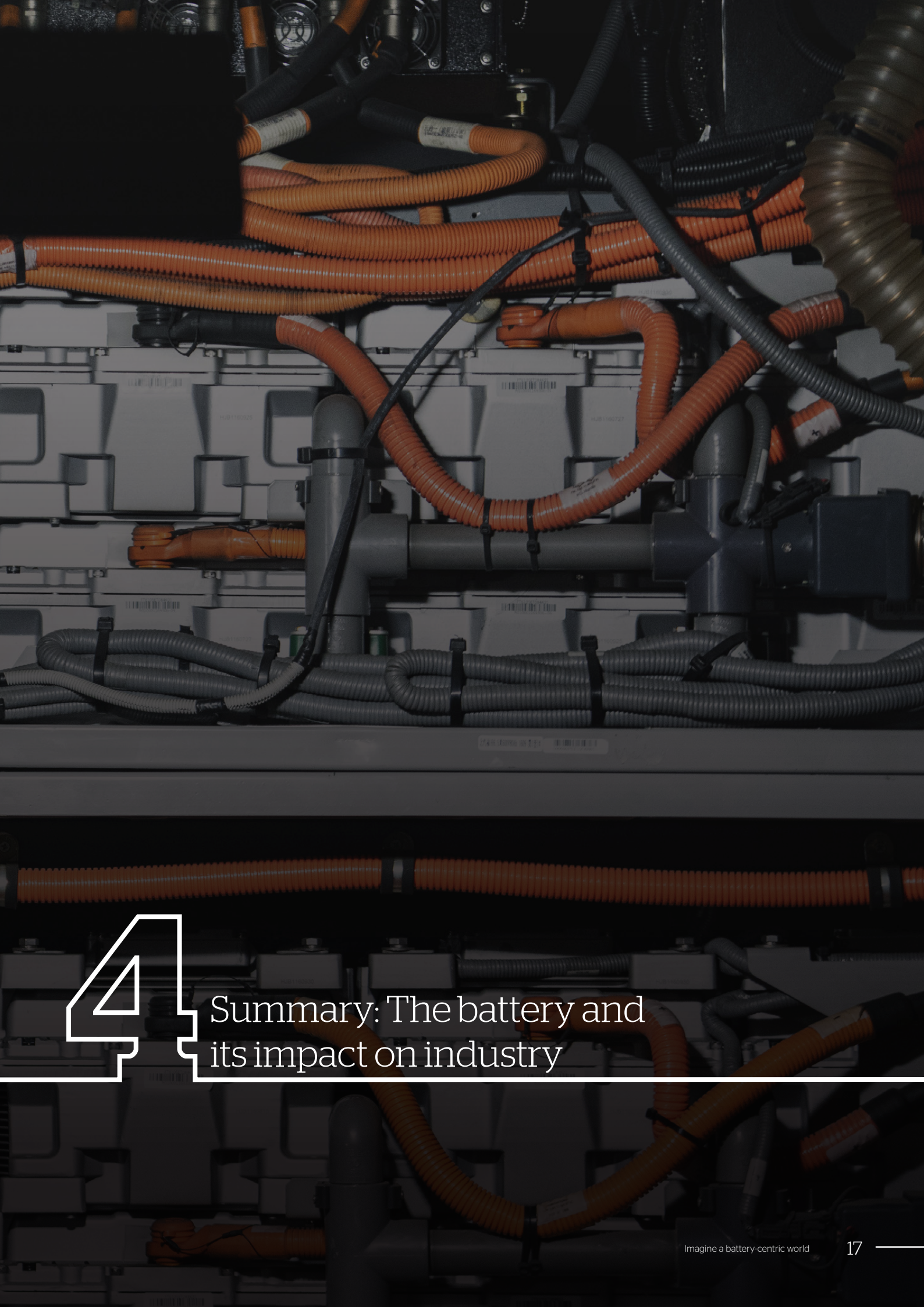
The IT industry has proved for many years that this virtualization scenario works – through the virtualization of servers and clients. Virtualization has led to the extensive cloudification of IT landscapes. The idea of hosting your own applications in your own data centers has largely gone by the wayside in modern IT architectures. The infrastructure parameters are clearly defined in IT, consisting of CPU performance, main memory, hard disk storage, network bandwidth, period of use and duration of use,

among others. The infrastructure that cloud providers offer can be defined by these same parameters.

Similar infrastructure parameters can be defined for energy storage (such as charging time, capacity, performance over the time axis, etc.).

In IT, the formerly unthinkable concept of not managing data, applications and data centers in-house, but obtaining them as services from the cloud is now a completely normal scenario. Users are simply no longer interested in how the service is provided. This may also be the case in the foreseeable future with the energy storage system described.





# 4

Summary: The battery and its impact on industry

# The battery and its impact on industry

In addition to the actual battery technology, IT technology is a key component of successfully putting this or comparable visions into practice. The ecosystem that will come together here will be decisive. In the automotive industry, key business fundamentals are being eliminated. The after sales area will be massively reduced for EVs, which will also affect suppliers and repair shops. The key differentiator of highly efficient and mature engines will also no longer exist. The **automotive industry** is therefore likely to have a keen interest in pushing ahead with innovative ideas in what is now a key technology for them. Building on the knowledge and experience of managing and bringing together different **suppliers** to create a quality product, **OEMs** could seek their opportunity.

However, perhaps **battery manufacturers** are also putting themselves at the heart of these newly forming ecosystems, since they produce the core of the new system and are often well funded.

From a corporate culture perspective, the so-called **hyperscalers** such as Google, Apple and Amazon are destined to have an important role in the ecosystem. They already know how to introduce new offerings in a market-dominating manner and achieve monopolistic positions with an aggressive growth strategy. In the field of autonomous driving, they already play a significant role and use their competencies as well as experience in data management. **Start-up companies** that participate in the market without any burdens or conflicts of interest with existing business models also have a good opportunity to take a leading role.

Of course, the battery-centric world scenario can also be a field of activity for **energy companies**. The oil industry and service station operators are losing a significant part of their customer base. Thus, a large and politically influential industry sector is being massively affected by these changes. The essential question will be whether the current prevailing attitude will evolve and the

necessary changes will be made in order to seize opportunities – even if it cannibalizes their existing business model.

**Utilities**, on the other hand, have a great deal of experience operating critical infrastructure and with the energy market in general. They will continue to play a leading role in the ecosystem of the future. There will be countless business models that combine profitability and sustainability and go far beyond the sale of vehicles, electricity and batteries. The future will show who can position themselves to succeed in these new market areas.

# Key Contacts



**Matthias Böhmer**

Manufacturing Managing Partner

Atos Information Technology GmbH

Otto-Hahn-Ring 6  
81739 München

Tel. +49 211 399 31364

matthias.boehmer@atos.net  
www.atos.net



**Dr. Roman A. Dudenhausen**

Vorstand / ceo

conenergy ag

Norbertstraße 3  
D-45131 Essen

Tel. +49 201 1022-220

dudenhausen@conenergy.com  
www.conenergy.com



**Heiko Schwidrogitz**

Geschäftsführer

ENERGY4U GmbH

An Atos Worldgrid Company

Albert Nestler Str 17  
76131 Karlsruhe

Tel. +49 721 610 52 100

heiko.schwidrogitz@atos.net  
www.energy4u.org



**Tim Kimpel**

Seniorberater

conenergy

unternehmensberatung gmbh

Norbertstraße 3  
D-45131 Essen

Tel. +49 201 1022-346

kimpel@conenergy.com  
www.conenergy.com



# About Atos

Atos is a global leader in digital transformation with 110,000 employees and annual revenue of € 12 billion. European number one in cybersecurity, cloud and high performance computing, the group provides tailored end-to-end solutions for all industries in 73 countries. A pioneer in decarbonization services and products, Atos is committed to a secure and decarbonized digital for its clients. Atos operates under the brands Atos and Atos|Syntel. Atos is a SE (Societas Europaea), listed on the CAC40 Paris stock index.

The purpose of Atos is to help design the future of the information space. Its expertise and services support the development of knowledge, education and research in a multicultural approach and contribute to the development of scientific and technological excellence. Across the world, the group enables its customers and employees, and members of societies at large to live, work and develop sustainably, in a safe and secure information space.

Find out more about us

[atos.net](https://atos.net)

[atos.net/career](https://atos.net/career)

Let's start a discussion together



---

# About conlenergy

con l energy AG is a leading service company for the energy industry. Founded by today's board members, Dr. Roman Dudenhausen and Dr. Niels Ellwanger, con l energy has won over 500 companies from all areas of the energy industry as customers. The basis of success is the connection between in-depth market and industry knowledge with pragmatic, solution-oriented implementation.

At conlenergy we are fully committed to a sustainable energy future. As a group, we support companies in their transformation process with consulting, marketing and information services as well as with efficient IT tools. We are a strong partner in change and develop holistic strategies for the challenges of the energy, heat and mobility transition in an increasingly digital world. Discover in which fields we are at your side as a qualified partner and benefit from the synergies within our group of companies.