



# SUSTAINABILITY STORIES

APRIL 2022



## THE ELECTRIFICATION ISSUE

# INTRODUCTION



## Welcome to NXP's *Sustainability Stories*: Issue 2.

*We live in an exciting and transformational time where semiconductor technology is more critical than ever.*

At NXP we believe in technology as a powerful catalyst for change. That's why we use innovation to enable a better, safer, more secure and sustainable world.

We recently published our annual [Corporate Sustainability Report](#) detailing the company's sustainability performance, progress, and the strategy and principles that continue to guide our journey.

This bi-annual magazine is another way you can join us in our sustainability journey.

As you'll see in the pages that follow, we believe in furthering our legacy of sustainable innovation and will continue to apply our technologies in ways that help advance global sustainability. I'm proud of our continued progress and energized by the work ahead. I hope the stories in this issue enlighten and inspire you.

Here's a taste of what you'll find in this issue:

- Our lead story reveals the surprising breadth of the revolution underway in electric transportation and how NXP's smart and secure technologies help realize that future.
- Our recurring DE&I feature discusses NXP's new *Inclusion Insights* initiative designed to embed inclusive practices throughout our company at every level.
- A visit to our wafer fabrication facilities in Austin, TX, highlights how materials aren't just recycled but reused by other manufacturers, adding another dimension to our commitment to sustainability.
- The latest on NXP's innovative work on developing sensors that can be powered by electricity in the soil.

I invite you to explore these stories and join us on our sustainability journey by visiting our [website](#) and [blog](#) or following us on [social media](#) where we post new stories and related content. And stay tuned for issue #3 of *Sustainability Stories* later this year!

**Jennifer Wuamett**  
EVP, General Counsel, Corporate Secretary and Chief Sustainability Officer

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# BUILDING THE FUTURE OF ELECTRIC TRANSPORTATION

Let's "look under the hood" on some of the key innovations that are helping build this future and, in many ways, already making it a reality.



BATTERIES  
ARE JUST  
THE BEGINNING



If you've seen an electric vehicle or hybrid on the road, or maybe you drive one, you're witnessing a transformation of transportation to electricity. What you may not have seen is the revolution underway in how vehicles manage battery charging and electricity use, the ways they connect and use AI and machine learning to get smarter and make driving safer, and the innovations that will redefine how we access and maintain them reliably and securely.

## The Present is Starting to Look Like the Future:

If the world's transition to using electrified transportation was a question, it was answered with an exclamation point last year.

**Global sales** of electric vehicles ("EVs") reached 6.75 million units in 2021, 108% more than in 2020 and included passenger vehicles, light trucks, and light commercial vehicles. **Every leading automaker** either sells or plans to introduce EV models, some will soon only sell EVs in select markets, and General Motors, Volvo, Jaguar, and Mercedes **announced plans** for all or only-EV lineups as soon as two years from now (and no later than

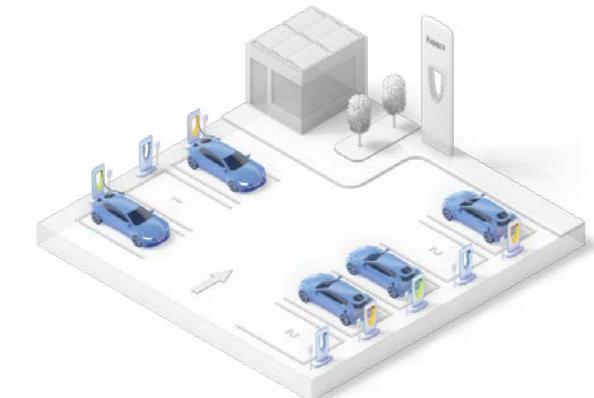
2035). It's hard to keep up with the announcements of new vehicles and plans, with manufacturers regularly making news ([Ford](#), [Sony](#), and [Honda](#) revealed new plans as this magazine was going to print).

*While this transformation might start with the idea of battery-powered vehicles, making it a reality involves going far beyond replacing fuel tanks with batteries.*

It means giving vehicles the battery power to get people and things where they need to go, and the charging capacity to go further, and putting into

a place a charging infrastructure that mirrors the availability of gas stations. It also requires making sure that all the EVs hitting roads can rely on reliable network connectivity that allows for easy access, maintenance, and guards their data and privacy. Making all of this happen needs to be safe and secure, too, as well as upgradeable to incorporate the latest innovations in AI and machine learning that enable driver assist and autonomous driving capabilities.

NXP is working every step of that transformation and building present-day electric transportation that is starting to look like the future.



## Batteries Are the Starting Point

While batteries aren't the end of the e-revolution story, they certainly are the beginning and as a fuel source they directly impact the driving range, functionality and, therefore, user adoption and satisfaction. They also have very little in common with the batteries we use in our everyday lives, swapping in and out of TV remotes or other devices when they run out. EV batteries are complex, intelligent machines and semiconductors play a significant role in their operation. The better they are managed, the farther EVs will go on a single charge.

For instance, Battery Management Systems ("BMS") include integrated circuits ("ICs") and sensors that control critical characteristics, namely voltage, temperatures, and current, which not only maximizes a battery's electrical output but balances its functions and helps ensure it operates safely. Two out of the top three EV makers used NXP BMS in 2021 (Volkswagen selected NXP as their strategic partner for BMS over two years ago), and our solution has been designed in to 16 of top 20 OEM battery systems.

[Click here for a technical deep dive on our \*\*battery solutions\*\*.](#)



## Using Less Means Going Further

Once batteries are operating at peak efficiency, the next phase of the story involves converting that power into torque that turns the wheels and runs all the onboard technologies (from entertainment systems to opening and closing windows). Vehicles are actually complex technology systems that use electricity to run hundreds of sensors and functions, and EVs rely on technology even more. This means that distributing and using electricity is as important as producing it when it comes to enhancing the driving experience.

NXP provides carmakers with a framework for building next generation of electric and hybrid vehicles called a

"[power control reference platform](#)" that combines our power inverter (it's what translates high-voltage battery power into the current necessary to drive a traction motor), our world-class microcontrollers, power management system chips, and gate driver chips to connect with other components of a vehicular system that have been designed into nine of the top 20 EV-OEM inverter projects.

### Convenient, Secure, and Fast Recharging

As any machine that consumes energy, EVs need to be refuelled and this means giving drivers convenient, fast, and easy access to recharging stations,

whether public or private. Perhaps not surprisingly, accomplishing this isn't as simple as providing more "outlets" or merely plugging in: charging must provide safe, as well as secure reliability in power measurement and financial transactions.

For example, grid operators need real-time and reliable data on energy consumption to efficiently and effectively manage the power load. Also, energy suppliers need customer IDs, accurate records of energy consumption, and up-to-the-moment tariff and billing info to create and deliver orders used for settlement of payment. Further, charger operators require records and analyses of performance data to manage

and maintain their infrastructure. Finally, EV charging station manufacturers need to monitor equipment health status and manage hardware and software repairs and updates.

Such connectivity also enables a variety of innovations, such as electricity prices adjusted by demand, incentivizing charging at off-hours, and EV owners selling excess power stores in their batteries back to the grid when it's needed most. In addition, it makes EV ownership easier and more satisfying.

Check out our [charging solutions](#) on our website.

*Charging must provide safe, as well as secure reliability in power measurement and financial transactions.*



## Secure Connectivity

Speaking of security, an EV is a collection of Internet of Things devices on wheels, if you think about it, which means they connect with other vehicles, the surrounding infrastructure and to data in the cloud so they can do things such as acquire real-time driving information and entertainment content, and access and accomplish AI and machine learning to improve their functionality (a stationary charging station is similarly connected). This creates potential “doorways” for hackers, making EV security as important as driving and charging performance.

Just this past January at the Consumer Electronics Show, NXP along with our partners demonstrated a solution that enables remote access to battery and energy management, which carmakers can use to improve performance and support intelligent vehicles.

*The power of the intelligent edge and the intelligent cloud working together allows for load balancing to make sure the grid isn't overwhelmed at peak charging times.*

*Find more details on our industry-leading work – such as the term **secure connectivity**.*

## The Road To 2030 Will Be Life-Changing

It's highly likely that you'll see more EVs or own one over the next few years, with [one research firm](#) estimating a ten-fold increase over the course of this decade (from 10 million EVs to 100 million in 2030, though many see the number growing even larger). Not only will each of those vehicles [emit less carbon](#) over their productive lifetimes but the commensurate increase in demand for renewable power sources will further reduce greenhouse gas emissions.

This transformation will impact not only how we drive but make the world around us more sustainable.

NXP is helping build that future.

## NXP WALKS THE TALK (WELL DRIVES IT, ACTUALLY)

**Employees Participate in the E-Revolution**

Team members from around the world are adopting EVs and EV-hybrids and it's changing the way they think about transportation.



"The car (a plug-in hybrid) allows me to commute through the hills around Graz in comfortable silence," explained Thomas Lentsch, VP of strategy working at our facility in Grakorn, Austria. "It made a different driver out of me: it's not the speed that matters anymore but the range I get with one charge and the smoothness of the ride."

aims to reduce this," he said. "It's very quiet, smooth driving, and even though I can't go as far as a full tank of gas in a combustion engine, it's more than enough for a daily commute."



NXP has been encouraging our employees to explore

the e-revolution since at least 2015, when we hosted a demo event in Glasgow, Scotland, at which Andy Turner, Radar Product Manager became a believer. "I considered myself a real petrol head," he said, "[but] it was clear to me that EVs are the future for most circumstances. Since then, my family has had four different electric vehicles."



Robin Liu, a System and Application Engineer for our powertrain and electrification product line from NXP Tianjin, China also cites the environmental impact while not sacrificing city driving comfort or range. "Air pollution here is very high, and the use of EVs in the cities

EV test drives continued through the pandemic, like the event our Toulouse, France team organized to demo Audi's latest electric car (the [e-tron](#) uses [NXP's Battery Management System](#)). NXP isn't just helping build the future of [electrical transportation](#), we're living it.

# Powering Electrified Ecosystems

## EV CHARGING

### EFFICIENT, SMART & SECURE



NXP supports EV charging systems by providing **high accuracy energy measurement products, smart and secure controllers and security products.**

### BATTERY CHARGING CHALLENGES

- Accurate power delivery measurement
- Increased security and safety at the edge
- Cloud onboarding
- Standardized device APIs for billing and control

- Mass deployment readiness
- Artificial intelligence (AI) and machine learning (ML)
- Availability and reliability

### HOW TO PAY



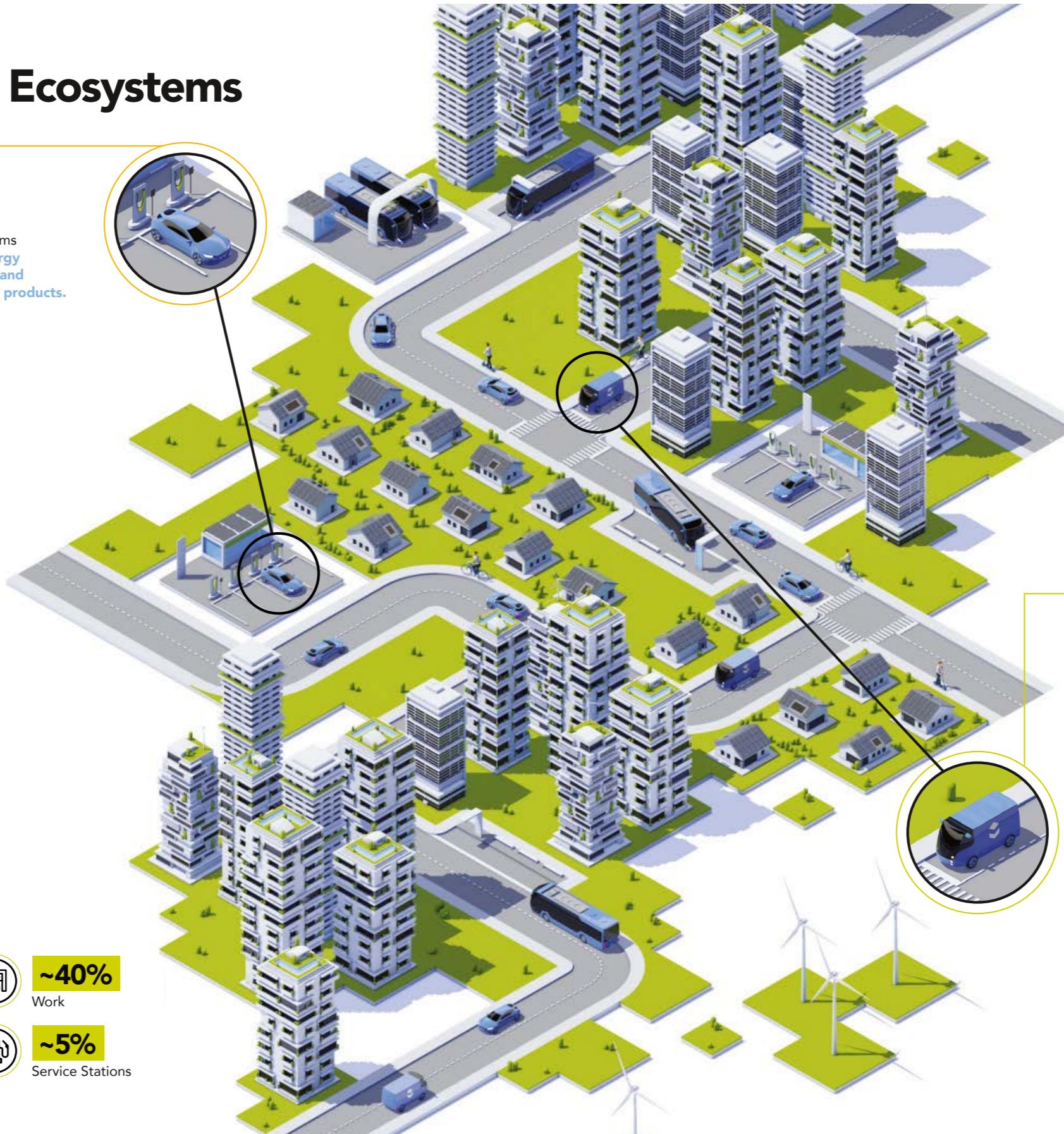
NXP MIFARE & NFC Reader ICs & MIFARE® 2GO

**2030 GOAL** → **Install 15,000+ chargers** within the EU

### MARKET SHIFT TOWARD MULTI-CHANNEL DISTRIBUTION MODEL IN EUROPE

**FUEL**  
100%  
Service Stations

<b>ELECTROMOBILITY</b>	
~40%	Home
~15%	Public
~40%	Work
~5%	Service Stations



## ENERGY MANAGEMENT & SECURITY

### EFFICIENT ENERGY MANAGEMENT

Begins with accurate and secure measurement  
NXP Kinetis MCUs & Azure.

### SECURE ELEMENT (SE)

Provides crypto protocols for secure communication with the EV and storage for credentials. Compliant with ISO 15118.

Enables secure communication between EVs and the cloud for data transfer (e.g. billing, authorization of new car brand).

### EDGELOCK 2GO

Allows key and credential rotation to onboard new application/provider specific certificates.

## EV BATTERIES

**"FAST" 7 KW CHARGE POINT**

8 hrs  
From empty

**"RAPID" 50 KW CHARGERS**

+100 mi  
In ~35min

Li-Ion battery pack prices **are decreasing**

\$917 kw/h

\$58 kw/h

BEVs' avg battery pack size **is increasing**

2021 | 279 mi

2023 | 302 mi

**6.4 M**  
Global EV Sales in 2021

**+104%**  
For the Year

## ENGAGING OUR TEAMS THROUGH INCLUSION INSIGHTS

Culture change happens over time, and it requires intent and observed behavioral changes.



Sherry Alexander, NXP's Vice President and Head of Diversity, Equality, and Inclusion is expanding NXP's DE&I programs and initiatives to meet the needs of today's multicultural workforce and to establish NXP as the technology company where the most talented employees across the globe choose to work.

Culture change happens over time, and it requires intent and observed behavioral changes. As NXP looks to foster a more inclusive culture within the company on a global scale, inclusion must be a meaningful part of our day-to-day activities.

As such, NXP launched *Inclusion Insights* to embed inclusive practices throughout our company at every level. *Inclusion Insights* are one- to five-minute exchanges about specific inclusion topics at the beginning of a meeting. They are intended to serve as regular reminders to each of us about the importance of being inclusive at work, at home, and in every aspect of our lives.

The concept is akin to safety moments, common within industries such as oil and gas where worker safety is paramount. Many companies are accustomed to starting all meetings with a safety moment. It could be as simple as communicating the emergency exits or a more complex discussion to share the root cause and corrective actions for a major safety event.

Safety moments – along with other safety-focused actions like site-level safety metrics and safety walks – serve as intentional, daily reminders about the importance of safety. And creating a heightened sense of awareness changes behavior.

So, we took this concept and applied it to inclusion. Whether opening a formal meeting with an *Inclusion Insight*, highlighting inclusive behaviors,

or discussing a specific topic like unconscious bias, we're focused on intentionally creating more awareness and demonstrating the behaviors we want to see within the company, which ties to the foundation of NXP's core values – trust and respect.

Better engagement, increased collaboration, high performance, and innovation are just a few benefits of inclusion. When our team members feel they are working in an inclusive climate, they are much more likely to come forward with new and different ideas, challenge thought processes, and highlight potential risks to projects, schedules and more, without fear. Inclusion creates an environment in which all team members feel valued, which enables everyone to perform at their best.

We've created an *Inclusion Insights* library to help our team members prepare for formal meetings like town halls. The library includes a collection of one-page insights covering topics like microaggressions, psychological safety and flexible work acceptance and accommodations. Each insight provides a brief explanation of a specific topic and its impact, and helpful tips and examples.

When team members are assured of their value, and feel accepted and respected, we increase engagement, innovation, and profitability. Everybody wins!

[Read more on NXP's diversity, equality, and inclusion initiatives on our website.](#)

# RECYCLING & REUSE



*"It's more about finding opportunities for beneficial business reuse versus simply diverting from landfill."*

Jason Heironimus  
Austin Environment,  
Health & Safety (EHS)

NXP'S TWO MANUFACTURING FACILITIES IN AUSTIN, TEXAS PUT MOST OF THE INDUSTRIAL "WASTE" GENERATED AT OUR SITES TO WORK IN OTHER INDUSTRIES AND APPLICATIONS, ACHIEVING AN OVERALL RECYCLING RATE OF 87 PERCENT IN 2021.

"It's more about finding opportunities for beneficial business reuse versus simply diverting from landfill," explained Jason Heironimus, Austin Environment, Health & Safety (EHS). "By thinking about how and where our waste materials can be put to work, we're not only increasing reuse and recycling, but also benefiting the overall supply chain and reducing expenses."

For instance, Heironimus noted that waste sulfuric acid from semiconductor manufacturing has both onsite and offsite reuse opportunities. NXP reuses waste sulfuric acid as a treatment chemical in our onsite wastewater and air emissions control systems and ships it offsite to be reused as a feedstock in the production of wastewater treatment chemicals. [NXP's Austin facilities](#) provide 2.5 million pounds annually for such applications.

Another reuse-ready material comes from a blend of waste photolithography chemicals which can be used as fuel in cement kilns and other waste-to-energy opportunities. NXP receives recycling credits from the State of Texas for this initiative. Even waste ethylene glycol from manufacturing has reuse applications in other industries.

Not everything is reuse-ready by default, according to Heironimus.

"Hydrofluoric acid is commonly used in manufacturing semiconductors. We neutralize it with calcium hydroxide, creating calcium fluoride, and then run it through a water press that turns it into a dewatered salt. The calcium fluoride is used as a feedstock in cement manufacturing, reducing the need for other natural resources."

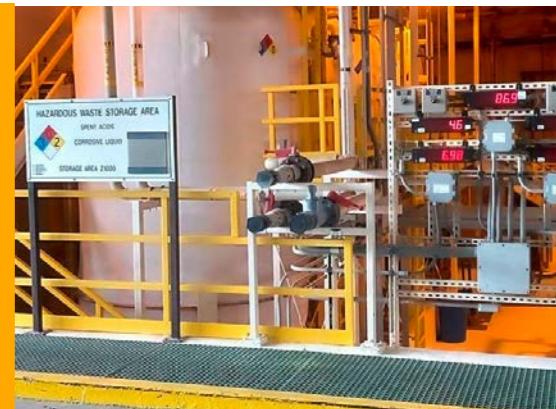
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*"That means 1.8 million pounds every year gets used in other industries instead of putting it in a landfill. It's been a very successful waste reuse initiative."*

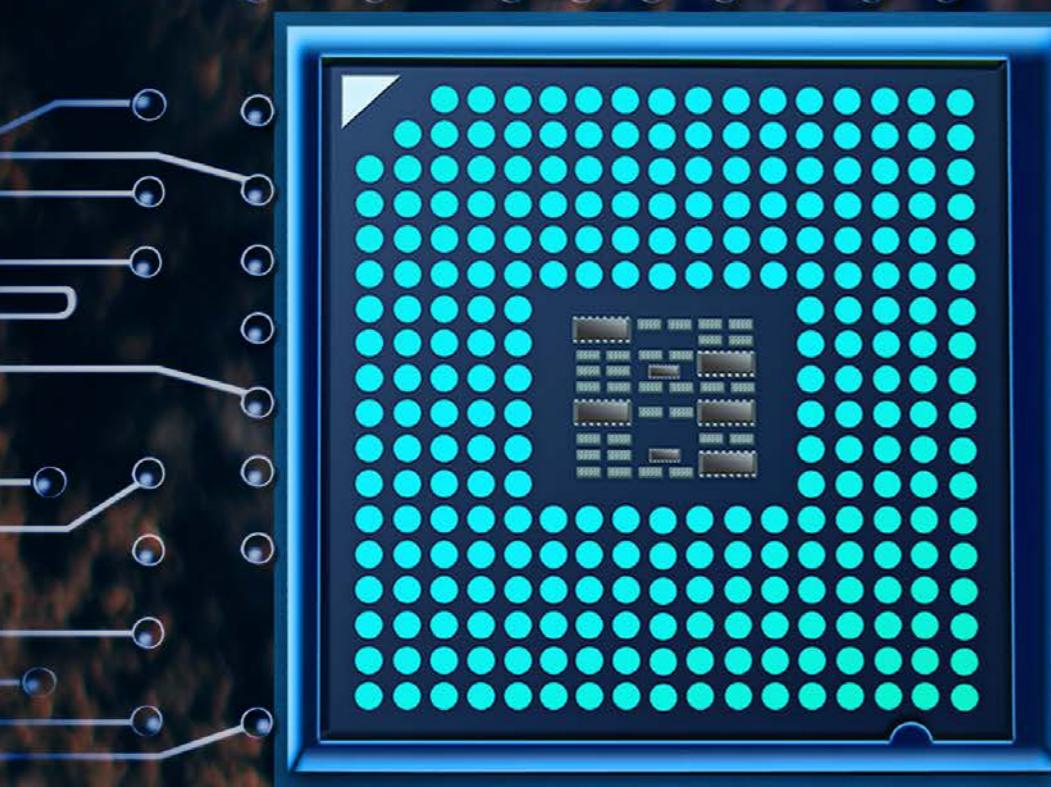
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Additionally, NXP has recycled parts from our own manufacturing equipment by taking infrastructure from one of our wafer fabs and repurposing it for pumping systems and collection tanks. This has allowed for more separation and collection of waste streams, which can then be reused or recycled.

"The ultimate opportunity is to partner with more businesses to find uses for the materials we can offer," Heironimus said. "We're always looking for new ways to co-develop solutions that do right by business and the environment."



# BUILDING THE BIO-IOT



*"The idea of a Bio-IoT that runs on a power source that is not only renewable but recycled is as promising as it is intriguing."*

Arjan Leeuwenburgh  
CTO Design Centre (CDC) NXP Semiconductors



ALTERNATIVE FUELS LIKE SOLAR AND WIND WILL CONTINUE TO GROW IN IMPORTANCE TO MEET THE IMMENSE POWER DEMANDS OF 75 BILLION MOBILE AND EDGE DEVICES EXPECTED TO BE IN USE BY 2030.<sup>1</sup>

NXP is looking ahead to innovate ways to harvest electricity from alternative renewables and has recently tested an integrated circuit (IC) powered by bacteria in soil.

<sup>1</sup>According to Omdia's IoT devices market tracker 1H21

# AN UNLIKELY POWER SOURCE

Plants excrete organic matter into the soil as a natural byproduct of their growth, which is then broken down by bacteria that release small amounts of electrons. This can be captured in a process similar to the way batteries are charged, which entails transferring the charge to a carbon electrode (anode) and then transferring it to a counter electrode (cathode). The amount of energy that this technology can harvest, called a Plant Microbial Fuel Cell (P-MFC), depends on parameters like fuel cell size, type of soil, and temperature (it's harder to capture charges in winter, for instance). Still, under typically temperate weather conditions, a single P-MFC could produce enough electricity to run a smart sensor like those already used to monitor the environment.

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About two years ago, NXP began collaborating with [Plant-E](#), a small startup comprised of environmental engineers dedicated to designing and building the electronics that would harvest and then deliver that energy.

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After quickly coming up with the silicon necessary for a demo of the potential, the NXP team set up a field test at our headquarters in Eindhoven, The Netherlands, which involved connecting [sensors](#) and sending wireless updates approximately once every four hours (six updates/day), which was sufficient to

monitor physical qualities such as water levels. This success prompted more innovation and development and led to an advanced model demonstrated at the 2022 Consumer Electronics Show that could power updates every five minutes, producing 290 readings/day and thereby suggesting a range of additional sensing and connectivity possibilities that included powering an edge node.



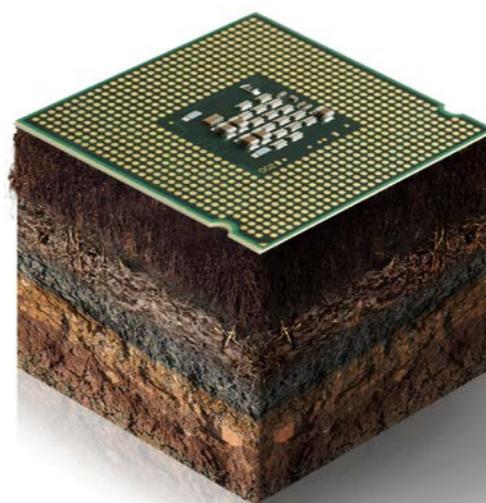
## Bio-IoT's Potential

P-MFC technology still faces significant innovation challenges, including overcoming operational difficulties harvesting electricity in cold climates. But the potential opportunities for a "Bio-IoT" are vast. Imagine farms in rural areas without reliable electricity using their soil to power sensors that monitor crop conditions or using P-MFCs that harvest electricity in warm months so that it can be stored for use in colder seasons. You may never be able to plug your smartphone into a nearby potted plant to charge it, but continued innovation could lead to breakthroughs

in low-power chips that open new frontiers in what, where, and how we use the many millions of smart devices that await us in the future.

The idea of a Bio-IoT that runs on a power source that is not only renewable but recycled is as promising as it is intriguing.

*After quickly coming up with the silicon necessary for a demo of the potential, the NXP team set up a field test at our headquarters in Eindhoven, The Netherlands*



# DOING MORE WITH LESS

*The promise of smart wearable technology to make our lives safer, more productive, and active is limited by at least two functional variables*



**PEOPLE DOING MORE WITH LESS CAN MEAN THE WORLD DOING SO, TOO.**

The promise of [smart wearable technology](#) to make our lives safer, more productive, and active is limited by at least two functional variables: How much can the device accomplish (how "smart" is it?) and how long can it operate on one charge (how "sustainable" is it?).

What do many of the world's most popular wearable devices like smart watches, glasses, and ear buds have in common? They require low power and are enabled by [NXP's battery-friendly i.MX RT Crossover MCUs](#).



At the 2022 Consumer Electronics Show (CES), NXP showcased the solution that enables these wearables to do more with less. The [i.MX RT500 MCU](#) delivers the optimal balance of high performance and

power efficiency to provide as much as three weeks' worth of battery life in a smart watch before needing a recharge.

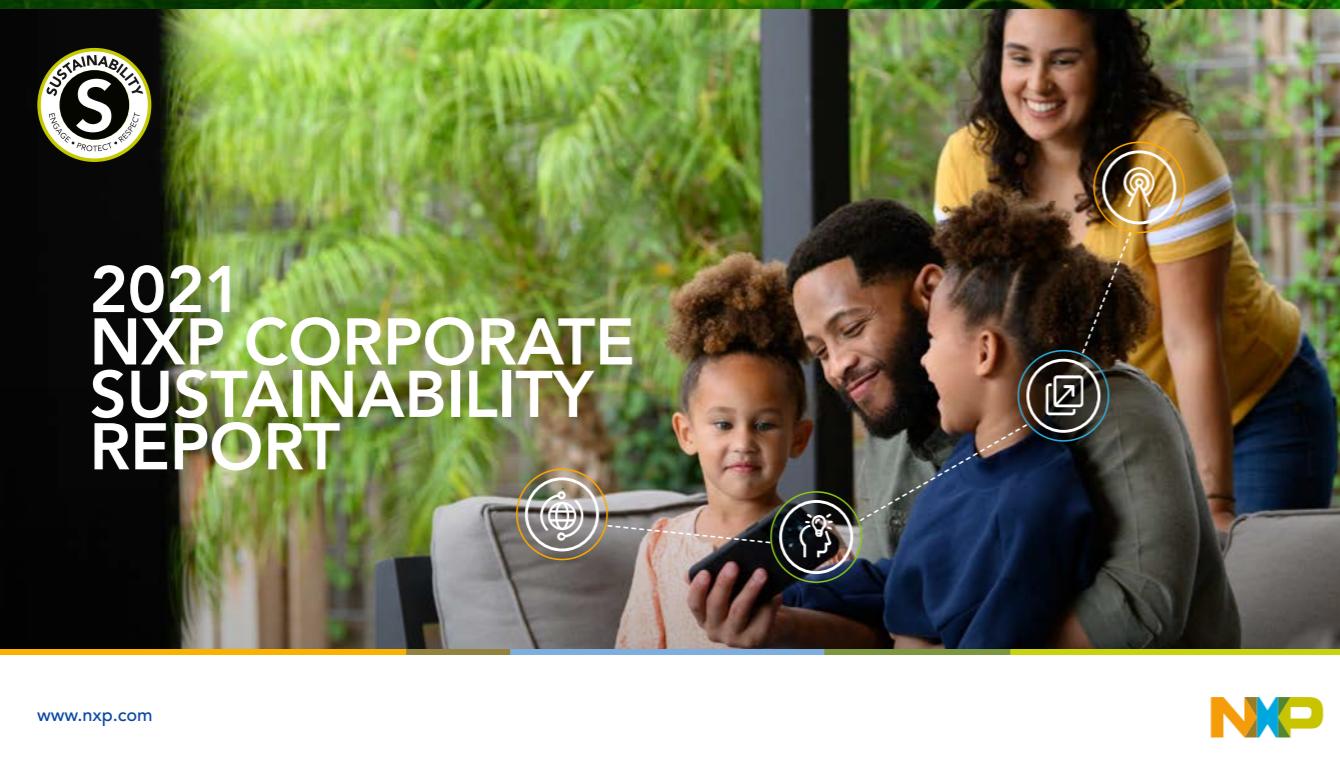
It's already used in such products as The Garmin Venu2 and Amazfit GTR 3 Pro smart watches.

The personal and global impacts of such real-world innovation also mirror one another: Smart tech that does more with less for an individual where she or he works and lives — called "the edge" — can also enable bringing those benefits to more people while using less energy to do it. Considering the many millions of devices sold every quarter, even the slightest reduction in energy consumption could reduce the need for additional power generation plants.

People doing more with less can mean the world doing so, too.

# NXP'S 2021 CORPORATE SUSTAINABILITY REPORT:

A year of continued progress in operations, oversight, and outcomes



NXP'S SUSTAINABILITY PERFORMANCE IN 2021 DEMONSTRATED OUR ONGOING EFFORTS TOWARD ENABLING A BETTER, SAFER, SECURE AND MORE SUSTAINABLE WORLD.

Published in April 2022, NXP's 2021 Corporate Sustainability Report details our journey over the past year and lays out the strategy and key focus areas that will continue to guide us. Here are a few highlights of the work we've accomplished and our commitments going forward.

## THE ONGOING JOURNEY

From an environmental perspective, in 2021 we succeeded in reducing our normalized carbon footprint (Scope 1 & 2) by 11% compared to 2020. The largest contributors to our carbon footprint include emissions from purchased electricity, and from the use of PerFluoroCarbons (PFCs) and Heat-Transfer Fluids (HTFs).

*NXP aims to achieve carbon neutrality by 2035 and in early 2022, we formally committed to the Science Based Targets initiative (SBTi). In addition to the 2035 carbon neutrality goal, another long-term goal is to transition to 100% renewable energy sources, whereas of 2021, 31% of our overall electricity use comes from renewable energy sources.*

Additionally, in 2021, NXP realized an 11% decrease in our normalized water consumption over 2020 and increased our overall waste recycling rate to 76% (on pages 17-18 of this issue of Sustainability Stories, there's an interesting story on some of those efforts at our two wafer fabs in Austin, Texas).

Once again, 100% of our smelters are certified Conflict-Free for tungsten, tantalum, tin, and gold (there's a story about that work in our [previous magazine issue](#) on pages 8-9).

We were also pleased that in 2021 NXP hired nearly 8,000 team members, including approximately 3,300 women. Women now represent 37% of NXP's

global workforce, including a growing number in R&D. In the U.S., we also increased the overall representation of our African American and Hispanic/Latino populations. We instituted a new [diversity, equality, and inclusion policy](#) and were voted Best Places to Work or leading employers in our Austin and Austria locations.

Our sustainability journey continues as we regularly analyze the performance of existing equipment for potential upgrades that use the latest sustainability-relevant technologies. We also explore alternative chemical and/or material opportunities to unlock new sustainable outcomes.

### Oversight

Last year was eventful for NXP's oversight activities, it started at the top with the [appointment of two new board members](#) with Environmental, Social, and Governance (ESG) backgrounds, and regular board review of our ESG strategy and long-term goals. We expanded our internal ESG Management Board and its direct engagement with more departments across the company.

Industry metrics recognized our ongoing progress, as [MSCI](#) – one of the largest independent providers of ESG ratings – raised our rating from B+ to AA in 2021. MSCI, along with other leading ratings agencies, [ISS](#), and [Sustainalytics](#), ranked us among the leaders in our peer group.



# THE ONGOING JOURNEY

## Solutions

At NXP, we believe that we can be a powerful catalyst for change and last year, we continued to deliver innovative solutions that advance a more sustainable future.

In 2021, we launched our latest generation of high-performance i.MX applications processors, which enable smart devices to lower their energy footprints by analyzing and processing data at the edge of computer networks, right where people use them. We also released eIQ®, an easy-to-use software development toolkit for manufacturers to easily add intelligence to smart home and industrial devices at the edge.

Another advancement introduced in 2021 was NXP's innovative crossover microcontroller, which enables fully charged wearables and smartwatches to last three times longer than previously

possible (under certain use conditions), thereby reducing their carbon footprint.

We made significant strides forward in our enablement of automotive electrification, as our battery management systems now power large eBus fleets in China and electric bikes in India. At the same time, our functional safety SiC inverter solution reduces switching loss of electric motors.

*We encourage you to read about these innovations and many more in our latest Report.*

### ESG MISSION

Enabling a better, safer, more secure and sustainable world through innovation

#### STRATEGY

##### INNOVATION



Innovate advancements that enable a better, safer, more secure and sustainable world

#### GUIDING PRINCIPLES

Push boundaries and explore new approaches to develop innovative and sustainable products and solutions

##### ENVIRONMENTAL



Optimize our use of resources and the beneficial social impacts associated with our operations

##### SOCIAL



Leverage our global and increasingly diverse team to actively drive our sustainability mission

##### GOVERNANCE



Collaborate with our stakeholders on global sustainability initiatives. Ensure accountability and build trust through transparency in our business practices and operations

Foster an environment of trust and respect, where team members collaborate to drive innovation, and are able to contribute to their full potential

Proactively assess risk and build resilience through robust governance systems, including appropriate goals and processes

*At NXP, we believe that we can be a powerful catalyst for change and last year, we continued to deliver innovative solutions that advance a more sustainable future.*



PARTNERSHIPS  
FOR A **MORE**  
**SUSTAINABLE WORLD**

# INNOVATION FOR PUBLIC GOOD

## A GLOBAL EFFORT

NXP's Public Cooperation Programs ("PCP") team draws on the company's expertise and resources to participate in dozens of projects around the world focused on various aspects of speeding sustainable solutions to market. It recognizes the central role that safety and security play in user adoption of any new technology solution. The PCP team handles all operational, financial, and legal matters involved in collaborative projects, allowing NXP's technical engineers to focus on research and development.

These efforts aim to contribute to [NXP's alignment with numerous United Nation's \(UN\) Sustainability Goals](#) as well as NXP's mission to work together and accelerate the breakthroughs that advance our world.

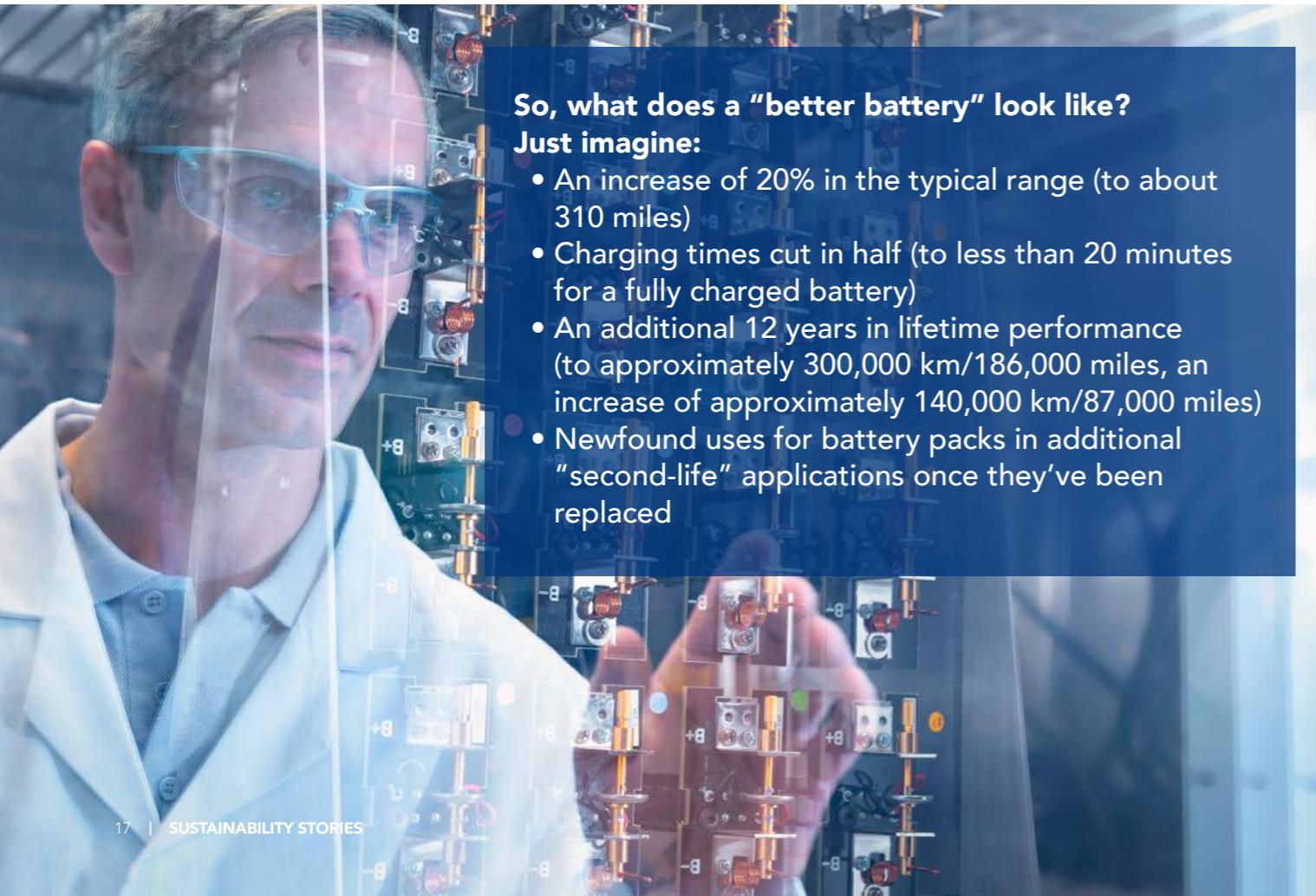
NXP'S COMMITMENT TO A BETTER, SAFER, MORE SECURE AND SUSTAINABLE WORLD MOTIVATES ITS PARTICIPATION IN DOZENS OF COLLABORATIVE RESEARCH PROJECTS WITH GOVERNMENT, ACADEMIC, NONPROFIT, AND CORPORATE PARTNERS TO INNOVATE APPROACHES, STANDARDS, AND SOLUTIONS TO MAKE SUSTAINABILITY MORE SCALABLE AND TRUSTWORTHY.

Here are highlights of just a few of these recent innovative projects:

## BETTER BATTERIES

Batteries that deliver extended range, shorten charging times, and enhance safety could encourage greater user confidence and help speed adoption of Electric Vehicles ("EVs"). NXP is participating in a [project](#) with other European technology partners to create such a better battery.

Called [LIBERTY](#), the project is also working on standardized EV safety and performance testing, as well as a semi-automated battery dismantling protocol to reduce the costs of recycling and reuse. Its objectives directly address the United Nation's Sustainable Development Goals (SDGs) 7, 9, and 13 while marshalling innovation resources in the fight against climate change.



### So, what does a "better battery" look like?

#### Just imagine:

- An increase of 20% in the typical range (to about 310 miles)
- Charging times cut in half (to less than 20 minutes for a fully charged battery)
- An additional 12 years in lifetime performance (to approximately 300,000 km/186,000 miles, an increase of approximately 140,000 km/87,000 miles)
- Newfound uses for battery packs in additional "second-life" applications once they've been replaced

## SCALING AUTONOMY

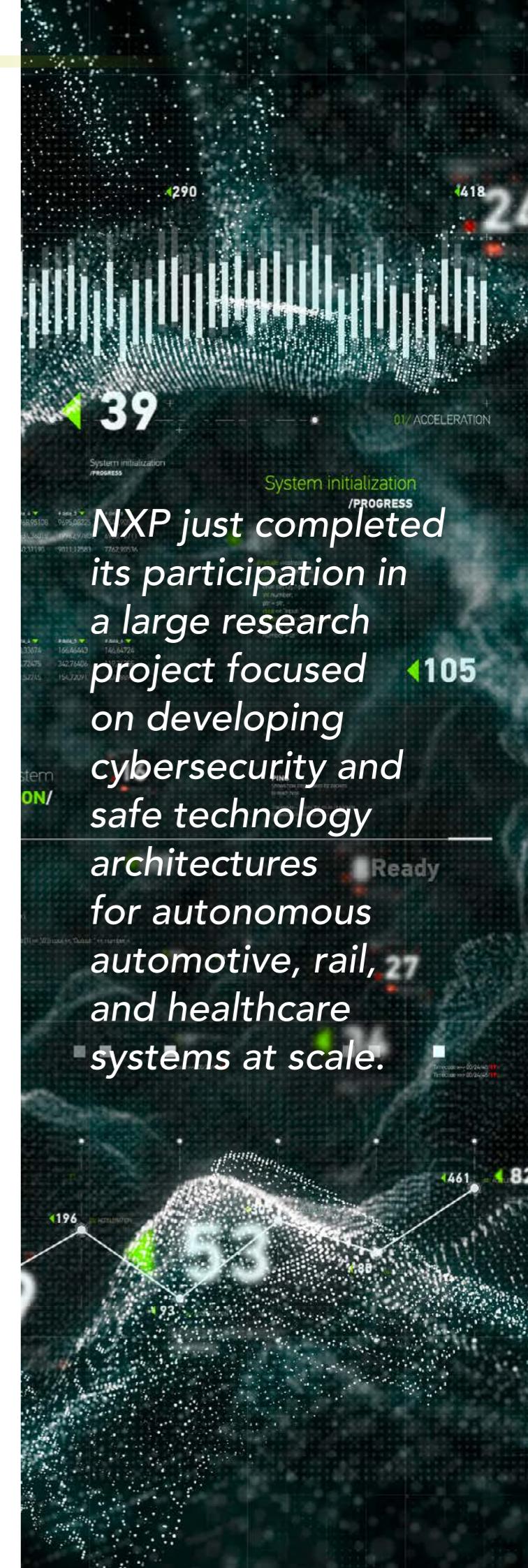
NXP's involvement is focused on smart solutions and tools for battery sensing, diagnostics, and controls. These enable accurate and cost-effective measurements capable of recognizing hidden performance issues that evolve slowly over the battery's lifetime and provide early detection of the appearance of small changes in self-discharge rate between cells.

We've been at the forefront of this transition as a leading provider of scalable battery management systems (BMS) used in automotive and industrial applications including 12 V, 48 V, high-voltage and battery pack monitoring applications.

The objective of the *Product Security for Cross Domain Reliable Dependable Automated Systems* project ([SECREDAS](#)) was to build references that combined high security and privacy protection while preserving functional-safety and operational performance that could be used for future vehicles and devices to increase the applications for autonomous technologies.

The consortium of 70 partners from industry, universities, and research organizations focused on creating the conceptual "blueprints" for scaling cybersecurity and safe technology for connected and automated vehicles, which could also be applicable to automated systems in rail transportation and health diagnostics, analyses, and communication.

NXP played an overall leadership role in the project and applied its expertise in product and solution areas such as in-vehicle networking, automotive high-end processors, V2X and secure connections to help ensure safe and secure usage of those technologies.



## TRUSTWORTHY AI

As billions of new smart devices are expected to be used in homes and industries over the next decade, it is anticipated that Artificial Intelligence will continue to evolve and be applied to more uses, creating an integrated and empowered smart infrastructure that can span across a continent, linking urban, industrial, transportation, and lifestyle aspects of society.

This emergent Artificial Internet of Things (AloT) won't deliver on its promised benefits unless people can trust it to be not just effective but safe and secure. In fact, NXP published a pioneering white paper on the importance of AI ethics and its applications to edge computing – The Morals of Algorithms -- which you can read [here](#).

The Intelligent Secure Trustable Things Project ([InSecTT](#)) project aims to provide explainable and trustable AI, a generic cross-domain reusable technology block for secure and reliable intelligent wireless systems in cross-domain use cases such as health, smart infrastructure, urban public transport, aeronautics, automotive, railway, manufacturing, maritime, and building construction and management. It's



hoped that this technology innovation will foster greater user trust and therefore encourage adoption.

NXP is both a member of InSecTT's core leadership team managing more than 40 partners across various initiatives and serves in a technical capacity on specific use cases, such as wireless connectivity and enhancing the reliability and trustworthiness of AI and machine interpretability, confidentiality, and resistance to adversarial examples, such as hacks. We're applying expertise we've acquired from offering a robust AI portfolio for automotive, industrial, smart city, and smart home applications.



For more information about NXP's Public Cooperation Programs please visit our [Research and Innovation](#) stories on our blog.

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# SUSTAINABILITY FROM STARTUPS

As part of NXP's ongoing journey toward enabling a better, safer, more secure and sustainable world, we're a sponsor of the [Extreme Tech Challenge \(XTC\)](#), a competition focused on empowering startups to innovate in 10 categories inspired by the United Nations' 17 Sustainable Development Goals, such as Cleantech Energy & Environment, Digital Health, Mobility, and Sustainable Smart Cities.

In India, we're in the second year of our lead sponsorship of the regional competition. During the robust first year, more than 192 Indian startups applied and then were reviewed by nearly 60 evaluators over the course of a month. The top-ten startups received months'

worth of free access to state-of-the-art lab equipment, and technology and partner support to help them convert their ideas into functioning prototypes. The three winners received prize money and mentorship from NXP India's technical experts to develop ideas ranging from battery pack design and manufacturing to help boost the growth of EVs in India, to miniaturized gas sensors to make homes safer.

"We have a huge number of customers, and they are masters at applying chip technology to new end-user innovations," explained [Lars Reger](#), NXP's Chief Technology Officer. "So, naturally we are open and eager to expand our ecosystem with startups

we hope can successfully apply our technology. In fact, as CTO I want to enable a 'playground for startups', and hope the Extreme Tech Challenge will contribute to that."

We were also a first time sponsor of the XTC regional competition in the [Netherlands and Belgium](#). The winner was a company that discovered a solution for cooling computer chips more efficiently for reduced energy consumption and improved chip performance. A special mention went to a biotech company that used beer waste and other food byproducts to make alternatives to single-use plastics. As a bonus, a third finalist was chosen to go to the global competition in recognition

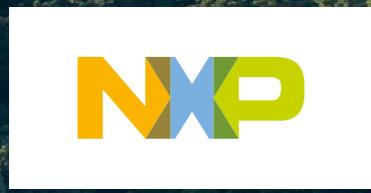
of their innovation that mimics natural cell membranes to make biocompatible and high performance medical device coatings.

Intriguingly, NXP's technologies and solutions are not just enablers of sustainable function, such as, [electric battery management](#), but they help developers design solutions that are easier to use, more reliable, safer, and use less energy.

The winners from India, the Netherlands and Belgium and 18 other regions will compete in the XTC Global Finals.

New stories will appear regularly during the year  
on our [website](#) and we encourage you to share  
your thoughts or email us at [csr@nxp.com](mailto:csr@nxp.com).

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