

## REPORT

# WIRELESS CHARGING IS THE FUTURE

Kontaktlo(o)s laden is a project from Dutch and German parties in the Eems Dollard Region





# Foreword

At the province of Groningen, we're constantly looking for innovative and sustainable options to make mobility, infrastructure and maintenance smarter and greener.

With the 'Kontaktlo(o)s Laden' project (Driving electric made easy by wireless charging), we're working together with the business community and governments in the Northern Netherlands and Northern Germany to develop, test and implement innovative and sustainable solutions in the area of wireless charging for electric vehicles. In other words: the development of self-driving vehicles with a wireless chargeable shuttle bus and the development of wireless chargeable e-bikes at various locations.

An important goal of the project is to maintain and improve accessibility and quality of life in the rural areas. In addition, the developments are good for employment and of course the environment. Wireless charging is also simple and easy. It encourages our residents to cycle even more. This project also gives a significant boost to the collaboration between the Netherlands and Germany in the border region. Companies in the Northern Netherlands and Northern Germany work together in 'Kontaktlo(o)s Laden' on developing the charging system. They are supported in this by the provinces of Groningen, Drenthe and Landkreis Emsland. The project was made possible by Interreg, a European subsidy scheme.

It is the first cross-border joint step in an important development for electric driving. But it certainly won't be the last. We really want to start a lasting sustainable movement.



**Fleur Gräper- van Koolwijk**  
MEMBER OF THE GRONINGEN PROVINCIAL EXECUTIVE  
LEAD PARTNER KONTAKTLO(O)S LADEN



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## Introduction

Realising innovative and sustainable solutions for charging e-bikes and self-driving vehicles inductively or wireless, i.e. without a plug. That is the goal of the Kontaktlo(o)s Laden project (Driving electric made easy by wireless charging) that kicked off in May 2018. That means: developing and realising new products, testing and demonstrating them in real life.

Wireless charging makes the use of electric vehicles a whole lot easier. And that means much easier for the customer as well. That's why the companies participating in the project see opportunities to develop new products. Afterwards, the companies can further develop the prototypes into a market-ready product. The cross-border collaboration provides an extra boost.

In this way, the project indirectly contributes to the reduction of CO2 and to improving the quality of life in rural areas. It also stimulates the collaboration between the Netherlands and Germany in the border region, promotes economic development and creates jobs.

Fourteen partners collaborated on the German and Dutch side: eleven companies and three government authorities: the provinces of Groningen, Drenthe and Landkreis Emsland. The project is primarily aimed at innovation but creating a network between Dutch and German companies and governments was also an important part.

Kontaktlo(o)s Laden was possible thanks to the European subsidy scheme Interreg. The project concluded with a final meeting on 24 March 2022.

In this brochure, we look back at the technology developed, the results of the subprojects and the process. And we look to the future.



## Technology low power

The 'low power' work package up to 3 kW focuses on wireless charging systems for lower powers. It is suitable for installation in electric bicycles and electric tricycles (Drymers). After extensive testing, the developed applications are now in use at various pilot locations. You can read more about these locations later in this brochure. But first, about the technology.

### What was developed?

The system consists of a receiving part, the so-called 'bicycle wireless charging kit', built into the front of the bicycle. There is also a charging station with a bicycle rack. The bicycle rack has an energy storage point with a battery and an energy distribution system to the present vehicles. This transports the necessary power to the vehicle. The system thus ensures the correct distribution of power to the various bicycles. A possible addition is a roof with integrated solar panels. This variant generates the required energy itself and is therefore completely circular.

To prepare the pilots at the locations, a test set-up with a roof was installed at project partner Witec in Stadskanaal. There are two e-bikes here, there is room to charge your own e-bike and two cars can be parked underneath to deliver back. This charging station can be used by visitors and personnel. For example, personnel can easily cycle back and forth between the various Witec buildings.

### Eric Vos, CEO Witec:

"We were early adopters. When we started the project, wireless charging was still completely new. That gave us a knowledge advantage. I still think it's amazing that we had this idea years ago and that there are now a lot of developments going on in this area. We had quite a bit to solve during this project. For example, not every bike is the same height. That means you have to find a solution for the transmitter and the receiver. The electricity

generated by the solar panels must be well-distributed among the bicycles. That was quite a software challenge again. We now have the charging stations at four locations. So it's very visible and you can really show the public what wireless charging means."

### Who did what?

Witec built the technical components, for example, for converting the electricity from the panels to the induction plate. They built the charging station in collaboration with INTIS. INTIS adapted its existing wireless charging technology for the applications for this project. Tizin developed the software, Otten GmbH built the carports, RKT Solar installed the solar panels, De Roo Wegenbouw-Milieutechniek did the paving, Klaver Fietsparkeren supplied the bicycle racks and Drymer the tricycles. A party outside the project supplied the e-bikes. Emsland Tourismus created the cycling routes.

# Technology high power

The 'high power' work package up to 30 kW focuses on wireless charging of an autonomous self-driving shuttle.

## What was developed?

The technology behind wireless charging is being used, but its application in autonomous transport is new. It works like a kind of induction hob. A plate in the road (transmitter) and a plate attached to the shuttle (receiver) slide over each other as the shuttle drives towards the charging point. The space between the plates is approximately twelve centimetres. A magnetic field is created in this space. This brings the energy from the ground to the vehicle.

An autonomous shuttle, without a wireless charging system, was already running on the grounds of the Ommelander Hospital Group in Scheemda. This bus was used to further develop and test the wireless charging system. The autonomous shuttle is owned by public transport company Arriva and the province of Groningen. The French supplier NAVYA provided access to the vehicle's IT system and contributed to the integration. INTIS developed a new wireless charging system for 'high power' and then installed the charging system. This occurred at the INTIS Research and Development Centre in Lathen (Emsland). Green Dino did a lot of programming to

improve the position determination of a self-driving vehicle when parking. It is essential that the vehicle parks automatically, with very small margins, above the induction plate in the road surface. The province of Groningen was responsible for the content progress of this work package.

In September 2021, the technology was presented for the first time at the International Motor Show in Munich (IAA Mobility). The autonomous shuttle was then moved to the Bytesnet site at the Zernike site in Groningen for an extensive test programme. Read more about this on page 17

The combination of self-driving and wireless charging completes the circle. It is the last step towards a fully-automatic system without human intervention.

## Ralf Effenberger, CEO INTIS:

"Combining wireless charging with autonomous driving is the ultimate challenge for wireless charging providers such as INTIS. The successful completion of this project has shown that wireless charging is now ready for this application. This project gave us the opportunity to leverage as much vehicle sensor data for the wireless charger as possible, specifically for the positioning of the vehicle over the transmitter chargers in the road. Close collaboration with NAVYA was a requirement for this. We've now successfully demonstrated that autonomous driving technology is fully capable of accurately positioning the vehicle for wireless charging."



## A pinnacle: autonomous shuttle demonstration at the Munich Motor Show

During the five-day Internationale Automobil Ausstellung (IAA) MOBILITY 2021 motor show in Munich, employees from the province of Groningen and representatives from INTIS demonstrated the vehicle and how the technology works.

The autonomous shuttle made hundreds of trips and was very well received. Politicians also visited. It was the only form of autonomous transport at the show that visitors could actually ride in. So they were able to experience the benefit themselves. This created a lot of enthusiasm among the participants. The e-bike wireless charging system was also shown. It attracted the interest of manufacturers and owners of e-bike component systems.

Hindrik de Haan, Kontaktlo(o)s Laden (Driving electric made easy by wireless charging) Project Manager for the province of Groningen: "The show was organised in six months. That was a huge challenge, especially during the pandemic. The collaboration for it was fantastic. All the parties had the same goal: to make the joint innovative project as visible as possible. Participating in the motor show was great for promoting the project and it gave us loads of energy. Even after that, the commitment and energy remained to bring the project to a successful conclusion with all the parties."

# M

## Emsland Moormuseum Geeste

The Emsland Moormuseum is a museum in Geeste (Germany) surrounded by a vast nature reserve. Visitors can cycle through the surrounding nature reserve, but it is too far to go on foot.

This location has a charging station for wireless charging of one tricycle (Drymer) with four charging points for visitors' e-bikes. The charging station has a bicycle rack and a roof with integrated solar panels.

Cycling routes have been developed in the area, ranging from fifty to sixty kilometres in length. That is approximately the range of an electric bicycle battery. This makes it possible to take a wonderful bike ride in this beautiful, vast nature reserve. Emsland Tourismus developed the routes which all start and end at the museum.

### App

An app has been developed for wireless charging of the e-bikes. The user can follow the charging process of the bicycle(s) with this app. If there are several bicycles at the charging station, you can see which bicycle has been charged the most. The intention is also to use the app as a booking system. So you can see which bicycles are available in a network of bicycles, book and pay for them. But that is not the case yet. Reservations are easy to make at the reception in the Moormuseum. This is handy in this early phase because the employees can immediately explain to the visitor how everything works.

### Ansgar Becker

**Curator/Deputy Director, explains why the Moormuseum participated in Kontaktlo(s) Laden (Driving electric made easy by wireless charging):** "As a museum, we're happy to support Landkreis Emsland in the area of sustainable development. Of course, the sustainable development of the Moor-Bargerveen nature reserve is very important to our museum."





## Eko-Tours Exloo

Eko-Tours offers tourist excursions and tours in Exloo (Drenthe) that visitors can take with all kinds of different electric vehicles. You can enjoy nature fully electrically or with electrical assistance.

Eko-Tours has a charging station for wireless charging of two tricycles (Drymers).\* The tricycles are parked under a roof with integrated solar panels. So the charging circle is complete. Visitors can hop on the Drymers and follow a touristic route in the area.

### Ruud Haak

**Owner of Eko-Tours, talks about their participation in the project:** "As a business, we were a logical choice. We're located in the area and we hold 'Eko' in high regard. Our visitors can book an excursion or tour and choose from one of the vehicles. Since recently, also the Drymer. We have an app for your phone that gives you an explanation of your surroundings during the route.

\*AT THE TIME OF THIS REPORT, THE PROJECT IS STILL ONGOING AND THE USE OF WIRELESS CHARGING AT EKO-TOURS IS UNCLEAR.

Students from NHL Stenden have mapped out a new route for the Drymers: the Peat and sand route.

I immediately liked the Kontaktlo(s) Laden (Driving electric made easy by wireless charging) initiative because we're always looking for new things and it's circular. We already have eighty solar panels on our building, which we use to power our other vehicles. So the charging station is a nice addition to what we already have. I think the wireless charging is really amazing in this project. It's completely new for us. And it was great that we could test it ourselves. It's a practical project that our company is involved with. I love that. In short: I believe in it wholeheartedly. It's a fantastic addition for us."

# Police unit of the Northern Netherlands, Groningen

A charging station with two wireless rechargeable e-bikes is being piloted at the Groningen Centre police station on the Rademarkt in Groningen. The police unit of the Northern Netherlands is participating in this through the national police project 'Sustainable deployability'.

In general, the police unit in the Northern Netherlands has to deal with large distances. A test location in the city of Groningen was chosen because there the distances are relatively small. Officers and office personnel can use the e-bikes for commuting to work and between the various police stations.

## Manuela Crame

**Fit@NP & Mentale Kracht Noord-Nederland coordinator explains the police's participation:** "We want to increase the employees' vitality and mobility. I am the bike ambassador for the sustainable deployability project. The aim is to encourage the personnel

to cycle more often. We want to make it as attractive and easy as possible for people to get on their bicycles. Wireless charging is user friendly and it saves time. Users don't have to carry chargers themselves. I'm curious to see if the wireless charger will get people to bike more. But I don't know yet.

We'll be monitoring bike use throughout the pilot. When the test period is complete, we'll ask the participants about their experiences. I'm curious about the reactions: if they liked it and whether wireless charging really makes people get on their bike faster. Then it can have added value for us."





# Shuttle bus at Bytesnet terrain Groningen

After the demonstration at the IAA Mobility 2021 in Munich, as described earlier on page 7 , the autonomous self-driving shuttle moved to the Bytesnet site at the Zernike complex in Groningen. Bytesnet is a company that supplies digital infrastructure to customers. They made this location available.

The shuttle was placed in a closed area; an ideal location to test the technology. The autonomous shuttle in Scheemda has previously already driven a fixed route on public roads with the permission of the Road Traffic Service (RDW). Without inductive or wireless charging.

An extensive programme was carried out on the Bytesnet site to test the wireless charging technology. The main goal was to see how the system works in the long(er) term. It also provided the opportunity to improve the system where possible.

### Hindrik de Haan

**Kontaktlo(o)s Laden (Driving electric made easy by wireless charging) Project Manager for the province of Groningen explains why this project is so interesting for the province of Groningen:** "The goal was to apply inductive charging to an existing vehicle, namely the NAVYA autonomous shuttle. And it worked. The province of Groningen really wants to start using this system. That's why we're looking for

a location for further test driving in combination with wireless charging. That however falls outside the scope of this the project.

For us, the shuttle is part of a larger whole. Autonomous transportation as the way to maintain and improve accessibility and quality of life in the Northern Netherlands. This form of transportation already exists but not yet in combination with wireless charging. That's why this development project is so interesting for the province of Groningen. This truly automates the entire process of driving, parking and charging."



# Collaboration and process

The goal of the Kontaktlo(o)s Laden project (Driving electric made easy by wireless charging) has been achieved. Technically innovative solutions have been realised for inductive or wireless charging of e-bikes and self-driving vehicles. New products have been developed, realised, tested and demonstrated in practice. Despite the necessary challenges, the innovative aspect has been preserved and the solutions have truly been achieved together. The collaboration between the Netherlands and Germany was unique.



## Very proud of what we've achieved

**Hindrik de Haan**  
Kontaktlo(o)s Laden Project Manager for the province of Groningen:

"It's really unique how we've developed such fantastic technology with such diverse parties. The innovative aspect is the most exciting thing about the project. A lot has been done in the development of wireless rechargeable e-bikes with charging stations. The demonstration of the autonomous shuttle bus at the Munich Motor Show gave an enormous energy boost. We learned a great deal from each other. I'm very proud of what we've achieved."

### Challenges

"Innovation and challenges go hand-in-hand. It's logical that the Interreg programme has quite a few regulations. It's the role of the province to guide the parties in all this. We

didn't know each other when we started the project. We had a lot of consultations throughout the project. At least once a week. Sometimes we even had different consultation structures parallel with each other in which we monitored progress on a weekly basis. We were soon delayed because two partners dropped out. We compensated for this loss with the remaining partners. For example, the companies INTIS and Witec took on the project management for the technology. They invested a lot of energy in it, which was really nice for the province. They are much more knowledgeable. So as Project Manager, I could concentrate on the process. And the coronavirus also caused a lot of problems. Especially due to the slow delivery of materials, we needed more time. As a result, the project was delayed by a year."

## We truly developed the prototypes together

**Eric Vos**

**CEO Witec:** "Together, we really achieved something. We truly developed the prototypes together. That's unique. The collaboration between the German and Dutch technicians went really well. Though we are different. The Dutch are quicker to look for alternative solutions while the Germans stick to the agreements."

## Good basis for increasing business contacts

**Markus Mebben**

**Project Engineer Emsland GmbH:** "Emsland GmbH supported the German project partners in the coordination and implementation of the operational project activities and the subsidy applications within the Interreg programme. We initiated and coordinated the cross-border communication between project partners from Germany and the Netherlands. We had to overcome the necessary hurdles in this project, especially due to the COVID-19 pandemic. The project is a good basis for the participating companies to increase business contacts in the Netherlands and further into Europe."

# Future

The technically innovative solutions have been realised. So what's next for wireless charging of vehicles?



## Now it's up to the market

### Eric Vos

**CEO Witec Motion:** "The prototypes are ready. We've demonstrated the technical possibilities. It works. So the project has now ended and it's time for the period of use. We are technically oriented at Witec Motion. Our strength is development and production. Not sales. Commercial parties will now take discussions further. Now it's up to the market."

## The autonomous shuttle on the road

### Hindrik de Haan

**Kontaktlo(o)s Laden (Driving electric made easy by wireless charging) Project Manager for the province of Groningen:** "The Kontaktlo(o)s Laden project has now ended. Definitive testing of the prototypes by users and the market was not part of this project. Companies must now expand with new collaborations. I'm confident that will occur. That makes this project even more valuable. There are already talks between companies about a spin-off of wireless rechargeable e-bikes with charging stations. And the province of Groningen would like to start a new project soon: the actual driving of the autonomous shuttle in combination with the built-in wireless charging technology. Support from businesses is needed for this. Various start-ups and a secondary vocational education (MBO) school will be located on a site in Stadskanaal. This is a possible test location for the autonomous shuttle. The intention is to have the autonomous shuttle running there and to give the MBO students a role in the new project. They are, after all, the future professionals."

## World première for wireless charging

### Ralf Effenberger

**CEO INTIS:** "As far as we know, the autonomous shuttle and the wireless chargeable e-bikes with charging stations represent a world première for the combination of wireless charging with these areas of application. Moreover, the solutions developed are workable demonstrations. This makes them applicable in the 'real' world in the foreseeable future. As mobility moves towards Connected, Autonomous, Shared and Electric (CASE), wireless charging can contribute significantly to increasing electrification. We're moving towards a reality where the application of electricity for mobility simply exists. The user doesn't have to think about it. In the near future, the applications for wireless charging may have the greatest success in the areas of autonomous industrial and public transport vehicles and shared micromobility. In the medium term, the technology will be extended to passenger cars with advanced driving assistance systems. Think of automated valet parking."

# Project partners

## **INTIS – Integrated Infrastructure Solutions GmbH**

Hermann-Kemper-Str. 23  
49762 Lathen, Duitsland

## **Witec Fijnmechanische Techniek B.V.**

Stelmaker 7  
9502 EG Stadskanaal

## **Klaver Fietsparkeren**

Weberstraat 5  
7903 BD Hoogeveen

## **Provincie Drenthe**

Westerbrink 1  
9405 BJ Assen

## **Provincie Groningen**

Sint Jansstraat 4  
9712 JN Groningen

## **Emsland Touristik Gmb**

Herzog-Arenberg-Straße 12  
49716 Meppen, Duitsland

## **Emsland Moormuseum**

Geestmoor 6  
49744 Geeste, Duitsland

## **Alwin Otten GmbH Kälte-Klima-Elektro**

Industriestr. 22  
49716 Meppen Duitsland

## **Emsland GmbH**

Haselünner Str. 3  
49716 Meppen, Duitsland

## **RKT Solar Solutions**

Oldenhofstraat 24  
9402 HN Assen

## **Green Dino BV**

Bronland 12G  
6708 PB Wageningen

## **Drymer b.v.**

Klompemaker 5  
9502 EP Stadskanaal

## **Tizin Mobile**

Peizerweg 87a  
9727 AH Groningen

## **De Roo Wegenbouw B.V.**

St. Gerardusstraat 238  
7826 CL Emmen

## **Colophon**

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