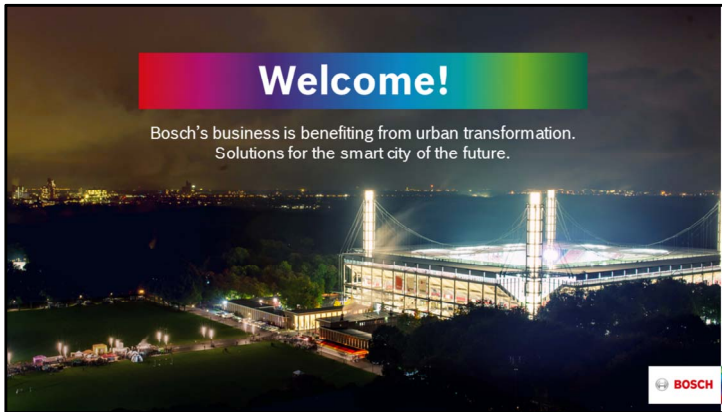




## **Bosch Energy and Building Technology press briefing**

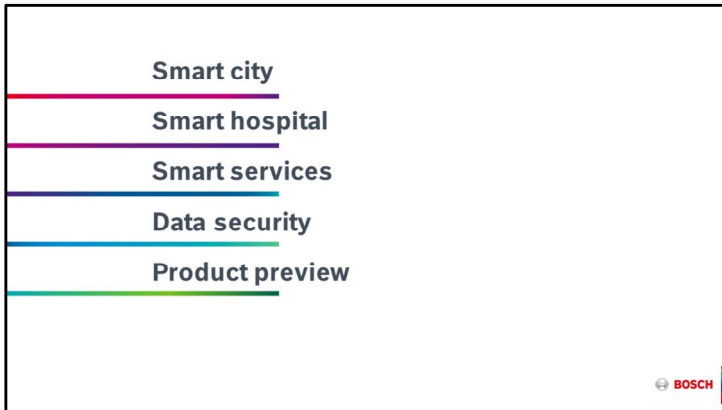
Presentation by Dr. Stefan Hartung,  
member of the board of management of Robert Bosch GmbH  
at the Bosch Energy and Building Technology 2017 press event on  
October 5, 2017  
in the Rheinenergiestadion, Cologne

Check against delivery.



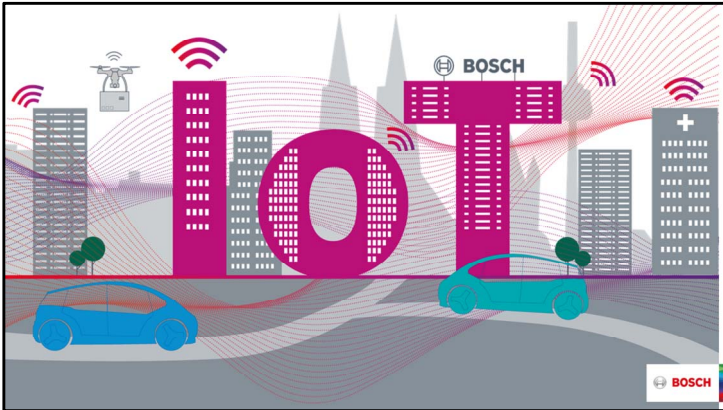
## **Welcome**

- Welcome to the Rheinenergiestadion in Cologne!
- This stadium, a place for sports, fun, and excitement, is the ideal venue for me to introduce to you our energy and building technology business.
- Safety, convenience, and efficiency lay the groundwork for fascination – a fascination with sports and technology alike.



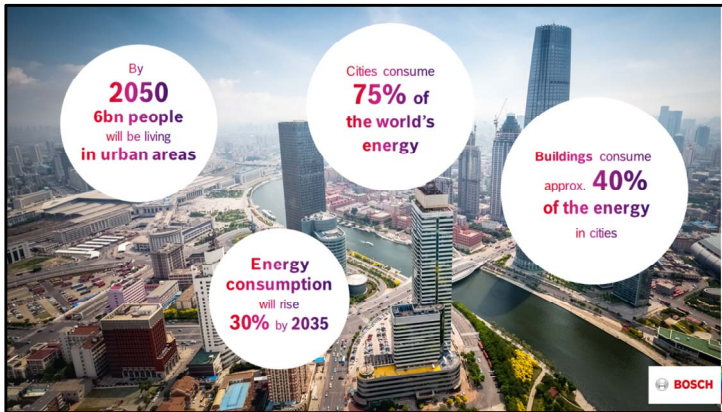
## Agenda

- As you will see, our Bosch solutions are fun to use and fascinate our customers.
- Today, I particularly wish to talk about smart cities and what Bosch can contribute to them.
- A city can become “smart” only if its buildings are smart; that’s why I also want to devote some time to the topic of smart hospitals.
- Besides smart buildings, a fundamental element of the smart city is smart services, so I will be introducing those to you today as well.
- I will also talk about the very important issue of data security.
- Finally, I will talk about the important issue of data security and provide a preview of the products in our exhibition.



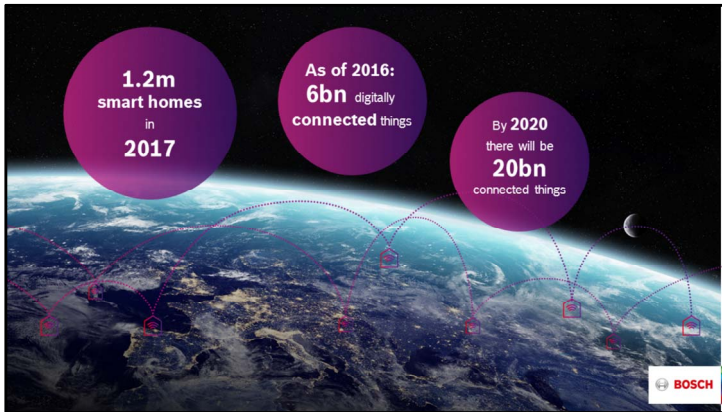
## Vision

- Let me start with a vision.
- Cologne, 2030:
- Energy is derived primarily from renewable sources. Virtual power plants – by which I mean a network of small distributed facilities that store power or feed it into the grid as needed – have replaced conventional facilities.
- Battery storage solutions are everywhere.
- All the buildings in the city are smart and intelligently connected to one another.
- Building maintenance no longer needs to be done by people; instead, smart services can monitor the condition of elevators or heating and air-conditioning systems in real time. In an emergency, a technician can be automatically notified.
- Access control for certain areas is automatic as well.
- Commuters can see in real time when and where it makes sense to switch to public electric transportation, avoiding traffic jams and emissions as far as possible.
- Residential buildings will feature interconnected household appliances, heating systems, and security systems.
- Why? Because this will allow us to offer our customers new services.
- All this and more is part of our vision of the smart city of the future.



## Market

- By 2050, experts predict there will be more than 6 billion people living in urban areas around the world – twice as many as there are now, and comprising 70 percent of the total global population.
- Cities account for some 75 percent of power consumption around the world, with 40 percent going to buildings alone.
- By 2035, global energy consumption will rise by 30 percent.



## Market

- The internet of things (IoT), meaning the number of connected devices, is seeing enormous growth.
- In 2016, more than 6 billion things were already digitally connected.
- By 2020, this number is expected to exceed 20 billion.



## Market

- Market research company Gartner predicts that, in the year 2022, an average family household will have 500 smart, connected objects.
- Motion detectors, smoke alarms, and cameras will be connected to the internet, as well as classic tablets, TVs, smartphones, electricity meters, and the many domestic appliances in the kitchen and laundry room.
- By 2020, some 230 million homes around the world will feature smart connectivity – or approx. 15 percent of all households.
- Experts predict the global market will be worth 250 billion dollars by 2020 as well.
- We at Bosch would like to tap into this potential.
- In 2016, Bosch sold 27 million connected products.
- Also in 2016, the Energy and Building Technology business sector’s 30,300 associates worldwide generated sales of 5.2 billion euros.
- Sales are expected to grow some 5 percent in 2017 – more than twice the rate of the previous year.
- This growth is being driven in part by solutions for smart cities, smart homes, and smart services.



## Market

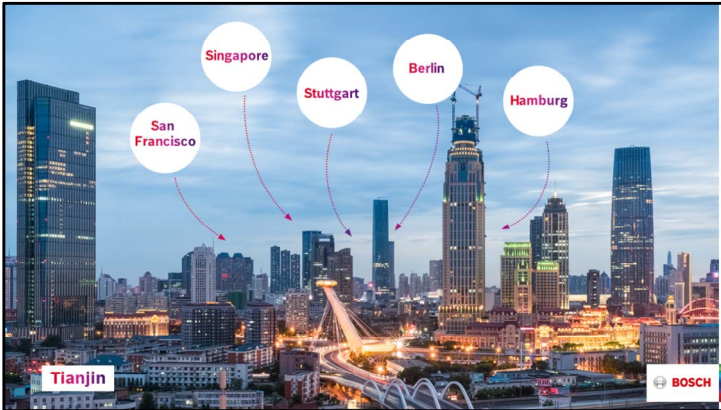
- We want to use connected technologies to make people's everyday lives safer, more convenient, and more efficient.
- And we will do that with vibrant, attractive, sustainable, and connected communities – whether here in Cologne, in Shanghai, San Francisco, or Mexico City.
- More and more, this everyday life will be located in megacities and other urban centers. Cities that will be increasingly connected. Cities that connectivity will once again turn into vibrant, attractive, and sustainable living environments for people.





## Market

- How does a city become intelligent? How does it become a “smart city”?
- The technical explanation is the internet of things (IoT).
- When it comes to the IoT, Bosch is better positioned than any other company, from sensors to software to services.
  - **Sensors:** Bosch is one of world’s biggest manufacturers of micromechanical sensors, the “sensory organs” of the IoT.
  - **Software:** Bosch employs more than 20,000 software engineers worldwide, nearly 4,000 of them for the IoT alone.
  - **Services:** Bosch is developing not only technology, but new business models as well. In the future, services will account for more than half the IoT market.
- And of course, we have already been successful in the hardware segment for decades.
- Bosch’s broad portfolio is the key to making the smart connected city a technological and commercial success.



## Smart city projects

- We are already applying the full scope of our IoT expertise in smart city projects:
  - In June 2017, we signed a contract for a strategic partnership with the Chinese port city of Tianjin.
  - Objective: to jointly implement the “Smart Tianjin” initiative.
  - The idea is to refit the port city to make it smart.
  - For its part in the initiative, Bosch will draw on expertise gained in smart city projects that are already in progress.
  - They include urban projects in Singapore, San Francisco, Stuttgart, Berlin, and the Hamburg docks.
  - For example, in San Leandro, near San Francisco, we have installed intelligent street lights. They help conserve energy. Our sensors there can also measure and assess air quality. Intelligent cameras monitor traffic.
  - Bosch is currently pursuing beacon projects in 14 different cities.
- It’s important to realize that “smart” is not reserved for cities that still exist only on the drawing board, like so many in Asia. Instead, it is more so the cities that already exist today that must solve urgent problems such as energy shortages and crime – and can do so with our technologies.



## Smart city projects

- For smart cities, Bosch offers solutions for mobility, energy, buildings, security, and safety, as well as e-governance, or digital city administration.
- In the field of energy, our portfolio includes virtual power plants; energy-efficient heating, hot-water, and cooling systems; and energy storage systems.
- The safety and security solutions cover systems for fire protection, access control, and video surveillance.
- For residential buildings, Bosch offers smart-home technology and connected household appliances as well as related services.
- And as the world's largest automotive supplier, Bosch also offers mobility solutions for the smart city of tomorrow.



## Smart city projects

- Let's take a look at San Francisco. The first Europeans settled there in 1776. Now, 240 years later, the continent's fourth-largest city is changing to adapt to the needs of the future.
- As part of the FivePoint project, the two new city districts of San Francisco Shipyard and Candlestick Point are being built on the site of an old navy shipyard and a former sports stadium.
- The plans call for 12,000 homes, a large shopping center, numerous office buildings, and 300 art studios.
- It is the largest urban development project in San Francisco's history since the earthquake of 1906.
- As a technical partner of FivePoint, the project developer, Bosch is devising smart solutions locally.



## Smart city projects

- One of the solutions for city administration is the city data platform: an administrative tool essential for monitoring all the data generated on site, whether from the traffic, power, or security systems.
- Residents all receive a smart community app with which they can adjust entry control systems or call up localized real-time information about public transportation.
- Connected communications make it easier for the city and its residents to exchange information.
- More security, less stress – that is what people in the connected city should experience.



## Outlook for the smart city market

- In the period up to 2020, the smart-city market will grow 19 percent each year, reaching a volume of 700 billion euros.
- In cross-departmental projects, Bosch has already doubled its sales in this sector over the past two years.
- As early as 2016, Bosch had achieved around 1 billion euros in sales through cross-selling projects, which combine all elements of Bosch expertise – products, solutions, and services.
- Bosch’s broad portfolio is the key to making the smart connected city a technological and commercial success.



## Smart hospital

- A city is only as smart as the smart buildings in it. Along with residential buildings, factories, and office buildings, these include other commercial structures such as hospitals.
- I am pleased to introduce to you today a new Bosch business area:
- *With building and energy solutions, Bosch serves as a consultant, installer, and service provider to support hospitals on their path to becoming smart hospitals!*



## Smart hospital

- Hospitals and clinics have the highest standards when it comes to reliability and availability.
- After all, they must be available 24 hours a day, 356 days a year.
- The rising complexity and connectivity of building, communication, IT, and medical technology are driving up personnel expenses at the same time that cost pressure is increasing.
- According to a study by Roland Berger, this is why nearly 90 percent of all hospitals have developed a digitalization strategy focused on improving their efficiency and profitability.





## Smart hospital

- With the help of intelligently connected camera and video technology, Bosch can prevent the theft of expensive medical equipment, prohibit unauthorized persons from entering secure areas, and notify the OR of the arrival of a rescue helicopter.
- The insurance industry reports that hospital operators across Europe are incurring losses in the millions due to theft of endoscopic equipment. Sensor-based video technology in entryways, at exits, and in corridors can provide crucial evidence for prosecuting any offenders.
- Prevention is just as important: intelligently controlled lighting, connected motion sensors on doors and windows, and intrusion alarm systems deter break-ins, prevent theft, and save hospital operators the high cost of replacing expensive medical equipment.
- Bosch aims to improve all a hospital's processes across domains, which benefits operators, doctors, and nursing staff.
- Most importantly, though, smart hospitals mean more time for patients. Doctors and nurses will be able to devote more time to their most important target group.
- Ladies and gentlemen, the internet of things has thus finally arrived in hospitals.
- Allow me to name a few specific examples where Bosch is actively involved.



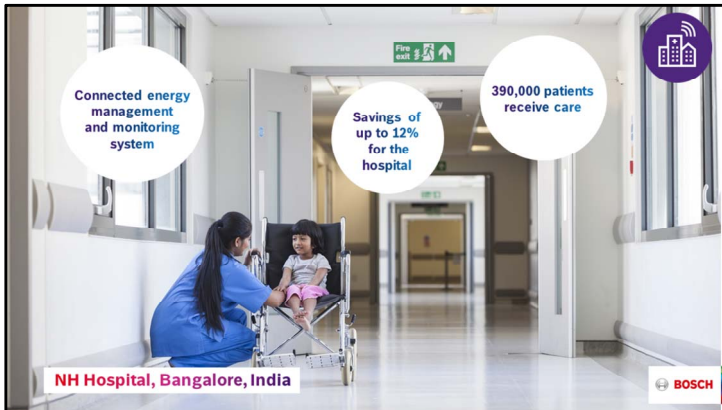
## Smart hospital

- In Germany, we provide the University Hospital Rechts der Isar with connected security technology.
- Its gates, intercom systems, fire alarms, and intruder alert and theft alarm systems are all supplied by Bosch.
- Four screens with multi-image display function make it possible to seamlessly monitor 34 clinics and departments.
- Connected cameras and monitors record the landing of a rescue helicopter, send notice of its arrival directly to the OR, and notify the relevant staff.
- Costs of acquiring more than 70 cameras were avoided.
- Operating costs were cut.
- Staff workload was eased.



## Smart hospital

- Through its North American subsidiary Climatec, Bosch has been a partner to Banner Health for many years. The company is one of the largest nonprofit healthcare providers in the U.S. (29 facilities in 7 states).
- Bosch develops and integrates solutions in new and retrofitted hospitals.
- In 15 different facilities, Bosch is the hospital operator's main point of contact.
- Installed solutions include: building automation, air conditioning, fire alarms, and nurse-call and infotainment systems for patients.
- Integrated and connected, from a single source. The aim is to use connected solutions to create environments for conveniently providing medical care to patients, environments that are both economically sound and safe to operate.



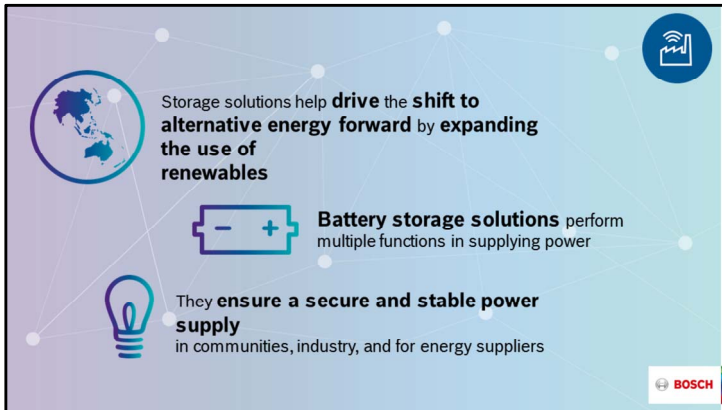
## Smart hospital

- Since December 2016, Bosch has been an energy partner for a cancer treatment center in Bangalore.
- The Mazumdar Shaw Medical Center has 750 beds and treats some 390,000 patients a year.
- The center is part of the NH network (Narayana Hrudayalaya), one of India's largest healthcare providers with 30 facilities at 18 locations.
- NH Hospital in India uses our connected energy management solution.
- Bosch has also equipped the hospital with a facility management solution, complete with an energy management and monitoring system.
- Ultimately, the new concept saves the hospital some 12 percent of its overall costs.
- Staff enjoy improved processes, receive energy data in real time on their smartphone, tablet, or desktop computer, and can respond immediately if they spot anything out of the ordinary.
- Here, connectivity provides the basis for further optimization measures in energy efficiency, and also offers an opportunity for integrating other areas, such as patient care.
- Smart energy management thus offers significant benefits...



### **Battery storage solutions**

- ...but Bosch is also concerned with storing energy.
- In India as in many parts of the world, a stable power supply is not a given.
- Our solutions can lessen the impact of the consequences.
- In Germany, too, we aim to provide a stable and secure power supply. After all:



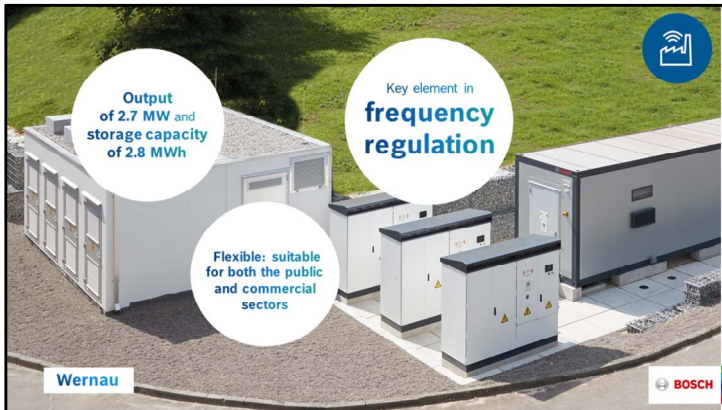
## Battery storage solutions

- Over the next few years, energy consumption will rise by some 30 percent around the world.
- This energy should come from renewable sources if possible, as this is the only way to achieve the climate targets of the Paris accord.
- For Bosch, therefore, it is important to assist in the shift toward renewable energy, for example by supplying energy storage units to Braderup in Schleswig-Holstein, Germany.



## Battery storage solutions

- Stationary energy storage systems solve one of the challenges presented by renewable energy: what should you do with energy that has been generated but is not needed right away?
- One of Europe's largest hybrid battery systems stores electricity generated by a community wind farm in Braderup and feeds it into the grid as required.
- Bosch designed and built the hybrid system with a total capacity of three megawatt hours (3 MWh). The system consists of a lithium-ion component (2 MWh) and a vanadium redox flow unit (1 MWh).
- Bosch also developed the electronic solution for managing the system plus the necessary software.
- Some ten kilometers of underground cable link the hybrid battery system to the grid operated by Schleswig-Holstein Netz AG.
- Whenever the power grid is unable to absorb any more clean electricity, the batteries step in and store the electricity for it to be released later.
- So there is no need to shut down the wind farm or turn its turbines out of the wind when the grid is overloaded.
- The double battery can store energy over the short and long term.
- With a total peak capacity of 2,325 kilowatts, the Braderup hybrid battery facility stores enough power to cover the electricity needs of 40 single-family homes for an entire week.



## Battery storage solutions

- This project was also an important research project for us. We took the experience gathered from our assessments and incorporated it into further refinements to our energy storage solutions.
- A few weeks ago, a newly developed battery storage system went into operation at Bosch Thermotechnik GmbH in the town of Wernau, near Stuttgart.
- It has an output of 2.7 MW and storage capacity of 2.8 MWh.
- This pilot facility is a standardized, modular solution that can serve a wide range of customers and applications.
- What makes it special is the air-conditioning system installed in the unit next to the batteries, thus ensuring that they have a long service life.
- Three inverters with a total rated output of 2,700 kVA and transformers convert the stored energy from direct current into alternating current, so it can be fed into the grid.
- If there should be a sudden power failure, Wernau's innovative battery storage system can supply customers with electricity usage of around 3,900 KWh/year.
- The system is suitable for use in both the public and the commercial sectors.
- In contrast to our solution in Braderup, the Wernau system has only lithium-ion batteries. Due to their structure, they can be charged and discharged faster than the vanadium redox flow units.
- It was primarily developed to improve frequency regulation in the power grid.





## Services

- Ladies and gentlemen, as I said at the beginning, services will play a crucial role in connectivity, both for customer benefits and for commercial success.
- Bosch aims to make connectivity technically feasible with its sensors and software, but it is also looking beyond that: we want to develop services that help enhance convenience and quality of life.
- We expect that by 2020, every web-enabled device will come with a service included.
- In our exhibition, my colleagues will present several examples of those services. I will just name them briefly now.



## Services

- Bosch developed its In-Store Analytics solution for retail businesses. It allows them to study their customers' behavior from anonymized data in a way that is compliant with all data privacy laws.
- Sales of products often depend on their placement within the store and at what point shoppers see them on their journey across the retail floor. In-Store Analytics provides those responsible for retail design and product-range planning with dedicated tools that improve how they track customer interaction in the store and help them incorporate those insights into the store design.
- Bosch IP panoramic cameras capture customers as they move through the store and record data on their positions. This makes it possible to precisely analyze what route customers take and how long they linger at different points throughout the store.
- Retailers can fully rely on the highly accurate KPIs delivered by In-Store Analytics. This level of data precision is made possible by a multistep analysis process. First, Intelligent Video Analytics faithfully translate shoppers' movements into anonymized position data. Then the data is further filtered by cloud-based algorithms, analyzed, and processed into reliable KPIs and graphics. The accuracy of the data is also monitored throughout the entire system uptime and corrected where necessary.
- In many other systems, customer movement is analyzed by an additional and expensive server PC, which usually has only a limited number of cameras to work with. The advantage of the Bosch solution is the distributed data generation in the cameras, which function as smart sensors to enable the analysis even of large retail spaces.



## Services

- Another service we wish to introduce to you today is predictive maintenance for elevators.
- We are taking our expertise from industrial manufacturing and applying it to elevators as well.
- Sensors and cameras can detect malfunctions in elevators before they cause real damage.
- This makes it possible to schedule maintenance well in advance. Unexpected breakdowns, such as the well-known scenario of getting stuck in the elevator, can be minimized.
- Another service Bosch offers is connecting the elevator's emergency call system to the Bosch control center, in which case a technician will arrive within 30 minutes to fix the problem.



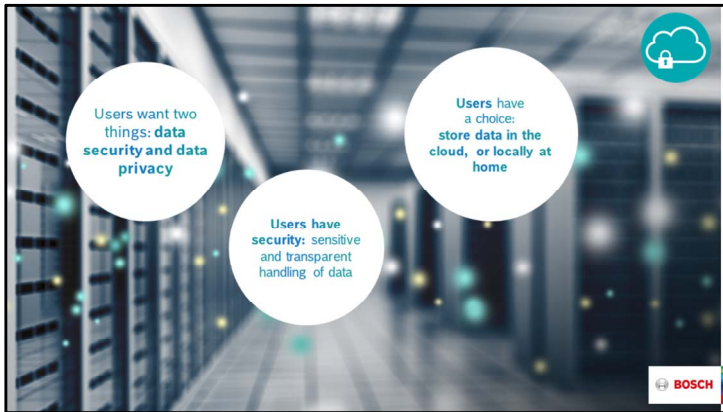
## Services

- One service that is very important to us is Bosch secure truck parking.
- According to its Federal Transport Ministry, Germany has a shortage of some 14,000 parking spaces for trucks – a figure that is set to rise sharply. This shortage, especially of secure parking options, has several consequences: TAPA EMEA (Transported Asset Protection Association Europe) reports that cargo theft in Europe is causing losses of over 16 billion euros per year.
- With the Bosch solution, parking lot operators can offer spaces they have available on an online platform.
- An app informs dispatchers and drivers about available spaces and their details. The security ranking feature in particular provides detailed information on the security measures in place at a parking lot.
- Freight forwarders, dispatchers, and truck drivers can book these available spaces directly on the platform. This eliminates the long search for a parking space and keeps them from having to park on the side of the road.
- Fewer trucks have to park at the side of the freeway.
- The cargo is secure, and drivers can enjoy a safe night of stress-free rest.



## **Data security**

- We can protect not only our customers, but also the data that they have entrusted to us.
- We want to be sure that our data is secure, especially in the places we feel safest: at home, within our own four walls, as well as at work or on the road.
- A survey indicates that data security is a special concern for 92 percent of those who already use smart home applications.



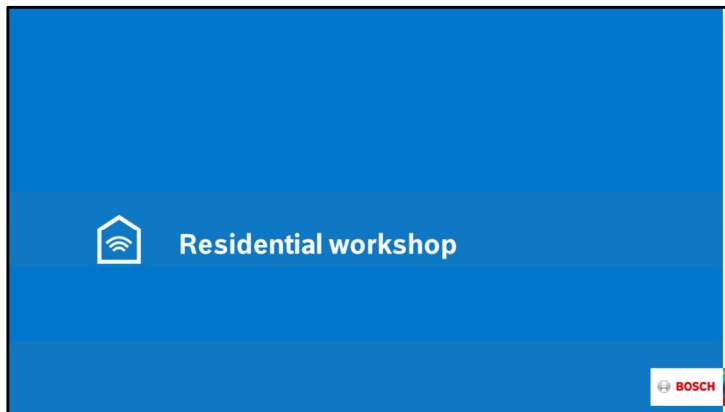
## Data security

- At Bosch, we pledge the following: to transparently handle data in a way that inspires trust. We believe that doing so will set us apart from the competition.
- Our users have the option of uploading their data to our cloud or storing it locally at home. Neither option limits the benefits of the services. In other words, customers have full control over what happens to their data.



## Data security

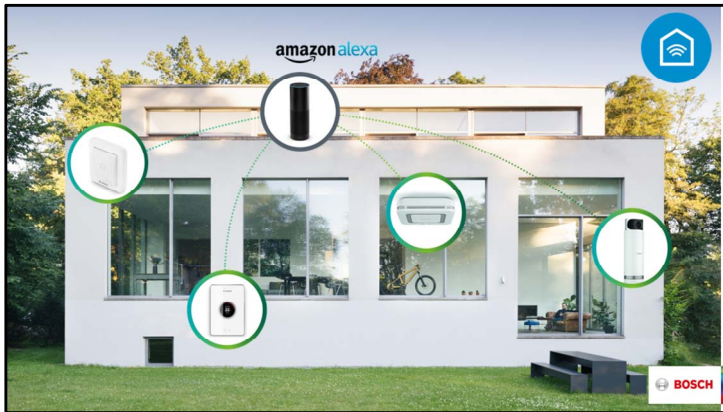
- Bosch solutions meet the highest standards of systems security, data privacy, and data security.
- The security of our smart home solutions has now also been confirmed by a renowned independent institute for IT security.
- We received the AV certification's highest possible rating thanks to our stringent standards in data privacy, encrypted communication and connections, active authentication, and secure remote management.
- Data privacy and information security are a fixed element of our corporate policy.



### **Product announcements**

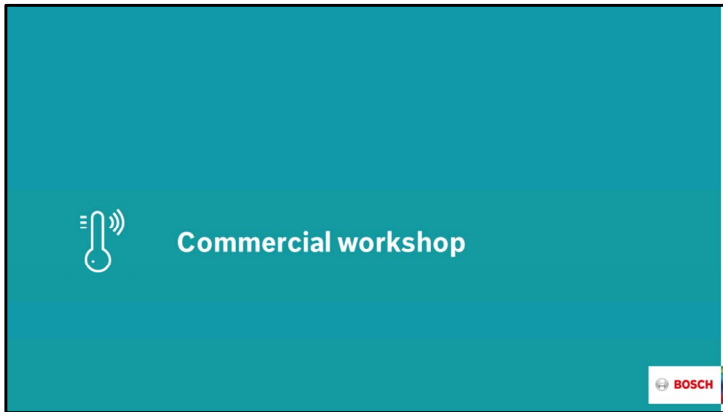
- I have now reached the end of my presentation, and wish to turn your attention to the workshops that will be taking place afterwards.
- We have split our exhibition into a residential and a commercial workshop.





## Product announcements

- In the residential workshop, we're introducing innovations in thermotechnology and the smart home.
- These include our smart home portfolio – for example, the 360-degree camera.
- Customers can now control many of our solutions using Amazon Alexa, too.



### **Product announcements**

- In our commercial workshop, our experts will present our services.
- There we will showcase products that are designed especially for use in commercial buildings.



## Product announcements

- Besides the latest solutions in security technology, in the commercial workshop you will see for example Air Quality Monitoring, a solution for analyzing and adjusting the indoor climate. The result is more fresh air, a more pleasant climate, and increased employee satisfaction.



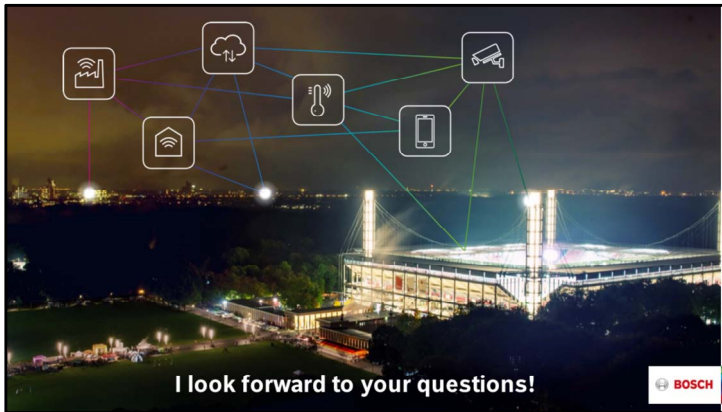
## Outlook

- As you will see, not only are we making the smart city a reality, but we are also working to improve your safety and security.
- We help make your healthcare, your power, your buildings, and your data secure.
- Our goal is to make our customers' lives safer, more convenient, and more efficient – in other words, to help improve their quality of life.



## Outlook

- More and more, the products, systems, and infrastructure Bosch offers its customers for residential and commercial buildings are intelligently connected and can be combined with services to form integrated solutions:
- Smart buildings, smart energy, and smart services.
- In just a few moments, right here in the stadium, you can experience for yourselves what that means: we will show you in our workshops and with a tour of the Rheinenergiestadion here in Cologne.
- One final important point: Bosch connected products are fun!
- And I hope you will have fun, too, as you experience our new product solutions.



- I now look forward to answering any questions you may have.